ACADEMIC REGULATIONS

COURSE STRUCTURE AND

DETAILED SYLLABUS

MECHANICAL ENGINEERING

B.TECH 4 YEAR UG COURSE

(Applicable for the batches admitted from 2020-2021)

REGULATION: R20

(I, II, III & IV Year Syllabus)

J.B.INSTITUTE OF ENGINEERING & TECHNOLOGY
AUTONOMOUS
Bhaskar Nagar, Moinabad Mandal, R.R. District,
Hyderabad – 500 075, Telegana State, India
Email: principal@jbiet.edu.in, Website: www.jbiet.edu.in

VISION AND MISSION OF THE INSTITUTION

VISION

To be a centre of excellence in engineering and management education, research and application of knowledge to benefit society with blend of ethical values and global perception.

MISSION

- To provide world class engineering education, encourage research and development.
- To evolve innovative applications of technology and develop entrepreneurship.
- To mould the students into socially responsible and capable leaders.

VISION AND MISSION OF THE DEPARTMENT

VISION

To be a premier center for producing comprehensive Mechanical Engineers with a niche in Research and Innovation useful to the society.

MISSION

- To educate by imparting knowledge and skills in the field of mechanical engineering and engage in continuous learning.
- To collaborate with reputed research and development organizations, educational institutions, industry and alumni for gaining exposure to real time technological challenges.
- To facilitate entrepreneurial attitude in addressing the dynamic needs of the society, ethically and morally.

Program Educational Objectives (PEOs)

PEO1

Amalgamate knowledge and skills to identify, formulate and solve wide range of Mechanical Engineering systems.

PEO2

Respond to challenges in the field of mechanical Engineering and provide cost effective solutions as a researcher and entrepreneur.

PEO3

Address interdisciplinary technological needs by adopting optimal unitization of diversified technological developments.

PEO4

Be able to lead project management teams successfully with utmost concern to professional ethical practices associated with society and environment.

Program Outcomes of Mechanical Engineering Department (POs)

PO1
Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO2
Problem Analysis: Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PO3
Design / Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.

PO4
Conduct investigations of complex problems: using research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions.

PO5
Modern Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6
The Engineer and Society: Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.

PO7
Environment and Sustainability: Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.

PO8
Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

PO9

Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.

PO10

Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.

PO11

Project Management and Finance: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12

Life-long Learning: Recognize the need for and have the preparation and ability to engage in independent and life- long learning in the broadest context of technological change. Any signatory needs to provide an overview of its learning outcomes and confirm that compliance of programs.

PSO1

Able to apply knowledge of design, analysis, development in implementation of the trending multidisciplinary technologies

PSO2

Able to convert creative ideas into cost effective and viable solutions from technological and societal perspective

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MECHANICAL ENGINEERING

B. Tech Course Structure -R20

I YEAR – I SEMESTER

S. No.	Code	Course Title	L	T	P	D	Credits
1	J110A	Differential Equations and Calculus	3	1	0	0	4
2	J110B	English	3	0	0	0	3
3	J110C	Engineering Physics	3	0	0	0	3
4	J115A	Programming for Problem Solving	3	0	0	0	3
5	J1101	English Language and Communication Skills Lab	0	0	2	0	1
6	J1102	Engineering Physics Lab	0	0	2	0	1
7	J1151	Programming for Problem Solving Lab	0	0	4	0	2
8		Induction Program	-	-	-	-	-
Total			**12**	**1**	**8**	**0**	**17**

I YEAR – II SEMESTER

S. No.	Code	Course Title	L	T	P	D	Credits
1	J120A	Linear Algebra and Advanced Calculus	3	1	0	0	4
2	J120C	Applied Chemistry	3	0	0	0	3
3	J129A	Basic Electrical and Electronics Engineering	3	1	0	0	4
4	J123A	Engineering Mechanics	3	0	0	0	3
5	J1201	Chemistry Lab	0	0	2	0	1
6	J1291	Basic Electrical and Electronics Engineering Lab	0	0	2	0	1
7	J1231	Engineering Drawing	0	0	0	6	3
8	J1292	Engineering and IT Workshop	0	0	4	0	2
9	J12M1	Environmental Science	2	0	0	0	0
Total			**14**	**2**	**8**	**6**	**21**

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MECHANICAL ENGINEERING

B. Tech Course Structure -R20

II YEAR – I SEMESTER

S. No.	Code	Course Title	L	T	P	D	Credits
1	J210C	Polymers and Nano Materials	3	0	0	0	3
2	J213A	Kinematics of Machines	3	0	0	0	3
3	J213B	Manufacturing Technology	3	0	0	0	3
4	J213C	Thermodynamics	3	0	0	0	3
5	J213D	Metallurgy and Material Science	3	0	0	0	3
6	J213E	Mechanics of Solids	3	0	0	0	3
7	J2131	Manufacturing Technology Lab	0	0	2	0	1
8	J2132	Materials Engineering Lab	0	0	2	0	1
9	J2133	Internship – I	0	0	2	0	1
10	J21M1	Gender Sensitization	2	0	0	0	0
Total			**20**	**0**	**6**	**0**	**21**

II YEAR – II SEMESTER

S. No.	Code	Course Title	L	T	P	D	Credits
1	J220A	Statistics and Numerical Methods	3	1	0	0	4
2	J223A	Mechanics of Fluids and Hydraulic Machines	3	0	0	0	3
3	J223B	Dynamics of Machinery	3	0	0	0	3
4	J223C	Thermal Engineering – I	3	0	0	0	3
5	J22EA	Managerial Economics and Management Science	3	1	0	0	4
6	J2231	Mechanics of Fluids and Hydraulic Machines Lab	0	0	2	0	1
7	J2232	Dynamics of Machinery Lab	0	0	2	0	1
8	J2233	Machine Drawing Practice Lab	0	0	0	4	2
9	J22M1	Professional Ethics	2	0	0	0	0
10	J2201	Soft Skills	2	0	0	0	0
Total			**19**	**2**	**4**	**4**	**21**

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B. Tech Course Structure -R20

III YEAR – I SEMESTER

S. No.	Code	Course Title	L	T	P	D	Credits
1	J313A	Metal Cutting and Machine Tools	3	0	0	0	3
2	J313B	Design of Machine Members – I	3	0	0	0	3
3	J313C	Thermal Engineering – II	3	0	0	0	3
4	J31EB	Operations Research	3	1	0	0	4
5	BTMEE1	Professional Elective – I	3	0	0	0	3
6	BTMEO1	Open Elective – I	3	0	0	0	3
7	J3131	Thermal Engineering Lab	0	0	2	0	1
8	J3132	Machine Tools Lab	0	0	2	0	1
9	J3133	Internship –II	0	0	2	0	1
10	J31M2	Cyber Security	2	0	0	0	0
11	J3101	Employability Skills	2	0	0	0	0
Total			**22**	**1**	**6**	**0**	**22**

III YEAR – II SEMESTER

S. No.	Code	Course Title	L	T	P	D	Credits
1	J323A	Design of Machine Members – II	3	0	0	0	3
2	J323B	Heat Transfer	3	1	0	0	4
3	J323C	Metrology and Instrumentation	3	0	0	0	3
4	BTMEO2	Professional Elective – II	3	0	0	0	3
5	BTMEE2	Open Elective – II	3	0	0	0	3
6	J3231	Metrology and Instrumentation Lab	0	0	2	0	1
7	J3232	Heat Transfer Lab	0	0	2	0	1
8	J3201	Life Skills and Professional Skills Lab	0	0	4	0	2
9	J32M1	Artificial Intelligence	2	0	0	0	0
Total			**17**	**1**	**8**	**0**	**20**

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MECHANICAL ENGINEERING

B. Tech Course Structure -R20

IV YEAR – I SEMESTER

S. No.	Code	Course Title	L	T	P	D	Credits
1	J413A	CAD/CAM	2	0	0	0	2
2	J413K	Finite Element Methods	3	0	0	0	3
3	BTMEE3	Professional Elective – III	3	0	0	0	3
4	BTMEE4	Professional Elective – IV	3	0	0	0	3
5	BTMEE5	Professional Elective – V	3	0	0	0	3
6	BTMEO3	Open Elective –III	3	0	0	0	3
7	J4131	Computer Aided Engineering Lab	0	0	2	0	1
8	J4132	CAM &PDP Lab	0	0	2	0	1
9	J4133	Industry Oriented Mini Project	0	0	4	0	2
10	J4134	Project Stage –I	0	0	6	0	3
Total			**17**	**0**	**14**	**0**	**24**

IV YEAR – II SEMESTER

S. No.	Code	Course Title	L	T	P	D	Credits
1	BTMEE6	Professional Elective – VI	3	0	0	0	3
2	BTMEO4	Open Elective – IV	3	0	0	0	3
3	J4231	Project Stage – II	0	0	14	0	7
4	J4232	Seminar	0	0	2	0	1
Total			**6**	**0**	**16**	**0**	**14**

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MECHANICAL ENGINEERING

List of Professional Elective Courses - R20

S. No.	Code	Course Title	L	T		P	D	Credits
Professional Elective Course – I								
1	J313D	Design for Manufacturing and Assembly	3	0		0	0	3
2	J313E	Theory of Metal Cutting	3	0		0	0	3
3	J313F	Power Plant Engineering	3	0		0	0	3
Professional Elective Course – II								
1	J323E	Mechanical Vibrations	3	0		0	0	3
2	J323F	Machine Tool Design	3	0		0	0	3
3	J323G	Automobile Engineering	3	0		0	0	3
Professional Elective Course – III								
1	J413B	Manufacturing of Composites	3	0		0	0	3
2	J413C	Micro Electro Mechanical Systems	3	0		0	0	3
3	J413D	Refrigeration and Air Conditioning	3	0		0	0	3
Professional Elective Course – IV								
1	J413E	Robotics	3	0		0	0	3
2	J413F	Production Planning and Control	3	0		0	0	3
3	J413G	Computational Fluid Dynamics	3	0		0	0	3
Professional Elective Course – V								
1	J413H	Additive Manufacturing	3	0		0	0	3
2	J413I	CNC Technology	3	0		0	0	3
3	J413J	Jet Propulsion and Rocket Engineering	3	0		0	0	3
Professional Elective Course – VI								
1	J423A	Quality Engineering in Manufacturing	3	0		0	0	3
2	J423B	Automation in Manufacturing	3	0		0	0	3
3	J423C	Renewable Energy Systems	3	0		0	0	3

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R20 - OPEN ELECTIVES

List of Subjects offered by various Board of Studies

<u>Open Elective – I</u>

S.No.	Code	Name of the Subject	Name of the BOS offering the Subject
1	J31OA	Elements of CIVIL Engineering	CIVIL
2	J31OB	Environmental Impact Assessment	CIVIL
3	J31OC	Energy Engineering	EEE
4	J31OD	Sensors and Transducers	EEE
5	J31OE	Automotive Technology	MECH
6	J31OG	Principles of Sensors and their Application	ECE
7	J31OH	Principles of Communications	ECE
8	J31OI	Fundamentals of Database Management System	CSE
9	J31OJ	Principles of Operating Systems	CSE
10	J31OK	Introduction to Data Structures through Python	IT
11	J31OL	Introduction to Web Design	IT
12	J31OM	Basics of Object Oriented Programming	ECM
13	J31ON	Fundamentals of Digital Logic Design	ECM
14	J31OP	Introduction to Mining Technology	MIE
15	J31OR	Numerical solution of Ordinary differential equations (Common to EEE,ECE,CSE,IT & ECM) OR Number Theory & Cryptography (Common to CE,EEE,ME,ECE,CSE,IT,ECM & MIE)	Mathematics
16	J31OS	Nano Materials	Physics
17	J31OT	Chemistry of Engineering Materials	Chemistry
18	J31OU	Technical Communication Skills	English
19	J31OV	Entrepreneurship	MBA

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R20 - OPEN ELECTIVES
List of Subjects offered by various Board of Studies

Open Elective – II

S.No.	Code	Name of the Subject	Name of the BOS offering the Subject
1	J32OA	Construction Management, Contracts and valuation	CIVIL
2	J32OB	Energy Audit & Green buildings	CIVIL
3	J32OC	Hybrid Electric Vehicles	EEE
4	J32OD	Energy Auditing Conservation and Managements	EEE
5	J32OE	Fundamentals of Operations Research	MECH
6	J32OG	Software Defined Radio	ECE
7	J32OH	Basics of IC Technology	ECE
8	J32OI	Fundamentals of Computer Networks	CSE
9	J32OJ	Introduction to Java Programming	CSE
10	J32OK	Computer Organization	IT
11	J32OL	Fundamentals of Human Computer Interaction	IT
12	J32OM	Introduction to Microprocessors and Microcontrollers	ECM
13	J32ON	Internet of Things	ECM
14	J32OP	Introduction to Surface Mining	MIE
15	J32OR	Numerical Solution of Partial Differential Equations	Mathematics
16	J32OS	Advanced Physics for Engineers	Physics
17	J32OT	Green Chemistry	Chemistry
18	J32OU	Technical Writing Skills	English
19	J32OV	Research Methodology	MBA

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R20 - OPEN ELECTIVES
List of Subjects offered by various Board of Studies

Open Elective – III

S.No.	Code	Name of the Subject	Name of the BOS offering the Subject
1	J41OA	Waste Management	CIVIL
2	J41OB	Road Safety Engineering	CIVIL
3	J41OC	Electrical Engineering Materials	EEE
4	J41OD	Non-Conventional Energy Sources	EEE
5	J41OE	Basics of Robotics	MECH
6	J41OG	Digital Systems Using VHDL	ECE
7	J41OH	MATLAB Programming Language	ECE
8	J41OI	Introduction to Python Programming	CSE
9	J41OJ	Introduction to Mobile Application Development	CSE
10	J41OK	Fundamentals of Object Oriented Programming Through C++	IT
11	J41OL	Fundamentals of Data Science	IT
12	J41OM	Introduction to Neural networks	ECM
13	J41ON	IC Applications	ECM
14	J41OP	Introduction to Geology	MIE
15	J41OR	Integral Transforms And Integral Equations	Mathematics
16	J41OS	NDT And Vacuum Technology	Physics
17	J41OT	Nano Chemistry	Chemistry
18	J41OU	Teamwork and Team Building	English
19	J41OV	Intellectual Property Rights	MBA

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R20 - OPEN ELECTIVES
List of Subjects offered by various Board of Studies

Open Elective – IV

S.No.	Code	Name of the Subject	Name of the BOS offering the Subject
1	J42OA	Air Pollution & Control	CIVIL
2	J42OB	Disaster Management	CIVIL
3	J42OC	Special Electrical Machines	EEE
4	J42OD	Electrical Safety Engineering	EEE
5	J42OE	Digital Manufacturing	MECH
6	J42OG	Consumer Electronics	ECE
7	J42OH	Nano Electronics	ECE
8	J42OI	Fundamentals of Cloud Computing	CSE
9	J42OJ	Introduction to Big Data Analytics	CSE
10	J42OK	Fundamentals of E-Commerce	IT
11	J42OL	E-Waste Management	IT
12	J42OM	Introduction to Embedded Systems	ECM
13	J42ON	Introduction to Network Security	ECM
14	J42OP	Introduction to Mine Environment	MIE

<table>
<tr><td>2020-21
onwards</td><td colspan="1">J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B. Tech: ME
I Year – I Sem</td></tr>
<tr><td>Course Code:
J110A</td><td rowspan="2">DIFFERENTIAL EQUATIONS
AND CALCULUS
(Common to CE, EEE,ME,ECE,
CSE,IT, ECM & MIE)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 4</td><td>3</td><td>1</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:
This course will enable students to:
1. methods of solving first order differential equations and learn about its applications to basic engineering problems
2. methods of solving higher order differential equations and learn about its applications to basic engineering problems
3. the Fourier series of a periodic function
4. improper integrals using Beta and Gamma functions
5. maximum and minimum value of a given function

Module 1: First Order, First Degree ODE and it Applications:
Differential equations of first order and first degree - Exact differential equation, Linear and Bernoulli differential equation, applications of differential equations of first order and first degree -Newton's law of cooling, Law of natural growth and decay, orthogonal trajectories.

Module 2: Second and Higher order ODE with Constant Coefficients:
Second order linear differential equations with constant coefficients: Solution of Homogenous, non-homogeneous differential equations, Non-Homogeneous terms of the type e^{ax}, sin(ax), cos (ax),polynomials in x, $e^{ax}.V(x)$, xV(x).Method of variation of parameters; Equations reducible to linear ODE with constant Coefficients: Euler-Cauchy equation, Legendre's equation.

Module 3: Sequences and Fourier series:
Unit 1: Definition of a Sequence, limit; Convergent, Divergent and Oscillatory sequences.
Series: Convergent, Divergent and Oscillatory Series; Series of positive terms; Comparison test, P-test, Alternating series: Leibnitz test, Absolute and Conditionally Convergence.

Unit 2: Determination of Fourier coefficients – Fourier series – even and odd functions, Fourier series in an arbitrary interval- even and odd periodic continuation – Half-range Fourier sine and cosine expansions

Module 4: Calculus and Improper Integrals:

Unit 1: Mean value theorems: Rolle's Theorem, Lagrange's Mean value theorem with their Geometrical Interpretation and applications, Cauchy's Mean value Theorem. Taylor's Series

Unit 2: Definition of Improper Integrals, Beta functions: Properties and other forms of beta functions (statements only) and problems, Gamma functions: Properties of Gamma functions (statements only), Relation between the Beta and Gamma functions (without proofs) and Evaluation of improper integrals using Beta and Gamma functions

Module 5: Functions of Multi Variables

Limits, Continuity, Partial differentiation, partial derivatives of first and second order, Jacobian, Taylor's theorem of two variables (without proof). Maxima and Minima of two variables, Lagrange's method of undetermined Multipliers

Text Books:

1. "Higher Engineering Mathematics", B.S. Grewal, Khanna Publishers, 2015
2. "Advanced Engineering Mathematics",Erwin kreyszig, 9^{th} Edition, John Wiley & Sons,2006.
3. "Advanced Engineering Mathematics", R.K.Jain & S.R.K. Iyengar, Narosa Publications, 5^{th} Edition, 2015.

Reference Books:

1. "A text book of Engineering Mathematics", N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2008.
2. "Higher Engineering Mathematics", Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11^{th} Reprint, 2010.

E - Resources:

1. https://nptel.ac.in/courses/111106100
2. https://www.math.ust.hk/~machas/differential-equations.pdf
3. https://en.wikipedia.org/wiki/Fourier_series
4. https://www.khanacademy.org/math/ap-calculus-bc/bc-integration-new/bc-6-13/a/improper-integrals-review
5. https://onlinecourses.nptel.ac.in/noc20_ma15/preview

Course Outcomes:

On completion of the course, the students will be able to:

1. Formulate and solve the First order linear differential equations
2. Apply the concepts of higher order linear differential equations with constant coefficients solving physical problems arising in engineering.
3. Determine Fourier series expansion of a given function
4. Analyse the improper integrals
5. Find the maxima and minima of multivariable functions.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	3	..	..	..	..	..	..	..	3	1	1
CO2	3	3	2	3	..	..	..	..	..	..	..	3	1	2
CO3	2	2	1	1	..	..	..	..	..	..	..	2	1	-
CO4	3	3	2	1	..	..	..	..	..	..	..	2	2	1
CO5	3	3	2	2	..	..	..	..	..	..	..	2	1	2
Average	3	3	1.9	1.6	-	-	-	-	-	-	-	2.4	1.2	1.5

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
I Year – I Sem</td></tr>
<tr><td>Course Code: J110B</td><td rowspan="2">ENGLISH
(Common to CE,EEE, ME & MIE)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:
This course will enable students to:

1. To improve the language proficiency of students in English with an emphasis on LSRW skills
2. To enrich Vocabulary and Grammar.
3. To equip students to study academic subjects more effectively and critically using the theoretical and practical components of English syllabus.
4. To develop study skills
5. To enhance the communication skills in formal and informal situations.

Module 1:
'The Raman Effect' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.
Vocabulary Building: The Concept of Word Formation --The Use of Prefixes and Suffixes.
Grammar: Identifying Common Errors in Writing with Reference to Articles and Prepositions. **Reading:** Reading and Its Importance- Techniques for Effective Reading.
Basic Writing Skills: Sentence Structures -Use of Phrases and Clauses in Sentences- Importance of Proper Punctuation- Techniques for writing precisely – **Paragraph writing** – Types, Structures and Features of a Paragraph - Creating Coherence- Organizing Principles of Paragraphs in Documents.

Module 2:
'Ancient Architecture in India' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.
Vocabulary: Synonyms and Antonyms, Homophones, Homonyms, and Homographs.
Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.
Reading: Improving Comprehension Skills – Techniques for Good Comprehension
Writing: Format of a Formal Letter-**Writing Formal Letters** E.g.., Letter of Complaint, Letter of Requisition, and Job Application with Resume.

Module 3:
'Blue Jeans' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.
Vocabulary: Acquaintance with Prefixes and Suffixes from Foreign Languages in English to form Derivatives-Words from Foreign Languages and their Use in English.
Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.
Reading: Sub-skills of Reading- Skimming and Scanning
Writing: Nature and Style of Sensible Writing- **Defining- Describing** Objects, Places and Events – **Classifying-** Providing Examples or Evidence and Essay Writing

Module 4:
'What Should You Be Eating' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.
Vocabulary: Standard Abbreviations in English
Grammar: Redundancies and Clichés in Oral and Written Communication.
Reading: Comprehension**-** Intensive Reading and Extensive Reading
Writing: Writing Practices--Writing Introduction and Conclusion -Précis Writing.

Module 5:
'How a Chinese Billionaire Built Her Fortune' from the prescribed textbook 'English for Engineers' published by Cambridge University Press.
Vocabulary: Technical Vocabulary and their usage
Grammar: Common Errors in English
Reading: Reading Comprehension-Exercises for Practice
Writing: Technical Reports- Introduction – Characteristics of a Report – Categories of Reports

Text Books:
1. "English for Engineers", Sudarshana, N.P. and Savitha, C, Cambridge University Press, (2018).

Reference Books:

1. Swan, M. (2016). Practical English Usage. Oxford University Press.
2. Kumar, S and Lata, P. (2018). Communication Skills. Oxford University Press.
3. Wood, F.T. (2007). Remedial English Grammar. Macmillan.
4. Zinsser, William. (2001). On Writing Well. Harper Resource Book.
5. Hamp – Lyons, L. (2006). Study Writing. Cambridge University Press.
6. Exercises in Spoken English. Parts I –III. CIEFL, Hyderabad. Oxford University Press.

Course Outcomes:
On completion of the course, the students will be able to:
1. Use English Language effectively in spoken and written forms.

2. Comprehend the given texts and respond appropriately.
3. Use the proper vocabulary and grammatically correct sentences.
4. Communicate confidently in various contexts and different cultures.
5. Acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	..	..	..	..	..	..	..	..	..	2	..	..	-	-
CO2	..	..	..	..	..	..	..	..	..	..	2	..	-	-
CO3	..	..	..	..	..	..	..	..	..	2	..	..	-	-
CO4	..	..	..	..	..	..	..	..	..	2	..	..	-	-
CO5	..	..	..	..	..	..	..	..	..	2	..	..	-	-
Average	..	..	..	..	..	..	..	..	..	2	2	..	-	-

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="1">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
I Year – I Sem</td></tr>
<tr><td>Course Code: J110C</td><td rowspan="2">ENGINEERING PHYSICS
(Common to CE, ME & MIE)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:
This course will enable students to:
1. Study various crystal structures and probing methods like X-Ray diffraction.
2. Impart knowledge concerning the electrical behavior of dielectric & magnetic materials.
3. Understands the fundamentals of oscillations and ultrasonics.
4. Explain principles of physical optics.
5. Understand basic lasing action; study various types of lasers and to have basic idea of fiber optics.

Module 1: Crystal Structures & X-ray Diffraction
Unit-1: Crystal Structures: Space lattice, crystallographic axes, Unit cell, Lattice parameters, Crystal systems, Bravais lattices, Atomic radius, Coordination number and atomic packing fraction of SC, BCC and FCC lattices, HCP structures. Miller indices, Crystal planes and directions, Inter-planar spacing of orthogonal crystal systems
Unit 2: X-ray Diffraction: Introduction, Bragg's law, Laue and Powder methods, Application of XRD to analyze Cubic structure.

Module 2: Dielectric Properties & Magnetic Properties
Unit 1: Dielectric Properties: Basic definitions, electronic, ionic and orientation polarizations (quantitative treatment), Internal fields in Solids, Clausius - Mossotti equation, Applications – Piezo electricity and Ferro-electricity.
Unit-2: Magnetic Properties: Basic definitions, origin of magnetic moment, Bohr magneton, classification of dia, para and ferro magnetic materials on the basis of magnetic moment, domain theory of ferro magnetism on the basis of hysteresis curve.

Module 3: Vibrations & Ultrasonic
Unit-1: Vibrations: Simple harmonic vibrations and its solutions (quantitative), Damped, Forced vibrations (qualitative) and Resonance. Applications: Torsional Pendulum and Compound Pendulum.
Unit-2: Ultrasonic: Production and properties of ultrasonics, piezoelectric effect Method, Applications of ultrasonics special reference to NDT.

Module 4: Wave Optics

Unit-1: Interference: Principle of Superposition, coherence and methods to produce coherent sources, interference in thin film by reflected light, Newton's Rings.

Unit-2: Diffraction – Distinction between Fraunhofer and Fresnel Diffraction, Farunhofer diffraction due to single slit, Plane Diffraction Grating, resolving power of Grating.

Unit-3: Polarization – Introduction, Polarization of light waves, Plane of vibration, plane of polarization, Malus's law, Brewster's law.

Module 5: Lasers & Fibre Optics

Unit-1: Lasers: Introduction, absorption, spontaneous emission, Stimulated emission, calculation of Einstein co-efficient for A &B, Population inversion, Pumping, Lasing action, Types of Lasers: Ruby laser, He-Ne laser, Semiconductor laser, Applications of laser.

Unit-2: Fibre Optics: Introduction, Construction and working principle of Optical fibre, Acceptance angle, Acceptance cone and Numerical aperture, Types of optical fibres, Applications of optical fibres.

Text Books:

1. "Engineering Mechanics", 2ndEdition, MK Harbola, Cengage Learning.
2. "Engineering Physics", Gaur and Gupta, McGraw Hills.
3. "Optics", Ajoy Ghatak, McGraw Hill Education, 2012.

Reference Books:

1. "The physics of vibrations and waves", H. J. Pain, Wiley, 2006.
2. "Principles of Lasers", O.Svelto.
3. "Introduction to Mechanics", M.K.Verma, Universities Press.
4. "Engineering Physics", P.K.Palanisamy, Scitech Publications, Fourth edition.

E - Resources:

1. http://www.gistrayagada.ac.in/gist_diploma/PHYSICS-StudyMaterial.pdf
2. http://www.faadooengineers.com/threads/3300-Applied-Physics-Ebooks-pdf freedownload?s=1b6cb6b1de4e7152298bd9d60156cd11
3. http://aip.scitation.org/journal/jap
4. http://www.springer.com/physics/journal/340 5. 5.
5. http://nptel.ac.in/courses/115101005/1
6. http://nptel.ac.in/courses/115106061/13.

Course Outcomes:

On completion of the course, the students will be able to:

1. familiar with Bragg's Law and explain its the relation to crystal structure
2. Explain the principles of physics in dielectrics, magnetic materials useful to engineering Applications.

3. Describe the types of oscillations and analyze them.
4. Interpret the intensity variation of light due to interference, diffraction and polarization.
5. Analyze working principle of lasers and to summarize its applications.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	2	-	-	-	-	-	-	-	-	-	1	1
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	1	3
CO4	2	2	1	-	-	-	-	-	-	-	-	-	1	2
CO5	3	1	2	-	-	-	-	-	-	-	-	-	2	1
Average	3	2	1.6	-	-	-	-	-	-	-	-	-	1.25	1.75

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
I Year – I Sem</td></tr>
<tr><td>Course Code: J115A</td><td rowspan="2">PROGRAMMING FOR PROBLEM SOLVING
(Common to CE,EEE ME & MIE)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:

This course will enable students to:

1. Learn the fundamentals of computers.
2. Understand the various steps in program development.
3. Understand the syntax and semantics of C programming language.
4. Learn the usage of structured programming approach in solving problems.
5. Gain the knowledge on searching and sorting methods

Module 1: INTRODUCTION TO PROGRAMMING:

Unit 1: Introduction to components of a computer system: disks, primary and secondary memory, processor, operating system, compilers, creating, compiling and executing a program etc., Number systems.

Unit 2: Introduction to Algorithms: steps to solve logical and numerical problems. Representation of Algorithm, Flowchart/Pseudo code with examples, Program design and structured programming

Unit 3: In Introduction to C Programming Language: variables (with data types and space requirements), Syntax and Logical Errors in compilation, object and executable code, Operators, expressions and precedence, Expression evaluation, Storage classes (auto, extern, static and register), type conversion, The main method and command line arguments

Unit 4: Bitwise operations: Bitwise AND, OR, XOR and NOT operators Conditional Branching and Loops: Writing and evaluation of conditionals and consequent branching with if, if-else, switch-case, ternary operator, goto, Iteration with for, while, do- while loops.I/O: Simple input and output with scanf and printf, formatted I/O, Introduction to stdin, stdout and stderr.

Module 2: ARRAYS, STRINGS, STRUCTURES AND PREPROCESSOR:

Unit 1: Arrays: one and two dimensional arrays, creating, accessing and manipulating elements of arrays.

Unit 2: Strings: Introduction to strings, handling strings as array of characters, basic string functions available in C (strlen, strcat, strcpy, strstr etc.), arrays of strings

Unit 3: Structures: Defining structures, initializing structures, unions, Array of structures.

Unit 4: Preprocessor: Commonly used Preprocessor commands like include, define, undef, If, ifdef, ifndef. ***Practice:*** Situational Dialogues – Role-Play- Expressions in Various Situations –Making Requests and Seeking Permissions - Telephone etiquette.

Module 3: POINTERS AND FILE HANDLING IN C:

Unit 1: Pointers: Idea of pointers, Defining pointers, Pointers to Arrays and Structures, Use of Pointers in self-referential structures, usage of self referential structures in linked list (no implementation) Enumeration data type.

Unit 2: Files: Text and Binary files, Creating and Reading and writing text and binary files, Appending data to existing files, Writing and reading structures using binary files, Random access using fseek, ftell and rewind functions

Module 4: FUNCTION AND DYNAMIC MEMORY ALLOCATION:

Unit 1: Functions: Designing structured programs, Declaring a function, Signature of a function, Parameters and return type of a function, passing parameters to functions, call by value, Passing arrays to functions, passing pointers to functions, idea of call by reference, Some C standard functions and libraries.

Unit 2: Recursion: Simple programs, such as Finding Factorial, Fibonacci series etc., Limitations of Recursive functions.

Unit 3: Dynamic memory allocation: Allocating and freeing memory, Allocating memory for arrays of different data types.

Module 5:

INTRODUCTION TO ALGORITHMS: Basic searching algorithms (linear and binary search techniques), Basic sorting algorithms (Bubble, Insertion, Quick, Merge and Selection sort algorithms) Basic concept of order of complexity through the example programs

TEXT BOOKS:

1. Ream Thareja, Programming in C, Oxford university press.
2. B.A. Forouzan and R.F. Gilberg, C Programming and Data Structures, Cengage Learning, (3rd Edition)

REFERENCES:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
3. Stephen G. Kochan, Programming in C, Fourth Edition, Pearson Education.
4. Herbert Schildt, C: The Complete Reference, McGraw Hill, 4th Edition
5. Byron Gottfried, Schaum's Outline of Programming with C,McGraw-Hill

Course Outcomes:

On completion of the course, the students will be able to:

1. Design the algorithms/flowcharts of C-programs.
2. Write the Code and test a given logic in C programming language.
3. Decompose a problem into functions and to develop modular reusable code.
4. Make Use of arrays, pointers, strings and structures to write C Programs.
5. Apply searching and sorting algorithms

CO-PO/PSO Mapping Chart (Draft) (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 – Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	-	-	-	-	-	-	-	-	-	1	-	-
CO2	2	2	3	2	2	-	-	-	-	-	-	-	1	-
CO3	3	2	2	-	-	-	-	-	-	-	-	1	1	-
CO4	3	2	2	2	-	-	-	-	-	-	-	1	1	1
CO5	3	2	2	-	-	-	-	-	-	-	-	1	2	2
Average	2.8	2.0	2.3	2.0	2.0	-	-	-	-	-	-	1.0	1.25	1.5

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B. Tech: ME
I Year – I Sem</td></tr>
<tr><td>Course Code: J1101</td><td rowspan="2">ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB
(Common to CE,EEE ME & MIE)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 1</td><td>0</td><td>0</td><td>2</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:
To facilitate computer-assisted multi-media instruction enabling individualized and independent language learning

1. To sensitize students to the nuances of English speech sounds, word accent, intonation and rhythm
2. To bring about a consistent accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking
3. To improve the fluency of students in spoken English and neutralize their mother tongue influence
4. To train students to use language appropriately for public speaking.
5. To train students to face the interviews

The following course content is prescribed for the English for the English Language and Communication Skills Lab based on Unit -6 of AICTE Model Curriculum 2018 for B. Tech First English. As the syllabus is very limited, it is required to prepare teaching/learning materials by the teachers collectively in the form of handouts based on the needs of the students in their respective colleges for effective teaching/learning and timesaving in the lab.
SYLABUS:
English Language and Communication Sills Lab (ELCS) will have two parts:

a) **Computer Assisted Language Learning (CALL) Lab:**
b) Interactive Communication Skills (ICS) Lab:

Module 1:
CALL Lab:
Understand: Listening Skill- Its importance – Purpose- Process- Types- Barriers of Listening. ***Practice*****:** Introduction to Phonetics – Speech Sounds – Vowels and Consonants.
ICS Lab:
Understand: Communication at Work Place- Spoken vs. Written language.
Practice: Ice-Breaking Activity and JAM Session- Situational Dialogues – Greetings – Taking Leave – Introducing Oneself and Others.

Module 2:

CALL Lab:

Understand: Structure of Syllables – Word Stress and Rhythm– Weak Forms and Strong Forms in Context.

Practice: Basic Rules of Word Accent - Stress Shift - Weak Forms and Strong Forms in Context.

ICS Lab:

Understand: Features of Good Conversation – Non-verbal Communication.

Practice: Situational Dialogues – Role-Play- Expressions in Various Situations – Making Requests and Seeking Permissions - Telephone Etiquette.

Module 3:

CALL Lab:

Understand: Intonation-Errors in Pronunciation-the Influence of Mother Tongue (MTI).

Practice: Common Indian Variants in Pronunciation – Differences in British and American Pronunciation.

ICS Lab:

Understand: How to make Formal Presentations.

Practice: Formal Presentations.

Module 4:

CALL Lab:

Understand: Listening for General Details.

Practice: Listening Comprehension Tests.

ICS Lab:

Understand: Public Speaking – Exposure to Structured Talks.

Practice: Making a Short Speech – Extempore.

Module 5:

CALL Lab:

Understand: Listening for Specific Details.

Practice: Listening Comprehension Tests.

ICS Lab:

Understand: Interview Skills.

Practice: Mock Interviews.

Facilities:

Computer Assisted Language Learning (CALL) Lab:

The Computer Assisted Language Learning Lab has to accommodate 30 students with 30 systems, with one Master Console, LAN facility and English language learning software for self- study by students. **System Requirement (Hardware**

component): *Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:*
i) Computers with Suitable Configuration
ii) High Fidelity Headphones

Interactive Communication Skills (ICS) Lab:

1. **The Interactive Communication Skills Lab:** A Spacious room with movable chairs and audio-visual aids with a Public-Address System, a LCD and a projector etc.

Course Outcomes:

On completion of the course, the students will be able to:

1. Better understanding of nuances of English language through audio- visual experience and group activities
2. Neutralization of accent for intelligibility
3. Speaking skills with clarity and confidence which in turn enhances their employability skills
4. The public speaking skills and facing the interviews
5. Good communication skills and use them at workplace.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 – Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	..	..	..	..	2	..	..	..	..	..	..	..	..	..
CO2	..	..	..	..	..	..	..	..	..	1	..	..	..	..
CO3	..	..	..	..	..	..	..	..	..	1	..	..	..	..
CO4	..	..	..	..	..	..	..	..	1	2	..	..	..	..
CO5	..	..	..	..	..	..	..	..	..	2	..	..	..	..
Average	..	..	..	..	2	..	..	..	1	1.49	..	..	..	..

<table>
<tr><td>AY 2020-21
onwards</td><td>J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B. Tech: ME
I Year – I Sem</td></tr>
<tr><td>Course Code:
J1102</td><td rowspan="2">ENGINEERING PHYSICS LAB
(Common to CE, ME & MIE)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 1</td><td>0</td><td>0</td><td>2</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:
This course will enable students to:
1. Demonstrate skills in scientific inquiry, problem solving and laboratory techniques.
2. Demonstrate competency and understanding of the concepts found in Mechanical, Electric and Electronic materials a broad base of knowledge in physics.
3. Solve Experimental problems that potentially draw an experimental knowledge in multiple areas of physics.
4. Upgrade practical knowledge in optics.
5. Analyze the behaviour and characteristics of various materials for its optimum utilization.

List of Experiments:

1. **Melde's Experiment**
   To determine the frequency of a vibrating bar or turning fork using Melde's arrangement
1. **Torsional Pendulum**
   To determine the rigidity modulus of the material of the given wire using torsional pendulum
2. **Newton's Rings**
   To determine the radius of curvature of the lens by forming Newton's rings.
3. **Diffraction Grating**
   To determine the number of lines per inch of the grating.
4. **LCR Circuit**
   To determine the Quality factor of LCR Circuit (Series& Parallel).
5. **Stewart's and Gee's Method**
   To determine the Magnetic induction by using circular coil.
6. **Sonometer**
   To determine the frequency of AC Supply sonometer.
7. **LASER**
   To study the characteristics of LASER sources.
8. **Dielectric Constant**
   To determine the Dielectric constant of the given material.

9. **Optical fiber.**
   Determination of Numerical Aperture and Bending losses of an optical fibre.

Note: Any 8 experiments are to be performed.

Text Books:

1. "Experiments in Applied Physics", Dr. Narendra, L. Mathakari, (Physics Lab Manual 4thedition) ,
2. "Engineering Physics Lab Resources" ,by Department of Physics JBIET.

Course Outcomes:

On completion of the course, the students will be able to:

1. Learn the experimental concepts on in Mechanical, Electric and Electronic materials.
2. Understand principle, concept, working, application and comparison of results with theoretical calculations.
3. Design, characterization and study of properties of material help the students to prepare new materials for various engineering applications.
4. Understand measurement technology.
5. Use new instruments and real time applications in engineering studies.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	2	-	-	-	-	-	-	-	-	-	2	1
CO4	3	-	-	-	-	-	-	-	-	-	-	-	1	1
CO5	3	-	-	-	-	-	-	-	-	-	-	-	1	1
Average	3	1.5	1.33	-	-	-	-	-	-	-	-	-	1.3	1

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech:
I Year – I Sem</td></tr>
<tr><td>Course Code: J1151</td><td rowspan="2">PROGRAMMING FOR PROBLEM SOLVING LAB
(Common to CE,EEE ME & MIE)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 2</td><td>4</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Programming for Problem Solving

Course Objectives:

This course will enable students to:

1. Work with an IDE to create, edit, compile, run and debug programs
2. Analyze the various steps in program development.
3. Develop programs to solve basic problems by understanding basic concepts in C like operators, control statements etc.
4. Develop modular, reusable and readable C Programs using the concepts like functions, arrays etc.
5. Write programs using the Dynamic Memory Allocation concept, files

1. SIMPLE NUMERIC PROBLEMS:

a) Write a program for find the max and min from the three numbers.
b) Write the program for the simple, compound interest.
c) Write program that declares Class awarded for a given percentage of marks, where mark<40%= Failed, 40% to <60% = Second class, 60% to <70%=First class, >=70% = Distinction. Read percentage from standard input.

2. EXPRESSION EVALUATION:

a) Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement)
b) Write a program that finds if a given number is a prime number
c) A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first n terms of the sequence.

3. ARRAYS AND POINTERS AND FUNCTIONS:

a) Write a C program to find the minimum, maximum and average in an array of integers.
b) Write a C program to find Addition of Two Matrices
c) Write a C program to find Multiplication of Two Matrices.
d) Write C programs that use both recursive and non-recursive functions

e) Write a program for reading elements using pointer into array and display the values using array.

4. Files:

a) Write a C program to display the contents of a file to standard output device.
b) Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents
c) Write a C program to count the number of times a character occurs in a text file. The filename and the character are supplied as command line arguments.

5. Strings:

d) Write a C program to determine if the given string is a palindrome or not (Spelled
e) Same in both directions with or without a meaning like madam, civic, noon, abcba, etc.)
f) Write a C program to count the lines, words and characters in a given text.

6. Sorting and Searching:

a) Write a C program for using binary search method.
b) Write a C program for linear search.
c) Write a C program that implements the Bubble sort method.
d) Write a C program that implements the Insertion sort method.
e) Write a C program that implements the Quick sort method.
f) Write a C program that implements the Merge sort method.

ADDITIONAL PROGRAMS (Given to Student as Assignment):

1) Write a program that prints a multiplication table for a given number and the number of rows in the table. For example, for a number 5 and rows = 3, the output should be:
   a. 5 x 1 = 5
   b. 5 x 2 =10
   c. 5 x 3 =15
2) Write a program that shows the binary equivalent of a given positive number between 0 to255.
3) Write a C program to find the sum of individual digits of a positive integer and test given number is palindrome.
4) Write a C program to generate all the prime numbers between 1 and n, where n is a value
   supplied by the user.
5) Write a C program to calculate the following, where x is a fractional value.

1-x/2+x^2/4-x^3/6.

6) Write a C program to read in two numbers, x and n, and then compute the sum of this Geometricprogression:1+x+x^2+x^3+............................+x^n. For example: if n is3 and xis5, then the program computes 1+5+25+125.
7) Write a C program to find the minimum, maximum and average in an array of integers.
8) Write a functions to compute mean, variance, Standard Deviation, sorting of n elements in single dimension array.
9) Write a C program that uses functions to perform the following:
   (a) Transpose of a matrix with memory dynamically allocated for the new matrix as row and column counts may not be same.
   (b) To find the factorial of a given integer.
   (c) To find the GCD (greatest common divisor) of two given integers.
10) Write a C program that does the following:
   (a) It should first create a binary file and store 10 integers, where the file name and 10 values are given in the command line. (hint: convert the strings using a to i function) Now the program asks for an index and a value from the user and the value at that index should be changed to the new value in the file. (hint: use fseek function). The program should then read all 10 values and print them back.
   (b) Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file).
11) Write a C program to convert a Roman numeral ranging from I to L to its decimal equivalent.
12) Write a C program that converts a number ranging from 1 to 50 to Roman equivalent
13) Write a C program that uses functions to perform the following operations:
   (a)To insert a sub-string in to a given main string from a given position
   (b) To delete n Characters from a given position in a given string.
14) Write a C program to construct a pyramid of numbers as follows:

1	*	1	1	*
1 2	* *	2 3	2 2	* *
1 2 3	* * *	4 5 6	3 3 3	* * *
			4 4 4 4	* *
				*

15) Write a C program that sorts a given array of names.

Reference Books:

1. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition)

2. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
3. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression)
4. Stephen G. Kochan, Programming in C, Fourth Edition, Pearson Education.
5. Herbert Schildt, C: The Complete Reference, McGrawHill, 4th Edition

Course Outcomes:

On completion of the course, the students will be able to:

1. **Formulate** the algorithms for simple problems
2. **Examine** syntax errors as reported by the compilers
3. **Define** and manipulate data with arrays, strings and structures
4. **Make** use of pointers of different functions types
5. **Create**, **read** and **write** to and from simple text and binary files

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	-	-	-	-	-	-	2	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	2	-	-	-	-	-
CO3	3	2	-	-	-	-	-	-	2	-	-	-	1	-
CO4	3	2	-	-	-	-	-	-	2	-	-	-	1	1
CO5	3	2	-	-	-	-	-	-	2	-	-	-	2	1
Average	3.0	2.0	-	-	-	-	-	-	2.0	-	-	-	1.3	1

AY 2020-21 onwards	**J. B. Institute of Engineering and Technology (UGC Autonomous)**	**B. Tech: ME I Year – II Sem**			
Course Code: J120A	**LINEAR ALGEBRA AND ADVANCED CALCULUS**	**L**	**T**	**P**	**D**
Credits: 4		**3**	**1**	**0**	**0**

Pre-requisite: Nil

Course Objectives:

This course will enable students to:

1. methods of solving first order differential equations and learn about its applications to basic engineering problems
2. methods of solving higher order differential equations and learn about its applications to basic engineering problems
3. the Fourier series of a periodic function
4. improper integrals using Beta and Gamma functions
5. maximum and minimum value of a given function

Module 1: Matrices and System of Equations

Matrices: Types of Matrices, Symmetric, Hermitian; Skew-symmetric; Skew-Hermitian; orthogonal matrices; Unitary Matrices; rank of a matrix by Echelon form and Normal form, Inverse of Non-singular matrices by Gauss-Jordan method; System of linear equations; solving system of Homogeneous and Non-Homogeneous equations.

Module 2: Eigen values, Eigen vectors and Matrix of Transforms

Linear Transformation and Orthogonal Transformation: Eigen values and Eigenvectors and their properties: Diagonalization of a matrix; Cayley-Hamilton Theorem (without proof); finding inverse and power of a matrix by Cayley-Hamilton Theorem; Quadratic forms and Nature of the Quadratic Forms; Reduction of Quadratic form to canonical forms using Linear Transformation and Orthogonal Transformations.

Module3: Multiple Integrals:

Evaluation of double integrals, change of order of integration, Change of variables (Cartesian & Polar coordinates), evaluation of triple integrals, change of variables (Cartesian to Spherical and Cylindrical polar coordinates) Applications: computation of Areas and volumes. Definition of a Sequence, limit; Convergent, Divergent and Oscillatory sequences.

Module 4:Vector Differential Calculus:
Scalar and vector fields, vector differentiation, level surfaces, directional derivative, gradient of a scalar field, divergence and curl of a vector field, Laplacian, Scalar potential functions, Tangent plane and normal line. Vector Identities (without proofs.

Module 5: Vector Integral Calculus:
Line, Surface and Volume Integrals, Green's theorem in a plane, Gauss-Divergence theorem and Stokes theorem (without proofs).

Text Books:

1. "Higher Engineering Mathematics", B.S. Grewal, Khanna Publishers, 2015
2. "Advanced Engineering Mathematics", Erwin kreyszig, 9th Edition, John Wiley & Sons, 2006.
3. "Advanced Engineering Mathematics", R.K.Jain& S.R.K. Iyengar, Narosa Publications, 5th Edition, 2015.

Reference Books:

1. "A text book of Engineering Mathematics", N.P. Bali and Manish Goyal, Laxmi Publications, Reprint, 2008.
2. "Higher Engineering Mathematics", Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi,11thReprint, 2010.

E - Resources:

1. https://nptel.ac.in/courses/122/104/122104018/
2. https://en.wikipedia.org/wiki/Eigenvalues_and_eigenvectors
3. https://nptel.ac.in/courses/111/107/111107108/
4. https://www.cheric.org/files/education/cyberlecture/e200303/e200303-301.pdf
5. https://www.whitman.edu/mathematics/calculus_online/chapter16.html

Course Outcomes:
On completion of the course, the students will be able to:

1. solve the consistent system of linear equations
2. apply orthogonal congruent Transformations to a quadratic form
3. evaluate multiple integrals in various coordinate system
4. apply the concept of gradient, divergence and curl to formulate engineering problems
5. convert line integrals to surface integrals and surface integrals to volume integrals

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	1	3	-	-	-	-	-	-	-	2	-	-
CO2	3	3	2	3	-	-	-	-	-	-	-	3	-	-
CO3	3	3	2	3	-	-	-	-	-	-	-	3	-	-
CO4	3	3	1	3	-	-	-	-	-	-	-	2	1	1
CO5	3	3	2	3	-	-	-	-	-	-	-	3	1	1
Average	3	3	1.6	3	-	-	-	-	-	-	-	2	1	1

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech: ME I Year – II Sem			
Course Code: J120C	**APPLIED CHEMISTRY** (Common to CE, ME & MIE)	**L**	**T**	**P**	**D**
Credits: 3		**3**	**0**	**0**	**0**

Pre-requisite: Nil

Course Objectives:
This course will enable students to:

1. To understand the microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
2. To know the suitability of water for domestic and industrial purposes.
3. To acquire Knowledge about different types of batteries and to understand the concepts of corrosion.
4. To impart the basic knowledge of spectroscopic techniques and molecular energy levels
5. To acquire knowledge of chemical reactions those are used in the synthesis of molecules

Module 1: Atomic Structure And Theories Of Bonding:
Atomic and Molecular orbitals. Linear Combination of Atomic Orbitals (LCAO), molecular orbitals of diatomic molecules, molecular orbital energy level diagrams of N_2, O_2, F_2, CO and NO.Crystal Field Theory (CFT): Salient Features of CFT – Crystal Field Splitting of transition metal ion d-orbitals in Tetrahedral, Octahedral and square planar geometries. Band structure of solids and effect of doping on conductance..

Module 2: Water And Its Treatment:
Introduction – hardness of water – Causes of hardness - Types of hardness: temporary and permanent – expression and units of hardness – Estimation of hardness of water by complexometric method. Potable water and its specifications. Steps involved in treatment of water – Disinfection of water by chlorination and ozonization. Boiler troubles-scale & sludge formation, foaming & priming. Boiler feed water and its treatment – Calgon conditioning, Phosphate conditioning and Colloidal conditioning. External treatment of water – Ion exchange process. Desalination of water – Reverse osmosis. Numerical problems

Module 3:
Unit-1: Electrochemistry
Electrochemical cells – electrode potential, standard electrode potential, Nernst equation, Numerical problems. types of electrodes – calomel, Quinhydrone and glass electrode. determination of pH of a solution by using quinhydrone and glass electrode.

Electrochemical series and its applications. Batteries – Primary (Lithium cell) and secondary batteries (Lead – acid storage battery Lithium ion battery).

Unit-2: Corrosion

Corrosion- Causes and effects of corrosion – theories of chemical and electrochemical corrosion – mechanism of electrochemical corrosion, Types of corrosion: Galvanic, water-line and pitting corrosion. Factors effecting rate of corrosion, Corrosion control methods- Cathodic protection – Sacrificial anode and impressed current cathodic methods. Techniques of coating-hot dipping, cementation and electroplating of Copper, electroless plating of Nickel.

Module 4: Spectroscopic Techniques And Applications:

Principles of spectroscopy, molar-extinction co-efficient, types of transitions in UV, selection rules, important terms in UV spectra and applications of electronic spectroscopy. Vibratinal spectroscopy-principle, stretching vibrations in IR, selection rule and applications. Basic concepts of Nuclear magnetic resonance Spectroscopy, chemical shift-factors effecting chemical shift (Electro negativity, Anisotropic effect, Hydrogen Bonding)and spin-spin splitting, coupling constant. Introduction to Magnetic resonance imaging.

Module 5:

Unit-1: Reaction Mechanism: Substitution reactions: Nucleophilic substitution reactions: Mechanism of S_N1, S_N2 reactions. Electrophilic and nucleophilic addition reactions: Addition of HBr to propene. Markownikoff and anti Markownikoff's additions. Grignard additions on carbonyl compounds. Elimination reactions: Dehydro halogenation of alkylhalides. Saytzeff rule. Oxidation reactions: Oxidation of alcohols using KMnO4 and chromic acid. Reduction reactions: reduction of carbonyl compounds using $LiAlH_4$& $NaBH_4$.

Unit-2: Synthesis of Drug Molecules: Structure, synthesis and pharmaceutical applications of Paracetamol and Aspirin.

Text Books:

1. "Engineering Chemistry", P. C. Jain & M. Jain, Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
2. "Fundamentals of Molecular Spectroscopy", C.N. Banwell.
3. "Organic Chemistry: Structure and Function", K.P.C. Volhardt and N. E. Schore, 5th Edition.
4. "University Chemistry", B.M. Mahan, Pearson, Narosa Publishing house,New Delhi,IV Edition.
5. "Physical Chemistry", P.W. Atkins, J.D.Paula, Oxford 8th edition.

Reference Books:

1. "Engineering Chemistry", M.Thirumalachary and Laxminarayan, Scitech Publications.
2. "Engineering Chemistry", B. L. Tembe, Kamaluddin and M.S.Krishnan, NPTEL web book).
3. "Stereochemistry of organic compounds", D.Narsipuri published by New age international publishers.

E - Resources:

1. https://www.imnh.isu.edu/digitalatlas/hydr/basics/main/chmtxt.
2. https://chem.libretexts.org/Core/.../Electrochemistry/Basics_of_Electrochemistry
3. https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/polymers.htm
4. https://www.scribd.com/document/6668739/Chemical-Energy-Source
5. https://sengerandu.wordpress.com/tutorials/physical-metallurgy/engineering-materials/

Course Outcomes:

On completion of the course, the students will be able to:

1. Acquire the knowledge of atomic, molecular and electronic changes,
2. Apply the various methods used in treatment of water for domestic and industrial purposes.
3. Understand the concepts of electrochemistry and corrosion.
4. Understand the basic concepts of spectroscopy.
5. Learn the major chemical reactions and implement the synthesis of drug molecules.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	1	..	..	..	..	..	..	..	..	..	..	..	-	-
CO2	3	..	..	..	..	1	..	..	..	..	..	2	2	1
CO3	3	..	..	..	..	1	..	..	..	..	..	2	1	-
CO4	2	..	..	..	..	..	..	..	..	..	..	..	-	-
CO5	2	..	..	..	2	..	..	..	..	..	..	..	2	2
Average	2.2	..	..	..	2	1	..	..	..	..	..	2	1.6	1.5

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
I Year – II Sem</td></tr>
<tr><td>Course Code: J129A</td><td rowspan="2">BASIC ELECTRICAL AND ELECTRONICS ENGINEERING
(Common to CE, ME & MIE)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 4</td><td>3</td><td>1</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:

This course will enable students to:

1. Introduce the concept of electrical circuits using network laws and theorems.
2. Outline and analyse single phase A.C and three phase A.C circuits.
3. Learn in recognizing of basic electronic devices such as Diodes, Transistors, to build circuits like amplifiers and oscillators etc.
4. Get knowledge on the various parameters useful for designing electronic system.
5. Acquire the knowledge of various configurations, characteristics and applications

Module 1:

Unit 1: DC Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Analysis of simple circuits with DC excitation. Kirchhoff's Laws, Network reduction techniques – series, parallel, series-parallel combinations.

Unit 2: Star to Delta and Delta to Star Transformations, Source transformations, Superposition, Thevenin and Norton Theorems.

Module 2:

Unit 1: AC Circuits: Representation of sinusoidal waveforms, peak and RMS values, phasor representation, real power, reactive power, apparent power, power factor.

Unit 2: Analysis of single-phase AC circuits consisting of R, L, C, RL, RC and RLC series combinations, resonance in series RLC circuit. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module 3:

Unit 1: P-N Junction Diode: P-N junction as a Diode, Symbol, Volt-Ampere characteristics, Ideal versus practical Diode, static and dynamic resistances, Diffusion and Transition Capacitances (qualitative analysis).

Unit 2: Rectifiers and Filters: Diode rectifier: Half wave Rectifier, Ripple Factor-Full Wave Rectifier, Bridge Rectifier, Rectifiers with Filters: Capacitive Filters, L-section Filters, π- section Filters.

Module 4:

Unit 1: Bipolar Junction Transistor (BJT): Symbol, Construction, principle of Operation, Current Components in a junction transistor Common Emitter, Common Base and Common Collector configurations. Transistor Biasing -Operating point, DC and AC load lines, Fixed Bias, Collector to Base bias, Self Bias (Voltage divider bias), Bias stability.

Unit 2: Small signal Transistor Analysis, h- Parameters, Definitions, Determination of h-parameters from CE transistor characteristics, Analysis of CE, CB and CC configurations using h-parameters and their Comparison.

Module 5:

Unit 1: Junction Field Effect Transistor: Construction, Principle of Operation, Volt-Ampere characteristics, comparison of BJT and JFET, small signal Model, MOSFET: Depletion and Enhancement MOSFET – construction and characteristics.

Unit 2: Special Purpose Devices:, Zener Diode ,Construction, operation & characteristics, Zener diode as a simple regulator, principle of operation and Characteristics of Tunnel Diode, , Principle of operation of SCR.

TEXT BOOKS:

1. V.K. Mehta and Rohith Mehta, "Basic Electrical Engineering", S. Chand Publications,2012.
2. S.Salivahan, R. Rengaraj "Basic Electrical Engineering", Tata McGrawHill, 2018.
3. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill,2009.
4. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press,2011.
5. Electronic Devices and circuits –S.Salivahana & N.Suresh Kumar, Mc Graw Hill

REFERENCE BOOKS:

1. Dr. Ramana Pilla, Dr. M. Suryakalavathi, "Basic Electrical Engineering", S. Chand, 2018.
2. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India,1989.
3. Network Theory by Sudhakar, Shyam Mohan Palli, TMH.
4. Network Theory by N.C.Jagan and C.Lakshminarayana, B.S.Publications.
5. Electronic Devices and Circuits- R.L.Boylestad and Louis Nashelsky, PEI/PHI, 9th Edtn, 2006.

E - Resources:

1. https://nptel.ac.in/courses/108/108/108108076/
2. https://nptel.ac.in/courses/108/105/108105112/
3. https://www.electrical4u.com/

Course Outcomes:

On completion of the course, the students will be able to:

1. Illustrate and solve electrical circuits using network laws and theorem.
2. Acquire knowledge about the single phase and three phase electrical circuits.
3. Learn in recognizing of basic electronic devices such as Diodes, Transistors, to build circuits like amplifiers and oscillators etc.
4. Given thorough knowledge on the various parameters useful for designing electronic system.
5. Acquire the knowledge of various configurations, characteristics and applications

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	2	2	2	-	-	-	-	-	-	2	1	-
CO2	3	3	2	2	2	-	-	-	-	-	-	2	1	1
CO3	3	3	3	3	2	-	-	-	-	-	-	2	-	-
CO4	3	2	3	2	2	-	-	-	-	-	-	2	1	-
CO5	3	2	2	2	2	-	-	-	-	-	-	2	2	2
Average	3	2.6	2.4	2.2	2	-	-	-	-	-	-	2	1.25	1.5

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="4">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
I Year – II Sem</td></tr>
<tr><td>Course Code: J123A</td><td rowspan="2">ENGINEERING MECHANICS
(Common to CE, ME, MIE)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Physics.

Course Objectives:
This course will enable students to:

1. Learn to determine resultant of force systems and solve problems using equations of equilibrium.
2. Perform analysis of bodies lying on rough surfaces, the basics structural analysis of trusses and principles of virtual work.
3. Obtain the centroid, Centre of Gravity and moment of inertia for various standard & composite sections.
4. Understand the basic concepts of dynamic and analysis as a particle and rigid bodies.
5. Understand the work energy principles & its applications and to know the concept of simple harmonic motions, free & forced vibration.

Module 1
Unit 1: Resultant Force system: Concepts of force, System of forces, components of forces in a plane and in space systems. Resultant of force systems. Moment of forces and its applications. Couples and its applications
Unit 2: Equilibrium of Force System: Free body diagram, equation of equilibrium of coplanar and spatial force systems.

Module 2
Unit 1: Friction: Laws of friction, application of friction to a single body & connecting systems, wedge friction.
Unit 2: Analysis of Trusses: Analysis of perfect trusses using method of joints and method of sections.
Unit 3: Virtual Work: Virtual displacements, Principle of virtual work for particle and ideal system of rigid bodies- problems on determinate beams only.

Module 3
Unit 1: Centroid & Centre of Gravity: Centroid of simple planes (from first principles), Centroid of Composite sections, Centre of gravity and its implications, Pappu’s theorems.
Unit 2: Area & Mass moment of Inertia: Definition of Area moment of Inertia, Moment of inertia of plane section from first principles, Theorems of moment of

inertia, moment of inertia of standard sections and composite sections, Mass moment of inertia of rectangular and circular plates, cylinder, cone & sphere.

Module 4

Unit 1: Kinematics: Rectilinear and Curvilinear motion, Velocity and Acceleration, Types of Rigid body motion, Kinematics of fixed axis rotation and Plane Motion.

Unit 2: Kinetics: Kinetics of Particle and Rigid Body in Translation, Fixed Axis Rotation, Equations of Plane Motion, Rolling Bodies.

Module 5

Unit 1: Work Energy Method: Work Energy Principle and its application to Translation, Fixed axis rotation and plane motion.

Unit 2: Mechanical Vibrations: Introduction to vibration, free and forced vibrations, simple harmonic motion, simple pendulum and compound pendulum.

Text Books:

1. Timoshenko & Young, "Engineering Mechanics",
2. Vijaykumar K. and J. Suresh Kumar, "Engineering Mechanics Statics and Dynamics", B. S. Publications. 2011..

Reference Books:

1. Basudev Bhattacharya, "Engineering Mechanics", Oxford University Press, New Delhi, 2nd Edition, 2014
2. S.S. Bhavikatti & J.G. Rajasekharappa, "Engineering Mechanics", 2010.
3. Irving. H. Shames, "Engineering Mechanics", Prentice–Hall, 2012.

E - Resources:

1. https://rb.gy/6nbwyl
2. https://rb.gy/s5qltu
3. https://nptel.ac.in/courses/122/104/122104015/

Course Outcomes:

On completion of the course, the students will be able to:

1. **Solve** problems dealing with forces in plane and space force system, draw free body diagrams to analyze various problems in equilibrium.
2. **Analyze** for smooth and frictional surface, simple trusses for forces and virtual work.
3. **Determine** the Centroid, centre of gravity and moment of inertia for elementary.
4. **Solve** problem in kinematics and kinetics of particles and rigid bodies.
5. **Analyze** body motion using work energy principles and able to apply the concept of simple harmonic motion and free vibrations in dynamics.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	2	-	-	-	-	-	-	-	3	1	-
CO2	3	2	2	2	-	-	-	-	-	-	-	3	2	-
CO3	3	2	2	2	-	-	-	-	-	-	-	3	2	-
CO4	3	2	1	3	-	-	-	-	-	-	-	3	2	-
CO5	3	2	1	3	-	-	-	-	-	-	-	3	2	-
Average	3	2	1.6	2.4	-	-	-	-	-	-	-	3	1.8	-

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="1">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
I Year – II Sem</td></tr>
<tr><td>Course Code: J1201</td><td rowspan="2">CHEMISTRY LAB
(Common to CE, ME & MIE)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 1</td><td>0</td><td>0</td><td>2</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:
This course will enable students to:

1. Estimation of hardness and chloride content in water to check its suitability for drinking purpose.
2. To determine the rate constant of reactions from concentrations as a function of time.
3. The measurement of physical properties like adsorption and viscosity.
4. To synthesize the drug molecules and check the purity of organic molecules by thin layer chromatographic (TLC) technique.
5. To measure the conductance and EMF values of different solutions.

List of Experiments

Experiment 1 :	Determination of total hardness of water by complexometric method using EDTA
Experiment 2 :	Determination of chloride content of water by Argentometry
Experiment 3 :	Estimation of an HCl by Conductometric titrations
Experiment 4 :	Estimation of Acetic acid by Conductometric titrations
Experiment 5 :	Estimation of HCl by Potentiometric titrations.
Experiment 6 :	Estimation of Fe^{2+} by Potentiometry using KMnO4
Experiment 7 :	Estimation of amount of $Cu^{+2}$by Colorimetry.
Experiment 8 :	Estimation of amount of $KMnO_4$ by Colorimetry.
Experiment 9 :	Synthesis of Aspirin and Paracetamol.
Experiment 10 :	Determination of acid value of coconut oil .
Experiment 11 :	Thin layer chromatography calculation of R_f values. Eg.ortho and para nitro phenols
Experiment 12 :	Determination of viscosity of castor oil and ground nut oil by using Ostwald's viscometer.
Experiment 13 :	Determination of partition coefficient of acetic acid between n-butanol and water.
Experiment 14 :	Determination of surface tension of a give liquid using stalagmometer.

Note: Any 8 experiments are to be performed.

Text Books:

1. "Senior practical physical chemistry",B.D. Khosla, A. Gulati and V. Garg ,(R. Chand & Co., Delhi)
2. "An introduction to practical chemistry", K.K. Sharma and D. S. Sharma, (Vikas publishing, N. Delhi)
3. "text book of practical organic chemistry ",Vogel's,5th edition.
4. "Text book on Experiments and calculations in engineering chemistry",S.S. Dara-

Course Outcomes:

On completion of the course, the students will be able to:

1. Learn the experimental concepts on in LED, Electric and Electronic materials.
2. Get the knowledge of fundamentals of Semiconductor physics.
3. Design, characterization and study of properties of material help the students to prepare new materials for various engineering applications.
4. Be exposed to the phenomena of electromagnetism and also to have exposure on magnetic materials and dielectric materials.
5. Lasers and fibre optics enable the students to apply to various systems like communications, solar cell, photo cells and so on.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 – Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	-	-	-	-	2	-	-	-	-	-	-	-	-
CO2	1	-	-	-	-	-	-	-	-	-	-	2	-	-
CO3	1	-	-	-	-	-	-	-	-	-	-	-	1	-
CO4	1	-	-	-	-	-	-	-	-	-	-	-	1	-
CO5	1	-	-	-	-	-	-	-	-	-	-	-	2	1
Average	1.5	-	-	-	-	2	-	-	-	-	-	2	1.3	1

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
I Year – II Sem</td></tr>
<tr><td>Course Code: J1291</td><td rowspan="2">BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB
(Common to CE, ME & MIE)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 1</td><td>0</td><td>0</td><td>2</td><td>0</td></tr>
</table>

Pre-requisite: Basic Electrical and Electronics Engineering

Course Objectives:

This course will enable students to:

1. Analyse a given network by applying various electrical laws and network theorems.
2. Know the response of electrical circuits for different excitations.
3. Calculate measure and know the relation between basic electrical parameters.
4. Study the Operation of basic Instruments & electronic components and their Applications.
5. Study the characteristics of Diodes and Transistors.

List of Experiments

Experiment 1 : Verification of Ohms Law.

Experiment 2 : Determination of unknown resistance.

Experiment 3 : Verification of KVL and KCL.

Experiment 4 : Transient response of series RL and RC circuits using DC excitation.

Experiment 5 : Transient response of RLC series circuit using DC excitation.

Experiment 6 : Resonance in series RLC circuit

Experiment 7 : Forward & Reverse Bias Characteristics of a PN Junction Diode

Experiment 8 : Zener diode Characteristics and Zener diode as a voltage Regulator

Experiment 9 : Input & Output Characteristics of Transistor in CB Configuration.

Experiment 10 : Input & Output Characteristics of Transistor in CE Configuration.

Experiment 11 : Half Wave Rectifier with & without filters

Experiment 12 : Full Wave Rectifier with & without filters

Experiment 13 : Bridge Rectifier with & without filters

Course Outcomes:

The student will be able to

1. Get an exposure to basic electrical laws.
2. Relate the response of different types of electrical circuits to different excitations.
3. Understand the measurement, calculation and relation between the basic electrical parameters.
4. Measure the voltage, frequency and phase of any wave form using CRO.
5. Perform experiment to study the characteristics of Diodes and Transistors

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	2	-	-	-	-	-	-	2	-	-
CO2	3	3	2	2	2	-	-	-	-	-	-	2	1	1
CO3	3	2	3	2	2	-	-	-	-	-	-	2	-	-
CO4	3	2	3	2	2	-	-	-	-	-	-	2	1	-
CO5	3	2	2	2	2	-	-	-	-	-	-	2	1	-
Average	3	2.4	2.4	2	2	-	-	-	-	-	-	2	1	1

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
I Year – II Sem</td></tr>
<tr><td>Course Code: J1231</td><td rowspan="2">ENGINEERING DRAWING
(Common to CE, MIE, EEE, ME)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>0</td><td>0</td><td>0</td><td>6</td></tr>
</table>

Pre-requisite: Engineering Mathematics.

Course Objectives:
This course will enable students to:

1. Learn how to prepare Engineering Drawings by Manual Drafting and Computer-Aided Drawings and Practice various methods of drawing Conic Sections & Curves.
2. Learn the principles of Orthographic Projections to show the projections of points, lines and planes effectively.
3. Learn to use the various methods for drawing the projections of solids.
4. Learn to use various methods for drawing the projections of sections of solids and surface developments of solids.
5. Learn to convert orthographic views into isometric views and vice versa.

Module 1

Unit 1: Principles of Engineering Drawing: Introduction to Engineering Drawings, Significance, Introduction to AutoCAD.

Unit 2: Conic Sections: Ellipse – Eccentric Method, Arcs Method, Concentric, Circle Method, Rectangular Method; Parabola – Eccentric Method, Rectangular Method, Tangent Method; Hyperbola – Eccentric Method, Rectangular Hyperbola.

Unit 3: Curves: Cycloid – Epicycloid, Hypocycloid, Involute of Circles.

Unit 4: Scales: Construction of Plain, Diagonal Scales.

Module 2

Unit 1: Principles of Orthographic Projections: Introduction to Orthographic Projections, Conventions.

Unit 2: Projections of Points and Lines: Projections of Points in four Quadrants, Projection of Lines in first quadrant, Inclined to both Principle Planes.

Unit 3: Projections of Planes: Projections of Planes in first quadrant and inclined to both Principle Planes for Regular Geometrical Figures – Circle, Square, Rectangle, Triangle, Pentagon, Hexagon.

Module 3

Unit 1: Projections of Solids: Projections of Right Regular Solids – Prisms and Pyramids of Square, Rectangle, Pentagon, Hexagon; Projections of Generated Solids – Cone, Cylinder.

Module 4

Unit 1: Sections of Solids: Sectional and Auxiliary Views of Right Regular Solids – Prisms and Pyramids of Pentagon, Hexagon; Generated solids – Cylinder and Cone.

Unit 2: Development of Surfaces of Solids: Surfaces of Right Regular solids – Prism, cylinder pyramid and cone

Module 5

Unit 1: Isometric Projections and Views: Principles of Isometric Projections, Isometric Scale, Isometric Views of Simple and Compound Solids; Conversion of Orthographic Views of simple objects to Isometric Views.

Unit 2: Orthographic Views: Conversion of Isometric Views to Orthographic Views.

(First Angle Projection Convention to be followed)

***Note:** Practice of few exercises from Unit I to Unit V using open source AutoCAD software to be considered for Internal Evaluation only.*

Text Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., "Engineering Drawing", Charotar Publishing House,2014.
2. K. Venugopal & V. Prabhu Raja, "Engineering Drawing + Auto CAD", New Age International Publishers. Fifth Edition, 2011.
3. AutoCAD Software Theory and User Manuals

Reference Books:

1. Narayana, K.L. & P Kannaiah, "Text book on Engineering Drawing", Scitech Publishers, 2008
2. Agrawal B. & Agrawal C. M., "Engineering Graphics", TMH Publication, 2012.

E - Resources:

1. https://nptel.ac.in/courses/112/103/112103019/
2. http://www.autocadtutorials.net/
3. https://urlzs.com/fLJ3T
4. https://urlzs.com/zky46

Course Outcomes:

On completion of the course, the students will be able to:

1. **Equipped** with the basic knowledge of using the drawing instruments and dimensioning practice.
2. **Represent** any three-dimensional object with two-dimensional drawings and exposed to the visual aspects of lines and planes.
3. **Visualize** of solids inclined to both the planes.
4. **Visualization** of sections of solids and their developments.
5. **Representation** of 3D objects through isometric and orthographic views

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	2	1	2	-	-	-	-	-	-	3	1	1
CO2	3	3	2	1	2	-	-	-	-	-	-	3	2	1
CO3	3	3	2	1	2	-	-	-	-	-	-	3	2	1
CO4	3	3	3	1	2	-	-	-	-	-	-	3	2	2
CO5	3	3	3	1	2	-	-	-	-	-	-	3	2	3
Average	3	3	2.4	1	2	-	-	-	-	-	-	3	1.8	1.6

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
I Year – II Sem</td></tr>
<tr><td>Course Code: J1292</td><td rowspan="2">ENGINEERING AND IT WORKSHOP
(Common to CE, MIE, EEE, ME)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 2</td><td>0</td><td>0</td><td>4</td><td>0</td></tr>
</table>

Pre-requisite: Basic knowledge about tools and different trades

Course Objectives:
This course will enable students to:
1. Develop understanding of various Engineering materials and Manufacturing processes
2. Know different tools used in Carpentry, fitting, tin smithy, house wiring, welding, foundry, machine shop and black smithy.
3. Develop Engineering Skill in making components, system integration and assembly to form a useful product.
4. Study/demonstrate the concepts of computer w.r.t. its hardware.
5. Install the operating system and perform various tasks

(A) ENGINEERING WORKSHOP

Trades for Practice (Minimum 1 Exercise from each category)
1. Carpentry
2. Fitting shop
3. Tin Smithy
4. Electrical house wiring
5. Foundry practices – mould preparation
6. Welding (Arc Welding)

Trades for Demonstration
1. Black Smithy
2. Machine shop

(B) IT WORKSHOP
1. a. Computer Hardware: Identification of Peripherals
   b. Study of UPS and SMPS
2. a. Assembling and disassembling of a PC
   b. Simple diagnostic exercises – Related to hardware
3. a. Installation of Windows Operating System
   b. Installation of Linux Operating System
4. a. Basic Windows and Linux Commands
   b. Simple diagnostic exercises –Related to Operating System

TEXT BOOKS:

1. P. N. Rao, "Manufacturing Technology", Tata McGraw Hill, 4^{th} Edition, 2013.
2. K. C. John, "Mechanical Workshop Practice", PHI Publishers, 2^{nd} Edition, 2010.
3. IT Essentials PC Hardware and Software Companion Guide Third Edition by Davis Anfinson and Ken Quamme CISC Press, Pearson Education.
4. PC Hardware and A+ Handbook – Kate J. Chase PHI (Microsoft)

Course Outcomes:

On completion of the course, the students will be able to:

1. Understand trades and techniques used in Workshop, chooses the best material/ manufacturing process
2. Use Apt tools for different engineering applications following precautionary measures.
3. Gain different skills of manufacturing and importance of dimensional accuracies and dimensional tolerances in assembling of various components.
4. Identify, assemble and dissemble the given configuration of a computer.
5. Install the operating system in the given configuration of a computer and execute commands for LINUX Operating System

Note: *The work load for this to be distributed in 75:25 for Engineering workshop and IT workshop*

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 – Weak														
Course Outcomes (Cos)	**Program Outcomes (Pos)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	-	-	-	-	-	-	-	2	2	2	3	3	3
CO2	-	-	-	-	-	-	-	-	2	2	2	3	3	1
CO3	-	-	-	-	-	-	-	-	2	2	2	3	3	3
CO4	-	-	-	-	-	-	-	-	2	2	2	3	3	3
CO5	-	-	-	-	-	-	-	-	2	2	2	3	3	2
Average	-	-	-	-	-	-	-	-	2	2	2	3	3	2.4

<table>
<tr><td>AY 2020 – 21 onwards</td><td colspan="4">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
I Year – II Sem</td></tr>
<tr><td>Course Code: J12M1</td><td colspan="4" rowspan="2">ENVIRONMENTAL SCIENCE</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 0</td><td>2</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:

This course will enable students to:

1. Study about the different natural resources available and how to use them.
2. Explain about biodiversity.
3. Discuss about Global Environmental Problems and Global Efforts.
4. Identify the global environmental problems.
5. Explain about sustainable development.

Module 1:

Unit-1: Ecosystems & Natural Resources, **Biodiversity:**

Concept, Classification of Resources: Water resources, Land resources, land degradation, Forest resources, Mineral resources, Energy resources. Concept of ecosystem, Classification of ecosystem, Functions of ecosystem. Biodiversity, Level, values, hotspots of biodiversity, Threats to Biodiversity, Conservation of Biodiversity

Module 2:

Unit 1: Global Environmental Problems and Global Efforts: Deforestation, Greenhouse effect, Global Warming, Sea level rise, Ozone depletion. International conventions/protocols: green-belt-development, Concept of Green Building, Clean Development Mechanism (CDM).

Unit 2: Environmental Impact Assessment (EIA) And Environmental Management Plan: Definition of Impact, classification of impacts, methods of baseline data acquisition. Impacts on different components: such as human health resources, air, water, flora, fauna and society, impact assessment methodologies. Environmental management plan (EMP).

Module 3:

Unit 1: Environmental Policy, Legislation, Rules and Regulations:

Environmental Protection Act: Air (Prevention and control of pollution) Act-1981, Water (Prevention and control of pollution) Act-1974, Forest Conservation Act**.**

Unit 2: Towards Sustainable Future:

Concept of Sustainable Development, Threats to Sustainability, Strategies for achieving Sustainable development, Environmental Ethics, Environmental Economics, Concept of Green Computing.

Text Books:

1. “Textbook of Environmental Science and Technology” by M Anji Reddy, BS Publications, 2007.
2. “Principles of Environmental Science and Engineering” by Rao P. Venugopala, Prentice Hall India Learning Private Limited (1 January 2006)
3. “Environmental Studies (A Text Book for Undergraduates)” by Dr. K Mukkanti, S. Chand , 2010
4. “Environmental Studies” by Kaushik Anubha, C P Kaushik, New Age International Private Limited (1 August 2018)

Reference Books:

1. “Environmental Studies” by Benny Joseph, McGraw Hill Education 2008
2. “Textbook of Environmental Studies for Undergraduate Courses” by Erach Bharucha 2005, University Grants Commission, University Press

E- Resources:

1. https://nptel.ac.in/courses/120/108/120108004/#

Course Outcomes:

On completion of the course, the students will be able to:

1. Compare the different natural resources available and how to use them.
2. Describe about biodiversity.
3. Analyze the Global Environmental Problems and Global Efforts.
4. Categorize the global environmental problems.
5. Prioritize the Sustainable development.

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	2	2	-	-	1	-	-	-	-	1	-	-
CO2	-	-	-	-	-	3	3	-	-	-	-	2	-	-
CO3	3	3	2	2	-	-	1	-	-	-	-	1	2	2
CO4	3	3	2	2	-	-	1	-	-	-	-	1	1	1
CO5	-	-	-	-	-	3	3	-	-	-	-	2	1	1
Average	3	3	2	2	-	3	1.8	-	-	-	-	1.4	1.3	1.3

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
II Year – I Sem</td></tr>
<tr><td>Course Code: J210C</td><td rowspan="2">POLYMERS AND NANO MATERIALS</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: NIL.

Course Objectives:
This course will enable students to:
1. To learn the preparation and applications of Plastics
2. learn about the different applications of conducting polymers and elastomers
3. To know the scope of Nanoscale materials and synthesis.
4. Understand the properties of Nanomaterials.
5. Give knowledge of various instrumental techniques to the analysis the Nanomaterials

Module-1:

Polymers:
Definition – Classification of polymers with examples – Types of polymerization – addition and condensation polymerization with examples. **Plastics:** Definition and characteristics- thermoplastic and thermosetting plastics, compounding and fabrication of plastics (compression and injection moulding). Preparation, Properties and engineering applications of PVC and Bakelite
Fibers: Characteristics of fibers – preparation, properties and applications of Nylon-6, 6 and Dacron. Kevlar- Liquid crystal polymers-Applications
Elastomers: Natural rubber and its vulcanization. Characteristics – preparation – properties and applications of Buna-S, Butyl and Thiokol rubber

Module-2:
Analysis and Testing of Polymers
Chemical analysis of Polymers: Spectroscopic methods – IR spectroscopy, Raman spectroscopy, NMR spectroscopy, Mass spectroscopy – X-Ray Diffraction analysis. Thermal analysis: Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC), Thermo Gravemetric Analysis (TGA). Physical testing of Polymers: Tensile strength, Tear resistance, Hardness, Abrasion Resistance, Fatigue Test, Brittle rupture, Ductile rupture.

Module-3:
Synthesis of Nano materials:
Introduction -synthesis of Nanostructure materials, Bottom-up approach and Top – down approach with examples-sol-gel method – solvothermal and hydrothermal routes, Chemical Vapor Deposition and precipitation methods

Module-4:

Properties of Nano materials:

Properties of Nanomaterials – Electronic properties, Energy bands and gaps in semiconductors, Fermi Surfaces-Optical properties- Fluorescence, Photoluminescence, Electroluminescence. Magnetic properties-mechanical properties-thermal properties

Module-5:

Instrumental Analysis:

Characterization techniques – Principle and block diagram of Scanning Electron Microscopy (SEM), Electron Dispersion Spectroscopy (EDS). Principle and block diagram of Transmission Electron Microscopy (TEM), Dynamic Light Scattering (DLS) and Atomic Force Microscopy (AFM) -Illustrative examples.

Text Books:

1. P. C. Jain & M. Jain, “Engineering Chemistry”, Dhanpat Rai Publishing Company (P) Ltd., New Delhi.
2. Dr. Anshu Srivastava, Er. Shakun Srivastava, “Fundamentals of Polymer science & Technology”, 1^{st} Edition, SK Kataria and Sons publishers, New Delhi, 2012
3. Mark A. Ratner, D. Ratner. “Nanotechnology a gentle introduction to the next big idea”, Pearson Education Inc., Asia, 2003.
4. Pradeep.T. “Nano:The essentials - understanding Nanoscience and Nanotechnology”. Tata Mc.Graw Hill, New Delhi, 2007.

Reference Books:

1. K. Haghi, Ajesh K. Zachariah, Nandakumar Kalariakkal. “Nanomaterials: Synthesis, Characterization, and Applications”. Apple Academic Press, 2013
2. Brechignac C., Houdy P., Lahmani M. (Eds.) “Nanomaterials and Nanochemistry” (Springer,) 748p. ISBN 978-3-540-72993-8, 2007
3. Phanikumar. “Principles of Nanotechnology”, SciTech Publications 2nd Edition, 2010.
4. M.Thirumalachary and Laxminarayan, “Engineering Chemistry” by Scitech Publications.

E-Resources:

1. shorturl.at/dioOR
2. shorturl.at/hmEGK
3. https://www.sciencedirect.com/book/9780444519566/nanochemistry
4. shorturl.at/hzKR8
5. shorturl.at/jtOR1

Course Outcomes: After completion of the course, students will be able to:

1. Learn the different synthetic methods of the plastics and fibers.
2. Learn the different synthetic methods of the rubbers and elastomers
3. Acquire the knowledge various synthetic methods of the Nano materials.
4. Understand the properties of Nano materials
5. Acquire the knowledge various instrumental methods of analysis (TEM, EDS, SEM, DLS & AFM).

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	-	-	-	2	-	-	-	-	-	-	3	-	-
CO2	3	3	2	2	3	-	-	-	-	-	-	2	-	-
CO3	3	-	-	2	3	-	-	-	-	-	-	3	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	2	1	-
CO5	3	3	3	2	3	-	-	-	-	-	-	3	3	3
Average	3	2.6	2.5	2	2.7	-	-	-	-	-	-	2.6	2	3

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="1">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
II Year – I Sem</td></tr>
<tr><td>Course Code: J213A</td><td rowspan="2">KINEMATICS OF MACHINES</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Mathematics, Engineering Mechanics.

Course Objectives:
This course will enable students to:

1. Understand the various types of mechanisms and machines.
2. Study the relative motion, velocity and accelerations of the various elements in a mechanism.
3. Understand different types of steering mechanisms and straight-line motion mechanisms.
4. Understand the analysis of velocity and acceleration in CAMS.
5. Know the different types of gears and gear trains.

Module 1

Unit 1: Mechanisms: Elements or Links – Classification – Rigid Link, flexible link, fluid link. Types of kinematic pairs – sliding, turning, rolling, screw and spherical pairs – lower and higher pairs – closed and open pairs. Constrained motion – completely constrained, partially or successfully constrained and incompletely constrained.

Unit 2: Machines: Mechanism and machines–kinematic chain–Degrees of freedom, Kutzbach's criteria and Grubler's criterion. Inversions of kinematic chain–inversions of quadric cycle chain, single slider crank chain and double slider crank chain. Mechanical advantage.

Module 2

Unit 1: Kinematics: Velocity and acceleration–Motion of link in machine–Determination of Velocity and acceleration– Graphical method – Application of relative velocity method for simple mechanisms, Acceleration diagram for a given mechanism, Kleins construction, Coriolis acceleration, determination of Coriolis component of acceleration.

Unit 2: Plane motion of body: Instantaneous center of rotation, centrode and axodes – relative motion between two bodies – Three centers in line theorem – Graphical determination of instantaneous centre, diagrams for simple mechanisms and determination of angular velocity of points and links.

Unit 3: Analysis of Mechanisms: Analysis of slider crank chain for displacement, velocity and acceleration of slider

Module 3

Unit 1: Steering Mechanisms: Conditions for correct steering – Davis Steering gear mechanism, Ackerman's steering gear mechanism

Unit 2: Hooke's Joint: Single and double Hooke's joint – velocity ratio – Universal coupling – application – problems.

Unit 3: Straight Line Motion Mechanisms: Exact type – Peaucellier, Hart, Scott-Russul mechanism. Approximate type–Grasshopper, Watt T. Chebicheff, Robert Mechanisms. Generated Types-Pantograph.

Module 4

Unit 1: Cams: Definitions of cam and followers, their uses. Types of cams, Types of followers, Terminology, Types of follower Motion - Simple Harmonic Motion, Uniform Velocity, Uniform Acceleration and Retardation - Determination of Maximum velocity and maximum acceleration during outward and return strokes in the above three cases.

Drawing of cam profiles with knife edge follower, roller follower and flat faced follower.

Module 5

Unit 1: Gears: Higher pairs, friction wheels and toothed gears – types of toothed gears. law of gearing-condition for constant velocity ratio for transmission of motion. Form of teeth - cycloidal and involute profiles. Velocity of sliding. Phenomena of interferences – Methods of interference, condition for minimum number of teeth to avoid interference. Expressions for arc of contact and path of contact.

Unit 2: Gear Trains: Introduction – Train value – Types – Simple, compound, reverted and epicyclic gear train. Methods of finding velocity ratio.

Text Books:

1. Thomas Bevan, "Theory of Machines", Pearson Publications, 3rd Edition, 2011.
2. R.K Bansal, "Theory of Machines", S Chand Publications, 5th Edition, 2010.

Reference Books:

1. R.S Khurmi& J.K Gupta, "Theory of Machines", S Chand Publications, 14th Edition, 2013.
2. P.L. Ballaney, "Theory of Machines", Khanna publishers.
3. JS Rao and RV Dukkipati, "Mechanism and Machine Theory", New Age Publishers.

E - Resources:

1. https://rb.gy/lwrqrg
2. https://rb.gy/uqcvmt
3. https://nptel.ac.in/courses/112/104/112104121/

Course Outcomes:

On completion of the course, the students will be able to:

1. **Describe** the concepts of machines, mechanisms and related terminologies.
2. **Analyse** planar mechanism for displacement, velocity and acceleration graphically.
3. **Analyse** different types of steering gear mechanisms to satisfy the condition for correct steering and straight-line motion mechanisms to generate exact and approximate straight-line motions.
4. **Analyse** various types of motion of the followers in cams.
5. **Apply** the knowledge of the different types of gears and gear trains.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	2	1	-	-	-	-	-	-	-	2	1	-
CO2	3	3	2	1	-	-	-	-	-	-	-	2	2	2
CO3	3	3	2	3	-	-	-	-	-	-	-	2	1	2
CO4	3	3	2	3	-	-	-	-	-	-	-	2	1	2
CO5	3	3	2	3	-	-	-	-	-	-	-	2	2	2
Average	3	3	2	2.2	-	-	-	-	-	-	-	2	1.4	2

<table>
<tr><td>AY 2020 - 21 onwards</td><td colspan="4">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME II Year – I Sem</td></tr>
<tr><td>Course Code: J213B</td><td rowspan="2">MANUFACTURING TECHNOLOGY</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Physics, Engineering Materials.

Course Objectives:
This course will enable students to:
1. Learn about the Sand Casting process, Patterns and Pattern making, Special casting processes and Methods of Melting.
2. Understand the basics of Welding, Types of welding and different methods for Cutting of Metals.
3. Gain knowledge of the process and application of Fabrication methods, such as Rolling, Extrusion of metals.
4. Gain knowledge of the process and application of Fabrication methods, such as forging processes, drawing.
5. Understand polymers, plastics and their processing techniques.

Module 1
Unit 1: Casting: Steps involved in making a casting – Advantage of casting and its applications – Patterns and Pattern making – Types of patterns – Materials used for patterns – pattern allowances and their construction – Principles of Gating – Gating ratio and design of Gating systems. Risers – Types function and design; casting design considerations – special casting processes – Centrifugal casting, Die casting, Investment casting; Solidification of pure metals and alloys.
Unit 2: Methods of Melting: Crucible melting and cupola operation.

Module 2
Unit 1: Welding: Classification of welding processes, types of welds and welded joints – their characteristics, Gas welding, Arc welding, Forge welding, resistance welding, Thermit welding and Plasma (Air and water) welding. Inert Gas welding – TIG and MIG welding, Friction welding, Induction welding, Explosive welding, Laser welding, Soldering and Brazing; Heat affected zones in welding – welding defects – causes and remedies; destructive and non-destructive testing of welds.
Unit 2:Cutting of Metals: Oxy Acetylene Gas cutting, water plasma cutting; Cutting of ferrous, non-ferrous metals.

Module 3
Unit 1: Hot and cold working: Hot working – cold working – strain hardening – Comparison of properties of Cold and Hot worked parts. Rolling fundamentals –

theory of rolling – types of Rolling mills and products – Forces in rolling and power requirements.

Unit 2: Extrusion of Metals: Basic extrusion process and its characteristics – Hot and cold extrusion, Forward and backward extrusion, Impact extrusion, Hydrostatic extrusion.

Module 4

Unit 1: Forging processes: Principles of forging – Tools and dies – Types of Forging – Smith forging, Drop Forging, Rotary forging, Roll forging – Forging hammers – forging defects.

Unit 2: Stamping, forming and other cold working processes: Blanking and piercing – Bending and forming – Drawing and its types – wire drawing and Tube drawing, coining, Hot and cold spinning – Types of presses and press tools. Forces and power requirement in the above operations

Module 5

Unit 1: Polymers: Introduction – Processing techniques of Polymers.

Unit 2: Processing of Plastics: Types of Plastics – Properties – applications and their Processing methods and Equipment – blow & injection moulding.

Text Books:

1. P.N. Rao, "Manufacturing Technology", Tata McGraw Hill, 2nd Edition, 2000.
2. SeropeKalpakjian and Steven R Schmid, "Manufacturing Processes for Engineering Materials", Pearson Publishers.
3. C. Elanchezhian and M. Vijayan, "Machine Tools", Anuradha Agencies, 2nd Edtn, 2012

Reference Books:

1. Sharma P C, "Production Technology", S. Chand Publications, 6th Edition, 2006.
2. R.K. Jain, "Production Technology", Khanna Publications, 2005.
3. Suresh Dalela& Ravi Shankar, "Production Engineering", Galgotia Publications.

E - Resources:

1. https://rb.gy/ltwuxf
2. https://rb.gy/60ohwo
3. https://nptel.ac.in/courses/112/107/112107145/
4. https://onlinecourses.nptel.ac.in/noc20_me14/preiew

Course Outcomes:

On completion of the course, the students will be able to:

1. **Make** the pattern, mould and casting.
2. **Prepare** metal joints by welding and use different methods for cutting metals.
3. **Well-versed** with the principles of Hot / Cold working and Rolling.

4. **Well-versed** with the principles of Forging, Stamping, forming and other cold working processes.
5. **Apply** the knowledge of polymer processing techniques in the industry.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	3	1	2	-	-	-	-	-	-	2	2	-
CO2	2	3	2	1	2	-	-	-	-	-	-	2	2	-
CO3	2	1	2	1	1	-	-	-	-	-	-	2	1	-
CO4	2	3	2	1	1	-	-	-	-	-	-	2	1	-
CO5	2	2	2	1	1	-	-	-	-	-	-	2	-	-
Average	2.2	2.4	2.2	1	1.4	-	-	-	-	-	-	2	1.5	-

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME II Year – I Sem</td></tr>
<tr><td>Course Code: J213C</td><td rowspan="2">THERMODYNAMICS</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Physics, Engineering Mathematics.

Course Objectives:
This course will enable students to:

1. Get basic knowledge of comprehensive and rigorous treatment of classical thermodynamics while retaining an engineering perspective.
2. Impart the knowledge of first law, second law, entropy principles and energy equation.
3. Develop an intuitive understanding of gas laws, mollier charts.
4. Know the concepts of gravimetric and volumetric analysis along with psychrometric chart.
5. Understand various air standard cycles and refrigeration cycles.

Module 1: Basic Concepts
System – Control Volume – Surrounding – Boundaries and Universe – Types of Systems – Macroscopic and Microscopic viewpoints – Concept of Continuum – Thermodynamic Equilibrium – State – Property – Process – Exact & Inexact Differentials – Cycle – Reversibility – Quasi static Process, Irreversible Process, Causes of Irreversibility – Energy in State and in Transition – Types – Displacement Work and other forms of work – Heat, Point and Path functions. Various Non -flow processes – Heat and Work Transfer – Zeroth Law of Thermodynamics – Concept of Temperature – Principles of Thermometry – Reference Points – Constant Volume gas Thermometer – Scales of Temperature – Ideal Gas Scale – Joule's Experiments

Module 2: THERMODYNAMIC LAWS
First law of Thermodynamics – Corollaries – First law applied to a Process and flow system – Steady Flow Energy Equation. Limitations of the First Law – Thermal Reservoir, Heat Engine, Heat pump , Parameters of performance. Second Law of Thermodynamics – Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries – PMM – I & II. Carnot's principle, Carnot cycle and its specialties. Clausius Inequality – Entropy, Principle of Entropy Increase. Energy Equation – Availability and Irreversibility – Thermodynamic Potentials – Gibbs and Helmholtz Functions – Maxwell Relations

Module 3: GAS LAWS AND MOLLIER CHARTS

Perfect Gas Laws – Equation of State – Specific and Universal Gas constants. Changes in Internal Energy. Throttling and Free Expansion Processes, Flow processes. Deviations from perfect Gas Model – Vander Waal's Equation of State – Compressibility charts – variable specific Heats – Gas Tables- Phase Transformations – Triple point at critical state properties during change of phase, Dryness Fraction – Clausius – Clapeyron Equation. Third Law of Thermodynamics. Property tables. Mollier charts – Steam Calorimetry.

Module 4: PSYCHROMETRIC PROPERTIES

Mixtures of perfect Gases – Mole Fraction, Mass friction Gravimetric and volumetric Analysis – Dalton's Law of partial pressure, Avogadro's Laws of additive volumes – Mole fraction, Volume fraction and partial pressure, Equivalent Gas constant and Molecular Internal Energy, Enthalpy, sp. Heats and Entropy of Mixture of perfect Gases and Vapour, Atmospheric air – Psychrometric Properties – Dry bulb Temperature, Wet Bulb Temperature, Dew point Temperature, Thermodynamic Wet Bulb Temperature, Specific Humidity, Relative Humidity, saturated Air, Vapour pressure, Degree of saturation – Adiabatic Saturation , Carrier's Equation – Psychrometric chart.

Module 5: THERMODYNAMIC CYCLES

Power cycles – Otto, Diesel, Dual Combustion cycles, Sterling Cycle, Atkinson Cycle, Ericsson Cycle, Lenoir Cycle – Description and representation on P–V and T–S diagram – Thermal Efficiency, Mean Effective Pressures on Air standard basis. Comparison of Cycles. Refrigeration Cycles – Bell Coleman cycle, Vapour compression cycle – Performance Evaluation.

Text Books:

1. PK Nag, "Engineering Thermodynamics", Tata McGraw Hill, 5th Edition, 2013.
2. Ethirajan Ratha Krishnan, "Engineering Thermodynamics", PHI, 2nd Edition, 2006.

Reference Books:

1. DP Mishra, Cengage Learning, "Engineering Thermodynamics", 2nd Impression, 2012.
2. Yunus A. Cengel, Michael A. Boles, "Thermodynamics An Engineering Approach", Tata McGraw Hill, 8th Edition, 2015.
3. J.P.Holman, "Thermodynamics", Tata McGraw Hill,4th Edition.

E - Resources:

1. shorturl.at/jzGMP
2. shorturl.at/motvX
3. https://nptel.ac.in/courses/112/105/112105123/

4. https://www.coursera.org/learn/thermodynamics-intro
5. https://www.sciencedirect.com/book/9780123749963/modern-engineering-thermodynamics

Course Outcomes:

On completion of the course, the students will be able to:

1. **Understand** the basic concepts of thermodynamic such as temperature, pressure, system, properties and types of processes, state, cycles and equilibrium.
2. **Apply** the concepts of first law, second law of thermodynamics and solve problems related to entropy.
3. **Identify** the properties of substances on property diagrams and obtain the data from property tables.
4. **Differentiate** gravimetric and volumetric analysis, compute problems on psychrometry
5. **Calculate** thermal efficiency and mean effective pressure for power cycles.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	1	-	-	-	-	-	-	-	-	-	2	1	-
CO2	3	2	2	2	2	-	-	-	-	-	-	2	2	-
CO3	2	3	2	2	2	-	-	-	-	-	-	3	2	1
CO4	3	3	2	3	2	-	-	-	-	-	-	3	2	2
CO5	3	2	3	2	2	-	-	-	-	-	-	3	1	2
Average	2.8	2.2	2.25	2.75	2	-	-	-	-	-	-	2.6	1.6	1.7

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME II Year – I Sem</td></tr>
<tr><td>Course Code: J213D</td><td rowspan="2">METALLURGY AND MATERIAL SCIENCE</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Chemistry, Engineering Physics.

Course Objectives:

This course will enable students to:

1. Understanding of the correlation between the internal structure of materials, their mechanical properties and various methods to quantify their mechanical integrity.
2. Learn to construct and interpretation of phase diagrams and Learn Iron-Carbon phase diagram and different types of heat treatment processes.
3. Learn structure, properties and applications of Ferrous and Non Ferrous material.
4. Get the basic knowledge on ceramics, polymers and composites with their properties and applications.
5. Familiarize students with the structure and physical properties of smart materials used in Engineering

Module 1

Unit 1: Structure of Metals: Grains and Grain Boundaries. Effect of grain size on the properties. Determination of grain size by different methods.

Unit 2: Constitution of Alloys: Necessity of alloying, Types of solid solutions, Hume - Rothery rules, Intermediate alloy phases.

Module 2

Unit 1: Phase Diagrams: Construction and interpretation of phase diagrams, Phase rule. Lever rule. Binary phase Diagrams, Isomorphous, Eutectic and Eutectoid transformations with examples.

Unit 2: Engineering Materials – I: STEELS: Iron-Carbon Phase Diagram and Heat Treatment: Study of Fe-Fe_3C phase diagram. Construction of TTT diagrams. Annealing, Normalizing, Hardening and Tempering of steels.

Module 3

Unit 1: Engineering Materials – II: CAST IRONS: Structure and properties of White Cast iron, Malleable Cast iron, Grey cast iron.

Unit 2: Engineering Materials – III: Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys, Aluminium and its alloys, Titanium and its alloys.

Module 4

Unit 1: Engineering Materials –IV: Ceramics, Polymers and Composites: Crystalline ceramics, glasses.

Unit 2: Cermets: Structure, properties and applications.

Unit 3: Composites: Classification, properties and applications.

Unit 4: Polymers: Classification, Properties and applications.

Module 5

Unit 1: Smart Materials: Introduction to Smart Materials, Principles of Piezoelectricty, Principles of Magnetostriction, Rare earth Magnetostrictive materials, Giant Magnetostriction and Magneto-resistance Effect, Shape Memory Effect,

Unit 2: Shape Memory Alloys, Shape Memory Polymers, Electro-rheological Fluids, Magneto Rhelological Fluids.

Text Books:

1. Sidney H. Avner, "Introduction to Physical Metallurgy", S Chand Publications, 2nd Edition, 1997.
2. Kodgire, "Material Science and Metallurgy for Engineers", Everest Publications, 14th Edition, 2003.
3. Donald R. Askeland, Wendelin J. Wright, "Fundamentals of Smart Materials",Cengage Learning, 3rd Edition, 2013.

Reference Books:

1. William and callister, "Materials Science and engineering".
2. Er. Amandeep Singh Wadhva, "Engineering Material and Metallurgy".
3. Traugott Fischer, "Materials Science for Engineering Students", 2009.

E - Resources:

1. shorturl.at/lry34
2. shorturl.at/ghUV8
3. https://www.materialstoday.com/amorphous/articles/s1369702120300742/
4. https://nptel.ac.in/courses/113/102/113102080/
5. https://www.coursera.org/learn/materials-science

Course Outcomes:

On completion of the course, the students will be able to:

1. **Determine** and correlating the grain size with the properties of different metals.
2. **Draw** interpretation of phase diagrams and determine the phases of metals at different temperatures.
3. **Identify** the properties and structure of ferrous and non- ferrous steel material.
4. **Classify** ceramics, polymers and composites with their properties and applications.
5. **Recognize and differentiate** the smart material, shape memory alloys

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 – Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	1	3	2	-	-	-	-	-	-	-	-	-
CO2	3	3	2	2	3	-	-	-	-	-	-	-	2	-
CO3	3	2	1	1	1	-	-	-	-	-	-	-	-	-
CO4	3	2	1	1	1	-	-	-	-	-	-	-	-	1
CO5	3	1	1	1	3	-	-	-	-	-	-	-	1	1
Average	3	2.2	1.2	1.6	2	-	-	-	-	-	-	-	1.5	1

AY 2020 - 21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech: ME II Year – I Sem			
Course Code: J213E	**MECHANICS OF SOLIDS** (Common to ME, MIE)	L	T	P	D
Credits: 3		3	0	0	0

Pre-requisite: Engineering Physics, Engineering Mechanics.

Course Objectives:
This course will enable students to:

1. Understand Material properties and relationship between them.
2. Student will acquire knowledge in drawing bending and shear force diagrams of beams of various loads and configurations.
3. Acquire sufficient knowledge about Flexural Stresses, Theory of simple bending, Determination bending stresses and section modulus, Design of simple beam sections. Learn the Shear Stresses & Shear stress distribution across various beams sections: rectangular, circular, triangular, etc.
4. Understand thoroughly the concepts of principal stresses applied to solid structural members and mohr's circle diagram and understand the topics of thin seamless cylindrical shells, longitudinal and circumferential stresses and strains, thin spherical shells, Thick Cylinders, and Compound cylinders.
5. Study in detail about Pure torsion of Circular Shafts, Torsional moment of resistance, and Design of shafts according to various theories of failure and Student becomes familiar with methods of evaluation of deflection of beams of various configurations

Module 1:
Stresses & Strains: Definitions, types of stresses and strains, elasticity and plasticity. Hooke's law, stress-strain diagrams for engineering materials, modulus of elasticity. Poisson's ratio, relationship between elastic constants, linear and volumetric strains, bars of uniform strength, temperature stresses, and composite bars.

Module 2:
Shear Force and Bending Moment diagrams: Definition of bending moment and shear force; relationship between intensity of loading, shear force and bending moment; bending moment and shear force diagrams for cantilever, simply supported and overhanging beams; simple theory of bending, moment of resistance, modulus of section.

Module 3
Unit 1: Flexural stresses: Theory of simple bending –Assumptions–Derivation of bending equation, Determination bending stresses –Section modulus of rectangular and circular (Solid and Hollow) sections.

Unit 2: Shear Stresses: Distribution of shear stresses in rectangular, I-section, T-section, solid and hollow circular sections.

Module 4

Unit 1: Deflection of Beams: Deflections of cantilever and simply supported beams including overhanging for point loads, U.D.L by double integration and Macaulay's method. Strain energy in bars due to gradually applied loads, impact loads and shock loads.

Unit 2: Torsion: Theory of pure torsion – Derivation of Torsion equations – Assumptions made in the theory of pure torsion – Torsional moment of resistance, Polar section modulus, Power transmitted by shafts – Combined bending and torsion and end thrust.

Module 5

Unit 1:Principal Stresses and Strains: Introduction –Stresses on an inclined section of a bar under axial loading, compound stresses, Normal and tangential stresses on an inclined plane for biaxial stresses –Two perpendicular normal stresses accompanied by a state of simple shear – Mohr's circle of stresses, Principal stresses and strains – theories of failures.

Unit 2: Thin and Thick Cylinders: Thin seamless cylindrical shells, Derivation of formula for longitudinal and circumferential stresses –hoop, longitudinal and Volumetric strains – changes in diameter, and volume of thin cylinders– Thin spherical shells. Thick Cylinders- Lami's equations, Compound cylinders

Text Books:

1. R.S. Kurmi and Gupta, "Strength of materials".
2. Popov, "Solid Mechanics".
3. W.A. Nash, "Strength of Materials", Tata McGraw Hill Publishers

Reference Books:

1. Jindal, "Strength of Materials", Umesh Publications.
2. H. J. Shah and S. B. Junnarkar, "Mechanics of Structures", Charotar Publishing House Pvt. Ltd. Vol – I.
3. S. S. Rattan, "Strength of Materials", Tata McGraw Hill.

E - Resources:

1. https://rb.gy/j4ja0h
2. https://rb.gy/ydbalp
3. https://nptel.ac.in/courses/112/102/112102284/

Course Outcomes:

On completion of the course, the students will be able to:

1. **Predict** mechanical behavior of the member by determining the stresses, strains and deflections produced by the various loads

2. **Draw** shear force and bending moment diagrams for statically determinate beam due to various types of loads and evaluate slope and deflection of statically determinate beams by the various loads
3. **Apply** the concept of theory of bending and solve numerical problems across various beam sections like rectangular, circular, triangular etc.
4. **Apply** the concepts of different types of stresses and strains in the design of simple beam sections, shafts,
5. **Solve** numerical problems to determine the torsional moments in shaft and to design shafts according to various theories of failure, and apply the concept of thick and thin cylinders

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	2	1	-	-	-	-	-	-	-	2	1	1
CO2	3	3	2	1	-	-	-	-	-	-	-	2	2	1
CO3	3	3	2	1	-	-	-	-	-	-	-	2	2	1
CO4	3	3	2	2	-	-	-	-	-	-	-	2	2	2
CO5	3	3	2	2	-	-	-	-	-	-	-	2	2	1
Average	3	3	2	1.4	-	-	-	-	-	-	-	2	1.8	1.2

<table>
<tr><td>AY 2020 - 21 onwards</td><td colspan="4">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
II Year – I Sem</td></tr>
<tr><td>Course Code: J2131</td><td colspan="4" rowspan="2">MANUFACTURING TECHNOLOGY LAB</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 1</td><td>0</td><td>0</td><td>2</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Physics, Engineering Materials.

Course Objectives:
This course will enable students to:

1. Understand the principles of metal casting processes with detailed design of gating, riser, pattern and sprue system.
2. Acquire basic operational skills on various advanced welding processes and identify safety measures in using welding setup.
3. Summarize the theory of press working operations used in the fabrication of sheet metal components.
4. Gain the knowledge on basic processing techniques of thermoplastics by injection and blow moulding

Module 1
Metal Casting

1: Pattern Design and making
2: Moulding, Melting and Casting

Module 2
Welding (Minimum 1 exercise each)

1: ARC Welding
2: Spot Welding
3: TIG welding
4: Gas Welding
5: Brazing
6: Plasma Welding

Module 3
Mechanical Press Working:

1: Blanking and piercing operations, study of simple, compound and progressive press tools

Module 4
Processing of Plastics

1: Injection Moulding
2: Blow Moulding

E - Resources:

1. https://books.google.co.in/books?id=6wFuw6wufTMC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

Course Outcomes:

On completion of the course, the students will be able to:

1. **Prepare** mould cavities using different types of patterns, get the training for melting and pouring the molten metal into mould cavity.
2. **Understand** the welding symbols, types of joints, defects in weld joints and the applications of arc welding, spot welding, TIG welding, brazing and plasma welding.
3. **Identify** sheet metal cutting operations.
4. **Classify** the processed plastics by injection, blow moulding and describe the process of manufacturing.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	1	-	-	-	-	-	2	-	-	2	2	-
CO2	1	1	2	-	-	-	-	-	2	-	-	1	2	1
CO3	1	1	-	-	-	-	-	-	1	-	-	-	2	-
CO4	1	1	-	-	-	-	-	-	2	-	-	1	2	-
Average	1.5	1.25	0.75	-	-	-	-	-	1.75	-	-	1	2	1

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
II Year – I Sem</td></tr>
<tr><td>Course Code: J2132</td><td rowspan="2">MATERIALS ENGINEERING LAB</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 1</td><td>0</td><td>0</td><td>2</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Materials, Mechanics of Solids

Course Objectives:
This course will enable students to:
1. Understand the preparation and study of microstructures of pure metals such as Fe, Cu and Al.
2. Get the knowledge of microstructures of different ferrous and non ferrous alloys.
3. Study the mechanical properties such as impact strength, hardness etc..
4. Study the young's modulus using beams.
5. Study the torsion moment using torsion test.

List of Experiments

Experiment 1 : Preparation and study of the Micro Structure of pure metals such as Fe, Cu and Al.

Experiment 2 : Preparation and study of the Microstructure of Plain Carbon Steels such as Mild steels, Low carbon Steels and High carbon Steels.

Experiment 3 : Study of the Micro Structures of Cast Irons.

Experiment 4 : Study of the Micro Structures of Copper Alloys.

Experiment 5 : Study of the Micro Structures of Aluminum Alloys.

Experiment 6 : Tensile test on UTM.

Experiment 7 : Impact test.

Experiment 8 : Hardness test.

Experiment 9 : Torsion test.

Experiment 10 : Deflection test on beams

E - Resources:
1. https://books.google.co.in/books?id=kBM8BAAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

Course Outcomes:

The student will be able to

1. **Find** the microstructures of pure metals such as Fe, Cu and Al.
2. **Find** the microstructures of Carbon steels and alloy steels.
3. **Find** out the various mechanical properties.
4. **Find** out the young's modulus using beams.
5. **Find** out the torsion moment using torsion test.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	-	-	-	-	-	-	-	3	2	-	2	1	1
CO2	-	-	-	-	-	-	-	-	3	2	-	2	1	1
CO3	-	-	-	-	-	-	-	-	3	2	-	2	1	1
CO4	-	-	-	-	-	-	-	-	3	2	-	1	1	1
CO5	-	-	-	-	-	-	-	-	3	2	-	1	1	1
Average	-	-	-	-	-	-	-	-	3	2	-	1.6	1	1

AY 2020 - 21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech: ME II Year – I Sem			
Course Code: J2133	INTERNSHIP – I	L	T	P	D
Credits: 1		0	0	2	0

Course Objectives:

The student will

1. Exposed to a particular job and a profession.
2. Increases personal behaviour, communication skills and /or knowledge on social activities
3. Enhance social functioning and interaction.
4. Enhance human well being and alleviate psychiatric symptoms.

Guidelines:

There is summer internship (Social activity related to Society), to be taken up during the vacation after I year II Semester and it will be evaluated in II Year I semester. A report to be submitted in prescribed format on the internship carried out by the student. The report will be evaluated by the committee consisting of head of the department, and internship coordinator and a senior faculty member of the department. There is no semester end examination for this.

Course Outcomes:

The student will be able to

1. Coordinate people in real life social activities.
2. Manage works efficiently in tough times.
3. Apply ethics and principles.
4. Act as volunteer in social well being programs.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	-	-	-	-	3	2	2	2	3	-	2	-	1
CO2	-	-	-	-	-	2	2	2	1	2	-	1	-	-
CO3	-	-	-	-	-	2	2	3	2	1	-	2	-	1
CO4	-	-	-	-	-	2	1	3	1	3	-	3	2	2
Average	2	-	-	-	-	2.25	1.75	2.5	1.5	2.25	-	2	2	1.3

AY 2020 - 21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech: ME II Year – I Sem			
Course Code: J21M1	**GENDER SENSITIZATION** (An Activity-based Course) (Common to CE, ME, MIE & EEE)	**L**	**T**	**P**	**D**
Credits: 0		**2**	**0**	**0**	**0**

Pre-requisite: NIL

Course Objectives:

This course will enable students to:

1. Develop students' sensibility with regard to issues of gender in contemporary India.
2. Provide a critical perspective on the socialization of men and women.
3. Introduce students to information about some key biological aspects of genders.
4. Expose the students to debates on the politics and economics of work.
5. Help students reflect critically on gender violence.

Module – I: UNDERSTANDING GENDER AND BIOLOGY-1

Gender: Why Should We Study It? (*Towards a World of Equals*: Unit -1)
Socialization: Making Women, Making Men (*Towards a World of Equals*: Unit 2)
Introduction. Preparing for Womanhood. Growing up Male. First lessons in Caste. Different Masculinities

Module – II: UNDERSTANDING GENDER AND BIOLOGY-2

Missing Women: Sex Selection and Its Consequences (*Towards a World of Equals*: Unit -4)
Declining Sex Ratio. Demographic Consequences.
Gender Spectrum: Beyond the Binary (*Towards a World of Equals*: Unit -10)
Two or Many? Struggles with Discrimination.

Module – III: GENDER AND LABOUR

Housework: The Invisible Labour (*Towards a World of Equals*: Unit -3)
"My Mother doesn't Work." "Share the Load."
Women's Work: Its Politics and Economics (*Towards a World of Equals*: Unit -7)
Fact and Fiction. Unrecognized and Unaccounted work. Additional Reading: Wages and Conditions of Work.

Module – IV: ISSUES OF VIOLENCE – 1

Sexual Harassment: Say No! (*Towards a World of Equals*: Unit -6)
Sexual Harassment, not Eve-teasing- Coping with Everyday Harassment- Further Reading: "*Chupulu*".

Domestic Violence: Speaking Out (*Towards a World of Equals*: Unit -8)

Is Home a Safe Place? –When Women Unite [Film]. Rebuilding Lives. Additional Reading: New Forums for Justice.

Thinking about Sexual Violence (*Towards a World of Equals*: Unit -11)

Blaming the Victim- "I Fought for my Life…." – Additional Reading: The Caste Face of Violence.

Module – V: JUST RELATIONSHIPS: BEING TOGETHER AS EQUALS

Mary Kom and Onler, love and acid just do not mix, love letters, mothers and fathers- further reading: Rosa Parks-The brave heart.

Text Books:

<u>**Essential Reading**</u>: All the Units in the Textbook**, "*Towards a World of Equals: A Bilingual Textbook on Gender*"** written by A.Suneetha, Uma Bhrugubanda, DuggiralaVasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, GoguShyamala, Deepa Sreenivas and Susie Tharu.

Course outcomes: At the end of this course students will be able to

1. Students will have developed a better understanding of important issues related to gender in contemporary India.
2. Students will be sensitized to basic dimensions of the biological, sociological, psychological and legal aspects of gender. This will be achieved through discussion of materials derived from research, facts, everyday life, literature and film.
3. Students will attain a finer grasp of how gender discrimination works in our society and how to counter it.
4. Students will acquire insight into the gendered division of labour and its relation to politics and economics.
5. Men and women students and professionals will be better equipped to work and live together as equals.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 – Weak														
Course Outcomes (Cos)	**Program Outcomes (Pos)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	-	-	-	-	-	-	-	-	2	-	-	-	1
CO2	-	-	-	-	-	-	-	-	-	-	2	-	-	1
CO3	-	-	-	-	-	-	-	-	-	2	-	1	-	1
CO4	-	-	-	-	-	-	-	-	-	2	-	-	-	1
CO5	-	-	-	-	-	-	-	-	-	2	-	-	-	1
Average	-	-	-	-	-	-	-	-	-	2	2	1	-	1

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="1">J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B. Tech: ME
II Year – II Sem</td></tr>
<tr><td>Course Code: J220A</td><td rowspan="2">STATISTICS AND NUMERICAL METHODS
(Common to ME,CE and MIE)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 4</td><td>3</td><td>1</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:

This course will enable students to:

1. Basic properties of probability and random variables
2. Types of hypothesis and hypothesis testing
3. Numerical methods to solve non-linear systems
4. Various methods of interpolation and its application
5. Concepts of numerical differentiation and integration

Module 1: Probability and Distributions:

Introduction to Probability, Random variables-Definitions of Random variables, Discrete and continuous Distributions- Binomial-Poisson and normal distributions-related properties

Module 2: Sampling Theory and Testing of Hypothesis:

Unit 1: Sampling distributions –Sampling distribution of means (σ known and Unknown)- Estimation-Point estimation-interval estimation-confidence interval estimates of parameters.

Unit 2: Tests of hypothesis -Large samples- Null hypothesis – Alternate hypothesis type I, & type II errors – critical region, confidence interval for mean testing of single variance, Difference between the means.

Module 3: Solutions of Non-linear Systems:

Introduction, Mathematical preliminaries, Solution of algebraic and transcendental equations–bisection method, the method of false position, Fixed point iterative method, Newton - Raphson method, and their order of convergence.

Module 4: Interpolation

Introduction; Errors in polynomial interpolation; Finite differences; Forward differences; Backward differences; Central differences; Symbolic relations and separation of symbols; Differences of a polynomial; Newton's formulae for interpolation; Central difference interpolation formulae; Gauss's central difference formulae and Lagrange's interpolation formulae.

Module 5: Numerical Differentiation and Integration
Solution of initial value problems by Taylor's series - Picard's method of successive approximations, Euler's method, Modified Euler's method and Runge - Kutta methods. Trapezoidal rule, Simpson's 1/3 rule, and Simpson's 3/8 rule, Gaussian quadrature 2 & 3-point formulae

Text Books:

1. "Advanced Engineering Mathematics", Erwin Kreyszig, John Wiley and Sons, 8^{th} Edition, 2008. 4
2. "Higher Engineering Mathematics", B.S. Grewal, Khanna Publications, 2017

Reference Books:

1. "Numerical methods for Scientific and Engineering Computation", M. K. Jain, S.R.K.Iyengar and R.K.Jain, New Age International Publications, 2008.
2. "Fundamentals of Mathematical Statistics", C.Gupta and V.K.Kapoor, S.Chand& Co,2006

E - Resources:

1. https://nptel.ac.in/courses/111/105/111105041/https://nptel.ac.in/courses/111/105/111105041/
2. https://www.sagepub.com/sites/default/files/upm-binaries/40007_Chapter8.pdf
3. https://link.springer.com/content/pdf/10.1007/978-3-642-61074-5_14.pdf
4. https://link.springer.com/content/pdf/bbm%3A978-3-319-69407-8%2F1.pdf
5. https://stackoverflow.com/questions/19290455/interpolation-in-a-link

Course Outcomes:
On completion of the course, the students will be able to:

1. Find mean and variance of a given probability distribution
2. Test the hypothesis for small and large samples.
3. Solve numerically algebraic and transcendental equations
4. Interpret an experimental data using interpolation
5. Solve numerically ordinary differential equations and integrations

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	2	3	-	-	-	-	-	-	-	2	1	1
CO2	3	3	2	3	-	-	-	-	-	-	-	2	-	1
CO3	3	3	2	3	-	-	-	-	-	-	-	2	-	-
CO4	3	3	2	3	-	-	-	-	-	-	-	2	1	1
CO5	3	3	2	3	-	-	-	-	-	-	-	2	-	-
Average	3	3	2	3	-	-	-	-	-	-	-	2	1	1

AY 2020 - 21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech: ME II Year – II Sem			
Course Code: J223A	**MECHANICS OF FLUIDS AND HYDRAULIC MACHINES**	**L**	**T**	**P**	**D**
Credits: 3	(Common to ME, MIE,EEE)	**3**	**0**	**0**	**0**

Pre-requisite: Engineering Physics, Engineering Mathematics, Engineering Mechanics

Course Objectives:
This course will enable students to:
1. Understand the physical properties of fluids, influence on fluid motion, types of pressures and measurement of pressure.
2. Understand the Kinematics and Dynamics of fluids, different types of flows, Equation of Continuity, Euler's and Bernoulli's equations, Momentum equation and its application
3. Study the Concept of Boundary Layer, Closed conduit flow, pipes in series and parallel, Measurement of flow using Pitot tube, Venturimeter.
4. Learn the principle, operation and performance of different types of hydraulic machines.
5. Acquire sufficient knowledge on working and performance characteristics of Centrifugal pumps and Reciprocating pumps

Module 1
Unit 1: Fluid Statics: Dimensions and units – physical properties of fluids – specific gravity – viscosity and surface tension –Vapour pressure and their influence on fluid motion – buoyancy.
Unit 2: Pressure Measurement: Atmospheric, gauge and vacuum pressures – measurement of pressure – Piezometer, U-tube and differential manometers.

Module 2
Unit 1: Fluid Kinematics: Stream line, path line and streak lines and stream tube – classification of flows – steady and unsteady, uniform and non-uniform, laminar and turbulent, rotational and irrotational flows – equation of continuity for one dimensional flow and three-dimensional flows.
Unit 2: Fluid Dynamics: Surface and body forces –Euler's and Bernoulli's equations for flow along a stream line – momentum equation and its application on pipe bend.

Module 3
Unit 1: Closed conduit flow: Reynold's experiment – Darcy Weisbach equation – Minor losses in pipes – pipes in series and pipes in parallel – total energy line – hydraulic gradient line. Measurement of flow: pitot tube, venturi meter, and orifice meter, Flow nozzle.

Unit 2: Boundary Layer Concepts: Definition – thicknesses – characteristics along thin plate – laminar and turbulent boundary layers (No derivation), boundary layer in transition -separation of boundary layer – submerged objects – drag and lift.

Module 4

Unit 1: Basics of turbo machinery: Hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes – jet striking centrally and at tip – velocity diagrams, work done and efficiency – flow over radial vanes.

Unit 2: Hydraulic Turbines: Classification of turbines – Heads and efficiencies – impulse and reaction turbines – Pelton wheel – Francis turbine and Kaplan turbine – working proportions – work done, efficiencies – hydraulic design –draft tube theory, functions and efficiency.

Unit 3: Performance of hydraulic turbines: Geometric similarity, Unit and specific quantities – characteristic curves – governing of turbines – selection of type of turbine – cavitation – surge tank –water hammer.

Module 5

Unit 1: Centrifugal pumps: Classification – working –work done – barometric head – losses and efficiencies – specific speed – performance characteristic curves – NPSH.

Unit 2: Reciprocating pumps: Working – Discharge – slip indicator diagrams.

Text Books:

1. Dr. P.N. Modi, Dr. S.M. Seth, "Hydraulics and Fluid Mechanics including Hydraulics Machines", Standard Book House, 20th Edition, 2015.
2. Er. R.K. Rajput, "Fluid Mechanics and Hydraulic Machines", S. Chand Publications, 6thEdition.

Reference Books:

1. Dr. D.S. Kumar, "Fluid Mechanics and Fluid Power Engineering", KATSON Publications, 2012
2. D. Rama Durgaiah, "Fluid Mechanics and Machinery", New Age International (P) Ltd, Publishers, Reprint 2004.
3. T.R. Banga, S.C. Sharma, "Hydraulic Machines", Khanna Publishers, 16th Edition, 2016

E - Resources:

1. https://nptel.ac.in/courses/112/105/112105183/
2. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-KANPUR/FLUID-MECHANICS/ui/TOC.htm
3. http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-%20KANPUR/machine/ui/TOC.htm

Course Outcomes:

On completion of the course, the students will be able to:

1. **Understand** the basics of Fluid Properties and evaluate numerical problems on the measurement of pressure.
2. **Apply** the various equations such as the Continuity equation, Euler's and Bernoulli's equations, Momentum equation, etc., to analyse the Kinematics and Dynamics of fluids and solve concern numerical problems
3. **Apply** the concepts of laminar and turbulent boundary layers in closed conduit flow and solve concern numerical problems.
4. **Analyse** the working of Hydraulic Turbines, solve the numerical problems concerning the hydraulic Turbine.
5. **Analyse** the working of Centrifugal pumps, Reciprocating pumps and Solve numerical problems concerning the pumps.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	-	1	-	-	-	-	-	-	-	2	1	-
CO2	3	3	2	2	1	-	-	-	-	-	-	2	1	1
CO3	3	3	2	2	2	-	-	-	-	-	-	3	2	1
CO4	3	3	3	3	1	-	-	-	-	-	-	3	2	2
CO5	3	3	3	2	1	-	-	-	-	-	-	3	2	1
Average	3	2.8	2.5	2	1.25	-	-	-	-	-	-	2.6	1.6	1.25

AY 2020 - 21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech: ME II Year – II Sem			
Course Code: J223B	DYNAMICS OF MACHINERY	L	T	P	D
Credits: 3		3	0	0	0

Pre-requisite: Engineering Physics, Engineering Mechanics, Mechanics of Materials and Kinematics of Machines.

Course Objectives:

This course will enable students to:

1. Understand techniques for studying motion of Machines and their components under the influence of forces due to inertia and externally applied load system.
2. Understand the precession motion gyroscopic principles and its effects on rotating members.
3. Assess the Dynamics of mechanical elements used in IC engines and automobiles
4. Deal with balancing of rotating and reciprocating parts of various machines and to study the influence of primary and secondary forces involved in the system.
5. Understand the concepts of free and forced vibrations in machines and its dynamic analysis.

Module 1:

Unit 1: Static and Dynamic Force Analysis of Planar Mechanisms: Introduction– Free Body Diagrams – Conditions for equilibrium – Two, three and four force systems – Inertia forces and D' Alembert's Principle – planar rotation about a fixed center

Unit 2: Precession: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motor cycle, aero-planes and ships.

Module 2:

Unit 1: Friction Clutches: Introduction to Friction and its types, Single Plate, Multi Plate, Cone Clutch and Centrifugal Clutch.

Unit 2: Brakes and Dynamometers: Simple block brakes, Band brake, Internal expanding brake of vehicle. Dynamometers – absorption and transmission types, General description and methods of operations.

Module 3

Unit 1: Turning Moment Diagram and Flywheels: Turning moment, Inertia Torque connecting rod angular velocity and acceleration, crank effort and torque diagrams, Fluctuation of energy, Flywheels and their design.

Unit 2: Governers: Watt, Porter and Proell governors, spring loaded governors – Hartnell and Hartung Governors with auxiliary springs. Sensitiveness, Isochronism and hunting.

Module 4: Balancing of Rotating Masses

Unit 1: Balancing of Rotating Masses: Balancing of rotating, single and multiple masses in single and different planes.

Unit 2: Balancing of Primary and Secondary Reciprocating Masses: Primary and Secondary balancing of reciprocating masses, Analytical and graphical methods - Unbalanced forces and couples Balancing of V, multi cylinder inline and radial engines for primary and secondary balancing.

Module 5: Vibration

Free Vibration of mass attached to vertical spring, Oscillations of Pendulum, Transverse loads, Vibrations of Beam with Concentrated and Distributed loads. Dunkerly's Method Raleigh's method Whirling of shafts – Critical speeds of shafts, Simple problems on free damped and forced vibration.

Text Books:

1. T. Bevan, "Theory of Machines", S. Chand Publications, 3rd Edition.
2. S SRatan, "Theory of Machines", Tata McGraw Hill, 2007 reprint

Reference Books:

1. P. L. Ballaney, "Theory of Machines and Mechanisms", Orient Publishers.
2. R. L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw Hill.
3. J.S Rao and RV Dukkipati, "Mechanism and Machine Theory", New Age Publishers.

E - Resources:

1. https://nptel.ac.in/courses/112/104/112104114/
2. https://urlzs.com/YTF41
3. https://urlzs.com/SqM8L

Course Outcomes:

On completion of the course, the students will be able to:

1. **Design** linkages and mechanisms for a given motion associated with forces.
2. **Analyze** the effect of precession motion and gyroscopic couples on moving bodies viz automobiles, aeroplanes and ships.
3. **Analyze** the effect of dynamics on various mechanical elements associated with IC engines and automobiles.
4. **Understand** the significance of balancing moving parts and its dynamic analysis to achieve the steady state of equilibrium.

5. **Understand** the behaviour of vibration and its effects on dynamic machine members.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	2	2	-	-	-	-	-	-	-	2	1	-
CO2	3	2	2	2	-	-	-	-	-	-	-	2	1	-
CO3	3	2	2	2	-	-	-	-	-	-	-	2	2	-
CO4	3	3	3	2	-	-	-	-	-	-	-	2	2	1
CO5	3	3	3	2	-	-	-	-	-	-	-	2	2	1
Average	3	2.6	2.4	2	-	-	-	-	-	-	-	2	1.6	1

AY 2020 - 21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech: ME II Year – II Sem			
Course Code: J223C	**THERMAL ENGINEERING – I**	**L**	**T**	**P**	**D**
Credits: 3		**3**	**0**	**0**	**0**

Pre-requisite: Engineering Physics, Thermodynamics

Course Objectives:
This course will enable students to:

1. Gain the basic knowledge on working of IC Engines, air standard cycles, compare with operation on air fuel cycles and various losses.
2. Know the process of combustion and different stages of combustion in SI and CI engines.
3. Know how to do performance test and draw heat balance sheet for IC Engines.
4. Know the working principles of air compressors and their classification based on different parameters.
5. Understand working principles of rotary, dynamic and axial flow compressors to evaluate their performance.

Module 1

Unit 1:Actual Cycles and their Analysis: Introduction – Comparison of Air Standard and Actual Cycles, Time Loss Factor, Heat Loss Factor, Exhaust Blow down, Loss due to Gas exchange Process, Volumetric Efficiency, Loss due to Rubbing Friction. Actual and Fuel Air Cycles of CI Engines.

Unit 2: I.C. Engines: Classification - Working principles, Valve and Port Timing Diagrams, Air standard, Air fuel and Actual cycles. Engine systems – Fuel, Carburetor, Fuel injection System, Ignition, Cooling and Lubrication.

Module 2

Unit 1: Combustion in S.I. Engines: Normal Combustion and abnormal combustion, Importance of flame speed and effect of engine variables. Type of Abnormal combustion – pre-ignition and knocking. Fuel requirements and fuel rating, anti-knock additives. Combustion chamber requirements and types.

Unit 2: Combustion in C.I. Engines: Four stages of combustion – Delay period and its importance – Effect of engine variables – Diesel Knock– Need for air movement, suction, compression and combustion induced turbulence. Open and divided combustion chambers and nozzles used. Fuel requirements and fuel rating.

Module 3

Unit 1: Testing and Performance of I.C. Engines: Parameters of performance – measurement of cylinder pressure, fuel consumption, air intake, exhaust gas composition, brake power, determination of frictional losses and indicated power. Performance test – Heat balance sheet and chart.

Module 4

Unit 1: Compressors: Classification–positive displacement and rotodynamic machinery. Power producing and power absorbing machines – fan, blower and compressor. Positive displacement and dynamic types – reciprocating and rotary types.

Unit 2: Reciprocating Compressors: Principle of operation, work required, Isothermal efficiency, volumetric efficiency and effect of clearance. Stage compression, under cooling, saving of work, minimum work condition for stage compression.

Module 5

Unit 1: Rotary (Positive displacement type) Compressors: Roots Blower, vane sealed compressor, Lysholm compressor–mechanical details and principle of working. Efficiency considerations.

Unit 2: Dynamic Compressors: Centrifugal compressors – Mechanical details and principle of operation, velocity and pressure variation. Energy transfer-impeller blade, shape-losses, slip factor, power input factor, pressure coefficient and adiabatic coefficient. Velocity diagrams – power.

Unit 3: Axial Flow Compressors: Mechanical details and principle of operation–velocity triangles, energy transfer per stage, degree of reaction, work done factor, isentropic efficiency, pressure rise calculations and polytropic efficiency.

Text Books:

1. V. Ganesan, “I.C. Engines” , Tata McGraw Hill, 4th Edition, 2012.
2. K.K. Ramalingam, “I.C. Engines”, SciTech Publishers, 2nd Edition, 2011.

Reference Books:

1. R.P. Sharma, “I.C. Engines”, DhanpathRai Publications, 8th Edition, 2010.
2. R.K. Rajput, “Thermal Engineering”, Lakshmi Publications, 9th Edtn, 2018.
3. John B. Heywood, “I.C. Engines”, Tata McGraw-Hill

E - Resources:

1. https://books.google.co.in/books/about/Internal_Combustion_Engines.html?id=UtxI5gXM1yQC
2. https://nptel.ac.in/courses/112/103/112103262/
3. https://freevideolectures.com/course/3110/turbomachinery-aerodynamics/33
4. https://journals.sagepub.com/doi/full/10.1177/1468087419877990
5. https://www.iitism.ac.in/~shibayan/MMC%2016101%20Fluid%20Machines/MMC%2016101_compressor_01.pdf

Course Outcomes:

On completion of the course, the students will be able to:

1. **Analyse** the working of IC engines on actual cycles and its application in industry and automobiles.
2. **Differentiate** the combustion process in both SI and CI engines, identify the various effects of abnormal combustion.
3. **Evaluate** the performance of IC Engines using several tests.
4. **Analyse** the working principles of various types of compressors and selection for industrial applications.
5. **Evaluate** the performance of rotary, dynamic and axial flow compressors

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	1	2	-	-	-	-	-	-	-	2	2	2
CO2	3	2	2	2	-	-	-	-	-	-	-	3	2	2
CO3	3	3	2	3	2	-	-	-	-	-	-	3	3	3
CO4	3	3	2	3	1	-	-	-	-	-	-	3	1	1
CO5	3	3	3	2	1	-	-	-	-	-	-	2	2	1
Average	3	2.8	2	2.4	1.3	-	-	-	-	-	-	2.6	2	1.8

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
II Year – II Sem</td></tr>
<tr><td>Course Code: J22EA</td><td rowspan="2">MANAGERIAL ECONOMICS AND MANAGEMENT SCIENCE
(Common to CE, ME, MIE & EEE)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 4</td><td>3</td><td>1</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: NIL

Course Objects:

This course will enable students to:

1. Understand Caste System
2. Learn women's work its politics and economics
3. Them aware rebuilding lives.
4. Understand about relationships, responsibilities and gender identities

Module 1:

Unit 1: Introduction to managerial economics, concepts of Managerial Economics: Demand Analysis: Law of Demand, Elasticity of demand & Demand forecasting.

Unit 2: Production & cost Analysis: Production functions, Law of returns, Economies of scale.

Unit 3: Cost concepts: Variable cost, fixed cost, Marginal cost, Semi-variable cost. Break – even analysis.

Module 2:

Unit 1: Market Structures: Different types of Markets.

Unit 2: Pricing: Methods of pricing and Strategies, Skimming and Penetration pricing.

Unit 3: Capital Budgeting: Estimation of fixed and working capital, methods & sources of raising capital. Methods of capital budgeting, Traditional & Discounted Techniques.

Unit 4: Financial Accounting & Financial Analysis: Overview of financial Accounts, Journal, Subsidiary books, Ledger, Trial Balance and preparation of Trading Account, Profit& Loss Account and Balance Sheet. Financial Analysis with the help of Ratios.

Module 3:

Unit 1: Management: Functions of Management, Taylor's scientific management, Fayol's principles of management.

Unit 2: Designing of organization structures: Different methods with merits and demerits and their suitability.

Unit 3: Human Recourse Management: Recruitment, Selection, Training and Development and Performance

Module 4:

Unit 1: Operation Management: Types of plant layout, Methods of production, Work study – procedure involved in Methods study and work Measurement. Statistical quality control. X, R, C & P charts.

Unit 2: Project Management: Program Evaluation & Review Technique (PERT), Critical Path Method (CPM), Identification of critical path.

Module 5:

Unit 1: Material Management: objectives, need for inventory control, EQC, ABC Analysis, VED Analysis, Purchase procedure, Store Management.

Unit 2: Marketing: Functions, Marketing Mix, Marketing strategies based on product life cycle, channels of distribution.

TEXT BOOKS:

1. Managerial Economics& Financial Accounting: Dr. M. Kasi Reddy, Dr. S. Saraswathi, Prentice Hall of India.
2. Managerial Economics: Varshney & Maheswari, Sultan Chand, 2009.

REFERENCES:

1. Financial Accounting for Management: Ambrish Gupta, Pearson Education, New Delhi, 2009.
2. Financial Accounting a Managerial Perspective: Narayanaswamy, PHI, 2008.
3. Financial Accounting, S. N. Maheswari & S.K. Maheswari, Vikas, 2008.

Course Outcomes:

The student will be able to

1. Describes the basic structure of Caste system in India and the major four categories to which all castes could be
2. Learn to keep themselves safe and alive in the face of domestic violence.
3. Learn to maintain equality in gender. The student should have understood the responsibility of being good
4. describes the basic structure of Caste system in India and the major four categories to which all castes could be

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	3	2	-	-	-	-	-	-	-	-	-	-	1
CO2	2	2	-	2	-	-	-	-	-	-	-	-	-	1
CO3	3	2	-	3	-	-	-	-	-	-	-	-	-	1
CO4	3	1	-	-	-	-	-	-	-	-	-	-	-	1
CO5	2	2	3	3	-	-	-	-	-	-	-	-	-	1
Average	**2.4**	**2.0**	**2.5**	**2.67**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	-	1

AY 2020 - 21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech: ME II Year – II Sem			
Course Code: J2231	MECHANICS OF FLUIDS AND HYDRAULIC MACHINES LAB	L	T	P	D
Credits: 1	(Common to ME, MIE,EEE)	0	0	2	0

Pre-requisite: Engineering Physics, Mechanics of Fluids and Hydraulic Machines.

Course Objectives:

This course will enable students to:

1. Gain practical knowledge in verification of the characteristics of fluid flow.
2. Get practical training in the calibration of fluid flow instruments.
3. Understand how to determine the major and minor losses in fluid flow.
4. Acquire practical knowledge in evaluating performance of hydraulic turbines and hydraulic pumps.

List of Experiments

Experiment 1: Verification of Bernoulli's Theorems

Experiment 2: Calibration of Venturi meter

Experiment 3: Calibration of Orifice meter.

Experiment 4: Calibration of Mouth piece / Orifice apparatus.

Experiment 5: Determination of loss of head due to sudden contraction in pipeline

Experiment 6: Determination of friction factor for a given pipe line

Experiment 7: Impact of jets on Vanes

Experiment 8: Performance Test on Pelton Wheel

Experiment 9: Performance test on Francis Turbine.

Experiment 10: Performance Test on Reciprocating Pump.

Experiment 11: Performance Test on Single Stage Centrifugal Pump.

Experiment 12: Performance Test on Multi Stage Centrifugal Pump.

E - Resources:

1. https://books.google.co.in/books?id=yCW_8APjwMkC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

Course Outcomes:

On completion of the course, the students will be able to:

1. **Demonstrate** skills in calibration of instruments such as Venturimeter, Orifice meter, etc.
2. **Evaluate** the minor and major losses in fluid flow.
3. **Analyse** the performance of hydraulic turbines and pumps used in power plants.
4. **Carry out** trouble shooting in hydraulic power plants.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	-	-	-	-	-	-	-	3	-	2	3	-	-
CO2	-	-	-	-	-	-	-	-	3	-	2	3	1	1
CO3	-	-	-	-	-	-	-	-	3	-	3	3	1	1
CO4	-	-	-	-	-	-	-	-	3	-	3	3	-	-
Average	-	-	-	-	-	-	-	-	3	-	2.5	3	1	1

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
II Year – II Sem</td></tr>
<tr><td>Course Code: J2232</td><td rowspan="2">DYNAMICS OF MACHINERY LAB</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 1</td><td>0</td><td>0</td><td>2</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Physics, Engineering Mechanics, Mechanics of Materials and Kinematics of Machines.

Course Objectives:

This course will enable students to:

1. Understand the kinematics and dynamics of mechanical elements linkages, gears, cams
2. Learn to design such elements to accomplish desired motions or tasks.
3. Understand types of motion
4. Understand static and dynamic balance

List of Experiments

Experiment 1: To determine the state of balance of machines for primary and secondary forces

Experiment 2: To determine the frequency of torsional vibration of a given rod

Experiment 3: Determine the effect of varying mass on the centre of sleeve in porter and proell governor

Experiment 4: Find the motion of the follower if the given profile of the cam

Experiment 5: The balance masses statically and dynamically for single rotating mass systems

Experiment 6: Determine the critical speed of a given shaft for different n-conditions

Experiment 7: For a simple pendulum determine time period and its natural frequency

Experiment 8: For a compound pendulum determine time period and its natural frequency

Experiment 9: Determine the effect of gyroscope for different motions

Experiment 10: Determine the pressure distribution of lubricating oil at various load and speed of a Journal bearing.

E - Resources:

1. https://books.google.co.in/books?id=k0fOA71sC5kC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

Course Outcomes:

On completion of the course, the students will be able to:

1. **Apply** the knowledge of different types of motion in real time applications
2. **Analyse** forces and torques of components in linkages
3. **Analyse** the static and dynamic balance
4. **Apply** forward and inverse kinematics of open-loop mechanisms

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	2	1	-	2	1	1
CO2	-	-	-	-	-	-	-	-	2	1	-	2	1	1
CO3	-	-	-	-	-	-	-	-	2	1	-	2	1	1
CO4	-	-	-	-	-	-	-	-	2	1	-	2	1	1
CO5	-	-	-	-	-	-	-	-	2	1	-	2	1	1
Average	-	-	-	-	-	-	-	-	2	1	-	2	1	1

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
II Year – II Sem</td></tr>
<tr><td>Course Code: J2233</td><td rowspan="2">MACHINE DRAWING PRACTICE LAB</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 2</td><td>0</td><td>0</td><td>0</td><td>4</td></tr>
</table>

Pre-requisite: Engineering Drawing.

Course Objectives:
This course will enable students to:

1. Understand the fundamental concepts of machine drawing, and develop the capacity to represent any machine part.
2. Develop knowledge of SI Conventions for working drawings of Machine Parts.
3. Draw the views of different machine elements and parts, such as Cotter Joints, Shaft couplings, Bearings, etc., with correct drawing proportions.
4. Develop skill to draw the Assembled Views for the part drawings of I C engine components, Valves, etc.

Module 1
Machine Drawing Conventions: Need for Machine Drawings – Introduction to SI Conventions – Introduction to types of Drawings and working Drawings for Machine Parts.

- **a)** Conventional representation of Materials, Common Machine Elements and Parts such as Screws, Nuts, Bolts, Keys, Gears, Bearings, Springs, etc.
- **b)** Types of Sections – Selection of sectional planes and drawing of sections and auxiliary sectional views. Parts not usually sectioned.
- **c)** Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centre lines, curved and tapered features.
- **d)** Title boxes - size, location and details - common abbreviations in general usage

Module 2

I. Drawing of Machine Elements and Simple Parts: Selection of Views, additional views for the following machine elements and parts with easy drawing proportions.

- **a)** **Screw Threads and Fasteners** - Popular forms of Screw Threads, Bolts, Nuts, Stud Bolts, Tap Bolts, Set Screws.
- **b)** **Keys** – Saddle Keys, Sunk Keys, Feather Keys, Woodruff Keys, Splines
- **c)** **Cotter Joints** – with Sleeves, with Socket and Spigot ends, with Gibs
- **d)** **Pin Joints** – Knuckle Joint.
- **e)** **Riveted Joints**: Various types of Riveted Joints for plates.
- **f)** **Welded Joints:** Various types of Welded Joints and symbols.

g) **Shaft coupling** – Sleeve or Muff Couplings, Flanged Couplings, Universal Couplings, Oldham Coupling.
h) **Pipe Joints**: Cast Iron Pipe Joints, Joints for Hydraulic Pipes, Pipe Fittings
i) **Pulleys**: Flat Belt Pulleys, ‘V’ – Belt Pulleys, Rope Pulleys.
j) **Bearings:** Journal Bearings – Solid, Bushed and Collared Journal Bearings, Pivot or Foot-Step Bearings.

Module 3

II. Assembly Drawings: Drawings of Assembled Views for the part drawings of the following using conventions and easy drawing proportions.

a) **Engine Parts:** Steam Engines: Stuffing Box, Cross Head, Eccentric. Petrol Engine: Connecting Rod, Piston Assembly.
b) **Other Machine Parts:** Screws Jack, Plain Machine Vice, Plummer Block, Tail-stock.
c) **Valves**: Gate Valve, Screw-down Stop Valve, Spring Loaded Safety / Relief Valve, Feed Check Valve and Aircock.

NOTE:

1. First angle projection to be adopted.
2. Few exercises from I & II to be practiced using open source AutoCAD software, exclusively for Internal Evaluation

Text Books:

1. Machine Drawing: K. L. Narayana, P. Kannaiah & K. Venkata Reddy; New Age Publishers, 5th Edition, 2016.
2. Machine Drawing: N.D. Bhatt; Charotar Publications, 47th Edition,2012

Reference Books:

1. Ajeet Singh, “Machine Drawing”, TMH Publications, 4th Edition, 2010.
2. P. S. Gill, “Machine Drawing”, Kataria Publications, 16th Edition, 1996.
3. Junarkar. N. D, “Machine Drawing”, Pearson Publication, 2009

E - Resources:

1. https://rb.gy/eln9yk
2. https://rb.gy/p9q0o0
3. https://rb.gy/erlhm8

Course Outcomes:

On completion of the course, the students will be able to:

1. **gain** thorough knowledge of the conventional representation of common Machine Elements and Parts such as Screws, Nuts, Keys, Bearings, Springs, etc.
2. **acquire** Very good skills in drawing of joints used in engineering practice, such as Cotter and Knuckle Joints, Riveted Joints, Welded Joints, etc.,

3. **draw** the assembly drawings of Machine Parts such as Stuffing Box, Eccentric, Connecting Rod, Screw Jack, Valves, etc.,
4. **Interpret** the machine drawings that in turn help the students in the preparation of the production drawings.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	-	-	-	2	-	-	-	3	2	-	1	1	1
CO2	-	-	-	-	2	-	-	-	3	2	-	1	2	1
CO3	-	-	-	-	2	-	-	-	3	2	-	1	2	1
CO4	-	-	-	-	-	-	-	-	3	2	-	2	2	1
CO5	-	-	-	-	-	-	-	-	3	2	-	2	2	1
Average	-	-	-	-	2	-	-	-	3	2	-	1.4	1.8	1

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
II Year – II Sem</td></tr>
<tr><td>Course Code: J22M1</td><td rowspan="2">PROFESSIONAL ETHICS
(Common to ALL)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 0</td><td>2</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: NIL

Course objectives:
The Student will:

1. know the importance of corporate social responsibility and values.
2. understand ethics as a professional responsibility.
3. Corporate ethical course and ethical audit.
4. understand importance of values and ethical living.
5. ensure safety at work place

Module 1:
Unit 1: Introduction to Ethics: Corporate Governance – importance of Corporate Governance, Ethics &CSR(Corporate Social Responsibility) Indian and western thoughts on ethics.
Unit 2: Value education, dimensions of ethics, goal setting importance of morality and ethics, basic ethical principles, moral developments theories, classification of ethical theories.

Module 2:
Unit 1: Professional and professionalism: Introduction to profession, professional associations, professional's roles and professional risks. Professional accountability, successful professional, ethics and profession.
Unit 2: Engineering as social experimentation, engineering ethics, roles of engineers, professional responsibilities, professional rights. Professional etiquettes- Dress code, Telephone call, Email writing.

Module 3:
Unit 1: Ethical codes and audits: Introduction, need for ethical codes, sample codes, corporate codes, limitations of the codes.
Unit 2: Need for Ethical Audit, Sustainability, Ethical standards, Ethical audit.

Module 4:
Unit 1: Human values and ethical living: Introduction, terminology, domains of learning, human values, attitudes, behavior values, attitudes and professionals.
Unit 2: Needs of life, harmony in life, what is ethical living, case studies.

Module 5:

Unit 1: Global issues and safety: Introduction, current scenario, business ethics, environmental ethics, computer ethics, media ethics, war ethics, bio-ethics, research ethics, intellectual property right.

Unit 2: Safety and risk, assessment of risk, risk and cost, engineers responsibility for safety, risk benefit, analysis, risk cause and management, case studies, providing for safe exit, ethical issues of safety.

REFERENCES:

1. Professional ethics by R. Subramanian, Oxford press.
2. Text book on Professional ethics and human values by R.S.Nagarajan, New age international.
3. Professional ethics and human value by D.R.Kiran, Tata McGraw Hills education.
4. Ethics in engineering by Mike W. Martin and Roland Schinzinger, Tata McGraw Hills education.
5. Fundamental of Ethics by Edmund G Seebauer and Robert L.Barry, Oxford university press.

E-resources:

1. http://jits.ac.in/humanvalues_professional-ethics/
2. https://www.tutorialspoint.com/engineering_ethics/engineering_ethics_introduction.htm
3. https://www.onlineethics.org/
4. https://onlinecourses.nptel.ac.in/noc19_hs35/preview

Course Outcomes:

The Student will be able to:

1. Use of ethical values and attitudes in their life.
2. Implement once he/she becomes a professional.
3. Solve the issues related with environment and technology
4. Apply the different types of professional ethical codes in their organization.
5. Use of the rules framed by the auditors.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	-	-	-	-	-	-	3	2	1	-	3	-	1
CO2	1	-	-	-	-	-	-	3	2	-	-	3	-	1
CO3	-	1	-	-	-	-	-	3	2	-	-	3	2	1
CO4	1	-	-	-	-	-	-	3	2	1	-	3	-	2
CO5	1	-	-	-	-	-	-	3	2	1	-	3	-	-
Average	1.0	1.0	-	-	-	-	-	3.0	2.0	1.0	-	3.0	2	1.25

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
II Year – II Sem</td></tr>
<tr><td>Course Code: J2201</td><td rowspan="2">SOFT SKILLS
(Common to ALL)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 0</td><td>2</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: NIL

Course Objectives:

This course will enable students to:

1. Understand the importance of advanced communication skills.
2. Obtain knowledge on intra personal skills and inter personal skills.
3. Gain knowledge on design thinking.
4. Know about the neuro linguistic programming.
5. Learn about self- concept and self- reliance.

Module 1: Advanced Communication:

Barriers of Communication Skills – Real-life case studies, Intra personal skills & Inter personal skills-Practical sessions, Adjustability, Adaptability, Change Planning & Management- For Self, Communication skills-debates, practical sessions & public speaking skills, Body language through NLP (neuro linguistic programming) communication.

Module 2: Design Thinking:

Introduction of Design Thinking, Digitization & Data – Latest Trends in Human Resource,

Thinking Out-of-the Box – Case-study & Activity Based, Dealing with Criticism & Conflict Resolution & Management, Diversity, Social Responsibility, Positive Attitude & Power of Positive Energy.

Module 3: Self-concept & Self-reliance:

Wheel of Life – Self-assessment & Activities, SWOT Analysis, Johari Window tool, developing a Vision & Action-plan, Emotional Intelligence, Stress & Anger Management, Empathy- Practice Sessions & Role-plays, Time management & Prioritization, Problem solving & Decision-making skills.

REFERENCES:

1. Dr Alex. K, Soft Skills, New Delhi: S.Chand, 2009.
2. Dr Ravikanth Rao. K, Dr P. Dinakar. Life Skills Education Paperback, 2016.

Web Resources:

1. https://www.youtube.com/watch?v=Bhf35YngKl4&ab_channel=DanielAlly
2. https://www.youtube.com/watch?v=gHGN6hs2gZY&ab_channel=AJ%26Smart
3. https://www.youtube.com/watch?v=_r0VX-aU_T8&ab_channel=Sprouts.
4. https://www.youtube.com/watch?v=aKGm3nprVA0&t=465s&ab_channel=DreamsAroundTheWorld
5. https://www.youtube.com/watch?v=JXXHqM6RzZQ&ab_channel=SmartDraw
6. https://www.youtube.com/watch?v=Zi4SvpAFRmY&t=309s&ab_channel=CommunicationCoachAlexLyon
7. https://www.youtube.com/watch?v=LgUCyWhJf6s&ab_channel=TheSchoolofLife
8. https://www.youtube.com/watch?v=BsVq5R_F6RA&ab_channel=watchwellcast
9. https://www.youtube.com/watch?v=czh4rmk75jc&ab_channel=WaysToGrow

Course outcomes:

At the end of this course students will be able to

1. Use the advance communication skills in daily life.
2. Utilize the importance of positive energy and positive attitude.
3. Handle criticism in a positive way.
4. Use knowledge to take proper decision in life
5. Grab knowledge on Self-awareness and time management.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO2	-	-	-	-	-	-	-	-	2	3	-	3	-	1
CO3	-	-	-	-	-	-	-	-	2	3	-	3	-	1
CO4	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO5	-	-	-	-	-	-	-	-	2	3	-	3	-	-
Average	-	-	-	-	-	-	-	-	2	3	-	3	-	1

<table>
<tr><td>AY 2020 - 21 onwards</td><td colspan="4">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
III Year – I Sem</td></tr>
<tr><td>Course Code: J313A</td><td rowspan="2" colspan="4">METAL CUTTING AND MACHINE TOOLS</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Physics, Engineering Materials.

Course Objectives:
This course will enable students to:

1. Learn the fundamental principles of metal removal processes performed on machine tools and get to know about the elements of cutting process.
2. To understand the tool interface characteristics for evaluating effect of temperature – heat on tool wear & surface condition of the material.
3. Gain knowledge on the constructional and working features of machine tools such as Lathe, Drilling, Boring and shaping.
4. Study the different types of metal cutting operations on the Milling and grinding machines.
5. Understand applications of Jigs and fixtures, Non-Traditional machining methods, their working principles and applications.

Module 1
Unit 1: Metal cutting: Elementary treatment of metal cutting theory – Basics of cutting process – Geometry of single point tool – angles chip formation and types of chips, chip breakers. Mechanics of orthogonal cutting – Merchant's diagram, cutting forces – cutting speeds, feed, depth of cut.

Module 2
Unit 1: Thermal Aspects of Metal Cutting: Sources of heat and heat distribution. Various methods of measurement of temperature – cutting fluids and applications
Unit 2: Tool Wear and Tool Life: Criteria for tool wear, flank and crater wear theories – criteria for tool life in roughing and finishing – Measurement of tool wear, Taylor's tool life equation, factors effecting tool life – Machinability.
Unit 3: Economics of machining: Tool life for maximum production – minimum cost.

Module 3
Unit 1: Engine lathe: Principle of working– types of lathe – specifications. Taper turning – Lathe attachments. Capstan and Turret lathe – Single spindle and multi-spindle automatic lathes – tool layouts.
Unit 2: Drilling Machine: Principles of working– specifications– types– operations performed; geometry of twist drill.

Unit 3: Boring Machine: Types of Boring machines and applications. Shaping– slotting and planning machines – Principles of working – machining time calculations.

Module 4

Unit 1: Milling Machines: Principles of working – Types of milling machines – Geometry of milling cutters – Methods of indexing

Unit 2: Grinding Machines: Theory of grinding – classification of grinding machines. Types of abrasives, bonds. Selection of grinding wheel. Lapping– honing and broaching machines.

Module 5

Unit 1: Jigs and Fixtures: Classification– Design principles for location and clamping.

Unit 2: Unconventional Machining: Principles of working and applications of USM, AJM, EDM, ECM, LBM and EBM (Mechanisms, MRR and Process parameters in each case)

Text Books:

1. P. N. Rao, "Manufacturing Technology: Metal cutting and Machine Tools", Tata McGraw-Hill Publications, 3rd Edition, Volume 2, 2013.
2. HMT Bangalore, "Production Technology", Tata McGraw-Hill Publishing Company Limited, 28th Edition, 2008
3. C. Elanchezhian, B. Vijaya Ramnath and M Vijayan, "Unconventional Machining Processes", Anuradha Publications, 1st Edition. 2005
4. B. L. Juneja, "Fundamentals of Metal Cutting and Machine Tools", New Age International Publishers. 2ndEdition, 2005.

Reference Books:

1. Richerd R Kibbe, John E. Neely, Roland O. Merges and Warren J. White. "Machine Tool Practices", Prentice Hall of India, 2009
2. Yoram and Koren, "Computer Control of Manufacturing Systems", Tata McGraw-Hill International Book Company, 2nd Edition, 2006.
3. V.K Jain, "Advanced Machining Processes", Allied publishers, 5th Edition. 2010.

E - Resources:

1. https://books.google.co.in/books?id=9rNldaV3FwcC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
2. https://nptel.ac.in/courses/112/105/112105233/
3. https://nptel.ac.in/courses/112/105/112105126/
4. https://books.google.co.in/books?id=ojUSAga14cMC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

Course Outcomes:

On completion of the course, the students will be able to:

1. **Gain** thorough knowledge about Metal Cutting process, the parameters involved– Geometry of single point tools and Cutting tool material.
2. **Select** the cutting tool materials, tool geometry, and appropriate machining processes for different combinations of tool and work materials and evaluating the effect of thermal characteristics on tool & job.
3. **Fabricate** various components by using Lathe, Drilling, Boring and shaping machines.
4. **Fabricate** various components by Milling, and grinding machines.
5. **Understand** of Non-Traditional machining, Jigs and Fixtures

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	1	-	-	2	-	-	-	-	-	-	-	2	-
CO2	2	2	-	2	2	-	-	-	-	1	-	-	2	-
CO3	2	1	1	-	2	-	-	-	-	1	-	-	2	-
CO4	2	1	1	-	2	-	-	-	-	1	-	-	2	-
CO5	3	2	2	1	2	-	-	-	-	1	-	-	3	-
Average	2.4	1.4	1.33	1.5	2	-	-	-	-	1	-	-	2.2	-

<table>
<tr><td>AY 2020 - 21 onwards</td><td colspan="4">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td>B. Tech: ME III Year – I Sem</td></tr>
</table>

AY 2020 - 21 onwards	**J. B. Institute of Engineering and Technology (UGC Autonomous)**	**B. Tech: ME III Year – I Sem**			
Course Code: J313B	**DESIGN OF MACHINE MEMBERS – I**	**L**	**T**	**P**	**D**
Credits: 3		**3**	**0**	**0**	**0**

Pre-requisite: Engineering Physics, Engineering Mechanics and Mechanics of Solids

Course Objectives:
This course will enable students to:

1. Gain the basic knowledge of formulation and analysis of different machine components.
2. Understand how to formulate and analyze stresses and strains in machine elements.
3. Learn and design power transmission shafts carrying various elements with geometrical features.
4. Learn and design mechanical springs.
5. Acquainted with standards, safety, reliability, importance of dimensional parameters and manufacturing aspects in mechanical design.

Module 1
Unit 1: Introduction: General considerations in the selection of Engineering Materials and their properties, Manufacturing considerations in design, BIS codes for steels.
Unit 2: Stresses in Machine Members & Fatigue Loading: Design for strength and rigidity, preferred numbers, the concept of stiffness in tension, bending, torsion and combined situations. Stress concentration, Theoretical stress Concentration factor, Fatigue stress concentration factor, notch sensitivity, Design for fluctuating stresses, Endurance limit, Estimation of Endurance strength, Goodman and Soderberg's theories of failures.

Module 2
Unit 1: Axially Loaded Joints: Design of Keys, stresses in keys, cotter joints, spigot and socket, gib and cotter joints, Knuckle joints.
Unit 2: Shaft Couplings: Rigid couplings, Muff, Split muff and Flange couplings (Unprotected and Protected). Flexible couplings, Pin bush coupling.
Unit 3: Design of Shafts: Solid and hollow shafts for strength and rigidity, Design of shafts for combined loads, Shaft sizes, BIS codes, Design of shaft for gear and belt drives.

Module 3
Unit 1: Riveted Joints: Modes of failure in riveted joints, Strength Equations, efficiency of the joints, Design of boiler joints, eccentrically loaded joints.

Unit 2: Welded Joints: Design of Fillet welds, axial loads, Circular fillet welds, bending and torsion, eccentrically loaded joints.
Unit 3: Bolted Joints: Design of bolts with pre stresses, Design of joints under eccentric loading, bolts of uniform strength, Cylinder cover joints.

Module 4
Unit 1: Mechanical Springs: Stresses and deflections of helical springs, Extension, compression springs, Springs for static and fatigue loading, natural frequency of helical springs, Energy storage capacity, torsion springs. Introduction to leaf springs.

Module 5
Unit 1: Columns and Struts: Introduction, Euler's and Rankine's theory of columns.
Unit 2: Power Transmission systems: Types ofBelts and Rope Drives, Transmission of power by Belt and Rope Drives, Transmission efficiencies. Pulleys for belt and rope drives, Materials for belt and rope drives. Introduction to Chain drives.

Text Books:

1. Bahl and Goel, "Mechanical Engineering Design", Standard Publications.
2. Pandya and Shah, "Machine Design", McGrahill, 2007

Reference Books:

1. V. Bhandari, "Design of Machine Elements"
2. R S Khurmi, "Machine Design", S Chand & Co. Publications, 2013.
3. S. Md. Jalaludeen, "Machine Design", Volume – II, 2016.

E - Resources:
1. https://nptel.ac.in/courses/112/105/112105124/
2. https://www.coursera.org/learn/machine-design1
3. https://www.academia.edu/38675030/A_Textbook_of_Machine_Design_by_R_S_KHURMI_AND_J_K_GUPTA
4. http://www.brainkart.com/subject/Design-of-Machine-Elements_72/
5. https://www.researchgate.net/publication/328926726_Design_of_Machine_Elements

Course Outcomes:
On completion of the course, the students will be able to:
1. **Analyze**, design and select machine elements for various applications.
2. **Analyze** Strength/Failure theories and Safety factors for machine members under steady and fatigue loads.
3. **Acquire** procedure to analyze and design of permanent joints such as Riveted and welded joints etc. for different applications. shafts, keys and shaft couplings.

4. **Identify** various types of springs and their applications and learn how to design helical and leaf springs with practical engineering problems.
5. **Acquire** procedure to analyze and design of temporary joints bolted joints for different applications

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	2	2	-	-	-	-	-	-	-	1	2	-
CO2	3	3	2	2	-	-	-	-	-	-	-	1	2	-
CO3	3	3	2	2	-	-	-	-	-	-	-	1	2	-
CO4	3	3	2	2	-	-	-	-	-	-	-	2	3	1
CO5	3	3	2	2	-	-	-	-	-	-	-	2	3	1
Average	3	3	2	2	-	-	-	-	-	-	-	1.4	2.4	1

<table>
<tr><td>AY 2020 - 21 onwards</td><td colspan="4">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME III Year – I Sem</td></tr>
<tr><td>Course Code: J313C</td><td rowspan="2">THERMAL ENGINEERING – II</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Physics, Thermodynamics, Thermal Engineering – I

Course Objectives:
This course will enable students to:
1. Gain the basic knowledge of Rankine cycle, performance enhancement techniques, combustion process and Boilers.
2. Understand the functions, types and applications of Draught and Nozzles.
3. Understand working principles of different types of steam turbines and their analysis.
4. Gain the knowledge on performance of reaction turbine and steam condensers.
5. Gain the knowledge of gas turbine and jet propulsion application

Module 1
Unit 1: Basic Concepts: Rankine cycle - Schematic layout, Thermodynamic Analysis, Concept of Mean Temperature of Heat addition. Methods to improve cycle performance – Regeneration and Reheating
Unit 2: Combustion: Fuels and combustion, concepts of heat of reaction, adiabatic flame temperature, stoichiometry, flue gas analysis.
Unit 3: Boilers: Classification – Working principles with sketches including H.P. Boilers – Mountings and Accessories. Equivalent evaporation, Efficiency

Module 2
Unit 1: Draught: Classification – Height of chimney for given draught and discharge – condition for maximum discharge – efficiency of chimney. Artificial draught – induced and forced.
Unit 2: Steam Nozzles: Functions – types–applications. Flow through nozzles – thermodynamic analysis – assumptions – velocity of nozzle at exit. Ideal and actual expansion in nozzle – velocity coefficient – condition for maximum discharge – critical pressure ratio. Criteria to decide nozzle shape: Super saturated flow, effects, degree of super saturation and degree of under cooling – Wilson line.

Module 3
Unit 1: Steam Turbines: Classification–Impulse turbine - Mechanical details– Velocity diagram–effect of friction – power developed, axial thrust, blade or diagram efficiency – condition for maximum efficiency.

Unit 2: De–Laval Turbine: Features – Methods to reduce rotor speed – Velocity compounding and Pressure compounding, Velocity and Pressure variation along the flow. Combined velocity diagram for a Velocity Compounded Impulse turbine.

Module 4

Unit 1: Reaction Turbine: Mechanical details – principle of operation – thermodynamic analysis of a stage – degree of reaction – velocity diagram – Parson's reaction turbine, condition for maximum efficiency.

Unit 2: Steam Condensers: Requirements of steam condensing plant – Classification of condensers – working principle of different types – vacuum efficiency and condenser efficiency – air leakage, sources and affects – air pump – cooling water requirement.

Module 5

Unit 1: Gas Turbines: Simple gas turbine plant – Ideal cycle, essential components – parameters of performance – actual cycle – regeneration, inter cooling and reheating – Closed and Semi-closed cycles, merits and demerits – concepts about compressors, combustion chambers and turbines of Gas Turbine Plants.

Unit 2: Jet Propulsion: Principle of Operation – Classification of jet propulsive engines – Working Principles with schematic diagrams and representation on T-S diagram – Thrust, Thrust Power and Propulsion Efficiency – Turbo jet engines with schematic Diagram, Thermodynamic Cycle and Performance Evaluation, Needs and Demands met by Turbo jet – Thrust Augmentation, Methods.

Unit 3: Rockets: Application – Working Principle – Classification – Propellant Type – Thrust, Propulsive Efficiency – Specific Impulse – Solid and Liquid propellant Rocket Engines.

Text Books:

1. R.K. Rajput, "Thermal Engineering", Lakshmi Publications, 3rd Edition, 2001.
2. V. Ganesan, "Gas Turbines", Tata McGraw Hill,, 3rd Edition, 2002.

Reference Books:

1. Dr. R. Yadav, "Thermodynamics and Heat Engines",, Central Publishing House, 7th Edition, 2012.
2. P.R. Khajuria, S.P. Dubey, "Gas Turbines and Propulsive Systems", DhanpatRai, 5th Edition, 2003.
3. Cohen, Rogers, Saravana Muttoo, "Gas Turbines Theory", Pearson Publishers, 7th Edition, 2019.

E - Resources:

1. https://nptel.ac.in/courses/112/103/112103277/
2. https://nptel.ac.in/courses/112/107/112107216/
3. http://www.thermopedia.com/content/1072/

4. http://www.iraj.in/journal/journal_file/journal_pdf/2-197-144801829853-59.pdf

Course Outcomes:

On completion of the course, the students will be able to:

1. **Apply** the knowledge of Rankine cycle in solving field problems while operating a power plant.
2. **Analyze** and incorporate suitable Draught system and Nozzle.
3. **Install** different types of steam turbines in the industry.
4. **Investigate** the operating principles and performance of Reaction turbine and Steam condensers.
5. **Analyze** working of gas turbine and jet propulsion system.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	2	1	2	-	-	-	-	-	-	3	1	2
CO2	3	3	3	2	-	-	-	-	-	-	-	3	3	1
CO3	3	3	2	3	-	-	-	-	-	-	-	3	1	1
CO4	3	3	2	3	2	-	-	-	-	-	-	3	1	1
CO5	3	3	3	3	3	-	-	-	-	-	-	3	2	3
Average	3	3	2.4	2.4	2.3	-	-	-	-	-	-	3	1.6	1.6

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
III Year – I Sem</td></tr>
<tr><td>Course Code: J31EB</td><td rowspan="2">OPERATIONS RESEARCH</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 4</td><td>3</td><td>1</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Mathematics

Course Objectives:
This course will enable students to:

1. Get the basic knowledge of Linear Programming and its applications to engineering problems and able to formulate a problem in LP model, and solve it using graphical method and Simplex method.
2. Be taught about the variants of the LP problem such as Transportation, Assignment, and Sequencing problems
3. Learn to find the optimal replacement time of equipment, and application of Group Replacement strategy
4. Get to know about solution methods to find the optimal strategy to maximize the outcome and Learn the importance of maintaining optimal inventory in any industry
5. Be exposed to the intricacies of waiting line models faced in real world situations and Solve problems using the Bellman's Principle of Optimality and understand the concept of Simulation and its application to inventory and queuing problems.

Module 1:
Unit 1: Introduction: Development – Definition– Characteristics and Phases – Types of models – Operations Research models – applications.
Unit 2: Allocation: Linear Programming Problem - Formulation – Graphical solution – Simplex method – Artificial variables techniques: Two–phase method, Big-M method; Duality Principle.

Module 2:
Unit 1: Transportation problem: Formulation – Optimal solution, unbalanced transportation problem – Degeneracy
Unit 2: Assignment problem – Formulation – Optimal solution - Variants of Assignment Problem; Traveling Salesman problem.

Module 3:
Unit 1: Sequencing: Introduction – Flow –Shop sequencing – n jobs through two machines – n jobs through three machines – Job shop sequencing – two jobs through 'm' machines

Unit 2: Replacement: Introduction – Replacement of items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail completely- Group Replacement.

Module 4:

Unit 1: Theory of games: Introduction – Terminology – Solution of games with saddle points and without saddle points- 2 x 2 games – m x 2 & 2 x n games - graphical method – m x n games - dominance principle.

Unit 2: Inventory: Introduction – Single item, Deterministic models – Types – Purchase inventory models with one price break and multiple price breaks – inventory models with and without shortage cost. Stochastic models – demand discrete variable or continuous variable – Single Period model with no setup cost.

Module 5:

Unit 1: Waiting lines: Introduction – Terminology-Single Channel – Poisson arrivals and Exponential Service times – with infinite population and finite population models– Multichannel – Poisson arrivals and exponential service times with infinite population.

Unit 2: Dynamic programming: Introduction – Terminology- Bellman's Principle of Optimality – Applications of dynamic programming- shortest path problem – linear programming problem

Unit 3: Simulation: Definition – types of simulation models- applications, advantages and disadvantage. Brief introduction of simulation languages – inventory and queuing problems using random numbers.

Text Books:

1. J. K. Sharma, "Operation Research", MacMillan Publishers India Ltd, 4th Edition, 2009.
2. A.C.S Kumar, "Operations Research (Quantitative Analysis for Business decision)", Yesdee Publishers, 1st Edition, 2015.

Reference Books:

1. Maurice Saseini, ArhurYaspanand and Lawrence Friedman, "*Operations Research: Methods and Problems",* Literary Licensing Publisher, 2013
2. A. M. Natarajan, P. BalaSubramani and A. Tamilarasi "*Operations Research*" Pearson Education, 4th Edition, 2009.
3. Wagner H. M, "*Principles of Operations Research",* PHI Publications, 2nd Edition, 2006.
4. Hillier / Libermann "*Introduction to Operations Research*", MacMillan Publishers, 10th Edition, 2017.

E - Resources:

1. https://rb.gy/1ckbxh
2. https://rb.gy/gev0g5

3. https://nptel.ac.in/courses/112/106/112106134/
4. https://nptel.ac.in/courses/111/107/111107128/

Course Outcomes:

On completion of the course, the students will be able to:

1. Allocate Optimally the resources in any industry, to maximize the overall gain and Determine the number of each item to be produced / procured, and the optimal product mix, within the framework of constraints in any organization
2. Find the optimal number of units to be transported such that the total transportation cost will be minimum and Assign the required men / machines to perform the given tasks in an optimal way
3. Schedule and sequence production runs by proper allocation of machines and men to get maximum gain or profit and Compute the economic order quantity
4. Understand the competitive situations in business organizations, and how to find the optimal strategies to be adopted according to the given situation
5. Find how to strike a balance between the waiting time cost and service facility cost and apply the Dynamic Programming model to practical problems like finding the shortest path for a salesman, optimal solution to a linear programming problem, etc.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	3	2	-	-	2	-	-	-	-	-	2	1	2
CO2	3	3	3	-	-	2	-	-	-	-	-	2	1	1
CO3	2	3	2	-	-	1	-	-	-	-	-	2	1	1
CO4	3	3	2	-	-	2	-	-	-	-	-	2	2	1
CO5	2	3	1	-	-	1	-	-	-	-	-	2	1	1
Average	2.4	3	2	-	-	1.6	-	-	-	-	-	2	1.2	1.2

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME III Year – I Sem</td></tr>
<tr><td>Course Code: J313D</td><td rowspan="2">DESIGN FOR MANUFACTURING AND ASSEMBLY
Professional Elective – I</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Manufacturing Technology, Machine Tools, Metrology.

Course Objectives:
This course will enable students to:

1. Acquire knowledge on the various stages of a product development process
2. Develop skills for using the various tools and techniques for developing products
3. Understand the different design guidelines for Metal casting and metal joining.
4. Understand the different design guidelines for Forging and extrusion and sheet metal operations.
5. Get exposure to Assembly procedures and DFA methodology.

Module 1
Unit 1: Introduction: Design philosophy – Steps in Design process – General Design rules for Manufacturability – Basic principles of designing for economical production – Creativity in design.
Unit 2: Materials: Selection of Materials for design – Developments in Material Technology –Criteria for material selection – Material selection interrelationship with process selection – process selection charts.

Module 2
Unit 1: Machining Process: Overview of various machining processes – general design rules for machining – Dimensional tolerance and surface roughness – Design for Machining ease – Redesigning of components for machining ease with suitable examples – General design recommendations for machined parts.

Module 3
Unit 1: Metal Casting: Appraisal of various casting processes – Selection of casting process– General design considerations for casting – casting tolerances – Use of Solidification Simulation in casting design – Product design rules for sand casting.
Unit 2: Metal Joining: Appraisal of various welding processes – Factors in design of weldments – General design guidelines – pre and post treatment of welds – Effects of thermal stresses in weld joints – Design of brazed joints.

Module 4

Unit 1: Forging: Design factors for Forging–Closed die forging design–parting lines of dies–Drop forging die design – General design recommendations.

Unit 2: Extrusion, Sheet Metal Work & Plastics: Design guidelines for Extruded sections – Design principles for Punching, Blanking, Bending, and Deep Drawing – Keeler Goodman Forming Limit Diagram – Component Design for Blanking.

Module 5

Design for Assembly: General design guidelines for Manual Assembly – Development of Systematic DFA Methodology – Assembly Efficiency – Classification System for Manual handling – Classification System for Manual Insertion and Fastening – Effect of part symmetry on handling time.

Text Books:

1. Geoffrey Boothroyd, "Product design for Manufacture and Assembly", Marcel Dekker Inc, 2nd Edition, 2010.
2. Kevin Otto and Kristin Wood, "Product Design", Pearson Education, 2004.

Reference Books:

1. A.K Chitale and R.C Gupta, "Product design and Manufacturing", Prentice Hall of India, 2003.

E - Resources:

1. https://rb.gy/6yajpb
2. https://rb.gy/istrcf
3. https://nptel.ac.in/courses/112101005/

Course Outcomes:

On completion of the course, the students will be able to:

1. **Apply** the knowledge of product development processes in the industry.
2. **Apply** the skills acquired on various tools and techniques for developing products
3. **Implement** the different design guidelines for Metal casting and metal joining.
4. **Implement** the different design guidelines for Forging and extrusion and sheet metal operations.
5. **Apply** the Assembly procedures and DFA methodology.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2	3	2	-	-	-	-	-	-	-	2	3	2
CO2	2	2	3	2	1	-	-	-	-	-	-	2	3	2
CO3	2	2	2	2	1	-	-	-	-	-	-	2	3	1
CO4	2	1	2	2	-	-	-	-	-	-	-	2	3	2
CO5	1	2	2	2	1	-	-	-	-	-	-	3	3	2
Average	1.8	1.8	2.4	2	1	-	-	-	-	-	-	2.2	3	1.8

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
III Year – I Sem</td></tr>
<tr><td>Course Code: J313E</td><td rowspan="2">THEORY OF METAL CUTTING
Professional Elective – I</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Metal Cutting & Machine Tools.

Course Objectives:
This course will enable students to:
1. Evaluate the cutting tools geometry and their areas of application based on principles of metal cutting.
2. Analyze cutting forces, cutting temperature and their measurement.
3. Evaluate tool wear, replacement strategy, tool materials and their properties.
4. Analyze the economics of machining.

Module 1
Unit 1: Introduction: Mechanism of chip formation, Orthogonal and Oblique cutting, Determination of shear plane angle, forces on the chips, forces in orthogonal cutting, merchant circle diagram and analysis, co-efficient of friction, power and energy relationship, velocity relationship, shear-strain relationship, factors affecting forces and power, types of chips, built-up edge, problems.

Module 2
Unit 1: Measurement of cutting forces: Reasons for measuring cutting forces, Classification of cutting force dynamometers – mechanical, piezoelectric, and strain gage type dynamometers, Dynamometers for lathe, drilling, and milling, Calibration of dynamometers.
Unit 2: Tool wear, tool life: Mechanisms of tool wear, Sudden, gradual wear, crater wear, flank wear, tool failure criteria, tool life equations, effect of process parameters on tool life.

Module 3
Unit 1: Geometry of cutting tools: Single point and multi point cutting tools, tools in hand nomenclature, tool point reference systems, tool angle specifications – ISO and ASA systems, conversion from one system to another. Effect of cutting parameters on tool geometry
Unit 2: Tool materials and their properties: Characteristics of tools materials, types of tool materials – carbon tool steels, high speed steels, cast alloys, cemented carbides, ceramics, diamonds, sialon, CBN, UCON, recommended cutting speeds for the above tools

Module 4

Unit 1: Thermal aspects in metal cutting: Heat sources in metal cutting, temperature in chip formation, temperature distribution, and experimental determination of tool temperatures.

Unit 2: Cutting fluids: Basic actions of cutting fluids, properties of cutting fluids, selection of cutting fluids, application of cutting fluids, recommended cutting fluids.

Module 5

Unit 1: Economics of machining: Introduction, elements of total production cost, optimum cutting speed and tool life for minimum cost, optimum cutting speed and tool life for maximum production, problems.

Text Books:

1. G. C. Sen and A. Bhattacharya, "Principles of Metal Cutting", New Central Book Agency.
2. M C Shaw, "Metal Cutting Principles", Oxford and IBH Publications.

Reference Books:

1. Boothroyd, "Fundamentals of Machining", Edward Amold Publishers.
2. V. Arshinov & G. Alekseev, "Metal Cutting Theory and Cutting Tool Design", Mir Publishers.
3. B. L. Juneja, G. S. Sekhom&Nitin Seth, "Fundamentals of Metal Cutting and Machine tools", New Age International Publisher
4. G. Kuppuswamy, "Principles of Metal Cutting", Universities Press.

E - Resources:

1. https://rb.gy/aqjyox
2. https://rb.gy/cihf5n
3. https://deewanbittal.files.wordpress.com/2017/12/manufacturing-engineering-ii.pdf
4. https://nptel.ac.in/courses/112/105/112105233/

Course Outcomes:

On completion of the course, the students will be able to:

1. **Analyze** a cutting tool, its geometry and arrive at the cutting process.
2. **Create** a cutting tool material and appropriate material to be cut.
3. **Apply** the methods of measuring the cutting forces, temperature and their significance
4. **Apply** a cutting tool with optimal tool life to maximize material removal rate.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	2	3	2	-	-	-	-	-	-	2	1	2
CO2	2	3	3	2	2	-	-	-	-	-	-	2	-	1
CO3	3	3	3	2	2	-	-	-	-	-	-	2	1	-
CO4	2	3	2	3	3	-	-	-	-	-	-	2	2	1
CO5	3	3	3	3	3	-	-	-	-	-	-	2	1	1
Average	2.6	2.8	2.6	2.6	2.4	-	-	-	-	-	-	2	1.2	1.2

<table>
<tr><td>AY 2020 - 21 onwards</td><td colspan="1">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
III Year – I Sem</td></tr>
<tr><td>Course Code: J313F</td><td rowspan="2">POWER PLANT ENGINEERING
Professional Elective – I</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Thermodynamics, Fluid Mechanics and Hydraulic Machines, Thermal Engineering – I, Thermal Engineering – II

Course Objectives:
This course will enable students to:
1. Gain basic knowledge of Different types of Power Plants, site selection criteria and combustion process.
2. Understand the concepts of diesel plant, gas turbine plant and methods of direct energy conversion.
3. Get knowledge on working principle of Hydro electric power plant and methods of Non-conventional energy sources.
4. Gain basic knowledge on different types of Nuclear power plants and nuclear fuel.
5. Understand the Power Plant Economics, discussing environmental and safety aspects of power plant operation

Module 1
Introduction to the Sources of Energy – Resources and Development of Power in India
Unit 1: Steam Power Plant: Plant Layout – Working of different Circuits – Fuel and handling equipment's – types of coals – coal handling – choice of handling equipment – coal storage and ash handling systems.
Unit 2: Combustion Process: Properties of coal – overfeed and under feed fuel beds – traveling grate stokers, spreader stokers, retort stokers – pulverized fuel burning system and its components – combustion needs and draught system – cyclone furnace – design and construction – Dust collectors – cooling towers and heat rejection. Corrosion and feed water treatment.

Module 2
Unit 1: Internal Combustion Engine Plant: Diesel power plant: Introduction – IC Engines, types, construction – Plant layout with auxiliaries – fuel supply system – air intake system – lubrication and cooling system – super charging.
Unit 2: Gas Turbine Plant: Introduction – Classification – construction – Layout with auxiliaries –Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and comparison
Unit 3: Direct Energy Conversion: Solar energy – Fuel cells – Thermo electric and Thermo Ionic – MHD generation.

Module 3

Unit 1:Hydro Electric Power Plant: Water power – Hydrological cycle – flow measurement –drainage area characteristics – Hydrographs – storage and Pondage – classification of dams and spill ways – Classification of plants – Typical layouts – plant auxiliaries – plant operation – pumped storage plants.

Unit 2: Power from Non-Conventional Sources: Utilization of Solar Collectors – Principle of Working – Wind Energy, types, HAWT, VAWT – Tidal Energy**.**

Module 4

Unit 1: Nuclear Power Station: Nuclear fuel –breeding and fertile materials – Nuclear reactor –reactor operation.

Unit 2: Types of Reactors: Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor. Radiation hazards and shielding – radioactive waste disposal

Module 5

Power Plant Economics and Environmental Considerations: Capital cost – Investment of fixed charges – operating costs. General arrangement of power distribution – Load curves and load duration curve. Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor – related exercises. Effluents from power plants and Impact on environment – pollutants and pollution standards – Methods of Pollution control

Text Books:

1. P. C. Sharma, "Power Plant Engineering" S.K. Kataria Publishers.
2. Arora and S. Domkundwar, "A Course in Power Plant Engineering".

Reference Books:

1. Rajput, "A Text Book of Power Plant Engineerin", Laxmi Publications.
2. Ramalingam, "Power plant Engineering", SciTech Publishers.
3. P. K. Nag, "Power Plant Engineering", Tata McGraw Hill, 2nd Edition.
4. G.D. Rai, "An Introduction to Power Plant Technology".
5. Elanchezhian, "Power plant Engineering", I.K. International Pub. 2019

E - Resources:

1. https://www.goodreads.com/book/show/25723036-power-plant-engineering
2. https://www.sciencedirect.com/topics/engineering/power-plant-technology
3. http://nptel.ac.in/courses/112106133/1
4. http://nptel.ac.in/courses/112106133/2

Course Outcomes:

On completion of the course, the students will be able to:

1. **Select** the suitability of site for a power plant and combustion processes.
2. **Propose** suitable power plant as per the requirement of industry.

3. **Explain** working of hydro-electric power plant and power generation from non-conventional sources.
4. **Explain** working principle of different types of nuclear power plant and radioactive waste disposable methods.
5. **Identify** the cost of power plant by calculating load factor, capacity factor, average load and peak load, etc on a power plant and Indicate safety aspects of power plants.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	-	2	2	2	-	-	-	-	-	-	3	-	-
CO2	3	-	3	3	3	-	-	-	-	-	-	3	2	1
CO3	3	2	3	3	2	-	-	-	-	-	-	3	1	1
CO4	3	-	3	3	3	-	-	-	-	-	-	3	-	-
CO5	3	2	-	1	-	-	-	-	-	-	-	3	1	2
Average	3	2	2.75	2.4	2.25	-	-	-	-	-	-	3	1.33	1.33

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
III Year – I Sem</td></tr>
<tr><td>Course Code: J3131</td><td rowspan="2">THERMAL ENGINEERING LAB</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 1</td><td>0</td><td>0</td><td>2</td><td>0</td></tr>
</table>

Pre-requisite: Thermodynamics, Thermal Engineering – I

Course Objectives:
This course will enable students to:
1. Determine the properties of fuels in engineering practice and get hands-on experience to use the apparatus like Pensky Marten Apparatus / Abel's Apparatus, Redwood Viscometer, Calorimeter, etc.,
2. Learn the importance of Valve Timing Diagram and Port Timing Diagram in I C engines and how to draw these diagrams.
3. Understand how to carry out the Performance Test on four-stroke diesel engine and two-stroke petrol engine and interpret the results
4. Learn how to disassemble and assemble the parts of IC engine, evaluate the Engine friction by conducting Morse test
5. Conducts Heat Balance Sheet on IC Engine and Performance Test on Reciprocating Air – Compressor Test Rig.

List of Experiments

Experiment 1:	To determine Flash and Fire point for a given liquid fuel – Pensky Marten Apparatus / Abel's Apparatus
Experiment 2:	To determine viscosity of given oil by Redwood Viscometer – I
Experiment 3:	To determine Carbon Residue of given fuel
Experiment 4:	To determine Calorific Value of a given fuel/ oil
Experiment 5:	I.C. Engines Valve Timing Diagram.
Experiment 6:	I.C. Engines Port Timing Diagram.
Experiment 7:	I.C**.** Engines Performance Test (4 Stroke Diesel engine)
Experiment 8:	I.C. Engines Performance Test (2 Stroke Petrol engine)
Experiment 9:	Evaluation of Engine friction by conducting Morse test on 4-stroke Multi cylinder Petrol Engine
Experiment 10:	Heat Balance Sheet on IC Engine
Experiment 11:	4- Stroke Petrol Engine Assembly and Disassembly
Experiment 12:	Performance Test on Reciprocating Air – Compressor Test Rig.

E - Resources:
1. https://books.google.co.in/books?id=TEjZFUcVTbgC&printsec=frontcover#v=onepage&q&f=false

Course Outcomes:

On completion of the course, the students will be able to:

1. **Evaluate** the properties of fuels like Flash Point, Fire point, Viscosity and Calorific Value using Abel's Apparatus, Redwood Viscometer, Calorimeter.
2. **Obtain** the Valve Timing Diagram and Port Timing Diagram of IC engines
3. **Conduct** Performance Tests on four-stroke diesel engine and two-stroke petrol engine and Morse test on four-stroke Multi cylinder Petrol Engine
4. **Apply** the knowledge to Disassemble and assemble the parts of IC engine, thereby understanding the significance and function of each part and draw heat balance sheet on IC Engine.
5. **Conduct** the Performance Test on Reciprocating Air – Compressor

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	3	-	1	1	-	-
CO2	-	-	-	-	-	-	-	-	3	-	1	2	-	-
CO3	-	-	-	-	-	-	-	-	3	-	1	2	1	1
CO4	-	-	-	-	-	-	-	-	3	-	1	2	-	-
CO5	-	-	-	-	-	-	-	-	3	-	1	2	-	-
Average	-	-	-	-	-	-	-	-	3	-	1	1.8	1	1

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B. Tech: ME
III Year – I Sem</td></tr>
<tr><td>Course Code:
J3132</td><td rowspan="2">MACHINE TOOLS LAB</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 1</td><td>0</td><td>0</td><td>2</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Physics, Engineering Materials.

Course Objectives:

This course will enable students to:

1. Understand the working principles of general-purpose Machines like Lathe Machine, Drilling Machine and Milling Machine
2. Gain knowledge of working of all parts of the general-purpose Machines.
3. Undergo hands on training on operation of all the general-purpose Machines and carry out operations like turning, drilling, slotting, thread cutting and milling.
4. Understand the working of special purpose machines like surface grinding machine, cylindrical grinding machine and tool and cutter grinding Machines.
5. Undergo hands on training on special purpose machines

LIST OF EXPERIMENTS

Experiment 1: Introduction of general-purpose machines -Lathe, drilling machine, Milling machine.
Experiment 2: Study parts of Shaper machine, slotting machine.
Experiment 3: Study of parts of all grinding machines.
Experiment 4: Study of material, geometry of tools used in metal cutting like single point, multipoint cutting tool.
Experiment 5: Plain and step turning on lathe machine.
Experiment 6: Taper turning on lathe machine.
Experiment 7: Thread cutting and knurling on – lathe machine.
Experiment 8: Drilling and Tapping.
Experiment 9: Shaping.
Experiment 10: Slotting.
Experiment 11: Milling.
Experiment 12: Surface Grinding.
Experiment 13: Cylindrical grinding.
Experiment 14: Tool and cutter grinder.

E - Resources:

1. https://books.google.co.in/books?id=ojUSAga14cMC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

Course Outcomes:

On completion of the course, the students will be able to:

1. **Use and apply** various measuring instruments in carrying the machine operations.
2. **Make** various shapes to the given metal by using general purpose machines.
3. **Make** required shapes to the given metal objects by operating special purpose Machines like cylindrical grinding machines, surface grinding machines.
4. **Make** different rake angles to the given metal removing tools.
5. **Handle** the special purpose machines.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	1	3	2	2	-	-	-	2	-	3	2	-	-
CO2	3	1	2	2	2	-	-	-	2	-	3	1	-	-
CO3	3	1	2	2	2	-	-	-	2	-	3	1	2	-
CO4	3	1	2	2	2	-	-	-	2	-	3	1	3	-
CO5	-	-	-	-	2	-	-	-	2	-	3	1	2	-
Average	3	1	2.25	2	2	-	-	-	2	-	3	1.2	2.3	-

AY 2020 - 21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech: ME III Year – I Sem			
Course Code: J3133	INTERNSHIP – II	L	T	P	D
Credits: 1		0	0	2	0

Course Objectives:

The student will

1. Be exposed to a particular job and a profession or industry.
2. Learn basic knowledge of how a industry runs.
3. Get better ideas for future academic projects.
4. Get communication skills and writing skills.

Guidelines:

There is summer internship, in collaboration with an industry of their specialization, to be taken up during the vacation after II-year II Semester examination and it will be evaluated in III Year I semester. A report to be submitted in prescribed format on the internship carried out by the student. The report will be evaluated by the committee consisting of head of the department, and internship coordinator and a senior faculty member of the department. There is no semester end examination for the seminar.

Course Outcomes:

The student will be able to

1. Choose industry based on his interest for future scope.
2. Apply basic industrial knowledge related to machines.
3. Extract different useful ideas for his/ her academic projects.
4. Write a report on industry visit.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	-	-	-	2	1	-	-	2	2	2	2	1	-
CO2	2	-	-	-	3	1	1	-	2	2	2	3	-	-
CO3	1	-	-	-	2	1	1	-	3	2	1	2	-	-
CO4	2	-	-	-	2	1	-	-	2	3	1	2	-	-
Average	1.75	-	-	-	2.25	1	1	-	2.25	2.25	1.5	2.25	1	-

AY 2020 - 21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech: ME III Year –I Sem			
Course Code: J31M2	CYBER SECURITY	L	T	P	D
Credits: 0		2	0	0	0

Pre-requisite: Nil

Course Objectives:
This course will enable students to:

1. To familiarize various types of cyber-attacks and cyber-crimes
2. To give an overview of the cyber laws
3. To study the defensive techniques against these attacks.
4. To understand security issues in organizations.
5. To know data privacy.

Module I: Introduction to Cyber Security:
Unit-1:
Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Assets and Threat, motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Spectrum of attacks, Taxonomy of various attacks, IP spoofing,
Unit-2
Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

Module II: Cyberspace and the Law & Cyber Forensics
Unit-1: Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy.
Unit-2: Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics, Special Techniques for Forensics Auditing.

Module III: Cybercrime: Mobile and Wireless Devices
Unit-1: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices:

Unit-2: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

Module IV: Cyber Security: Organizational Implications

Unit-1: Introduction, cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations

Unit-2: Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

Module V: Privacy Issues, Cybercrime: Examples and Mini-Cases

Unit-1: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy indifferent domains- medical, financial, etc.

Unit-2: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of

Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances. The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

Text Books

1. Nina Godbole and SunitBelpure, Cyber Security Understanding Cyber Crimes, ComputerForensics and Legal Perspectives, Wiley.
2. B. B. Gupta, D. P. Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles,Algorithm, Applications, and Perspectives, CRC Press, ISBN 9780815371335, 2018.

Reference Books

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu,J. David Irwin, CRC Press T&F

Web Resources

1. http://uou.ac.in/foundation-course
2. http://uou.ac.in/progdetail?pid=CEGCS-17

Course Outcomes

On completion of the course, the students will be able to:

1. Understand cyber-attacks and types of cybercrimes.
2. Summarize Cyber Laws and Cyber Forensics.
3. Understand frauds in Wireless era.
4. Analyze and evaluate the cyber security needs of an organization.
5. Outline Data Privacy and privacy policies.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2	2	-	2	2	1	-	-	-	-	1	-	-
CO2	-	-	2	-	1	2	-	-	-	-	-	1	-	-
CO3	2	3	1	-	2	1	1	-	-	-	-	-	-	-
CO4	2	2	2	-	-	-	1	-	-	-	-	1	2	1
Average	-	-	-	-	-	1	2	-	-	-	-	2	-	-

AY 2020 - 21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech: ME III Year – I Sem			
Course Code: J3101	**EMPLOYABILITY SKILLS** (Common to All)	L	T	P	D
Credits: 0		2	0	0	0

Pre-requisite: NIL

Course Objectives:

This course will enable students to:

1. Understand the importance of Listening skills.
2. Know how reading skills help an individual.
3. Obtain knowledge and practice session on speaking effectively.
4. Understand why proper writing skills are important.
5. Implement business Etiquette in day to day life.

Module 1: Listening Skills:

The Listening Process, Hearing and Listening, Types of Listening-Superficial Listening-Appreciative Listening-Focused Listening-Evaluative Listening- Attentive Listening-Empathetic Listening, Listening with a purpose, Barriers to Listening-Physical Barriers-Psychological Barriers-Linguistic Barriers-Cultural Barriers.

Improving Listening Comprehension

Listening comprehension-Effective Listening Strategies- Listening in Conversational Interaction-Listening to structured talks, Team Listening

Module 2: Speaking Skills:

The Speech process-The Message-The Audience- The Speech Style-Encoding-Feedback Conversations and Oral Skills-Body Language-Types of Conversations: Formal and Informal-Strategies for Good Conversation, Improving Fluency and Self-expression- Articulation, good pronunciation-Voice quality- Accent and Intonation Speaking Techniques- Body Language-Eye Contact-Facial Expression-Gesture-Posture and Body Movements.

Speaking Techniques

Techniques to Develop Effective Word Accent- Word Stress, Using Correct Stress - Patterns – Developing Voice Quality-Rhythm in Corrected speech and developing correct tone

Module 3: Writing Skills and Business Etiquettes:

Effective Resume writing, Letter writing skills

Business Etiquettes: Personal Grooming &Behavioural Etiquettes – Event Based Learning Activity, -Facial -Introduction & Role-plays. Personal Values, Developing Values, Cultivating Habits – Real-life cases, Activities

REFERENCES:

1. Rizvi, Ashraf M. Effective Technical communication, New Delhi: Tata McGraw-Hill, 2005.
2. Influencer: The new science of leading change by Joseph Grenny, Kerry Patterson, David Maxfield, Ron McMillan and Al Switzler.
3. Skill with people by Les Gibli

Web Sources:

1. https://www.youtube.com/watch?v=JIdPnUFr36g&ab_channel=LearnEnglishLab
2. https://www.youtube.com/watch?v=xrEq1UujOo&ab_channel=LearnEnglishLab
3. https://www.youtube.com/watch?v=srn5jgr9TZo&ab_channel=SimerjeetSingh
4. https://www.youtube.com/watch?v=O0qT4cKwtk&ab_channel=LearnEnglishLab
5. https://www.youtube.com/watch?v=p6qVJ1KhHek&ab_channel=LearnEnglishwithLet%27sTalk-FreeEnglishLessons.
6. https://www.youtube.com/watch?v=I4uL5mkcAJc&ab_channel=LearnEnglishwithLet%27sTalkFreeEnglishLessonsLearnEnglishwithLet%27sTalk-FreeEnglishLessonsVerified

Course outcomes:

At the end of this course students will be able to

1. Practice listening and probing any problem.
2. Understand the importance of reading skills.
3. Understand how to speak effectively.
4. Write essays and letter using proper vocabulary.
5. Practice creativity in day to day life

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO2	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO3	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO4	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO5	-	-	-	-	-	-	-	-	2	3	-	3	1	1
Average	-	-	-	-	-	-	-	-	2	3	-	3	1	1

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
III Year – II Sem</td></tr>
<tr><td>Course Code: J323A</td><td rowspan="2">DESIGN OF MACHINE MEMBERS – II</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Note: Design data hand book is permitted

Pre-requisite: Engineering Physics, Engineering Mechanics, Mechanics of Solids, Design of Machine Members-I

Course Objectives:

This course will enable students to:

1. Understand the design procedures for complete machine members under dynamic conditions by utilising the concepts of strength of materials mathematical equations and design data handbooks.
2. Understand the design criteria for sliding contact and rolling contact bearings.
3. Understand the design criteria for various parts of IC engines viz piston, connecting rod, crankshaft and cylinders.
4. Understand the design criteria for mechanical power transmission elements viz pulleys, belts, chains and ropes.
5. Understand the design criteria for Precision power transmission components viz spur gears, helical gears, bevel gears, worm gears and power screws.

Module 1

Unit 1: Sliding Contact Bearings: Types of Journal bearings – bearing construction – bearing design, bearing materials.

Unit 2: Rolling Contact Bearings: Types of rolling contact bearings, selection of bearing type, selection of bearing life – Design for cyclic loads and speeds, Static and dynamic loading of ball & roller bearings.

Module 2

Unit 1: Design of IC Engine Parts: Connecting Rod: Thrust in connecting rod, stress due to whipping action on connecting rod ends.

Unit 2: Piston: Forces acting on piston – Construction – Design and proportions of piston.

Unit 3: Cylinder: Cylinders and cylinder liners.

Module 3

Gears: Design of Spur, Helical and Bevel Gears: Lewis beam strength equation, Dynamic loads on gear tooth, Wear load and design for wear strength.

Module 4

Unit 1: Design of Worm Gears: Properties of worm gears – Selection of materials, Strength and wear rating of worm gears, Force analysis, Friction in worm gears, thermal considerations.

Unit 2: Design of Power Screws: Design of screw – Square ACME, Buttress screws, compound screw, differential screw, and ball screw – design of nut – possible failures.

Module 5

Design of curved beams: Introduction – stresses in curved beams – Expression for radius of neutral axis for rectangular, circular, trapezoidal and T-Section; Design of crane hooks, C-clamps.

Text Books:

1. V. Bhandari , " Design of machine element", TMH publications
2. Pandya & Shah," Machine Design ".

Reference Books:

1. P. Kannaiah, "Machine Design", SciTech Publications
2. S. Md. Jalaludeen, "Machine Design", Volume II.
3. PV Raman Murti& M. Vidyasagar, "Design Data Book", BS Publications.

E - Resources:

1. https://nptel.ac.in/courses/112/106/112106137/
2. https://www.academia.edu/38675030/A_Textbook_of_Machine_Design_by_R_S_KHURMI_AND_J_K_GUPTA
3. http://www.brainkart.com/subject/Design-of-Machine-Elements_72/
4. https://www.researchgate.net/publication/328926726_Design_of_Machine_Elements

Course Outcomes:

On completion of the course, the students will be able to:

1. **Design** various mechanical elements to arrive at dimensional geometry for a given loading systems and for its effective functional criteria.
2. **Design** various types of journal bearing ball bearings and roller bearings under dynamic conditions.
3. **Design** various parts of IC engines under the influence of dynamic and inertia forces.
4. **Design** Power Transmission Systems associated with use of belts, chains and ropes.
5. **Design** critical components of Power Transmission Systems under severe conditions for dynamic forces, wear theories and heavy loading systems.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	3	3	2	-	-	-	-	-	-	-	2	2	-
CO2	2	3	3	2	-	-	-	-	-	-	-	2	2	-
CO3	2	3	3	3	-	-	-	-	-	-	-	3	2	-
CO4	2	3	3	3	-	-	-	-	-	-	-	3	3	1
CO5	2	3	3	2	-	-	-	-	-	-	-	2	3	1
Average	2	3	3	2.4	-	-	-	-	-	-	-	2.4	2.4	1

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
III Year – II Sem</td></tr>
<tr><td>Course Code: J323B</td><td rowspan="2">HEAT TRANSFER</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 4</td><td>3</td><td>1</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Differential Equations, Thermodynamics, Fluid Mechanics.

Course Objectives:
This course will enable students to:
1. Identify the important Heat Transfer modes in any physical system and conduction equation in different coordinates.
2. Know the difference of one-dimensional steady state conduction heat transfer and one-dimensional transient conduction heat transfer.
3. Impart the concept of convective heat transfer with dimensional analysis and concept of forced convection
4. Gain knowledge on free convection heat transfer and Condensation.
5. Understand the concept of radiation heat transfer, importance of shape factor and Heat exchangers.

Module 1
Unit 1: Introduction: Modes and mechanisms of heat transfer–Basic laws of heat transfer–General discussion about applications of heat transfer.
Unit 2: Conduction Heat Transfer: Fourier rate equation–General heat conduction equation in Cartesian – Cylindrical and Spherical coordinates.
Unit 3: Simplification and forms of the field equation: Steady, unsteady and periodic heat transfer– Initial and boundary conditions.

Module 2
Unit 1: One Dimensional Steady State Conduction Heat Transfer: Homogeneous slabs, hollow cylinders and spheres – overall heat transfer coefficient – electrical analogy – Critical radius of insulation. Variable Thermal conductivity – Systems with heat sources or Heat generation. Extended surface (fins) Heat Transfer – Long Fin, Fin with insulated tip and Short Fin – Application to error measurement of Temperature.
Unit 2: One Dimensional Transient Conduction Heat Transfer: Systems with negligible internal resistance – Significance of Biot and Fourier Numbers – Chart solutions of transient conduction systems – Concept of Functional Body

Module 3
Unit 1: Convective Heat Transfer: Classification of systems based on causation of flow, condition of flow, configuration of flow and medium of flow – Dimensional analysis as a tool for experimental investigation – Buckingham Pi Theorem –

application for developing semi-empirical non-dimensional correlation for convection heat transfer – Significance of non-dimensional numbers – Concepts of Continuity – Momentum and Energy Equations.
Unit 2: Forced convection: External Flows – Concepts about hydrodynamic and thermal boundary layer – use of empirical correlations for convective heat transfer – Flatplates and Cylinders.
Unit 3: Internal Flows: Concepts about Hydrodynamic and Thermal Entry Lengths– Division of internal flow based on this –Use of empirical relations for Horizontal Pipe Flow and annulus flow.

Module 4
Unit 1: Free Convection: Development of Hydrodynamic and thermal boundary layer along a vertical plate – Use of empirical relations for Vertical plates and pipes.
Unit 2: Heat Transfer with Phase Change: Boiling, Pool boiling–Regimes Calculations on Nucleate boiling – Critical Heat flux and Film boiling
Unit 3: Condensation: Film wise and drop wise condensation –Nusselt's Theory of Condensation on a vertical plate – Film condensation on vertical and horizontal cylinders using empirical correlations.

Module 5
Unit 1: Heat Exchangers: Classification of heat exchangers–overall heat transfer Coefficient and fouling factor – Concepts of LMTD and NTU methods – Problems using LMTD and NTU methods.
Unit 2: Radiation Heat Transfer: Emission characteristics and laws of black-body radiation–Irradiation – total and monochromatic quantities – laws of Planck, Wien, Kirchhoff, Lambert, Stefan and Boltzmann– heat exchange between two black bodies – concepts of shape factor– Emissivity – heat exchange between grey bodies – radiation shields – electrical analogy for radiation networks.

Text Books:

1. Holman, "Heat Transfer", Tata McGraw Hill, 8thEdition, 2000.
2. P.K. Nag, "Heat Transfer", Tata McGraw Hill, 2002.

Reference Books:

1. R.C.sachdeva, "Fundamentals of Engineering Heat and Mass Transfer", New Age International, 3rd Edition, 2008.
2. Ghoshdastidar, "Heat Transfer", Oxford University Press, 2nd Edition.
3. R.K. Rajput, "Heat and Mass Transfer", S.Chand, 1st Edition, 2009.

E - Resources:

1. https://www.google.co.in/books/edition/Heat_and_Mass_Transfer/g1oiDQAAQBAJ?hl=en&gbpv=1
2. https://www.google.co.in/books/edition/Fundamentals_of_Heat_and_Mass_Transfer/hIviT25WWIEC?hl=en&gbpv=0

3. https://nptel.ac.in/courses/112/108/112108149/
4. https://ocw.tudelft.nl/courses/fluid-flow-heat-mass-transfer/
5. https://www.sciencedirect.com/journal/international-communications-in-heat-and-mass-transfer

Course Outcomes:

On completion of the course, the students will be able to:

1. **Understand** basic modes of heat transfer and compute problems in steady state and unsteady state heat conduction.
2. **Explain** steady and transient heat conduction in one dimension.
3. **Interpret and analyze** free and forced convection heat transfer, flow regimes of boiling and condensation
4. **Understand** the importance of free convection heat transfer with phase change and concept of condensation.
5. **Understand** the principles of radiation heat transfer and apply LMTD and NTU methods to design heat exchangers.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	2	2	-	-	-	-	-	-	-	3	1	1
CO2	3	3	2	3	2	-	-	-	-	-	-	2	3	3
CO3	2	3	3	3	-	-	-	-	-	-	-	3	2	2
CO4	3	3	2	3	1	-	-	-	-	-	-	3	2	1
CO5	3	3	2	3	-	-	-	-	-	-	-	3	2	2
Average	2.8	2.8	2.2	2.8	1.5	-	-	-	-	-	-	2.8	2	1.8

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME III Year – II Sem</td></tr>
<tr><td>Course Code: J323C</td><td rowspan="2">METROLOGY AND INSTRUMENTATION</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Machine Drawing, Metal Cutting and Machine Tools, Mechanics of Fluids and Hydraulic Machines.

Course Objectives:
This course will enable students to:
1. Understand the concept of Limits, fits and tolerances, and learn to use the Limit Gauges, Sine bar etc.
2. Learn the methods of Measurement of flat surfaces, and Surface Roughness Measurement.
3. Gain knowledge of basic principles of Measurement and Measurement systems, and the sources of error, their classification and elimination.
4. Understand and perform the measurement of different parameters, such as Temperature, Pressure and Flow.
5. Understand and perform measurement of Force, Torque, Power, and Strain.

Module 1
Unit 1: Limits, fits and tolerances: Unilateral and bilateral tolerance system, hole and shaft basis system. Inter-changeability and selective assembly. FD and IT grades and fit designations
Unit 2: Limit Gauges: Taylor's principle – Design of GO- and NO-GO gauges. Measurement of angles, Bevel protractor and Sine bar. Measurement of flat surfaces, straight edges, surface plates, optical flat and auto collimator

Module 2
Unit 1: Surface Roughness Measurement: Roughness – Waviness. Surface roughness parameter symbols – Roughness measurement by Taylor Hobson. Methods of measurement of surface finish - Talysurf. Screw thread measurement – Gear measurement. Machine Tool Alignment Tests on lathe, milling and drilling machines
Unit 2: Coordinate Measuring Machines: Types and Applications of CMM.

Module 3
Unit 1: Definition – Basic principles of measurement – Measurement systems – generalized configuration and functional descriptions of measuring instruments – examples. Dynamic performance characteristics – sources of error – Classification and elimination of error

Unit 2: Measurement of Displacement: Theory and construction of various transducers to measure displacement – Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers – Calibration procedures.

Module 4

Unit 1: Measurement of Temperature: Classification – Various Principles of measurement – Expansion, Electrical Resistance – Thermistor, Thermocouple – Pyrometers – Temperature Indicators.

Unit 2: Measurement of Pressure: Bellows – Diaphragm gauges. Low pressure measurement – Thermal conductivity gauges – ionization pressure gauges, Mcleod pressure gauge.

Unit 3: Measurement of Flow: Rotameter– magnetic– Ultrasonic– Turbine flow meter – Hot wire anemometer – Laser Doppler Anemometer (LDA)

Module 5

Unit 1: Strain Measurements: Strain measurements – electrical strain gauge – gauge factor – method of usage of resistance strain gauge for bending – Strain gauge Rosettes.

Unit 2: Measurement of Force, Torque and Power: Elastic force meters – load cells – Torsion meters – Dynamometers

Text Books:

1. IC Gupta, "Engineering Metrology", DanpathRai Publications.
2. R. K. Jain, "Engineering Metrology", Khanna Publishers.
3. D.S. Kumar, "Measurement Systems: Applications and Design", Anuradha Agencies
4. B.C. Nakra& K.K. Choudhary, "Instrumentation, Measurement and Analysis", TMH

Reference Books:

1. S. Bhaskar, "Instrumentation and Control Systems", New age Publications, 1998.
2. BIS Standards on Limits & Fits, Surface Finish, Machine Tool Alignment etc.
3. Connie Dotson, Thomson, "Fundamentals of Dimensional Metrology", 4^{th} Edition

E - Resources:

1. https://rb.gy/zy22k6
2. https://rb.gy/9zula2
3. https://rb.gy/o4p87g
4. http://nptel.ac.in/courses/112106138/
5. http://elearning.vtu.ac.in/newvtuelc/courses/10ME42B.html

Course Outcomes:

On completion of the course, the students will be able to:

1. **Understand** the significance of Limits, fits and tolerances, and will be able to use the Limit Gauges, Bevel protractor, and Sine bar etc.
2. **Perform** the measurement of Surface Roughness, Screw thread measurement, Gear measurement; and Machine Tool Alignment Tests and Apply the Coordinate Measuring Machine to measure the height, width, and depth of the target.
3. **Understand** the basics of Instrumentation systems and identify the sources of error, their classification and elimination. Use the various transducers to measure displacement.
4. **Perform** measurement of Temperature, Pressure and Flow.
5. **Perform** measurement of strain Force, Torque and Power

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	1	-	3	3	-	-	-	-	-	-	3	3	-
CO2	3	1	-	3	3	-	-	-	-	-	-	3	3	-
CO3	3	1	2	3	2	-	-	-	-	-	-	3	-	-
CO4	3	-	3	3	3	-	-	-	-	-	-	3	-	-
CO5	3	-	3	3	3	-	-	-	-	-	-	3	-	-
Average	3	1	2.6	3	2.8	-	-	-	-	-	-	3	3	-

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME III Year – II Sem</td></tr>
<tr><td>Course Code: J323E</td><td rowspan="2">MECHANICAL VIBRATIONS
Professional Elective – II</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Mechanics, Kinematics of Machines, Dynamics of Machines

Course Objectives:

This course will enable students to:

1. Understand and appreciate the importance of vibrations in mechanical design of machine parts that operate in vibratory conditions.
2. Obtain linear vibratory models of dynamic systems with changing complexities (SDOF, MDOF).
3. Write the differential equation of motion of vibratory systems.
4. Make free and forced (harmonic, periodic, non-periodic) vibration analysis of single and multi-degree of freedom linear systems.

Module 1

Single degree of Freedom systems – I: Undamped and damped free vibrations, forced vibrations, coulomb damping; Response to excitation, rotating unbalance and support excitation, vibration isolation and transmissibility.

Module 2

Unit 1: Single degree of Freedom systems – II: Response to Non-Periodic Excitations, UNIT impulse – UNIT step and UNIT Ramp functions, response to arbitrary excitations, The Convolution Integral, shock spectrum, System response by the Laplace Transformation method.

Unit 2: Vibration measuring instruments: Vibrometers, velocity meters & accelerometers.

Module 3

Two-degree freedom systems: Principal modes – undamped and damped free and forced vibrations; undamped vibration absorbers.

Module 4

Multi degree freedom systems: Matrix formulation, stiffness and flexibility influence coefficients; Eigen value problem; normal modes and their properties, Free and forced vibration by Modal analysis, Method of matrix inversion, Torsional vibrations of multi- rotor systems and geared systems; Discrete- Time systems.

Module 5

Unit 1: Numerical Methods: Raleigh's stodola's, Matrix iteration, Rayleigh- Ritz Method and Holzer's methods.

Unit 2: Continuous system: Free vibration of strings–longitudinal oscillations of bars- traverse vibrations of beams- Torsional vibrations of shafts.

Unit 3: Critical speeds of shafts: Critical speeds without and with damping, secondary critical speed.

Text Books:

1. Meirovitch, "Elements of Vibration Analysis", Tata McGraw Hill, 2001.
2. G. K. Groover, "Mechanical Vibrations", 2^{nd} Edition, NemChand Publications, 1972

Reference Books:

1. SS Rao, "Mechanical Vibrations", Pearson, 4th Edition, 2009.
2. Rao V.Dukkipati& J Srinivas, "Mechanical Vibration", PHI, 2010.
3. Mechanical Vibrations Practice and Basic Theory: V. Ram Murthy, Narosa Publishing House, New Delhi, 2000.

E - Resources:

1. http://www.math.psu.edu/tseng/class/Math251/Notes-MechV.pdf
2. https://engineering.purdue.edu/~deadams/ME563/notes_10.pdf
3. http://nptel.ac.in/courses/112103111/#
4. https://engfac.cooper.edu/pages/tzavelis/uploads/Vibration%20Theory.pdf
5. https://aerocastle.files.wordpress.com/2012/10/mechanical_vibrations_5th-edition_s-s-rao.pdf

Course Outcomes:

On completion of the course, the students will be able to:

1. **Appreciate** the need and importance of vibration analysis in mechanical design of machine parts that operate in vibratory conditions
2. **Analyze** the mathematical model of a linear vibratory system to determine its response
3. **Obtain** linear mathematical models of real-life engineering systems
4. **Use** Lagrange's equations for linear and nonlinear vibratory systems

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	3	2	3	-	-	-	-	-	-	-	-	1	2
CO2	2	3	2	3	-	-	-	-	-	-	-	-	1	2
CO3	2	3	2	3	-	-	-	-	-	-	-	1	2	2
CO4	2	3	2	3	-	-	-	-	-	-	-	1	2	2
CO5	2	3	2	3	-	-	-	-	-	-	-	1	2	2
Average	2	3	2	3	-	-	-	-	-	-	-	1	1.6	2

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
III Year – II Sem</td></tr>
<tr><td>Course Code: J323F</td><td rowspan="2">MACHINE TOOL DESIGN
Professional Elective – II</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Mechanics, Kinematics of Machines, Dynamics of Machines

Course Objectives:
This course will enable students to:
1. Implement the tool design process when designing tooling for the manufacturing of a product.
2. Apply geometric tolerance principles in the designs of tooling.
3. Evaluate and select appropriate materials for tooling applications.
4. Design, develop, evaluate cutting tools and work holders for a manufactured product.
5. Design, develop and evaluate appropriate gauging /gauging systems to define limits and specifications of a work piece during the manufacturing process.

Module 1
Introduction to Machine Tool Drives and Mechanisms: Introduction, Working and Auxiliary Motions in Machine Tools, Kinematics of Machine Tools, Motion Transmission

Module 2
Regulation of Speeds and Feeds: Aim of Speed and Feed Regulation, Stepped Regulation of Speeds, Multiple Speed Motors, Ray Diagrams and Design Considerations, Design of Speed Gear Boxes, Feed Drives, Feed Box Design.

Module 3
Design of Machine Tool Structures: Functions of Machine Tool Structures and their requirements, Design for Strength, Design for Rigidity, Materials for Machine Tool Structures, Machine Tool Constructional Features, Beds and Housings, Columns and Tables, Saddles and Carriages.

Module 4
Unit 1: Design of Guide ways, Power Screws and Spindles: Functions and Types of Guide ways, Design of Guide ways, Design of Aerostatic Slide ways, Design of Anti-Friction Guide ways, Combination Guide ways, Design of Power Screws.
Unit 2: Design of Spindles and Spindle Supports: Functions of Spindles and Requirements, Effect of Machine Tool Compliance on Machining Accuracy, Design of Spindles, antifriction Bearings.

Module 5

Dynamics of Machine Tools: Machine Tool Elastic System, Static and Dynamic Stiffness Acceptance Test

Text Books:

1. PB Mahapatra, “Operations Management”, PHI Publications.
2. Dr. KC Arora &Shinde, “Aspects of Material handling”, Lakshmi Publications.

Reference Books:

1. D. K Pal, S. K. Basu, “Design of Machine Tools”, Oxford Publications.
2. N. S. Acherkhan, “Machine Tool Design”, Vol. I, II, III and IV, MIR.

E - Resources:

1. https://nptel.ac.in/courses/112/105/112105126/
2. https://nptel.ac.in/courses/112/105/112105124/
3. http://www.amtonline.org/amt_items/Vol_II_Chap10_MachDgn_additive_2013_Rev3.pdf
4. https://nptel.ac.in/content/storage2/courses/112103174/pdf/mod4.pdf
5. https://nptel.ac.in/courses/112/106/112106180/

Course Outcomes:

On completion of the course, the students will be able to:

1. **Understand** basic motions involved in a machine tool.
2. **Design** machine tool structures.
3. **Design** and analyze systems for specified speeds and feeds.
4. **Select** subsystems for achieving high accuracy in machining.
5. **Understand** control strategies for machine tool operations and apply appropriate quality test for quality assurance

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	2	2	-	1	-	-	-	-	-	-	2	-	-
CO2	1	2	2	-	1	-	-	-	-	-	-	2	3	-
CO3	1	2	2	-	1	-	-	-	-	-	-	2	3	-
CO4	1	2	2	-	1	-	-	-	-	-	-	2	2	-
CO5	1	2	2	-	1	-	-	-	-	-	-	2	2	-
Average	1	2	2	-	1	-	-	-	-	-	-	2	2.5	-

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
III Year – II Sem</td></tr>
<tr><td>Course Code: J323G</td><td rowspan="2">AUTOMOBILE ENGINEERING
Professional Elective – II</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Thermal Engineering – I

Course Objectives:
This course will enable students to:
1. Learn basics of automobiles, drives, engine lubrication systems, emissions and pollution aspects.
2. Know about the fuel injection systems for S.I. Engine and C.I. Engine, Alternative fuels and Hybrid vehicles.
3. Understand the types and requirements of Cooling system, Functions and types of Ignition system
4. Understand the functioning of current-voltage regulator, bendix drive mechanism, lighting systems and Transmission system components.
5. Understand the construction and operational features of Steering system, Suspension system and Braking system.

Module 1
Unit 1: Introduction: Components of four-wheeler automobile – chassis and body – power unit – power transmission – rear wheel drive, front wheel drive, 4-wheel drive – types of automobile engines – engine construction.
Unit 2: Engine lubrication: Splash and pressure lubrication systems – oil filters – oil pumps – crank case ventilation – engine service – reboring, decarburization, nitriding of crankshaft.
Unit 3: Emission from Automobiles: Pollution standards, National and International– Pollution Control Techniques – Noise Pollution & control.

Module 2
Unit 1: S.I. Engine Fuel System: Fuel supply systems, Mechanical and electrical fuel pumps – carburetor – types – air filters – petrol injection – Electronic injection system
Unit 2: C.I. Engines Fuel System: Requirements of diesel injection systems – types of injection systems – fuel pump – nozzle. Alternative fuels for Automobiles-injection, Classification, Properties. Injection timing – testing of fuel pumps. Hybrid vehicles.

Module 3
Unit 1: Cooling System: Cooling Requirements – Air Cooling, Liquid Cooling and Forced Circulation System – Radiators – Types – Cooling Fan – water pump – thermostat – evaporating cooling – pressure sealed cooling – anti freeze solutions.

Unit 2: Ignition System: Function of an ignition system – battery ignition system, constructional features of storage battery, auto transformer, contact breaker points, condenser and spark plug– Magneto coil ignition system – electronic ignition system using contact breaker, electronic ignition using contact triggers – spark advance and retard mechanism.

Module 4

Unit 1: Electrical System: Charging circuit – generator – current-voltage regulator – starting system – Bendix drive mechanism – solenoid switch – lighting systems – Horn – wiper – fuel gauge – oil pressure gauge – engine temperature indicator etc.

Unit 2: Transmission System: Clutches – principle – types, cone clutch, single plate clutch, multi plate clutch, magnetic and centrifugal clutches – fluid fly wheel – Gear boxes, types, sliding mesh, construct mesh, synchro mesh gear boxes, epicyclic gear box – over drive torque converter. Propeller shaft – Hoatch-Kiss drive, Torque tube drive – universal joint, differential – rear axles, types – wheels and tyres.

Module 5

Unit 1: Steering System: Steering geometry – camber, castor, king pin rake, combined angle – toe in – center point steering. Types of steering mechanism, Ackerman steering mechanism, Davis steering mechanism – steering gears, types – steering linkages

Unit 2: Suspension System: Objects of suspension systems – rigid axle suspension system – torsion bar – shock absorber – Independent suspension system.

Unit 3: Braking System: Mechanical brake system, Hydraulic brake system – Master cylinder, Wheel cylinder, Tandem master cylinder – Requirement of brake fluid. Pneumatic and Vacuum brakes.

Text Books:

1. Kripal Singh, “Automobile Engineering”, Standard Publishers Distributors, Vol. 1, & Vol. 2, 2007
2. K.M Gupta, “Automobile Engineering”, Umesh publication, Vol. 1 & Vol. 2 by, 2012
3. K.K. Ramalingam, “Automobile Engineering”, SciTech Publications Pvt Ltd, 2nd Edition, 2015.

Reference Books:

1. Jack Erjavec, “A System approach to Automotive Technology”, YesDee Publishing Pvt Ltd, 5th Edition, 2009.
2. William Crouse, “Automobile Engineering”, Tata McGraw Hill Publishers, 10th Edition, 2017.
3. Joseph Heitner, “Automotive Mechanics”, CBS Publishers, 2nd Edition, 2004.

E - Resources:

1. https://books.google.co.in/books?id=nBVefxD_0agC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=true
2. https://nptel.ac.in/courses/107/106/107106088/
3. https://www.slideshare.net/sudhavel/futuristic-trends-in-automobile-engineering?qid=fc942712-e13d-4bc2-940f-aaacc9913b6f&v=&b=&from_search=6
4. https://www.engineeringbookspdf.com/download/?file=13332
5. https://www.iaeme.com/MasterAdmin/uploadfolder/IJCIET_09_13_186/IJCIET_09_13_186.pdf

Course Outcomes:

On completion of the course, the students will be able to:

1. **Identify** the basic automobile components, gain adequate knowledge of the Engine lubrication system, Crank case ventilation and Emission controls for Automobiles
2. **Analyze** the requirements and functioning of the Fuel Injection Systems and carry out testing of fuel pumps
3. **Show** reasonable prowess in gaining the knowledge on Cooling Systems and Ignition Systems of automobiles
4. **Explain** the working of various components of the automobile Electrical System and Transmission System
5. **Analyze** the working of Steering System, Suspension System and Braking system

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	-	3	3	3	-	-	-	-	-	-	3	1	-
CO2	3	-	3	3	3	-	-	-	-	-	-	2	1	1
CO3	3	-	3	3	3	-	-	-	-	-	-	2	1	-
CO4	3	-	3	3	3	-	-	-	-	-	-	2	1	-
CO5	3	-	3	3	3	-	-	-	-	-	-	2	1	-
Average	3	-	3	3	3	-	-	-	-	-	-	2.2	1	1

<table>
<tr><td>AY 2020 - 21 onwards</td><td colspan="1">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
III Year – II Sem</td></tr>
<tr><td>Course Code: J3231</td><td rowspan="2">METROLOGY AND INSTRUMENTATION LAB</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 1</td><td>0</td><td>0</td><td>2</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Mathematics, Engineering Physics and Chemistry

Course Objectives:
This course will enable students to:
1. Understand the usage of common measurement equipment, and learn the basic concepts of Accuracy, Precision, Uncertainty, Error etc.
2. Gain basic knowledge of measuring linear displacement, Temperature, flow, speed and strain measurements, and Calibration of the measuring systems used.
3. Learn the use of Vernier calipers, Micrometers, Dial bore indicators, etc., to measure Lengths, Heights and Diameters
4. Learn to use the Bevel Protractor, Tool Maker's Microscope, Sine bar for Angle and Taper measurements.
5. Understand how to carry out the measurement of Spur Gear elements, Thread measurement by Three Wire Method, and measurement of Surface roughness using Talysurf.

List of Experiments

Experiment 1: Calibration of LVDT for the measurement of linear displacement.
Experiment 2: Temperature measurement.
Experiment 3: Study and calibration of Photo and Magnetic speed pickups for the speed measurement.
Experiment 4: Calibration of strain gauge for cantilever beam**.**
Experiment 5: Study and calibration of Rotameter for flow measurement**.**
Experiment 6: Measurement of a lengths, Heights and diameters by Vernier calipers and micrometers.
Experiment 7: Measurement of bores by internal micrometer and dial bore indicators
Experiment 8: Measurement of Spur Gear elements.
Experiment 9: Angle and Taper measurements by Bevel Protractor and Sine bar.
Experiment 10: Thread measurement by Three Wire Method.
Experiment 11: Surface roughness measurement using Talysurf.
Experiment 12: Tool Makers Microscope

E - Resources:
1. https://books.google.co.in/books?id=OXeQDwAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

Course Outcomes:

On completion of the course, the students will be able to:

1. **Calibrate** the measuring instruments, and conduct the experiments with minimum error in measurements.
2. **Apply** the basic knowledge of Linear Displacement, Temperature, flow, speed and strain measurements, with good accuracy and precision, in practical situations.
3. **Use** the various Metrological instruments like Verniercalipers, Micrometers, Bevel Protractor, Talysurf, and Tool Maker's Microscope.
4. **Use** Bevel Protractor, Tool Maker's Microscope, Sine bar for Angle and Taper measurements.
5. **Interpret** the results of experiments and draw correct inferences.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	3	-	2	3	2	-
CO2	-	-	-	-	-	-	-	-	3	-	2	3	3	-
CO3	-	-	-	-	-	-	-	-	3	-	2	3	3	-
CO4	-	-	-	-	-	-	-	-	3	-	2	3	-	-
CO5	-	-	-	-	-	-	-	-	1	-	2	3	3	-
Average	-	-	-	-	-	-	-	-	2.6	-	2	3	2.8	-

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
III Year – II Sem</td></tr>
<tr><td>Course Code: J3232</td><td rowspan="2">HEAT TRANSFER LAB</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 1</td><td>0</td><td>0</td><td>2</td><td>0</td></tr>
</table>

Pre-requisite: Thermodynamics, Heat Transfer

Course Objectives:
This course will enable students to:
1. Impart experimental experience in Heat Transfer Lab those support Mechanical Engineering.
2. Provide students with an opportunity of direct experience of doing Heat Transfer Lab calculation so that they can understand the basics of the principles and able to make a critical assessment of industrial environment
3. Learn fundamentals in element of Heat Transfer & its applications. So as to identify, formulate and solve the problems of Heat Transfer device designs.
4. Develop an idea about how to measure heat transfer coefficients/constant like h, emissivity, Stefan Boltzmann constants for devices like metal rod, lagged pipe, etc.,
5. Encourage the students to understand importance energy conversation and make them to experience with practical applications in Heat Transfer Lab

List of Experiments

Experiment 1: Composite Slab Apparatus – Overall heat transfer co-efficient.

Experiment 2: Heat transfer through lagged pipe.

Experiment 3: Heat Transfer through a Concentric Sphere

Experiment 4: Thermal Conductivity of given metal rod.

Experiment 5: Heat transfer in pin-fin Apparatus

Experiment 6: Experiment on Transient Heat Conduction.

Experiment 7: Heat transfer in forced convection apparatus.

Experiment 8: Heat transfer in natural convection

Experiment 9: Parallel and counter flow heat exchanger.

Experiment 10: Emissive apparatus.

Experiment 11: Stefan Boltzmann Apparatus.

Experiment 12: Critical Heat flux apparatus

Experiment 13: Study of heat pipe and its demonstration

E - Resources:

1. https://www.google.co.in/books/edition/A_Heat_Transfer_Textbook/gLK8DwAAQBAJ?hl=en&gbpv=1&dq=JOHN.H.+LIENHARD&printsec=frontcover

Course Outcomes:

On completion of the course, the students will be able to:

1. **Apply** the knowledge of heat transfer to perform experiments related to conduction heat transfer
2. **Evaluate** heat transfer coefficient in free and forced convection heat transfer situation
3. **Determine** fin efficiency and emissivity in respective experiments
4. **Observe** the phenomena of drop and film wise condensation
5. **Evaluate** the performance of heat exchangers in parallel & counter flow types

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	3	-	1	2	1	1
CO2	-	-	-	-	-	-	-	-	3	-	1	2	1	1
CO3	-	-	-	-	-	-	-	-	3	-	1	2	1	1
CO4	-	-	-	-	-	-	-	-	3	-	1	2	-	-
CO5	-	-	-	-	-	-	-	-	3	-	1	2	1	1
Average	-	-	-	-	-	-	-	-	3	-	1	2	1	1

AY 2020 - 21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech: ME III Year – II Sem			
Course Code: J3201	LIFE SKILLS AND PROFESSIONAL SKILLS LAB (Common to ALL)	L	T	P	D
Credits: 2		0	0	4	0

Pre-requisite: NIL

Course Objectives:
This course will enable students to:

1. Understand importance of self-assessment and awareness.
2. Recognize the emotional needs of themselves and others.
3. Define social skills and need of positive vibe.
4. Employ Leadership Traits and skills in day to day life.
5. Quantify the importance of Thinking out of Box, Creativity and Innovation.

Module: I
Self-Introduction and Practice Session-Importance of Communication Skills-Advance communication skills needed for effective communication-Self-assessment and self-awareness with required tools and Activity based approach.

Module: II
Empathy Practice Sessions & Role-plays -Assertive Behavior-Emotional Intelligence-Conflict Resolution and Anger Management

Module: III
Social skills and how to handle criticism-Social Interaction Skills – Role-plays-Diversity & Social Responsibility- Positive Attitude- Power of Positive Energy.

Module: IV
Leadership-Traits & skill-Activities – Case Studies-Assessments - Team Building skills –Activities –Case studies on Interaction with industry people.

Module: V
Thinking Out-of-the Box – Case-study & Activity Based- Creativity & Innovation-Developing a Vision & Action-plan - Thinking Skills – Various Types of Thinking - Power of Questioning Skills– Practice Sessions & Role plays

REFERENCES:

1. Butterfield, Jeff. Soft Skills for Everyone. Delhi: Cenege., 2010.
2. Raman, Meenakshi and Sangeeta Sharma. Technical Communication-Principles and Practice. Third Edition, New Delhi: UP., 2015.

3. Rizvi, M Ashraf. Effective Technical-Communication. New Delhi: Tata McGraw-Hill., 2005

Web Resources:

1. https://www.youtube.com/watch?v=TwZ7LgrPwR0&ab_channel=ChetChat.
2. https://www.youtube.com/watch?v=Bhf35YngKl4&ab_channel=DanielAlly
3. https://www.youtube.com/watch?v=baHrcC8B4WM&ab_channel=TEDxTalks
4. https://www.youtube.com/watch?v=LgUCyWhJf6s&ab_channel=TheSchoolofLife
5. https://www.youtube.com/watch?v=KY5TWVz5ZDU&ab_channel=ThatsEasyLearning
6. https://www.youtube.com/watch?v=F4Zu5ZZAG7I&ab_channel=TEDxTalks
7. https://www.youtube.com/watch?v=mzgxE9GIiPk&ab_channel=TEDxTalks
8. https://www.youtube.com/watch?v=2lEp4TVpxgA&ab_channel=LearningREADefined
9. https://www.youtube.com/watch?v=8yGhNwDMT-g&ab_channel=TeamBuildingGames
10. https://www.youtube.com/watch?v=MMFPdnXv6aY&ab_channel=PebblesKidsStories
11. https://www.youtube.com/watch?v=CSROnM17S8s&ab_channel=AbbyCampbell
12. https://www.youtube.com/watch?v=K1EHZW4oFGg&ab_channel=AuthenticEducation
13. https://www.youtube.com/watch?v=1dO0dO__wmE&ab_channel=LitmosHeroes

Course outcomes:

At the end of this course students will be able to

1. Recognize importance of self-awareness and assessment.
2. Translate the needs of others and themselves.
3. Practice being social and possess positive energy.
4. Employ Leadership Traits and skills in day to day life.
5. Understand the importance of Thinking- out- of - the-Box.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO2	-	-	-	-	-	-	-	-	2	3	-	3	-	
CO3	-	-	-	-	-	-	-	-	2	3	-	3	-	1
CO4	-	-	-	-	-	-	-	-	2	3	-	3	-	1
CO5	-	-	-	-	-	-	-	-	2	3	-	3	-	-
Average	-	-	-	-	-	-	-	-	2	3	-	3	-	1

<table>
<tr><td>AY 2020 - 21 onwards</td><td colspan="4">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
III Year – II Sem</td></tr>
<tr><td>Course Code: J32M1</td><td rowspan="2" colspan="4">ARTIFICIAL INTELLIGENCE</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 0</td><td>2</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-Requisites: Mathematics, Probability and statistics, Knowledge in programming Language

Course Objectives:
The Student will:

1. Know the AI based problems.
2. Illustrate AI techniques for representing the basic problem.
3. Illustrate Advanced AI techniques to solve the problem.
4. Define Learning and explain various learning techniques.
5. Understand the usage expert system.

Module 1:
Introduction: AI problems, Agents and Environments, Structure of Agents, Problem Solving Agents
Basic Search Strategies: Problem Spaces, Uninformed Search (Breadth-First, Depth – First Search, Depth-first with Iterative Deepening), Heuristic Search (Hill Climbing, Generic Best – First, A*), Constraint Satisfaction (Backtracking, Local Search)

Module 2:
Advanced Search: Constructing Search Trees, Stochastic Search, A* Search Implementation, Minimax Search, Alpha-Beta Pruning
Basic Knowledge Representation and Reasoning: Propositional Logic, First-Order Logic, Forward Chaining and Backward Chaining, Introduction to Probabilistic Reasoning, Bayes Theorem

Module 3:
Advanced Knowledge Representation and Reasoning: Knowledge Representation Issues, Non- monotonic Reasoning, Other Knowledge Representation Schemes
Reasoning Under Uncertainty: Basic probability, Acting Under Uncertainty, Bayes' Rule, Representing Knowledge in an Uncertain Domain, Bayesian Networks

Module 4:
Learning: What Is Learning? Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Examples, Winston's Learning Program, Decision Trees

Module 5:

Expert Systems: Representing and Using Domain Knowledge, Shell, Explanation, Knowledge Acquisition.

TEXT BOOK:

1. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, Prentice- Hall, 2010.

REFERENCE BOOKS:

1. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivasankar B. Nair, The McGraw Hill publications, Third Edition, 2009.
2. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education, 6th ed., 2009.

E - RESOURCES:

1. https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_pdf_version.htm
2. https://www.alljntuworld.in/download/artificial-intelligence-ai-materials-notes/
3. https://drive.google.com/file/d/1mPiI4jy6YkJRDiCT21xgzN0VDNkrW23X/view
4. https://nptel.ac.in/courses/106/105/106105077/

Course outcomes:

The Student will be able to:

1. Identify the AI based problems.
2. Apply AI techniques for representing the basic problem.
3. Apply Advanced AI techniques to solve the problem.
4. Analyze Learning and explain various learning techniques.
5. Illustrate the use of expert system.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	3	3	-	-	-	-	-	-	-	-	-	1	1
CO3	3	3	-	-	-	-	-	-	-	-	-	-	1	1
CO4	3	3	3	-	-	-	-	-	-	-	-	-	1	-
CO5	3	3	-	-	-	-	-	-	-	-	-	-	-	-
Average	3.0	3.0	3.0	-	-	-	-	-	-	-	-	-	1	1

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
IV Year – I Sem</td></tr>
<tr><td>Course Code: J413A</td><td rowspan="2">CAD/CAM</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 2</td><td>2</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Drawing, Metal Cutting &Machine Tools.

Course Objectives:
This course will enable students to:
1. Learn about computer graphics and their application in CAD and 2D &3D transformations like reflection, rotation etc.
2. Understand the different geometric modeling techniques like solid modeling, surface modeling, and feature based modeling etc. and to visualize how the components look like before its manufacturing or fabrication.
3. Learn about the numerical control machining and CNC part programming.
4. Learn importance of group technology; computer aided process planning, computer aided quality control.
5. Understand overall configuration and elements of computer integrated manufacturing systems.

Module 1
Computer Graphics: Raster scans graphics coordinate system – database structure for graphics modeling – transformation of geometry – 3D transformations – mathematics of projections – clipping – hidden surface removal.

Module 2
Geometric Modeling: Requirements – geometric models – geometric construction models, curve representation methods – surface representation methods – modeling facilities desired – solid modeling.

Module 3
Unit 1: Numerical control: NC – NC modes, NC elements, NC machine tools – structure of CNC machine tools, features of Machining center – turning center.
Unit 2: CNC Part Programming: fundamentals – manual part programming methods – Computer Aided Part Programming.

Module 4
Unit 1: Group Tech: Part family – coding and classification – production flow analysis – advantages and limitations – Computer Aided Processes Planning – Retrieval type and Generative type.
Unit 2: Computer aided Quality Control: Terminology in quality control – the computer in QC – contact inspection methods – noncontact inspection methods:

optical, noncontact inspection methods: non optical – computer aided testing – integration of CAQC with CAD/CAM.

Module 5

Unit 1: Computer integrated manufacturing systems: Types of Manufacturing systems – Machine tools and related equipment – material handling systems – computer control systems – Human labourin the manufacturing systems – CIMS benefits.

Unit 2: Introduction to 3D Printing: Process chain – Classification – description about SLA, SLS and FDM processes.

Text Books:

1. A Zimmers & P.Groover, "CAD / CAM", PHI, 1st Edition, 2009.
2. Ibrahim Zeid, "CAD / CAM Theory and Practice", TMH, 3rd Edition, 2001.

Reference Books:

1. P. Groover, "Automation, Production systems & Computer integrated Manufacturing", Pearson Education, 2014.
2. Radhakrishnan and Subramanian, "CAD / CAM / CIM", New Age, 2nd Edition, 2000.

E - Resources:

1. https://rb.gy/2rnapl
2. http:// nptel.ac.in/courses/112102101/
3. http://nptel.ac.in/courses/112102103
4. https://nptel.ac.in/courses/112/102/112102101/

Course Outcomes:

On completion of the course, the students will be able to:

1. **Explain** the basic structure and components of computer hardware used in CAD/CAM. Apply computer graphics techniques in modeling.
2. **Know** how to use drafting and modeling methods in CAD/CAE fields.
3. **Apply** the knowledge of CNC machining and part programming to produce objects of intricate shapes with high level of accuracy
4. **Use** the principles /methods of GT, CAPP and Computer Aided Quality Control for product development.
5. **Get** exposure various elements and their functions in CIM.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	1	2	1	-	-	-	-	-	-	-	3	1	2
CO2	2	2	3	2	-	-	-	-	-	-	-	3	2	1
CO3	3	2	3	1	-	-	-	-	-	-	-	3	-	1
CO4	3	3	3	3	-	-	-	-	-	-	-	3	1	-
CO5	3	3	2	3	-	-	-	-	-	-	-	3	3	-
Average	2.8	3	3	2	-	-	-	-	-	-	-	3	1.7	1.6

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
IV Year – I Sem</td></tr>
<tr><td>Course Code: J413K</td><td rowspan="2">FINITE ELEMENT METHODS</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Mathematics, Engineering Mechanics, Mechanics of Solids.

Course Objectives:
This course will enable students to:
1. Equip the Finite Element Analysis fundamentals and formulations.
2. Enable the students to formulate the axial, truss, beam problems.
3. Enable the students to formulate 2D problems with special cases and use of numerical integration.
4. Enable the students to formulate 3D problems and one dimensional dynamic problem.
5. Enable the students to formulate heat transfer problems and perform engineering simulations using Finite Element Analysis software.

Module 1
Unit 1: Fundamental Concepts: Introduction to Finite Element Methods for solving field problems, Methods of Engineering Analysis, Functional Approximation Methods: Rayleigh- Ritz Method, Weighted Residual Methods, Applications of FEM, Advantages and Disadvantages of FEM, Stress and Equilibrium, Strain – Displacement relations, Stress – strain relations. Basic Steps of FEM, Characteristics of Finite Element, Convergence Requirements.
Unit 2: One Dimensional problems: Formulation of Stiffness Matrix for a Bar Element using virtual work and potential energy approaches, Properties of Stiffness Matrix, Characteristics of Shape Functions, Quadratic shape functions. Assembly of global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions. Problems on uniform and stepped bars for different loading conditions.

Module 2
Unit 1: Analysis of Trusses: Derivation of Stiffness Matrix for Trusses, Stress and strain Calculations, Calculation of reaction forces and displacements.
Unit 2: Analysis of Beams: Derivation of Stiffness matrix for two nodded, two degrees of freedom per node beam element, Load Vector, Deflection, Stresses, Shear force and Bending moment, Problems on uniform and stepped beams for different types of loads applied on beams.

Module 3

Unit 1: Finite element – formulation of 2D Problems: Plane stress, plane strain and axis symmetry, Derivation of shape functions and Element stiffness matrix for two dimensional CST Element, Finite element modeling of axis symmetric solids subjected to axis symmetric loading with triangular elements.
Unit 2: Isoperimetric Formulations & Numerical Integration: Two dimensional Triangular and four nodded quadrilateral Isoperimetric Elements. Numerical integration and Gauss quadrature.

Module 4
Unit 1: Finite element – formulation of 3D problems: Introduction to finite element formulation of three dimensional problems in stress analysis - Derivation of Shape functions and Element stiffness matrix for Tetrahedron Element-Properties of Shape functions for 3D Tetrahedral Element.
Unit 2: Dynamic Analysis: Formulation of mass matrices for uniform bar and beam Elements using lumped and consistent mass methods, Evaluation of Eigen values and Eigen vectors for a stepped bar and beam Problems**.**

Module 5
Unit 1: Steady state heat transfer analysis: One Dimensional Finite Element analysis of fin and composite slabs. Two dimensional steady state heat transfer problems: Derivation of Thermal Stiffness matrix for 2D heat transfer problems-CST, Derivation of thermal force vector for 2D heat transfer problems.
Unit 2: Introduction to Finite Element Analysis Software: Modeling, analysis and post processing

Text Books:

1. S.S. Rao, “The finite element methods in Engineering”, Elsevier, 4th Edition.
2. Tirupathi K. Chandrupatla and Ashok D. Belagundu, “Introduction to finite elements in engineering”.

Reference Books:

1. Alavala, “Finite Element Methods”, PHI, 2nd Edition, 2010.
2. J. N. Reddy, “An Introduction to Finite Element Methods”, Tata McGraw Hill.
3. O.C.Zienkowitz, “The Finite Element Method in Engineering Science”,Tata McGraw Hill.

E - Resources:

1. https://nptel.ac.in/courses/112/104/112104116/
2. https://nptel.ac.in/courses/112/104/112104193/
3. https://homepages.cae.wisc.edu/~suresh/ME964Website/M964Notes/Notes/introfem.pdf
4. https://www.pdfdrive.com/finite-element-analysis-e24706861.html

Course Outcomes:
On completion of the course, the students will be able to:

1. **Apply** FE method for solving field problems using Virtual work and Potential energy formulations.
2. **Analyze** axial bar, truss and beam problems using FEM.
3. **Analyze** 2D structural problems using CST element and analyze plane stress, plane strain and axis symmetric problems and Apply the concepts of numerical integration in FE modeling
4. **Formulate** 3D elements, apply finite element method to estimate natural frequencies for stepped bar and beam.
5. **Solve** linear 1D and 2D heat conduction and convection heat transfer problems, apply finite element analysis software for engineering solutions.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	3	2	2	-	-	-	-	-	-	2	-	1
CO2	3	3	3	2	2	-	-	-	-	-	-	2	2	2
CO3	2	3	3	3	2	-	-	-	-	-	-	3	3	2
CO4	2	3	3	3	2	-	-	-	-	-	-	3	3	2
CO5	2	3	3	3	2	-	-	-	-	-	-	3	3	2
Average	2.4	3	3	2.6	2	-	-	-	-	-	-	2.6	2.75	1.8

AY 2020 - 21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech: ME IV Year – I Sem			
Course Code: J413B	**MANUFACTURING OF COMPOSITES** Professional Elective – III	L	T	P	D
Credits: 3		3	0	0	0

Pre-requisite: Engineering Physics, Engineering Materials, Manufacturing Technology.

Course Objectives:
This course will enable students to:
1. Understand the concepts of composites, their properties, applications, and testing methods.
2. Learn about the manufacturing processes for Thermosetting matrix composites and Thermoplastic matrix composites
3. Gain knowledge of various methods of processing the Metal Matrix Composites.
4. Learn about the Ceramic Matrix Composites, Nano-composites, and Carbon-Carbon Composites, their properties, Fabrication methods, and Applications
5. Learn various methods of Repair and Non-destructive testing for composite materials

Module 1
Unit 1: Introduction to Composites: Concept of composites – Classification of composites – Applications of composites – Metals vs Composites – Composites lay-up nomenclature – Laminating stacking – Standard orientation and sequence of ply.
Unit 2: Properties and testing of composites: Composite properties – Volume fraction calculations – Elastic behavior. Composites testing – types of testing – Physical testing, Mechanical testing, chemical testing, Thermal testing, Rheological testing.

Module 2
Unit 1: Manufacturing of Polymer Matrix Composites: Processes for Thermosetting matrix composites – Hand layup and spray up techniques, Filament winding, Pultrusion, Resin transfer moulding, Autoclave moulding.
Processes for Thermoplastic matrix composites – Injection moulding, Film stacking, Diaphragm forming. Thermoplastic tape laying. Stacking of reinforcements – Manufacturing Process Selection – Criteria, Product Fabrication Techniques – Mould and Tool Making method.

Module 3
Manufacturing of Metal Matrix Composites (MMC): Introduction – Classification, Advantages and disadvantages – Reinforcements and Matrices. Processing of MMC –

Processing methods – Liquid state processing, Stir Casting, Infiltration, Squeeze casting – Gas pressure – Pressure die – Solid state fabrication – Diffusion bonding – Sintering – In situ fabrication of MMC – Co-deposition methods – Electrolytic co-deposition – Spray co-deposition – Vapour co-deposition.

Module 4

Unit 1: Manufacturing of Ceramic Matrix Composites (CMCs): Introduction – Types – Properties – Interfaces – Fabrication methods of CMCs – Polymer Infiltration and Pyrolysis – Chemical Vapour Infiltration – Liquid Silicon Infiltration – Direct Oxidation Process – Slurry Infiltration – Selective Laser Sintering – Applications of CMCs. Carbon – Carbon Composites – Introduction, Processing of CCC, Advantages – limitations and Applications of CCC.

Unit 2: Nano Composites: Nano-composites and fillers – Synthesis of nano-composites – Solution casting – Melt blending – In-situ polymerization – Electro deposition – Advantages – limitations and Applications of nano-composites.

Module 5

Unit 1: Repair and NDT of Composites: Repair of Composites – Damage in Composites – Damage Assessment – Contaminations – Types of repair – Scarfing and Stepping

Unit 2: Non-destructive testing methods for composite materials- Ultrasonic Testing (UT) – Acoustography – Radiographic Testing (RT) – Shearography Testing – Thermography.

Text Books:

1. Mazumdar S, "Composites manufacturing: materials, product, and process engineering", CRC press, 2001.
2. Balasubramanian, M., "Composite materials and processing", CRC press, 2013.
3. Campbell Jr, F.C. ed, "Manufacturing processes for advanced composites", Elsevier, 2003.

Reference Books:

1. B. D. Agarwal and L. J. Broutman, Wiley, "Analysis and performance of fiber Composites", Inter science, New York, 1980.
2. R. M. Jones, "Mechanics of Composite Materials", McGraw Hill Company, New York, 1975.
3. Isaac and M Daniel, "Engineering Mechanics of Composite Materials", Oxford University Press, 1994.

E - Resources:

1. https://rb.gy/gyg9re
2. https://rb.gy/rsbsui
3. https://nptel.ac.in/courses/112/104/112104221/

Course Outcomes:

On completion of the course, the students will be able to:

1. **Describe** the important properties of composites, their applications, and testing methods.
2. **Identify** the manufacturing methods of Polymer Matrix Composites
3. **Apply** the knowledge acquired in the manufacturing of Metal Matrix Composites, Ceramic Matrix Composites, and Nano-composites to practical situations
4. **Identify** and assess the damage in Composites by Non-destructive testing methods, and repair the same
5. **Apply** the knowledge of various methods for Repair and Non-destructive testing for composite materials

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	1	-	-	2	1	-	-	-	-	-	2	-	-
CO2	1	1	-	-	-	1	-	-	-	-	-	2	-	-
CO3	2	1	3	2	-	2	-	-	-	-	-	2	3	-
CO4	1	3	3	3	2	1	-	-	-	-	-	2	3	-
CO5	2	3	3	3	3	2	-	-	-	-	-	1	3	2
Average	1.5	1.6	3	2.6	2.3	1.4	-	-	-	-	-	1.8	3	2

AY 2020 - 21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech: ME IV Year – I Sem			
Course Code: J413C	**MICRO ELECTRO MECHANICAL SYSTEMS**	**L**	**T**	**P**	**D**
Credits: 3	Professional Elective – III	**3**	**0**	**0**	**0**

Pre-requisite: Basic Electrical and Electronics Engineering, Material Science.

Course Objectives:
This course will enable students to:
1. Understand concept of MEMS and Microsystems.
2. Recognize the importance of Engineering Science for Microsystems Design and Fabrication.
3. Recognize the importance of Engineering Mechanics for Microsystems Design.
4. Understand concept of thermo Fluid Engineering & Microsystems Design.
5. List the Materials for MEMS & Microsystems and their fabrication.

Module 1
Overview and working principles of MEMS and Microsystems: MEMS & Microsystems, Evolution of Micro fabrication, Microsystems & Microelectronics, Microsystems & miniaturization, Applications of MEMs in Industries, Micro sensors, Micro actuation, MEMS with Micro actuators Micro accelerometers, Micro fluidics.

Module 2
Engineering Science for Microsystems Design and Fabrication: Atomic structure of Matter, Ions and Ionization, Molecular Theory of Matter and Intermolecular Forces, Doping of Semiconductors, The Diffusion Process, Plasma Physics, Electrochemistry, Quantum Physics.

Module 3
Engineering Mechanics for Microsystems Design: Static Bending of Thin plates, Mechanical Vibration, Thermo mechanics, Fracture Mechanics, Thin- Film Mechanics, Overview of Finite Element Stress Analysis.

Module 4
Thermo Fluid Engineering & Microsystems Design: Overview of Basics of Fluid Mechanics in Macro and Mesoscales, Basic equations in Continuum Fluid Dynamics, Laminar Fluid Flow in Circular Conduits, Computational Fluid Dynamics, Incompressible Fluid Flow in Micro conduits, Fluid flow in Sub micrometer and Nano scale, Overview of Heat conduction in Solids, Heat Conduction in Multilayered Thin films and in solids in sub micrometer scale, Design Considerations, Process

Design Mechanical Design, Mechanical design using FEM, Design of a Silicon Die for a Micro pressure sensor.

Module 5

Materials for MEMS & Microsystems and their fabrication: Substrates and Wafers, Active substrate materials, Silicon as a substrate material, Silicon compounds, Silicon Piezo resistors, Gallium Arsenide, Quartz, Piezoelectric Crystals and Polymers, Photolithography, Ion implantation, Diffusion and oxidation, Chemical and Physical vapor deposition, etching, Bulk micro manufacturing, Surface Micromachining, The LIGA Process.

Text Books:

1. Tia-Ran Hsu, "MEMS & Microsystems: Design & Manufacturing", TMH, 2002.
2. Chang Liu, "Foundation of MEMS", Pearson, 2012.

Reference Books:

1. Maluf, M., "An Introduction to Micro electromechanical Systems Engineering", Artech House, 2000.
2. Trimmer, W.S.N., "Micro robots and Micromechanical Systems: Sensors & Actuators", Vol 19, 1989.
3. Trim., D.W, "Applied Partial Differential Equations", PWS-Kent Publishing, 1990

E - Resources:

1. https://www.engr.sjsu.edu/trhsu/ME189_Chapter%201.pdf
2. https://www.pdfdrive.com/mems-and-microsystems-design-manufacture-and-nanoscale-e884943.html
3. http://nptel.ac.in/courses/117105082/
4. https://www.mems-exchange.org/MEMS/what-is.html

Course Outcomes:

On completion of the course, the students will be able to:

1. **Apply** the knowledge of MEMS and Microsystems in various engineering fields.
2. **Relate** Engineering Science for Microsystems Design and Fabrication.
3. **Relate** Engineering Mechanics for Microsystems Design.
4. **Apply** the knowledge of Thermo Fluid Engineering & Microsystems Design in various engineering fields.
5. **Select** Materials for MEMS & Microsystems and their fabrication.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2	2	2	2	-	-	-	-	-	-	2	1	-
CO2	3	2	2	2	2	-	-	-	-	-	-	2	1	-
CO3	2	2	2	2	2	-	-	-	-	-	-	2	-	-
CO4	2	2	2	2	2	-	-	-	-	-	-	2	2	1
CO5	1	2	2	2	2	-	-	-	-	-	-	2	-	-
Average	2	2	2	2	2	-	-	-	-	-	-	2	1.3	1

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
IV Year – I Sem</td></tr>
<tr><td>Course Code: J413D</td><td rowspan="2">REFRIGERATION AND
AIR CONDITIONING
Professional Elective – III</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Physics, Thermodynamics

Course Objectives:
This course will enable students to:

1. Learn the working of basic refrigeration cycles with applications and air refrigeration systems.
2. Analyze the working principle and performance of VCR system along with classification of refrigerants
3. Impart the working principles of VAR system, Steam jet refrigeration system and compute problems
4. Learn different parts of air conditioning system and understand the requirements of human comfort
5. Understand the working principles of gas liquefaction in cryogenics

Module 1
Introduction to Refrigeration: Necessity and applications – unit of refrigeration and C.O.P. – Mechanical Refrigeration – Types of Ideal cycles of refrigeration.
Air Refrigeration: Bell Coleman cycle and Brayton Cycle, Open and Dense air systems –Actual air refrigeration system problems – Refrigeration needs of Aircrafts.

Module 2
Vapour Compression Refrigeration: Working principle and essential components of the plant–simple Vapour Compression Refrigeration cycle – COP – Representation of cycle on T-S and p-h charts – effect of sub cooling and super heating – cycle analysis – Actual cycle Influence of various parameters on system performance – Use of p-h charts – Numerical Problems.
Refrigerants: Desirable properties – classification – refrigerants used – Nomenclature –Ozone Depletion – Global Warming.

Module 3
Principles of Evaporators: Classification – Working Principles – Expansion devices, Types, Working Principles
Vapour Absorption System: Calculation of maximum COP – description and working of NH_3-water system and Li-Br – water (Two shell & Four shell) System, Principle of operation, Three Fluid absorption system, salient features.

Steam Jet Refrigeration System: Working Principle and Basic Components – Principle and operation of (i) Thermoelectric refrigerator (ii) Vortex tube or Hilsch tube.

Module 4

Introduction to Air Conditioning: Psychometric Properties & Processes – Characterization of Sensible and latent heat loads – Need for Ventilation – Consideration of Infiltration – Load concepts of RSHF, GSHF – Problems – Concept of ESHF and ADP.

Requirements of human comfort and concept of effective temperature: Comfort chart –Comfort Air conditioning, Air conditioning Load Calculations.

Air Conditioning systems: Classification of equipment – cooling, heating, humidification and dehumidification – filters – grills and registers – fans and blowers.

Module 5

Cryogenics: Application of cryogenics, Gas liquefaction systems – LindeHampson, Linde dual pressure, Claude cycle – merits of one system over other system – Production of liquid air, Production of liquid nitrogen and production of liquid oxygen

Text Books:

1. C.P. Arora, "Refrigeration and Air Conditioning", Tata McGraw Hill, 3rd Edition, 2009.
2. S.C. Arora, Domkundwar, "A Course in Refrigeration and Air conditioning", Dhanpatrai Publishers, 8th Edition, 2012.

Reference Books:

1. C. Thomas Olivo, R. Warren Marsh, "Principles of Refrigeration", Delmar Publishers, 3rd Edition 1990.
2. P.L. Bellaney, "Refrigeration and Air Conditioning", Khanna Publishers, 7th Edition, 1985.
3. P N Ananthanarayanan, "Basic Refrigeration and Air-Conditioning", Tata McGraw Hill, 3rd Edition, 2006.

E - Resources:

1. https://www.slideshare.net/REHMAN4226/a-text-book-of-refrigerarion-and-airconditioning-by-r-s-khurmi
2. https://nptel.ac.in/courses/112/107/112107208/
3. http://ecoursesonline.iasri.res.in/course/view.php?id=84

Course Outcomes:

On completion of the course, the students will be able to:

1. **Understand** the principles and applications of refrigeration systems
2. **Understand** vapour compression refrigeration system and identify methods for performance improvement
3. **Explain** the working principles of steam jet, Vapour absorption, thermoelectric and vortex tube systems
4. **Analyze** air conditioning processes using principle of psychrometry and evaluate cooling and heating load in an air conditioning system
5. **Understand** the applications of cryogenics and gas liquefaction system.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	1	1	2	-	-	-	-	-	-	3	1	-
CO2	3	2	3	2	1	-	-	-	-	-	-	3	2	1
CO3	3	-	2	1	1	-	-	-	-	-	-	3	1	1
CO4	3	3	3	2	1	-	-	-	-	-	-	3	2	2
CO5	2	-	2	-	2	-	-	-	-	-	-	3	2	1
Average	2.8	2.3	2.2	1.5	1.4	-	-	-	-	-	-	3	1.6	1.25

AY 2020 - 21 onwards	**J. B. Institute of Engineering and Technology (UGC Autonomous)**	**B. Tech: ME IV Year – I Sem**

Course Code: J413E	**ROBOTICS** Professional Elective – IV	**L**	**T**	**P**	**D**
Credits: 3		**3**	**0**	**0**	**0**

Pre-requisite: Engineering Mathematics, Instrumentation, CAD/CAM.

Course Objectives:

This course will enable students to:

1. Be familiar with the features of automation in robotics. Learn about the various components of Industrial Robotics.
2. Be taught about the Kinematic Motion Analysis, Homogeneous transformation, Forward and inverse kinematics, and solution of relevant problems.
3. Be able to solve problems involving Differential Kinematics of planar and spherical manipulators, and Jacobians. Be made familiar Dynamic analysis of Robot motion, and solution of problems on planar two link manipulators.
4. Study the features of Trajectory planning for avoidance of obstacles, and solution of problems on different types of motion.
5. Be made to learn about the Robot actuators and Feedback components. Learn the Application of Robots in manufacturing activities, such as Material handling, Assembly and Inspection

Module 1

Introduction: Automation and Robotics – An over view of Robotics–classification by coordinate system and control systems

Components of the Industrial Robotics: Degrees of freedom – End effectors: Mechanical gripper – Magnetic – Vacuum cup and other types of grippers – General consideration on gripper selection and design.

Module 2

Motion Analysis: Basic rotation matrices – Composite rotation matrices – Euler Angles –Equivalent Angle and Axis – Homogeneous transformation – Problems.

Manipulator Kinematics: D-H notations – Joint coordinates and world coordinates – Forward and inverse kinematics – problems.

Module 3

Differential Kinematics: Differential Kinematics of planar and spherical manipulators – Jacobian – problems.

Robot Dynamics: Lagrange – Euler formulations – Newton-Euler formulations – Problems on planar two link manipulators.

Module 4

Trajectory planning: Joint space scheme – cubic polynomial fit – Avoidance of obstacles

Types of motion: Slew motion – joint interpolated motion – straight line motion – problems

Module 5

Robot actuators and Feedback components: Actuators: Pneumatic and Hydraulic actuators.

Electric Actuators: DC servo motors – stepper motors.

Feedback components: position sensors – potentiometers, resolvers and encoders – Velocity sensors – Tactile sensors.

Robot Application in Manufacturing: Material handling – Assembly and inspection.

Text Books:

1. Groover M P, "Industrial Robotics", MCH Publishers, 2010.
2. JJ Craig, "Introduction to Robotic Mechanics and Control", Pearson, 3rd Edition, 2001.

Reference Books:

1. Fu K B, "Robotics", Tata McGraw Hill, 1987.
2. Asada and Slotine, "Robot Analysis and Intelligence", Wiley Inter-Science.
3. Mark W. Spong and M. Vidyasagar, "Robot Dynamics & Control", John Wiley & Sons (ASIA) Pvt. Ltd.

E - Resources:

1. https://rb.gy/dw0rkv
2. https://rb.gy/iayh9d
3. https://nptel.ac.in/courses/112/105/112105249/
4. https://nptel.ac.in/courses/112/101/112101098/

Course Outcomes:

On completion of the course, the students will be able to:

1. **Understand** the design and working of the various components of Robot such as End effectors, grippers, control systems etc.
2. **Perform** calculations of Robot motion involving forward kinematics, inverse kinematics, Homogeneous transformations etc.
3. **Apply** Differential Kinematics, Jacobian, Lagrange-Euler formulations, etc., to solve problems of planar and spherical manipulators.
4. **Analyze** the various types of motion (slew motion, straight line motion, etc.,) for solving problems in Trajectory planning.

5. **Apply** the knowledge of various types of Robot actuators and Feedback components, and applications of industrial robots in the activities of manufacturing.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	1	2	2	2	-	-	-	-	-	-	2	-	-
CO2	3	3	2	2	2	-	-	-	-	-	-	1	2	-
CO3	3	2	2	2	2	-	-	-	-	-	-	1	2	-
CO4	3	2	2	1	1	-	-	-	-	-	-	2	3	2
CO5	1	2	1	2	2	-	-	-	-	-	-	2	3	2
Average	2.6	2	1.8	1.8	1.8	-	-	-	-	-	-	1.6	2.5	2

<table>
<tr><td>AY 2020 - 21 onwards</td><td colspan="4">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td>B. Tech: ME IV Year – I Sem</td></tr>
<tr><td>Course Code: J413F</td><td rowspan="2">PRODUCTION PLANNING AND CONTROL
Professional Elective – IV</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Management Science for Engineers, Operations Research.

Course Objectives:
This course will enable students to:

1. Understand the meaning and objectives of PPC functions and elements of PPC, types of production and Organization of PPC department
2. Understand the concept and importance of forecasting comma types of forecasting, qualitative methods and quantitative methods
3. Understand the functions of inventory, inventory cost, EOQ models, inventory control systems (P system, Q system) study the importance of ABC analysis and VED analysis, MRP, ERP and concepts of line of balance and JIT inventory
4. Understand the routing procedures, route sheets, bills of materials, scheduling policies, standard scheduling methods.
5. Understand the concepts of line balancing methods of aggregate plan, change planning, expediting and control aspects, also studying the dispatching procedures follow up, types of follow-up and applications of components in PPC

Module 1
Introduction: Definitions – objectives of production planning and control- functions of production planning and control-elements of production control – types of production –organization of production planning and control – internal organizations department

Module 2
Forecasting: Definition – Importance of forecasting – types of forecasting, their uses – general principles of forecasting techniques – Qualitative methods and quantitative methods.

Module 3
Inventory management: Functions inventory- Relevant inventory cost- ABC analysis- VED Analysis- EOQ model – Inventory control systems – P–Systems and Q–Systems Introduction to MRP and ERP, LOB (Line of balance), JIT inventory, Japanese concepts

Module 4

Routing: Definition – routing procedure – Route sheets – Bill of material – factors affecting routing procedure.

Scheduling: Definition – difference with loading. Scheduling polices – techniques, standard scheduling methods – job shop, flow shop.

Module 5

Line balancing, aggregate planning – methods for aggregate planning – Chase planning, expediting, control aspects

Dispatching: Activities of dispatcher – Dispatching procedure – follow up – definition – reasons for existence of functions – types of follow up – applications of computer in production planning control

Text Books:

1. M. Mahajan, "Production Planning and Control", Dhanpath Rai & Co, 2010.
2. Jain & Jain, "Production Planning and Control", Khanna publications,7^{th} Edition, 2014.

Reference Books:

1. SK Mukhopadhyaya, "Production Planning and Control Text & cases", PHI.
2. R. PanneerSelvam, "Production and operations Management", PHI, 3^{rd} Edition, 2014.
3. Chase, "Operations Management", PHI

E - Resources:

1. https://rb.gy/6dz8fj
2. https://www.sciencedirect.com/book/9780128183649/production-planning-and-control
3. https://nptel.ac.in/courses/112/107/112107143/
4. https://nptel.ac.in/courses/110/107/110107141/

Course Outcomes:

On completion of the course, the students will be able to:

1. **Understand** the objectives and functions of PPC, also different types of production
2. **Understand** the importance and types of sales forecasting and different methods used for forecasting.
3. **Understand** the inventory management, EOQ models, ABC analysis, VED analysis, MRP. ERP, LOB, JIT principles.
4. **Understand** what is routing, the routing procedures, route sheets, difference between scheduling and loading, standard scheduling methods.
5. **Understand** in obtaining concepts of line balancing, aggregate planning, dispatching follow-up expediting and control aspects.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	1	2	1	2	2	-	-	-	-	-	-	1	-	-
CO2	2	2	1	1	1	-	-	-	-	-	-	1	-	2
CO3	3	2	1	2	1	-	-	-	-	-	-	2	-	3
CO4	1	2	1	2	1	-	-	-	-	-	-	1	-	3
CO5	3	2	2	1	2	-	-	-	-	-	-	2	-	2
Average	2	2	1.2	1.6	1.4	-	-	-	-	-	-	1.4	-	2.5

<table>
<tr><td>AY 2020 - 21 onwards</td><td colspan="4">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME IV Year – I Sem</td></tr>
<tr><td>Course Code: J413G</td><td colspan="4" rowspan="2">COMPUTATIONAL FLUID DYNAMICS
Professional Elective – IV</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Fluid Mechanics, Linear Algebra, Partial differential Equations

Course Objectives:
This course will enable students to:
1. Understand the numbering system and errors in numerical techniques and representation of integers, fractions etc.
2. Impart the knowledge of governing equations for fluid flow and finite difference applications in heat conduction and convection.
3. Learn the numerical method used to solve the partial differential equation.
4. Review of equations governing fluid flow and heat transfer
5. Learn the concept of Finite volume method and Interpolation method.

Module 1
Elementary details in numerical techniques: Number system and errors – representation of integers, fractions, floating point arithmetic, loss of significance and error propagation – condition for instability – computational methods for error estimation – convergence of sequences.

Module 2
Applied Numerical Methods: Solution of a system of simultaneous Linear Algebraic Equations – Iterative schemes of Matrix Inversion – Direct Methods for Matrix inversion, Direct Methods for banded matrices. Finite Difference applications in heat conduction and convection – Heat conduction, steady heat conduction in a rectangular geometry, transient heat conduction – finite difference application in convective heat transfer – closure.

Module 3
Finite Differences – discretization, consistency, stability. Fundamentals of fluid flow modeling – Introduction, elementary finite difference quotients, implementation aspects of finite-difference equations, consistency, explicit and implicit methods

Module 4
Introduction to first order wave equation – stability of hyperbolic and elliptic equations, fundamentals of fluid flow modeling, conservative property, the upwind scheme. Review of Equations governing Fluid Flow and Heat Transfer – Introduction, conservation of mass, Newton's second law of motion – expanded forms of Navier-

stokes equations – conservation of energy principle – special forms of the Navier-stokes equations.

Module 5

Steady flow – dimensionless form of Momentum and Energy equations – Stokes equation, conservative body force fields – stream function – Vorticity formulation.

Finite volume method: Approximation of surface integrals – volume integrals – Interpolation and differentiation practices – upwind interpolation – linear interpolation and quadratic interpolation.

Text Books:

1. Suhas V. Patankar, "Numerical heat transfers and fluid flow", Hemashava Publishers Corporation, Tata McGraw Hill.
2. Muralidaran, "Computational Fluid Flow and Heat Transfer", Narosa Publications, 2nd Edition, 2014.

Reference Books:

1. John D. Anderson, "Computational Fluid Dynamics – Basics with applications" Tata McGraw Hill.
2. Tapan K. Sengupta, "Fundamentals of Computational Fluid Dynamics", Universities Press

E - Resources:

1. https://www.google.co.in/books/edition/Computational_Fluid_Dynamics/3QUtDQAAQBAJ?hl=en&gbpv=1
2. https://www.google.co.in/books/edition/An_Introduction_to_Computational_Fluid_D/Gc4AWPJqb4AC?hl=en&gbpv=1
3. https://nptel.ac.in/courses/112/105/112105045/
4. https://www.sciencedirect.com/book/9780080999951/computational-fluid-dynamics-principles-and-applications
5. https://www.coursera.org/lecture/digital-thread-implementation/computational-fluid-dynamics-HXjWG

Course Outcomes:

On completion of the course, the students will be able to:

1. **Solve** the errors involved in numerical techniques
2. **Analyze** the internal fluid flow phenomena of thermal fluid flow.
3. **Acquire** the knowledge of various types of fluid flow governing equations.
4. **Analyze** fluid flow governing equations and special forms of Navier-stokes equation.
5. **Explain** finite volume method, interpolation concepts and compute problems.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2	1	-	2	-	--	-	-	-	-	2	-	-
CO2	2	3	-	2	2	-	-	-	-	-	-	2	2	1
CO3	3	2	-	3	2	-	-	-	-	-	-	3	-	-
CO4	3	2	-	2	-	-	-	-	-	-	-	2	1	-
CO5	2	2	-	3	2	-	-	-	-	-	-	2	2	1
Average	2.4	2.2	1	2.5	2							2.2	1.7	1

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
IV Year – I Sem</td></tr>
<tr><td>Course Code: J413H</td><td rowspan="2">ADDITIVE MANUFACTURING
Professional Elective – V</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Physics, CAD/CAM, Composite Materials.

Course Objectives:
This course will enable students to:

1. Understand the need for Additive Manufacturing / Rapid Prototype / 3D Printing Technologies in product development, and the required Tooling and Applications.
2. Learn the Basic Concepts of CAD and Reverse Engineering, CAD model preparation, Tool path Generation, etc., Acquire knowledge of Software for Additive Manufacturing Technology.
3. Study the principles of Liquid based Additive Manufacturing Systems such as Stereo-lithography Apparatus (SLA).
4. Study the principles of Solid based Additive Manufacturing Systems such as Fused Deposition Modeling and Laminated Object Manufacturing, their advantages and applications.
5. Study the principles of Powder based Additive Manufacturing Systems such as Selective Laser Sintering, Three-Dimensional Printing, Laser Engineered Net Shaping (LENS), and Electron Beam Melting, their advantages and applications.

Module 1
Introduction: Overview – History - Need-Classification – Additive Manufacturing / Rapid Prototype / 3D Printing Technologies in product development – Materials for Additive Manufacturing Technology – Tooling – Applications.

Module 2
CAD & Reverse Engineering: Basic Concept – Digitization techniques – Model Reconstruction – Data Processing for Additive Manufacturing Technology: CAD model preparation – Part Orientation and support generation – Model Slicing – Tool path Generation – softwares for Additive Manufacturing Technology: MIMICS, MAGICS.

Module 3
Liquid based additive manufacturing systems: Classification – Liquid based system – Stereo-lithography Apparatus (SLA) – Principle, process, advantages and applications.

Module 4

Solid based additive manufacturing systems: Solid based system – Fused Deposition Modeling – Principle, process, advantages and applications – Laminated Object Manufacturing.

Module 5

POWDER BASED ADDITIVE MANUFACTURING SYSTEMS: Selective Laser Sintering – Principles of SLS process – Process – advantages and applications – Three-Dimensional Printing – Principle – process – advantages and applications – Laser Engineered Net Shaping (LENS) – Electron Beam Melting.

Text Books:

1. Chua C.K., Leong K.F, “Rapid prototyping: Principles and applications”, World Scientific Publishers, 3rd Edition, 2010.
2. Gebhardt A., “Rapid Prototyping”, Hanser Gardener Publications, 2003.

Reference Books:

1. Liou L.W. and Liou F.W., “Rapid Prototyping and Engineering Applications: A tool box for prototype development”, CRC Press, 2007.
2. Kamrani A.K. and Nasr E.A., “Rapid Prototyping: Theory and practice”, Springer, 2006.
3. Hilton P.D. and Jacobs P.F., “Rapid Tooling: Technologies and Industrial Applications”, CRC press, 2000.

E - Resources:

1. https://rb.gy/rtfxjt
2. https://rb.gy/ndvq97
3. https://nptel.ac.in/courses/112/104/112104265/

Course Outcomes:

On completion of the course, the students will be able to:

1. **Compare** and assess different technologies like Additive Manufacturing / Rapid Prototype / 3D Printing, and select the suitable process.
2. **Apply** the principles of CAD and Reverse Engineering in product design and development.
3. **Use** the Liquid based Additive Manufacturing Systems in practice.
4. **Use** the Solid based Additive Manufacturing Systems in practice.
5. **Use** the Powder based Additive Manufacturing Systems in practice.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	1	3	2	1	-	-	-	-	-	-	2	-	-
CO2	2	3	3	3	3	-	-	-	-	1	-	2	3	3
CO3	2	2	3	2	2	-	-	-	-	1	-	2	3	3
CO4	2	2	3	2	2	-	-	-	-	1	-	2	3	3
CO5	2	2	3	2	2	-	-	-	-	1	-	2	3	3
Average	2	2	3	2.2	2	-	-	-	-	1	-	2	3	3

<table>
<tr><td>AY 2020 - 21 onwards</td><td colspan="4">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME IV Year – I Sem</td></tr>
<tr><td>Course Code: J413I</td><td rowspan="2">CNC TECHNOLOGY
Professional Elective – V</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Drawing, Basic Electrical and Electronics Engineering CAD/CAM.

Course Objectives:
This course will enable students to:
1. Understand the fundamentals of numerical control, Fundamentals of N/C Machine control and CNC Machine Elements
2. Acquire knowledge of Tooling systems for CNC Machines and features of NC Part Programming
3. Get exposure to the basics of Computer-Aided Programming, APT programming problems
4. Get Introduction to DNC systems, advantages and disadvantages of DNC, Know the latest developments in CNC and its Maintenance
5. Learn about Micro Controllers, their Hardware components, Programming Logic Controllers, basic structure, principle of operation & Applications in CNC Machines.

Module 1
Features of NC Machines: Fundamentals of numerical control – advantage of NC systems – classification of NC systems – point to point – NC and CNC – incremental and absolute – open and closed loop systems – Features of N/C Machine Tools – design consideration of NC machine tool – methods of improving machine accuracy.
CNC Machines Elements: Machine Structure – Guide ways – feed drives – spindles – spindle bearings – measuring Systems – Tool monitoring systems.

Module 2
Tooling for CNC Machines: Interchangeable tooling system – preset and qualified tools, coolant fed tooling system – modular featuring – quick change tooling system – automatic head changers – Feedback devices
NC Part Programming: Manual Programming – Basic concepts – point to point contour programming – canned cycles – parametric programming.

Module 3
Computer-Aided Programming: General information – APT programming – Examples APT programming problems (2D machining only). NC programming on CAD/CAM systems – the design and implementation of post processors. Introduction to CAD/CAM software – Automatic Tool Path generation

Module 4

DNC Systems and Adaptive Control: Introduction – type of DNC systems – advantages and disadvantages of DNC – adaptive control with optimization – Adaptive control with constraints – Adaptive control of machining processes like turning, grinding.

Latest developments: Machining center – Turing center – Communication networking – recent developments of CNC systems – Virtual NC systems.

Maintenance of CNC Machines: Economics of Manufacturing using CNC Machines

Module 5

Micro Controllers: Introduction – Hardware components – I/O pins, ports, external memory, counters, timers and serial data I/O interrupts. Selection of Micro Controllers – Embedded Controllers – Applications and Programming of Micro Controllers

Programming Logic Controllers (PLC's): Introduction – Hardware components of PLC System – basic structure, principle of operations. Programming mnemonics timers, Internal relays and counters – Applications of PLC's in CNC Machines.

Text Books:

1. YoramKoren, "Computer Control of Manufacturing Systems", Tata McGraw Hill, 2010.
2. Michel P. Groover, 'CAD/CAM", Tata McGraw Hill, 1st Edition, 2009.

Reference Books:

1. Manfred Weck, "Machining Tools Hand Book: Automation & Control", John Wiley and Sons Publications, Volume 3, 1984.
2. HMT, "Mechatronics", Tata McGraw Hill, 5th Edition, 2005.
3. Kalpak Jain, "Manufacturing Engineering and Technology", Pearson Publication, 4th Edition, 2012.

E - Resources:

1. https://rb.gy/flcfru
2. https://rb.gy/tmwegw
3. https://rb.gy/8oteqs
4. https://nptel.ac.in/courses/112/102/112102103/

Course Outcomes:

On completion of the course, the students will be able to:

1. **Get** exposure to the design considerations of NC machine tools and CNC Machine Elements
2. **Analyze** the Tooling system of CNC and utilize the basic knowledge of NC Part Programming for simple jobs
3. **Acquire** knowledge of computer aided programming, APT Programming and CAD/CAM Software.

4. **Acquire** complete knowledge about DNC Systems and Learn latest advancements in CNC system,
5. **Apply** the knowledge gained about the features and operating principles of Micro Controllers, Embedded Controllers, and Programming Logic Controllers in CNC Machines.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	1	2	2	2	-	-	-	-	-	-	2	-	-
CO2	2	3	3	3	3	-	-	-	-	-	1	2	3	2
CO3	2	3	2	2	2	-	-	-	-	-	1	2	3	2
CO4	1	3	3	2	2	-	-	-	-	-	-	2	2	2
CO5	1	2	1	1	1	-	-	-	-	-	-	1	3	2
Average	1.6	2.4	2.2	2	2	-	-	-	-	-	1	1.8	2.8	2

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
IV Year – I Sem</td></tr>
<tr><td>Course Code: J413J</td><td rowspan="2">JET PROPULSION AND ROCKET ENGINEERING
Professional Elective – V</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Thermodynamics, Fluid Mechanics and Hydraulic Machines, Thermal Engineering - II

Course Objectives:
This course will enable students to:
1. Study thermodynamic cycles of Gas Turbine and performance improvement methods.
2. Imparts the concepts of Jet Propulsion and its applications.
3. Know the differences of Turbo-prop and Turbo-jet engine and Performance evaluation.
4. Study the Ram-Jet and Rocket engine working principles along with advantages and applications.
5. Learn types of rocket technologies with different systems and propulsion concepts

Module 1
Elements of Gas Turbine – Thermodynamic Cycles – open, closed and semi-closed – parameters of performance – cycle modifications for improvement of performance.

Module 2
Jet propulsion: Historical sketch – reaction principle – essential features of propulsion devices – Thermal Engines – Classification of Energy flow, thrust, thrust power and propulsion efficiency – Need for Thermal Jet Engines and application.

Module 3
Turboprop and Turbojet – I: Thermo dynamic cycles – plant layout – essential components – principles of operation – performance evaluation
Turboprop and Turbojet – II: Thrust Augmentation and Thrust reversal – Contrasting with piston Engine Propeller plant.

Module 4
Ramjet: Thermo dynamic Cycle – plant layout – essential components – principle of operation – performance evaluation – comparison among atmospheric thermal jet engines – serque jet and pulse jet – elementary treatment.
Rocket Engines: Need – applications – Basic principles of operation and parameters of performance – classification of solid and liquid propellant rocket engines, advantages, domains of application – propellants – comparison of propulsion systems.

Module 5

Rocket Technology – I: Flight mechanics – Application, Thrust profiles, Acceleration – staging of Rockets – need – Feed systems – Injectors and expansion nozzles – Rocket heat transfer and ablative cooling.

Rocket Technology – II: Testing & instrumentation – Need for Cryogenics – Advanced propulsion Systems – elementary treatment of Electrical, Nuclear and plasma Arc propulsion.

Text Books:

1. P. Khajuria, S.P. Dubey, “Gas Turbines and propulsive systems”, Dhanpatrai Pub, 1997.
2. M. C. Ramaswamy, “Gas Dynamics & Space Propulsion”, Jaico Publishing House, 1st Edition, 2008.

Reference Books:

1. Ei. Sayed, Ahmad F, “Fundamentals of Aircraft and Rocket Propulsion”, Springer, 2016.

E - Resources:

1. https://www.google.co.in/books/edition/Jet_Propulsion/yy2YoIKDC3gC?hl=en&gbpv=1
2. https://www.google.co.in/books/edition/Fundamentals_of_Jet_Propulsion_with_Appl/VdELAQAAQBAJ?hl=en&gbpv=0
3. https://nptel.ac.in/courses/101/101/101101002/
4. https://www.coursera.org/lecture/thermodynamics-intro/07-06-lets-look-inside-a-jet-engine-UtUOI
5. https://www.sciencedirect.com/book/9780080102641/combustion-chambers-for-jet-propulsion-engines

Course Outcomes:

On completion of the course, the students will be able to:

1. **Analyze** different types of gas turbine thermodynamic cycles.
2. **Understand** the concept of jet propulsion and compute performance problems.
3. **Identify** difference between Turbo-prop and Turbo-jet Engines.
4. **Compute** problems related to performance on Ram-Jet and Rocket Engine
5. **Explain** rocket technologies with propulsion concepts.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	3	2	3	2	-	-	-	-	-	-	2	-	-
CO2	2	1	2	2	1	-	-	-	-	-	-	2	-	-
CO3	2	1	2	2	1	-	-	-	-	-	-	2	-	-
CO4	2	3	2	3	2	-	-	-	-	-	-	2	1	1
CO5	3	1	-	1	1	-	-	-	-	-	-	2	1	1
Average	2.2	1.8	2	2.2	1.4	-	-	-	-	-	-	2	1	1

<table>
<tr><td>AY 2020 - 21 onwards</td><td colspan="4">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
IV Year – I Sem</td></tr>
<tr><td>Course Code: J4131</td><td rowspan="2">COMPUTER AIDED ENGINEERING LAB</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 1</td><td>0</td><td>0</td><td>2</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Drawing, Machine Drawing, CAD/CAM

Course Objectives:

This course will enable students to:

1. Learn the software’s and equipments associated with CAD/CAM.
2. Understand the basic concepts about CAD/CAM.
3. Understand the concepts of Surface Modelling and sheet Metal Working.
4. Learn basic concepts of deflection and stresses in 2D and 3D trusses and beams.
5. Understand the concept of stresses in 3D and shell structures.

List of Experiments

Experiment 1: Introduction to AutoCAD package, apply the features of AutoCAD on various sketches

Experiment 2: Part modeling and Assembly of machine component Stuffing Box

Experiment 3: Part modeling and Assembly of machine component Screw Jack

Experiment 4: Part modeling and Assembly of machine component Connecting rod

Experiment 5: Part modeling and Assembly of machine component Knuckle Joints

Experiment 6: Part modeling and Assembly of machine component Cotter and couplings

Experiment 7: Sheet metal operation

Experiment 8: Surface modelling operation

Experiment 9: A Study of a FEA package and modeling stress analysis of a Bar of constant cross sectional area tapered and stepped bars.

Experiment 10: Analysis of various Trusses

Experiment 11: Analysis of Simply supported beam

Experiment 12: Analysis of cantilever beam

Experiment 13: Beams with UDL

Experiment 14: Beams with varying load

Software Requirements: **Auto CAD, Solidworks and ANSYS.**

E - Resources:

1. https://books.google.co.in/books?id=hEkjURbiN7MC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

Course Outcomes:

On completion of the course, the students will be able to:

1. **Design** a part or assembly of parts using Computer-Aided Design software.
2. **Apply** top-down design principles to model a design.
3. **Apply** the knowledge of surface and sheet metal working operations in Practice.
4. **Apply** the knowledge of deflection and stresses on 2D and 3D Components.
5. **Analyze** stresses in 3D model and shell structures.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	-	-	-	3	-	-	-	3	-	-	3	3	-
CO2	-	-	-	-	3	-	-	-	2	-	-	3	3	-
CO3	-	-	-	-	3	-	-	-	3	-	-	3	3	2
CO4	-	-	-	-	3	-	-	-	2	-	-	3	3	2
CO5	-	-	-	-	3	-	-	-	3	-	-	3	3	2
Average	-	-	-	-	3	-	-	-	2.6	-	-	3	3	2

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
IV Year – I Sem</td></tr>
<tr><td>Course Code: J4132</td><td rowspan="2">CAM & PDP LAB</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 1</td><td>0</td><td>0</td><td>2</td><td>0</td></tr>
</table>

Pre-requisite: CAD/CAM, Finite Element Methods, Engineering Drawing, Machine Drawing, Metrology.

Course Objectives:

This course will enable students to:

1. Learn the part programming techniques in Plain turning, Step turning operations.
2. Learn the basic programs for CNC Milling operations
3. Exposed to manufacturing of simple components on 3D Printing machine
4. Understand the production drawings of given objects and the conventional representation of Electrical, Hydraulics and Pneumatics symbols and Identify the conventional representational of manufacturing processes, heat treatment processes and dimensional tolerances.
5. Learn the conventional representational of geometrical dimensions, geometrical tolerances and described about preparation of bill of materials and process flow charts.

<u>List of Experiments</u>

Experiment 1: Plain turning operation on CNC lathe.

Experiment 2: Step Turning operation on CNC lathe.

Experiment 3: Rectangular Pocketing on CNC Milling Machine

Experiment 4: Circular pocketing on CNC Milling Machine

Experiment 5: STL file generation (stitching, orientation, scaling etc..) in magics / Idea maker software and Slicing of STL files

Experiment 6: Pinion Shaft, with Notes on Heat Treatment & Surface Treatment, Tolerances and Surface Finish Symbols.

Experiment 7: Charts: (i) Electrical Symbol, (ii) Hydraulics Symbol, (iii) Pneumatics Symbols.

Experiment 8: Limits, Fits and Tolerances, Representative Diagrams and Tables.

Experiment 9: Helical Gear, with Dimensional Tolerances, Geometrical Tolerances, Gear Data, Heat Treatment Note and Surface Finish Symbols.

Experiment 10: Symbols for Geometrical Tolerances (Position and Form Tolerances).

Experiment 11: Representation of Geometrical Tolerances on Production Drawings.

Experiment 12: Chart showing Various Manufacturing Processes for Achieving required Surface Finish Values.

Experiment 13: Symbols for Surface Finish.

Experiment 14: Part Drawings for Single Tool Post with Bill of Material.

Experiment 15: Part Drawings for Bearing Bracket with Bill of Material.

Experiment 16: Part Drawings for Footstep Bearing, with BoM and Process Sheet.

Experiment 17: Part Drawings for Eccentric, with BoM and Process Sheet.

Note: Any 14 experiments are to be performed.

Software: CNC Offline Simulation, Master CAM, 3D Printing Machine

E - Resources:

1. https://books.google.co.in/books?id=hEkjURbiN7MC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
2. K. L. Narayana, P. Kannaiah, "Production Drawing",New age International, 2013.

E - Resources:

1. https://nptel.ac.in/courses/112/104/112104250/
2. https://nptel.ac.in/content/storage2/courses/112105125/pdf/mod10les2.pdf
3. https://mech.iitm.ac.in/Production%20Drawing.pdf
4. http://ftp.ngcareers.com/production_drawing_by_kl_narayana_pdf_free_download.pdf

Course Outcomes:

On completion of the course, the students will be able to:

1. **Apply** the Programming knowledge in writing the programs for Turning, Step turning operations.
2. **Write** the basic programs for CNC Milling operations
3. **Produce** simple components on 3D Printing machine
4. Analyze production drawing, conventional symbols and examine the conventional representation of manufacturing processes, heat treatment processes and dimensional tolerances.
5. Illustrate the geometrical dimensions, geometrical tolerances, bill of materials and process flow charts for manufacturing of a given product.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	-	-	-	3	-	2	-	2	-	-	2	2	1
CO2	3	-	-	-	3	-	2	-	2	-	-	2	1	1
CO3	2	-	-	-	3	-	2	-	3	-	-	2	-	1
CO4	3	-	-	-	3	-	2	-	2	-	-	2	2	-
CO5	2	-	-	-	3	-	2	-	1	-	-	3	-	-
Average	2.4	-	-	-	3	-	2	-	2	-	-	2.2	1.6	1

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME IV Year – I Sem</td></tr>
<tr><td>Course Code: J4133</td><td rowspan="2">INDUSTRY ORIENTED MINI PROJECT</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 2</td><td>0</td><td>0</td><td>4</td><td>0</td></tr>
</table>

Course Objectives:

The student will

1. Understand the principals functions and practices adopted in industry for successful management of production and maintenance function
2. Understand various manufacturing processes for producing industrial components for different applications
3. Understand various techniques of maintenance functions in a manufacturing industry
4. Understand the work force management for successful execution of job

Guidelines:

There is an Industry Oriented Mini Project, in collaboration with an industry of their specialization to be taken up during the vacation after III year II semester examinations. Industry Oriented Mini Project is submitted in a report form and presented before the committee in IV year I semester. It is evaluated for 100 marks by the committee consisting of Head of the Department, supervisor of the Industrial Oriented mini project and a senior faculty member of the department.

Course Outcomes:

The student will be able to

1. Know the principal functions and practices of an industry associated with manufacturing products for various applications of mechanical engineering
2. Get exposed to various manufacturing processes being used and industrial infrastructure for machines and materials
3. Understand the procedures and techniques/methods of repairs and maintenance functions
4. Understand the complexity of handling workforces in executing the jobs

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	2	3	-	-	-	-	2	3	-	3	2	1	-
CO2	-	2	3	-	-	-	-	2	3	-	3	2	1	1
CO3	-	2	3	-	-	-	-	2	3	-	3	2	1	-
CO4	-	2	3	-	-	-	-	2	3	-	3	2	1	-
Average	-	2	3	-	-	-	-	2	3	-	3	2	1	1

AY 2020 - 21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech: ME IV Year – I Sem			
Course Code: J4134	PROJECT STAGE – I	L	T	P	D
Credits: 3		0	0	6	0

Course Objectives

The student will

1 Test the knowledge of principles functions and practices required for the project.

2 Go through the fundamentals required for project completion.

3 Understand the practices adopted in the industry for successful management of maintenance activities.

4 Discuss the techniques used to complete the project.

Guidelines:

UG project work shall be carried out in two stages: Project Stage – I during IV Year I Semester, Project Stage – II during IV Year II Semester. Each stage will be evaluated for 100 marks. Student has to submit project work report at the end of each semester. First report includes project work carried out in IV Year I semester and second report include project work carried out in IV Year I & II Semesters. SEE (Semester End Examinations) for both project stages shall be completed before the commencement of SEE Theory examinations.

For Project Stage – I, the Project Review committee (PRC) consisting of Head of the Department, project coordinator and two senior faculty members shall evaluate (SEE) the project work for 70 marks and project supervisor (CIE) shall evaluate for 30 marks.

The student is deemed to have failed, if he

i. Does not submit a report on Project Stage - I or does not make a presentation of the same before the evaluation committee as per schedule, or

ii. Secures less than 40% marks in the sum total of the CIE and SEE taken together

A student who has failed may reappear once for the above evaluation, when it is scheduled again; if he fails in such “one re-appearance” evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

Course Outcomes:

The student will be able to

1. Familiarize with the knowledge required for project completion.
2. Understand fundamentals and principles required for project completion.
3. Identify suitable procedure to complete the project.
4. Understand the techniques applied to complete the project

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	3	2	1	2	-	-	-	-	-	1	3	2	1
CO2	-	3	3	2	2	-	-	-	-	-	3	3	1	1
CO3	-	3	3	3	2	2	-	-	-	-	2	3	2	1
CO4	-	3	3	3	2	2	-	-	-	-	2	3	2	1
Average	-	3	2.75	2.25	2	2	-	-	-	-	2	3	1.75	1

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME IV Year – II Sem</td></tr>
<tr><td>Course Code: J423A</td><td rowspan="2">QUALITY ENGINEERING IN MANUFACTURING
Professional Elective – VI</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Mathematics, Production Planning and Control.

Course Objectives:
This course will enable students to:

1. Understand the significance of Quality engineering in the design of production processes, Quality Loss Function, and Evaluations and types of tolerances.
2. Learn about Analysis of Variance (ANOVA), different types of ANOVA, and Critique of F-test.
3. Get exposed to the concepts of Orthogonal Arrays, Strategies in Experimentation, Designing, conducting and analyzing an experiment, and Interpolation of experimental results.
4. Learn about Tolerance design, Parameter design and Case studies on parameter and tolerance designs.
5. Understand the basic Quality tools such as ISO-9000 Quality System, Business Process Re-engineering, Six-sigma, etc.

Module 1
Quality value and engineering: An overall quality system – Quality engineering in product design – Quality engineering in design of production processes – Quality engineering in production.
Loss function and quality level: Derivation and use of Quality Loss Function (QLF) – Economic consequences of tightening tolerances as a means to improve quality – Evaluations and types tolerances – N-type – S-type and L-type.

Module 2
Analysis of variance (ANOVA): No-way ANOVA – One-way ANOVA – Two-way ANOVA – Critique of F-test – ANOVA for four level factors

Module 3
Orthogonal arrays: Introduction to OA – Degrees of Freedom – Structure of OA – Linear Graphs & Interaction tables – Strategies in Experimentation – Typical test strategies – Better test strategies & Efficient test strategies – steps in designing – conducting and analyzing an experiment.
Interpolation of experimental results: Interpretation methods – Percent contribution – estimating the mean.

Module 4

Tolerance design and tolerance: Functional limits – Tolerance design for N-type – L-type and S-type characteristics – Tolerance allocation for multiple components.

Parameter and tolerance design: Introduction to parameter design – Signal to noise ratios – Parameter design strategy – some of the case studies on parameter and tolerance designs.

Module 5

Quality Tools: ISO-9000 Quality System – Business Process Re-engineering (BPRE) – Six-sigma – Bench making – Quality circles – Brain Storming – Fishbone diagram.

Text Books:

1. Phillip J. Ross, "Taguchi Techniques for Quality Engineering", McGraw Hill Publishers, 2nd Edition, 1995.
2. G. Taguchi, A. Elsayed, "Quality Engineering in Production systems", Tata McGraw Hill Publishers. 3rd Edition, 1989.

Reference Books:

1. Madhav S. Phadke, "Quality Engineering using Robust Design", Pearson Education. 3rd Edition, 2008
2. Poornima M. Charantimath, "Total Quality Management", Pearson Publications, 2nd Education, 2006.
3. Tapan P. Bagchi, "Taguchi Methods Explained: Practical steps to Robust Resign", Prentice Hall IndPvt. Ltd., 1993.

E - Resources:

1. https://rb.gy/q9egsh
2. https://rb.gy/joasdx
3. https://nptel.ac.in/courses/112/106/112106249/

Course Outcomes:

On completion of the course, the students will be able to:

1. **Know** how to implement Quality in the design and manufacturing of products, Use of Quality Loss Function and Evaluation methods of different types of tolerances.
2. **Apply** the methodology of ANOVA for experimental results.
3. **Use** different Strategies in Experimentation and obtain the necessary expertise for designing, conducting and analyzing an experiment, and apply the methods for Interpretation of experimental results.
4. **Design** various types of Tolerances, and Allocate Tolerance for multiple components.
5. **Solve** the problems concerned with parameter and tolerance designs.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	1	2	2	-	-	-	-	-	-	2	3	-
CO2	3	3	1	2	1	-	-	-	-	-	-	2	2	-
CO3	2	2	2	2	1	-	-	-	-	-	-	2	2	2
CO4	2	2	3	2	2	-	-	-	-	-	-	1	2	2
CO5	2	2	1	2	2	-	-	-	-	-	-	2	2	2
Average	2.4	2.4	1.6	2	1.6	-	-	-	-	-	-	1.8	2.2	2

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME
IV Year – II Sem</td></tr>
<tr><td>Course Code: J423B</td><td rowspan="2">AUTOMATION IN MANUFACTURING
Professional Elective – VI</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Production Planning and Control, Material Handling systems, Operations Research.

Course Objectives:

This course will enable students to:

1. Understand the strategies of automation and mechanical feeding mechanisms
2. Understand the principles of material handling systems and various automation techniques used in manufacturing plant
3. Design different materials handling equipment.
4. Understand the automation of material handling component.
5. Understand the concept of fundamentals of industrial controls.

Module 1

Introduction: Types and strategies of automation – pneumatic and hydraulic components circuits – Automation in machine tools. Mechanical feeding and tool changing and machine tool control transfer the automation.

Automated flow lines: Methods or work part transport transfer Mechanical buffer storage control function – design and fabrication consideration.

Module 2

Analysis of Automated flow lines: General terminology and analysis of transfer lines without and with buffer storage – partial automation – implementation of automated flow lines.

Module 3

Assembly system and line balancing: Assembly process and systems assembly line – line balancing methods – ways of improving line balance – flexible assembly lines.

Module 4

Automated material handling: Types of equipment – functions – analysis and design of material handling systems conveyor systems – automated guided vehicle systems.

Automated storage systems – Automated storage and retrieval systems; work in process storage – interfacing handling and storage with manufacturing.

Module 5

Fundamentals of Industrial controls: Review of control theory – logic controls – sensors and actuators – Data communication and LAN in Manufacturing

Business process Re-engineering: Introduction to BPE logistics – ERP – Software configuration of BPE – concurrent Engineering – Techniques of Rapid Proto typing.

Text Books:

1. Mikell. P Groover, "Automation, production systems and computer integrated manufacturing", PHI, 3rd edition. 2012.
2. Mike P.Grower,"Automation, Production Systems and CIM", PHI.

Reference Books:

1. P. Radha Krishnan & S. Subrahamanyarn and Raju, "CAD/CAM/CIM", NewAge International Publishers. 2003.
2. Singh/JohnWiley, "System Approach to Computer Integrated Design and Manufacturing", 1996
3. Richard A. Wyskand Hsu-PinWang, "Computer Aided Manufacturing Tien-Chien Chang", Pearson, 2009.
4. R Thomas Wright and Michael Berkeihiser, "Manufacturing and Automation Technology", GoodHeart Willcox Publishers.

E - Resources:

1. https://www.springer.com/gp/book/9781461295860
2. https://rb.gy/j5sdk8
3. https://rb.gy/vdqzct
4. https://nptel.ac.in/courses/112/102/112102011/
5. https://nptel.ac.in/courses/112/103/112103293/

Course Outcomes:

On completion of the course, the students will be able to:

1. **Apply** the circuit knowledge in industrial applications
2. **Analyze** the flow lines and implement buffer storage systems in real time industry applications
3. **Apply** the knowledge of balance the assembly line for optimal output.
4. **Apply** the design procedures of material handling equipment's and components.
5. **Memorize** fundamentals of Industrial controls and Business process Re-engineering and apply in the industry

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	2	2	2	-	-	-	-	-	-	1	-	-
CO2	2	2	3	2	2	-	-	-	-	-	-	2	2	-
CO3	3	2	2	1	1	-	-	-	-	-	-	2	-	-
CO4	3	2	2	2	1	-	-	-	-	-	-	1	3	-
CO5	2	2	2	2	2	-	-	-	-	-	-	1	-	-
Average	2.4	2	2.2	1.8	1.6	-	-	-	-	-	-	1.4	2.5	-

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech: ME IV Year – II Sem</td></tr>
<tr><td>Course Code: J423C</td><td rowspan="2">RENEWABLE ENERGY SYSTEMS
Professional Elective – VI</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Chemistry, Environmental Sciences.

Course Objectives:
This course will enable students to:
1. explain the concepts of Non-renewable and renewable energy systems
2. understand various applications of solar energy and methods to utilise solar energy in domestic and commercial purpose.
3. locate proper site for wind turbine and do research in the wind turbine design.
4. properly utilize used waste domestic and agricultural products for small scale self-sustainable energy production.
5. utilize ocean energy in an economic manner.

Module 1
Global and National Energy Scenario: Over view of conventional & renewable energy sources, need & development of renewable energy sources, types of renewable energy systems, Future of Energy Use, Global and Indian Energy scenario, Renewable and Non-renewable Energy sources, Energy for sustainable development, Potential of renewable energy sources, renewable electricity and key elements, Global climate change, CO2 reduction potential of renewable energy- concept of Hybrid systems.

Module 2
Solar Energy: Solar energy system, Solar Radiation, Availability, Measurement and Estimation, Solar Thermal Conversion Devices and Storage, Applications Solar Photovoltaic Conversion solar photovoltaic, solar thermal, applications of solar energy systems.

Module 3
Wind Energy: Wind Energy Conversion, Potential, Wind energy potential measurement, Site selection, Types of wind turbines, Wind farms, wind Generation and Control. Nature of the wind, power in the wind, factors influencing wind, wind data and energy estimation, wind speed monitoring, classification of wind, characteristics, applications of wind turbines, offshore wind energy – Hybrid systems, wind resource assessment, Betz limit, site selection, wind energy conversion devices. Wind mill component design, economics and demand side management, energy wheeling, and energy banking concepts. Safety and environmental aspects, wind energy potential and installation in India.

Module 4

Biogas: Properties of biogas (Calorific value and composition), biogas plant technology and status, Bio energy system, design and constructional features. Biomass resources and their classification, Biomass conversion processes, Thermo chemical conversion, direct combustion, biomass gasification, pyrolysis and liquefaction, biochemical conversion, anaerobic digestion, types of biogas Plants, applications, alcohol production from biomass, bio diesel production, Urban waste to energy conversion, Biomass energy programme in India

Module 5

Ocean Energy: Ocean wave energy conversion, principle of Ocean Thermal Energy Conversion (OTEC), ocean thermal power plants, tidal energy conversion, Tidal and wave energy its scope and development, Scheme of development of tidal energy.

Small hydro Power Plant: Importance of small hydro power plants and their Elements, types of turbines for small hydro, estimation of primary and secondary power.

Geothermal Energy: Geothermal power plants, various types, hot springs and steam ejection

Text Books:

1. J Wakhil, “Power plant technology”.
2. G.D Rai, “Non-Conventional Energy Sources”.

Reference Books:

1. Solar Energy - Principles of thermal collection and storage by S. P. Sukhatme
2. Solar Engineering of Thermal Processes by J. A. Duffie and W. A. Beckman
3. Biomass Regenerable Energy by D. D. Hall and R. P. Grover.
4. Renewable Energy Sources by Twidell, J.W. and Weir, A., EFN Spon Ltd., 1986.

E - Resources:

1. https://rb.gy/lowau9
2. https://rb.gy/yz3fe7
3. https://nptel.ac.in/courses/108/108/108108078/]
4. https://nptel.ac.in/courses/121/106/121106014/

Course Outcomes:

On completion of the course, the students will be able to:

1. Understand renewable energy sources
2. Apply solar based technologies in place of non renewable energy sources.
3. Create a better scope on wind energy utilization and research.
4. Apply the basics of reusing bio degradable waste in relevant industries.
5. Utilize ocean energy in a continuous productive way.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	-	-	-	1	-	-	-	-	-	-	2	2	-
CO2	3	-	3	2	3	-	-	-	-	-	-	3	3	1
CO3	2	-	2	2	2	-	-	-	-	-	-	3	1	1
CO4	2	-	-	1	2	-	-	-	-	-	-	3	-	-
CO5	2	-	2	2	2	-	-	-	-	-	-	3	-	-
Average	2.2	-	2.3	1.75	2	-	-	-	-	-	-	2.8	2	1

<table>
<tr><td>AY 2020 - 21 onwards</td><td>J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B. Tech: ME
IV Year – II Sem</td></tr>
<tr><td>Course Code: J4231</td><td rowspan="2">PROJECT STAGE – II</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 7</td><td>0</td><td>0</td><td>14</td><td>0</td></tr>
</table>

Course Objectives

This course will enable students to:

1. Be in a position to put their ideas and thoughts into practice to realize a product.
2. Go for the patent rights for their projects.
3. Prepare technical presentation in the journals.
4. understand the skills required for teamwork and public speaking

Guidelines:

For Project Stage – II, the external examiner shall evaluate the project work for 70 marks and the project supervisor shall evaluate it for 30 marks. The student is deemed to have failed, if he

(i) does not submit a report on Project Stage - II, or does not make a presentation of the same before the external examiner as per schedule, or

(ii) secures less than 40% marks in the sum total of the CIE and SEE taken together.

For conducting viva-voce of project stage – II, Principal selects an external examiner from the list of experts in the relevant branch submitted by the HODs of the College.

A student who has failed may reappear once for the above evaluation, when it is scheduled again; if student fails in such, one reappearance evaluation also, he has to reappear for the same in the next subsequent semester, as and when it is scheduled.

Course Outcomes:

On completion of the course, the students will be able to:

1. Design innovative products.
2. Express engineering methodology to design product.
3. Publish the paper in the reputed journals.
4. Work efficiently in the teams

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	3	2	1	2	-	-	-	-	-	1	3	2	1
CO2	-	3	3	2	2	-	-	-	-	-	3	3	1	-
CO3	-	1	2	3	2	-	-	-	-	3	2	3	-	-
CO4	-	3	3	3	2	2	-	-	3	-	2	3	-	1
Average	-	2.5	2.5	2.25	2	2	-	-	3	3	2	3	1.5	1

AY 2020 - 21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech: ME IV Year – II Sem			
Course Code: J4232	SEMINAR	L	T	P	D
Credits: 1		0	0	2	0

Course objectives

This course will enable students to:

1. select a technical topic related to mechanical engineering, study, analyse that
2. prepare a report and make a presentation on the selected topic.
3. improve the communication skills
4. understand the impact of engineering solutions on the society
5. demonstrate the knowledge of professional and ethical responsibilities.

Guidelines:

For the seminar, the student shall collect the information on a specialized topic, prepare a technical report, and submit it to the department. It is evaluated by the departmental committee consisting of Head of the Department, seminar supervisor and a senior faculty member. The seminar report is evaluated for 100 internal marks. There is no semester end examination for the seminar.

Course outcomes

On completion of the course, the students will be able to:

1. Acquired the basic skills to for performing literature survey and paper presentation
2. Provide students better communication skills.
3. Describe the current topics in Electronics, Communication, Electronic, Instrumentation and related areas based on current publications.
4. Prepare the report
5. Apply the knowledge of professional and ethical responsibilities.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	1	2	3	3	2	-	-
CO2	-	-	-	-	-	-	-	1	2	3	3	2	-	1
CO3	-	-	-	-	-	-	-	1	2	3	3	2	-	-
CO4	-	-	-	-	-	-	-	1	2	3	3	2	-	-
CO5	-	-	-	-	-	-	-	1	2	3	3	2	-	1
Average	-	-	-	-	-	-	-	1	2	3	3	2	-	1

<table>
<tr><td>AY 2020-21
Onwards</td><td colspan="4">J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B.Tech
III Year – I Sem</td></tr>
<tr><td>Course Code:
J31OA</td><td rowspan="2" colspan="4">ELEMENTS OF CIVIL ENGINEERING
(Open Elective-I)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits:3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:

This course will enable students to:

1. Study the basic requirements of civil engineering components.
2. Study the basic concepts of surveying.
3. Study the different types of building materials and components.
4. Study to deal with fire risk prevention and control.
5. Study about Highway development in India, Necessity for Highway planning, different road development plans

Module-1:

Unit-1: Introduction:

History of the civil engineering, sub – disciplines of civil engineering.

Module-2:

Unit-1: Surveying

Introduction, divisions of surveying, classification of surveying, principles of surveying. Linear measurements and errors–introduction, methods of linear measurements, chaining instruments, types of error and correction. Compass surveying – introduction, angular measurement using compass, whole circle bearing and reduced bearing, fore bearing, and back bearing. Traverse surveying –introduction, chain, and compass traversing, closing error and adjustments. Levelling– introduction, types of levelling instruments, dumpy level, adjustment of level, levelling staff

Module-3:

Unit-1: Building Materials and Construction

Materials**:** Introduction to construction materials like ferrous and nonferrous metals, alloys, Stones, Bricks, Lime, Cement, Timber, Sand, Aggregates, Mortar, Concrete, and bitumen. Construction: Types of building, different loads considered in building design, types of foundation in building, other developments, and constructions of buildings

Module-4:

Unit-1: Fire and Earthquake Protection in Building:

Introduction, fire protection in building, structural and architectural safety requirements of resistive structures, fire resistive properties of building materials, fire exit requirements, force and acceleration on building due to earthquake, building response characteristics, building drift.

Module-5:

Unit-1: Water Supply, Sanitary and Electrical Works in Building:

Introduction, water supply system, water supply layout of a building, house drainage, traps, electrical works in building.

Unit-2: Highway Engineering:

Introduction, historical background of road or highway, classification of roads, pavements and roads, traffic control mechanism.

TEXTBOOKS:

1. "Elements of Civil Engineering'' by Mimi Das Saikia, Bhargab Mohan Das and Madan Mohan Das, PHI Learning Private Limited New Delhi.
2. "Elements of Civil Engineering'' by Dr. R.K. Jain and Dr. P.P. Lodha, McGraw Hill Education, India Pvt. Ltd.
3. "Surveying Vol. I'' by Dr. B. C. Punmia, Ashokkumar Jain, Arunkumar Jain16th Edition Publisher: Laxmi Publication Delhi.
4. "Building drawing"byM.G.Shah, C.M.Kale and S.Y.Patki,Tata McGraw Hill.

REFERENCES:

1. "Surveying Theory and Practice" by James M Anderson and Edward M Mikhail McGraw Hill Education, India Pvt. Ltd. (7th Edition).
2. "Surveying and Leveling" by R. Subramanian, Oxford University.
3. "Building drawing" by M.G.Shah, C.M.Kale and S.Y.Patki,Tata McGraw Hill.
4. "Civil Engg. Drawing" by S. C. Rangwala, Charotar Pub. House Anand.

E-Resources:

1. https://nptel.ac.in/courses/105/106/105106201/

Course outcomes:

On completion of the course, students will be able to:

1. **Explain**the basic requirements of civil engineering components.
2. **Evaluate** area for irregular shaped bodies.
3. **Explain** the various building materials.
4. **Plan** the building against the fire.
5. **Discuss** the highway development in India.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 – Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	1	-	-	-	1	-	-	-	-	-	-	-	-
CO2	2	1	-	-	-	1	-	-	-	-	-	-	-	-
CO3	2	1	-	-	-	1	-	-	-	-	-	-	-	-
CO4	2	1	-	-	-	1	-	-	-	-	-	-	-	-
CO5	2	1	-	-	-	1	-	-	-	-	-	-	-	-
Average	2	1	-	-	-	1	-	-	-	-	-	-	-	-

<table>
<tr><td>AY 2020-21
Onwards</td><td colspan="1">J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B.Tech
III Year – I Sem</td></tr>
<tr><td>Course Code:
J31OB</td><td rowspan="2">ENVIRONMENTAL IMPACT ASSESSMENT
(Open Elective-I)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits:3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Environmental Science.

Course Objectives:

This course will enable students to:

1. Study the need of environmental impact assessment.
2. Study the role of EIA and different methodologies of EIA.
3. Discuss the guidelines of EIA for the project.
4. Study the different approaches to mitigate the adverse impact on environment.
5. Identify the EIA for specific case studies.

Module 1:

Unit-1: Impact of developmental projects – sustainable development – Need for Environmental Impact Assessment (EIA), Rapid and Comprehensive EIA, Environmental Impact statement (EIS) – EIA capability and limitations – Legal provisions on EIA – stages of EIA.

Module 2:

Unit-1: Role of NEPA in EIA, CEQ, Environmental documents. EIA/ EIS& FONSI relationship, processing of EIA/EIS, Environmental attributes.

Methodologies: Criteria to be considered for the selection of EIA methodologies, Adhoc, overlays, Check lists – Matrices – Networks – Cost-benefit analysis with their advantages and limitations.

Module 3:

Unit-1: EIA guidelines for Development Projects, Rapid and Comprehensive EIA.

Prediction and Assessment: Assessment of Impact on land, water, air, and noise. Social and cultural activities and on flora and fauna – mathematical models – public participation. Forest act 1980.

Module 4:

Unit-1: Environment management plan:

Plan for mitigation of adverse impact on Environment – Options for mitigation of impact on water, air, land and on flora and fauna – Addressing the issues related to project affected people. Post project monitoring. ISO 9000, 14000 & 18000.

Module 5:

Unit-1:

EIA for Water resource developmental projects, Highway projects: Nuclear Power plant projects, Mining project (Coal, Iron ore), Thermal Power Plant, Infrastructure Construction Activities.

Text Books

1. “Environmental Impact Assessment” by S.R. Khandeshwar N.S. Raman, A.R. Gajbhiye, I k international house publishing, pvt ltd. 1st addition Sep 2019.
2. “Environmental Impact Assessment” by Barthwell, R. R. New Age International Publications. 3rd addition Oct 2017.

Reference Books

1. “Environmental Impact Analysis” by Jain R.K.-Van Nostrand Reinhold Co, H K E S international publication, 3rd addition oct 2014.
2. “Environment Impact Assessment” by Anjaneyulu, B S Publication, 2nd addition Jan 2010

Web Resources

1. https://nptel.ac.in/courses/120/108/120108004/

Course Outcomes

On completion of the course, the students will be able to:

1. **Explain** the stages and need for environmental impact assessment.
2. **Discuss** different methodologies for environmental impact prediction and assessment.
3. **Evaluate** the environmental management plans.
4. **Solve** the problems associated with adverse impact on environment.
5. **Apply** the knowledge of EIA on different construction projects.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	2	-	-	-	1	2	3	-	-	-	-	2	1
CO2	-	-	-	-	-	2	3	1	-	-	-	-	1	1
CO3	-	-	-	-	-	2	2	3	-	-	-	-	2	1
CO4	-	2	-	-	-	1	2	3	-	-	-	-	1	3
CO5	-	-	-	-	-	1	3	2	-	-	-	-	2	2
Average	-	0.8	-	-	-	1.4	2.4	2.4	-	-	-	-	1.6	1.6

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="1">J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B.Tech
III Year – I Sem</td></tr>
<tr><td>Course Code: J31OC</td><td rowspan="2">Energy Engineering
(Open Elective-I)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisites: Nil

Course Objectives:
This course will enable students to:
1. To provide basic knowledge about various types of energy resources.
2. To familiarize the students about conventional energy systems.
3. To understand the practical significance of hydro-electric technology, wind, solar and biomass energy technologies.
4. Illustrate how biomass is currently used as a source of energy, its Future potential both in providing energy and in producing alternative fuels.
5. To familiarize energy conservation and management.

MODULE-I: INTRODUCTION TO ENERGY RESOURCES
World Energy status – Indian scenario, Energy resources – conventional and renewable, fuel cells, hydrogen energy, small hydro resources; Need for energy storage, energy storage methods; Environmental aspects of energy – Economics.

MODULE-II: CONVENTIONAL ENERGY SYSTEMS
Unit-I: Coal fired steam thermal power plant – layout, working, T-S diagram of water and steam, rankine cycle for steam turbine, efficiency.
Unit-II: Gas turbine power plant – various options, layout, working and T-S diagram for simple and combined cycle power plant, comparison, efficiency.
Nuclear power plants: fuels, nuclear fuel cycle, reactors, nuclear power plant, nuclear waste management.

MODULE-III: HYDRO ELECTRIC TECHNOLOGY
Hydro Electric plants – Types, energy conversion schemes, power equation, environmental aspects – Hydro-Thermal coordination. Ocean Energy Technology, Wave and tidal energy - fundamentals - energy converters - power plant - limitations.

MODULE-IV: WIND, SOLAR AND BIOMASS ENERGY TECHNOLOGIES
Unit-I: Wind turbine types and construction – power equation – wind energy conversion systems grid connection - environmental aspects.
Unit-II: Solar energy basics – energy from the sun, solar constant, solar spectrum, clarity index, V-I characteristics of a solar cell – solar module –Solar PV plant – hybrid systems.
Biomass energy resources – conversion technologies – urban waste to energy conversion – Biogas plant.

MODULE-V: ENERGY CONSERVATION AND MANAGEMENT

Unit-I: Principle of energy conservation - waste heat recovery - Heat pump – Economics of energy conservation, cogeneration, combined cycle plants, electrical energy conservation opportunities.

Unit-I: Definition and Objectives of Energy Management, Energy Management System, Top management support, Energy policy purpose, Roles and responsibilities of energy manager. Energy Audit: Type and Methodology, Energy audit reporting format, Understanding Energy Costs, Fuel and Energy Substitution, Energy Audit Instruments.

TEXT BOOKS

1. S.Rao and Dr.B.B.parulekar, "Energy Technology", Khanna pub., Third edition, 1999.
2. Non-conventional energy resources by B.H.Khan, TMH, 2006.
3. Desai,AV, "Energy Demand: Analysis, Management and Conservation", WileyEastern Limited, 1990.

REFERENCE BOOKS

1. G.D.Rai, "Non-conventional energy sources", Khanna pub. Fourth Edition, 2002.
2. Pulfrey, D.L., Photovoltaic Power Generation, Van Nostrand Co., 1983.
3. Abbasik "Renewable Energy Sources and their Environment", PHI, 2008.
4. B.Mohanty, R.S.Liu, U.V Krishna Mohan Rao, "Energy Audit Management for theIndian Industry", Directorate the Institute of Charted Accountants of India, New Delhi,2001.
5. Encyclopedia of Energy – McGraw Hill Publication.
6. Energy Management Handbook, John Wiley & Sons, Wayne C.Turner.
7. Kothari et al. "Renewable Energy Sources and Emerging Technologies", PHI, 2008.

E-Resources:

1. http://nptel.ac.in/courses/112105051/
2. https://www.youtube.com/watch?v=Ota2_LUuar0
3. https://www.youtube.com/watch?v=Ota2_LUuar0
4. https://www.youtube.com/watch?v=3dJAtHaSQ98
5. https://www.youtube.com/watch?v=xokHLFE96h8
6. http://www.tatapower.com/businesses/renewable-energy.aspx
7. http://www.cleanlineenergy.com/technology/wind-and-solar

Course Outcomes:

On completion of the course, the students will be able to:

1. **Provide** basic knowledge about various types of energy resources.
2. **Familiarize** the students about conventional energy systems.
3. **Understand** the practical significance of hydro-electric technology, wind, solar and biomass energy technologies.

4. **Know** how biomass is currently used as a source of energy, its Future potential both in providing energy and in producing alternative fuels.
5. **Familiarize** energy conservation and management.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	-	2	-	-	3	2	3	-	-	-	-	-	2
CO2	-	-	3	-	-	2	3	2	-	-	-	-	-	3
CO3	-	-	3	-	-	3	3	3	-	-	-	-	-	2
CO4	-	-	3	-	-	3	3	2	-	-	-	-	-	3
CO5	-	-	3	-	-	2	3	3	-	-	-	-	-	2
Average	-	-	2.8	-	-	2.6	2.8	2.6	-	-	-	-	-	2.4

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech III Year – I Sem</td></tr>
<tr><td>Course Code: J31OD</td><td rowspan="2">SENSORS AND TRANSDUCERS
(Open Elective-I)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisites: Nil

Course Objectives:

1. To make students familiar with the constructions and working principle of different types of sensors and transducers
2. To make students aware about the measuring instruments and the methods of measurement and the use of different transducers.
3. To make students familiar with the Potentiometer, Loading effect, Strain gauge
4. To make students aware about Linear Variable Differential Transformer, LVDT Accelerometer
5. To make students aware piezoelectric and pyro-electric transducers

MODULE – I

Measurements and Instrumentation of Transducers: Measurements – Basic method of measurement – Generalized scheme for measurement systems – Units and standards – Errors – Classification of errors, error analysis – Statistical methods – Sensor – Transducer – Classification of transducers – Basic requirement of transducers.

MODULE – II

Characteristics of Transducers: Static characteristics – Dynamic characteristics – Mathematical model of transducer – Zero, first order and second order transducers – Response to impulse, step, ramp and sinusoidal inputs.

MODULE– III

Resistive Transducers: Potentiometer –Loading effect – Strain gauge – Theory, types, temperature compensation – Applications – Torque measurement – Proving Ring – Load Cell – Resistance thermometer – Thermistors materials – Constructions, Characteristics – Hot wire anemometer.

MODULE – IV

Inductive and Capacitive Transducer: Self inductive transducer – Mutual inductive transducers – Linear Variable Differential Transformer – LVDT Accelerometer – RVDT – Synchros – Microsyn – Capacitive transducer – Variable Area Type – Variable Air Gap type – Variable Permittivity type – Capacitor microphone.

MODULE – V

Miscellaneous Transducers: Piezoelectric transducer – Hall Effect transducers – Smart sensors – Fiber optic sensors – Film sensors – MEMS – Nano sensors, Digital transducers.

TEXT BOOKS:

1. Sawhney. A.K, "A Course in Electrical and Electronics Measurements and Instrumentation", 18th Edition, DhanpatRai& Company Private Limited, 2007.
2. Patranabis. D, "Sensors and Transducers", Prentice Hall of India, 2003.

REFERENCE BOOKS:

1. Renganathan. S, "Transducer Engineering", Allied Publishers, Chennai, 2003.
2. Doebelin. E.A, "Measurement Systems – Applications and Design", Tata McGrawHill, New York, 2000.
3. John. P, Bentley, "Principles of Measurement Systems", IIIEdition, PearsonEducation, 2000.
4. Murthy. D. V. S, "Transducers and Instrumentation", Prentice Hall of India, 2001.
5. Sensor Technology Hand Book – Jon Wilson, Newne 2004.
6. Instrument Transducers – An Introduction to their Performance and design – byHerman K. P. Neubrat, Oxford University Press.

E-Resources:

1. http://cas.ee.ic.ac.uk/people/dario/files/E302/1-Sensors.pdf

Course Outcomes:

On completion of the course, the students will be able to:

1. **Concept** behind working of measurement systems and different types of sensors and transducers.
2. **Sensor** to measure various physical parameters used in Industry and normal measurement applications
3. **Working** principle of resistive, inductive and capacitive transducers and their applications.
4. **Understanding** of digital and proximity sensors and their applications.
5. **Understanding** of thermocouples, piezoelectric and pyro-electric transducers and their applications.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	-	-	-	-	1	-	-	-	-		-	2	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	2	1	1	1	-	-	-	1	-	-	-	2	1
CO4	2	-	-	-	1	-	2	-	-	-	-	-	2	-
CO5	1	-	-	-	1	-	-	-	-	-	-	-	1	-
Average	1.6	1.5	1	1	1	1	2		1	-	-	-	1.6	1

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech III Year – I Sem</td></tr>
<tr><td>Course Code: J31OE</td><td rowspan="2">AUTOMOTIVE TECHNOLOGY
(Open Elective-I)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Chemistry, Engineering Physics.

Course Objectives:
This course will enable students to:
1. Provide an overview on automobile engineering
2. Learn different fuels and advanced control systems
3. Study the concepts and drive train configurations of electric and hybrid electric vehicles
4. Understand use of intelligent vehicle technologies like navigation in automobiles
5. Provide awareness of safety security and regulations

Module 1
Unit-1: Structural systems of automobile– chassis and body, power unit, transmission system, Steering System, Suspension System, Braking System.
Unit-2: Other systems of automobile- Ignition systems, Fuel System, Cooling System, Electrical System.

Module 2
Unit-1: Fuels: Types of Fuels-Gasoline fuels, CNG, Biofuels, advantages and limitations.
Unit-2: Advanced Engine Controls: Concept of an electronic engine control system, electronic fuel injection - throttle body fuel injection, multi-point fuel injection, gasoline direct injection, common rail direct injection, electronic ignition control.

Module 3
Unit-1: Fuel Cell and Solar Vehicles: Fuel cell vehicle – Operating principle, types of fuel cells, fuel cell options for fuel cell vehicle and fuel cell hybrid vehicle. Solar vehicle - Solar photovoltaic cell, solar array, solar car electrical system and drive train.
Unit-2: Electric and Hybrid Vehicles: Electric vehicles - Layout of an electric vehicle, performance, energy consumption, advantage and limitations. Hybrid electric vehicles - Concepts, types of hybrid drive train architecture, merits and demerits.

Module 4
Unit-1: Telematics Systems: Global positioning system, geographical information systems, navigation system.
Unit-2: Comfort Systems: Automotive vision system, adaptive cruise control system, active suspension system, power steering and power windows.

Module 5

Unit-1: Safety and Security Systems: Active and passive safety, airbags, seat belt tightening system, collision warning systems, anti-lock braking systems, traction control system, electronic immobilizers, remote keyless entry, smart card system, number plate coding.

Unit-2: Emission and noise control regulations- Pollution standards, National and international – Pollution Control – Techniques – Noise Pollution & control.

Text Books:

1. William B Riddens, "Understanding Automotive Electronics", 5th edition, Butter worth Heinemann Woburn, 1998.
2. MehrdadEhsani, YiminGao, Sebastien E. Gay and Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design", CRC Press, 2005.
3. Kripal Singh, "Automobile Engineering", Standard Publishers, Vol. 1 & 2, 2007

Reference Books:

1. Automotive Hand Book" Robert Bosch, SAE, 5th edition, 2000.
2. LjuboVlacic, Michel Parent and Fumio Harashima, "Intelligent Vehicle Technologies", Butterworth-Heinemann publications, Oxford, 2001.
3. Iqbal Husain, "Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
4. "Navigation and Intelligent Transportation Systems – Progress in Technology", Ronald K Jurgen, Automotive Electronics Series, SAE, USA, 1998.

E - Resources:

1. https://rb.gy/zm8le8
2. https://rb.gy/ceck4k
3. https://nptel.ac.in/courses/107/106/107106088/
4. https://nptel.ac.in/courses/108/102/108102121/

Course Outcomes:

On completion of the course, the students will be able to:

1. **Outline** the overview of automobile engineering
2. **Identify** the different fuels and advanced control systems
3. **Develop** the concepts and drive train configurations of electric and hybrid electric vehicles
4. **Apply** the use of intelligent vehicle technologies like navigation in automobiles
5. **Aware** of safety security and regulations

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	-	3	3	3	-	-	-	-	-	-	2		
CO2	3	-	3	3	3	-	-	-	-	-	-	2		
CO3	3	-	3	3	3	-	-	-	-	-	-	2		
CO4	3	-	3	3	3	-	-	-	-	-	-	2		
CO5	3	-	3	3	3	-	-	-	-	-	-	2		
Average	3	-	3	3	3	-	-	-	-	-	-	2		

<table>
<tr><td>AY 2020-21
onwards</td><td colspan="1">J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B.Tech
III Year – I Sem</td></tr>
<tr><td>Course
Code:J31OG</td><td rowspan="2">PRINCIPLES OF SENSORS AND THEIR APPLICATIONS
(Open Elective-I)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:
This course will enable students to:
1. To understand the concepts of measurement technology.
2. To learn the different sensors used to measure various physical parameters.
3. To Acquire knowledge on Optical sensors.
4. To understand the concepts Acoustic sensors.
5. To learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development.

Module 1:
Unit 1: INTRODUCTION
Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers .
Unit 2: Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor Output Signal Types.

Module 2:
Unit 1:MOTION, PROXIMITY ANDRANGINGSENSORS
Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive.
Unit 2:LVDT – RVDT – Synchro – Microsyn, Accelerometer.,– GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).

Module 3:
Unit 1: FORCE, MAGNETIC AND HEADINGSENSORS
Strain Gage, Load Cell, Magnetic Sensors–types, principle, requirement and advantages: **Unit 2:**Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers.

Module 4:
Unit 1: OPTICAL, PRESSURE ANDTEMPERATURE SENSORS9
Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure –

Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD.
Unit 2: Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart Sensors
Film sensor, MEMS & Nano Sensors, LASER sensors.

Module 5 :
Unit 1: SIGNAL CONDITIONING andDAQSYSTEMS9
Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multi-channel data acquisition .
Unit 2: Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.

TEXT BOOKS:

1. Ernest O Doebelin, "Measurement Systems – Applications and Design", Tata McGraw-Hill,2009.
2. Sawney A K and PuneetSawney, "A Course in Mechanical Measurements and Instrumentation and Control", 12th edition, DhanpatRai& Co, New Delhi,2013.

REFERENCES

1. Patranabis D, "Sensors and Transducers", 2nd Edition, PHI, New Delhi,2010.
2. John Turner and Martyn Hill, "Instrumentation for Engineers and Scientists", Oxford Science Publications,1999.
3. Richard Zurawski, "Industrial Communication Technology Handbook" 2nd edition, CRC Press, 2015.

E-RESOURCES:

1. https://www.sciencelearn.org.nz/resources/1602-electricity-and-sensors
2. https://predictabledesigns.com/introduction-to-electronic-sensors/

OUTCOMES:

The students will be able to

1. **Expertise** in various calibration techniques and signal types for sensors.
2. **Apply** the various sensors in the Automotive and Mechatronics applications
3. **Study** the basic principles of various smart sensors.
4. **Apply** Optical and Acoustic sensors in Home Appliances.
5. **Implement** the DAQ systems with different sensors for real time applications

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	3	2											
CO2	2	2		2										
CO3	3	2		3										
CO4	3	1												
CO5	2	2	3	3										
Average	**2.4**	**2.0**	**2.5**	**2.67**										

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech
III Year – I Sem</td></tr>
<tr><td>Course Code: J31OH</td><td rowspan="2">PRINCIPLES OF COMMUNICATIONS
(Open Elective-I)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Communication systems

Course Objectives:
The Student will

1. provide the basic concepts of communication systems.
2. gain knowledge about Amplitude modulation and Angle Modulation.
3. study sampling and pulse modulation methods.
4. study and compare different binary digital modulation techniques.
5. understand the basic concepts of information theory.

Module 1: Introduction

Unit 1: Block diagram of Electrical communication system, Radio communication: Types of communications, Analog, pulse and digital types of signals,

Unit 2: Noise – Types of noise, sources of noise, calculation of noise in Linear systems and noise figure.

Module 2: Amplitude Modulation

Unit 1: Need for modulation, Types of Amplitude modulation, AM, DSB SC, SSB SC, Power and BW requirements, generation of AM, DSB SC, SSB SC, Demodulation of AM: Diode detector, Product demodulation for DSB SC & SSB SC.

Unit 2: Angle Modulation: Frequency & Phase modulations, advantages of FM over AM, Bandwidth consideration, Narrow band and Wide band FM, Comparison of FM & PM.

Module 3: Pulse Modulations

Unit 1: Sampling, Nyquist rate of sampling, Sampling theorem for Band limited signals, PAM, regeneration of base band signal, PWM and PPM.

Unit 2: Time Division Multiplexing, Frequency Division Multiplexing, Asynchronous Multiplexing.

Module 4: Digital Communication

Unit 1: Advantages, Block diagram of PCM, Quantization, effect of quantization, quantization error, Base band digital signal, DM, ADM, ADPCM and comparison.

Unit 2: Digital Modulation: ASK, FSK, PSK, DPSK, QPSK demodulation, coherent and incoherent reception, Modems.

Module 5: Information Theory

Unit 1: Concept of information, rate of information and entropy, Source coding for optimum

rate of information, Coding efficiency, Shanon-Fano and Huffman coding
Unit 2: Error control coding: Introduction, Error detection and correction codes, block codes, convolution codes

TEXT BOOKS :
1. Communication Systems Analog and Digital – R.P. Singh and SD Sapre, TMH, 20th reprint, 2004.
2. Principles of Communications – H. Taub and D. Schilling, TMH, 2003.

REFERENCES:
1. Electronic Communication Systems – Kennedy and Davis, TMH , 4th edition, 2004.
2. Communication Systems Engineering -John. G. Proakis and MasoudSalehi, PHS, 2nd ed.2004.

E - Resources:
1. https://nptel.ac.in/courses/Nanoelectronics/ IIT Madras/ab1011/102/111102111/

Course Outcomes:
The student will be able to:
1. **illustrate** the main concepts of analoge and digital communication systems.
2. **analyze** and design an AM and FM modulator/demodulator.
3. **explain**, discuss, and compare different binary digital modulation techniques.
4. **distinguish** different types of noise and explain the effects of noise on communication system.
5. **use** the basic concepts of information theory.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	1	-	-	-	-	-	-	-	-	-	1	1	-
CO2	2	2	1	-	-	-	-	-	-	-	-	-	2	-
CO3	1	1	-	-	-	-	-	-	-	-	-	-	1	-
CO4	1	1	-	-	-	-	-	-	-	-	-	-	2	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-	1	-
Average	2	2	1	-	-	-	-	-	-	-	-	1	1.2	-

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech
III Year – I Sem</td></tr>
<tr><td>Course Code: J31OI</td><td rowspan="2">FUNDAMENTALS OF DATA BASE MANAGEMENT SYSTEM
(Open Elective-I)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-Requisites: A course on “Data Structures”

Course objectives:
The Student will

1. Understanding of the architecture and functioning of database management systems.
2. Understand and apply the principles of data modeling using relational model and
3. develop a good database design.
4. Understand the use of structured query language (SQL) and its syntax.
5. Apply normalization techniques to normalize a database.
6. Understand the need of database processing and learn techniques for controlling the Consequences of concurrent data access.

Module 1:
Introduction to Data Base Systems
Data base System Applications, data base System VS file System – View of Data – Data Abstraction –Instances and Schemas – data Models – the ER Model – Relational Model – Other Models – Database Languages – DDL – DML.
Database Access for applications Programs
data base Users and Administrator – Transaction Management – data base System Structure – Storage Manager – the Query Processor.

Module 2:
Introduction to the Relational Model
Integrity Constraint Over relations – Enforcing Integrity constraints – Querying relational data – Logical data base Design – Introduction to Views – Destroying /altering Tables and Views.
Relational Algebra
Selection and projection set operations – renaming – Joins – Division – Examples of Algebra overviews – Relational calculus – Tuple relational Calculus – Domain relational calculus.

Module 3:
Form of Basic SQL Query
Examples of Basic SQL Queries – Introduction to Nested Queries – Correlated Nested Queries Set – Comparison Operators – Aggregative Operators – NULL values – Comparison using Null values – Logical connectivity’s – AND, OR and NOT – Impact on SQL Constructs – Outer Joins – Disallowing NULL values.

Schema refinement

Problems Caused by redundancy – Decompositions – Problem related to decomposition – reasoning about FDS – FIRST, SECOND, THIRD Normal forms – BCNF – Lossless join Decomposition – Dependency preserving Decomposition – Schema refinement in Data base Design – Multi valued Dependencies – FORTH Normal Form.

Module 4:

Transaction Concept

Transaction State- Implementation of Atomicity and Durability – Concurrent Executions – Serializability- Recoverability– Implementation of Isolation – Lock –Based Protocols – Timestamp Based Protocols- Validation- Based Protocols.

Recovery and Atomicity

Log – Based Recovery – Recovery with Concurrent Transactions – Buffer Management – Failure with loss of nonvolatile storage-Advance Recovery systems- Remote Backup systems.

Module 5:

Data on External Storage

-File Organization and Indexing – Cluster Indexes, Primary and Secondary Indexes – Index data Structures – Hash Based Indexing – Tree base Indexing – Comparison of File Organizations – Indexes and Performance Tuning- Intuitions for tree Indexes – Indexed Sequential Access Methods (ISAM).

Advanced Database Management System

Introduction to Distributed Database-Reference Architecture, fragmentation, Allocation, Joins.

Text Books:

1. Data Base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA McGrawHill 3rd Edition
2. Data base System Concepts, Silberschatz, Korth, McGraw hill, V edition.

Reference Books:

1. Data base Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.
2. Fundamentals of Database Systems, ElmasriNavrate Pearson Education
3. Introduction to Database Systems, C.J.Date Pearson Education.

E - Resources:

1. http://www.iran-lms.com/images/images/Books/PDF/Fundamentals-of-Database-Systems-Pearson-2015-Ramez-Elmasri-Shamkant-B.-Navathe.pdf
2. https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fcs.gmu.edu%2F~aobaidi%2Ffall_05%2Findex_files%2FLectures%2FENCh10.ppt
3. https://www.youtube.com/watch?v=T7AxM7Vqvaw
4. https://cs.ulb.ac.be/public/_media/teaching/infoh303/dbmsnotes.pdf

5. https://www.w3schools.in/dbms/intro/

Course outcomes:

The Student will be able to

1. **Identify** the underlying concepts of database technologies.
2. **Design** a database schema for a given problem domain.
3. **Formulate** SQL queries and integrity constraints over relations.
4. **Apply** normalization on database for eliminating redundancy.
5. **Summarize** transaction properties, concurrency control and recovery techniques and learn various data storage and security mechanisms.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	2	-	1	-	-	-	-	-	-	-	-	2
CO2	3	3	3	2	2	-	-	-	-	-	-	-	-	2
CO3	3	3	2	2	2	-	-	-	-	-	-	-	-	2
CO4	3	2	3	3	2	-	-	-	-	-	-	-	-	3
CO5	2	2	3	1	3	-	-	-	-	-	-	-	-	1
Average	**2.8**	**2.6**	**2.6**	**2.0**	**2.0**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.0**

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="4">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech III Year – I Sem</td></tr>
<tr><td>Course Code: J31OJ</td><td rowspan="2" colspan="4">PRINCIPLES OF OPERATING SYSTEMS
(Open Elective-I)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-Requisites:

1. Programming for Problem solving, Data structures and Algorithms (not mandatory).
2. Computer Organization.

Course objectives:

The Student will

1. Understand the basic concepts and functions of computer operating systems.
2. Apply the concurrency control among the operating system programs execution.
3. Demonstrate the techniques used to manage the memory during program execution.
4. Explain the various storage management methods and functions of operating systems.
5. Design the security features against attacks on operating system.

Module 1:

Background

Overview: Basic Elements, Evolution of the Microprocessor, Instruction Execution, Interrupts, Cache Memory, Direct Access Memory.

System Structures: Computer Systems Organization, Computer System Architecture, Operating System Architecture, Systems Calls, Operating System structure, Building and Booting an Operating System.

Module 2:

Process Management

Process Concepts: Introduction, Process Scheduling, Scheduling Criteria, Scheduling Algorithms, Critical-Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Mutex Locks, Semaphores, Monitors, Classic Problems of Synchronization.

Deadlock: Deadlock Characterization, Deadlock Prevention, Detection and Avoidance, Recovery from Deadlock.

Module 3:

Main Memory: Background, Contiguous Memory Allocation, Paging, Page-Table Structure, Swapping, Segmentation.

Virtual Memory: Background, Demand Paging, Page Replacement Algorithms, Frames Allocation, Thrashing.

Module 4:

Mass-Storage Structure: Overview, Disk Structure, Disk Attachment, Disk Scheduling, Swap-Space Management, RAID Structure.

File system Management: File Concepts, File System Structure, File System Operations, Directory Implementation, Allocation Methods, Free-Space Management.

Module 5:

Mass-Storage Structure: Overview, Disk Structure, Disk Attachment, Disk Scheduling, Swap-Space Management, RAID Structure.

File system Management: File Concepts, File System Structure, File System Operations, Directory Implementation, Allocation Methods, Free-Space Management.

Text Books:

1. Operating System Concepts-A. Silberschatz, Peter B. Galvin, Greg Gagne, 10th Edition, John Wiley& Sons inc.
2. Operating Systems Internals and Design Principles – William Stallings, 7th Edition, Prentice Hall.

Reference Books:

1. Principles of Operating Systems-NareshChauhan, Oxford Higher Education.
2. Operating System A Design Approach-Crowley, TMH.
3. Modern Operating Systems-Andrew S Tanenbaum, 2nd Edition Pearson, PHI.

E - Resources:

1. https: // www.tutorialspoint .com/operating_system/
2. https: // www.studytonight.com/operating-system/
3. https: // learn.saylor.com/course/view.php?id=948&sectioned=967
4. https: //nptel.ac.in/courses/106/105/106105214/
5. https://www.edx.org/course/computer-hardware-and-operating-systems

Course outcomes:

The Student will be able to

1. **Compare** differing structures of operating systems including process management.
2. **Apply** different CPU scheduling algorithms and various Memory management techniques.
3. **Illustrate** the use of Bankers algorithm for deadlock avoidance and File system organization.
4. **Demonstrate** various mass storage management techniques
5. **Analyze** different aspects of protection and security concepts

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	2
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	3
CO3	3	2	3	-	-	-	-	-	-	-	-	-	-	2
CO4	2	2	2	-	-	-	-	-	-	-	-	-	-	2
CO5	3	3	2	-	-	-	-	-	-	-	-	-	-	2
Average	**2.8**	**2.2**	**2.2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.2**

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech III Year – I Sem.</td></tr>
<tr><td>Course Code: J31OK</td><td rowspan="2">INTRODUCTION TO DATA STRUCTURES through PYTHON
(Open Elective-I)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Programming in C

Course Objectives:
This course will enable students to:
1. Understand fundamentals of programming.
2. Adapt Basic taxonomy of python.
3. Familiarize with OOP.
4. Understand Data Structure in Python.
5. Design Solutions with OOP Paradigm.

Module I: Introduction
Unit 1:
Relationship between computers and programs, Basic principles of computers, Fundamentals of Programming and File systems,
Unit 2:
Using the Python interpreter, Introduction to binary computation, Input / Output.

Module II: Data types and control structures
Unit 1:
Keywords, Operators (unary, arithmetic, etc.), Data types, variables, expressions, and statements, Assignment statements, Strings and string operations.
Unit 2:
Control Structures: loops and decision

Module III: Modularization and Classes
Unit 1:
Standard modules, Packages and using of Packages.
Unit 2:
Defining Classes, Defining functions, Functions and arguments.

Module IV: Data Structures and Exceptions
Unit 1:
Data Structures (array, List, Tuples and Dictionary).
Unit 2:
Error processing, Exception Raising and Handling.

Module V: Object oriented design
Unit 1:
Programming types, Object Oriented Programming, Object Oriented Design.
Unit 2:
Inheritance and Polymorphism.

Text Books:
1. Data Structures and Algorithms in Python. Michael T. Goodrich , Roberto Tamassia , Michael H. Goldwasser, Wiley, 2013.Reference Books:

Reference Books:
1. Data Structures and Algorithms Using Python Rance D. Necaise, JOHN WILEY & SONs.

E - Resources:
1. https://www.my-mooc.com/en/mooc/introduction-to-python-programming/

Course Outcomes:
On completion of the course, the students will be able to:
1. **Recall** fundamentals of programming.
2. **summarize** Basic taxonomy of python.
3. **Get** Familiarity with OOP.
4. **Apply** Data Structure in Python.
5. **Solve** Problems with OOP Paradigm.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	2	1	1	-	-	-	-	-	-	-	-	2	1
CO2	1	2	2	1	-	-	-	-	-	-	-	-	1	2
CO3	2	2	2	2	-	-	-	-	-	-	-	-	1	1
CO4	2	2	2	2	-	-	-	-	-	-	-	-	2	2
CO5	1	2	2	2	-	-	-	-	-	-	-	-	2	1
Average	1.6	2	1.8	1.6	-	-	-	-	-	-	-	-	1.6	1.4

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech
III Year – I Sem.</td></tr>
<tr><td>Course Code: J31OL</td><td rowspan="2">INTRODUCTION TO WEB DESIGN
(Open Elective-I)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:

This course will enable students to:

1. Know regarding internet related technologies.
2. Understanding of the current industry support for web technologies.
3. Explain the basic concepts of CSS.
4. Visualize the basic concepts of PHP.
5. Understanding PHP functions and Methods

Module I:

UNIT-I: Basics in Web Design: Brief History of Internet, what is World Wide Web, why create a web site, Web Standards, Audience requirement.

UNIT -II: Web Design Principles: Basic principles involved in developing a web site, Planning process, Five Golden rules of web designing, Designing navigation bar page design, Home Page Layout, Design Concept.

Module II:

UNIT-I: What is HTML, HTML Documents, Basic structure of an HTML document, creating an HTML document, Mark up Tags, Heading-Paragraphs, Line Breaks, HTML Tags, HTML Tables, HTML Forms.

UNIT II: Introduction to elements of HTML, working with Text Working with Lists, Tables and Frames, working with Hyperlinks, Images and Multimedia, Working with Forms and controls.

Module III:

UNIT-I: Concept of CSS, Creating Style Sheet and types of CSS, CSS Properties, CSS Styling(Background, Text Format, Controlling Fonts), Working with block elements and objects, Working with Lists and Tables, CSS Id and Class, Box Model(Introduction, Border properties, Padding Properties, Margin properties).

UNIT-II: Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class, Navigation Bar, Image Sprites, Attribute sector), CSS Colors, Creating page Layout and Site Designs.

Module IV:

UNIT-I: Downloading, installing, configuring PHP, The anatomy of a PHP Page. Basic

Security Guidelines, Variables, Data Types, Operators and Expressions, Constants, Flow Control Functions; Switching Flow, Loops.

UNIT II: Code Blocks and Browser Output, Objects, Strings Processing, Form processing, connecting to database, using cookies, dynamic contents.

Module V:

UNIT I: Creating the Web Site, Saving the site, working on the web site, Creating web site structure, Creating Titles for web pages, Themes-Publishing web sites.

Text Books:

1. Dietel and Dietel : ―Internet and World Wide Web - How to Program‖, 5th Edition, PHI/Pearson Education,2011
2. Web Technologies: HTML,CSS, XML,PhpBlackBook.

Reference Books:

1. Chris Bates, ―Web Programming, building internet applications‖, 2ndEdition, WILEY, Dreamtech,2008.
2. HTML 5 in simple steps Kogent Learning Solutions Inc, DreamtechPress.
3. Beginning CSS: Cascading Style Sheets for Web Design Ian Pouncey, ichard York Wiley India

E - Resources:

1. https://nptel.ac.in/courses/106/105/106105084/
2. http://www.nptelvideos.in/2012/11/internet-technologies.html
3. http://www.nptelvideos.com/php/php_video_tutorials.php

Course Outcomes:

At the end of the course , students will be able to

1. **Develop** the application of the HTML for document structure.
2. **Develop** the skills in analyzing the usable of a website.
3. **Create** dynamic webpage, using PHP.
4. **Using** PHP to manipulate Files.
5. **Develop** the concept of web publishing.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	3
CO2	3	2	3	-	-	-	-	-	-	-	-	-	3	3
CO3	3	2	3	-	-	-	-	-	-	-	-	-	3	3
CO4	3	2	3	-	-	-	-	-	-	-	-	-	3	3
CO5	3	3	3	-	-	-	-	-	-	-	-	-	3	3
Average	3	2.4	3	-	-	-	-	-	-	-	-	-	3	3

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B.Tech III Year – I Sem		
Course Code: J31OM	**BASICS OF OBJECT ORIENTED PROGRAMMING** (Open Elective-I)	**L**	**T**	**P/D**
Credits: 3		3	0	0

Pre-requisite: Basic Knowledge of C and C++

Course Objectives:

The Students will

1. Familiar with concepts of OOP
2. Explain inheritance and polymorphism
3. Familiar with packages and interfaces
4. Familiar with exception handling and multithreading
5. Familiar with applet programming and event handling.

Module I:

Unit 1: Introduction: Concepts of Object Oriented Programming, Encapsulation and Polymorphism, history of Java.

Unit 2 : Java buzzwords, data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and casting, simple java program.

Module II:

Unit 1: Classes and Objects: Concepts of classes, objects, constructors, methods, this keyword, garbage collection, overloading methods and constructors, parameter passing, recursion. String handling.

Unit 2 :Inheritance 1: Base class object, subclass, member access rules, super uses, using final with inheritance, method overriding, abstract classes

Module III:

Unit 1: Interfaces 2: Defining an interface, implementing interface, differences between classes and interfaces and extending interfaces.

Unit 2 : Packages: Defining, creating and accessing a package, importing packages, access control, exploring package - java.io.

Module IV:

Unit 1 : Exception handling: Concepts of exception handling, benefits of exception handling, exception hierarchy, checked and unchecked exceptions, usage of-try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes.

Unit 2 : Multithreading: Differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, daemon threads, thread groups.

Module V:

Unit 1: Applets: Concepts of applets, differences between applets and applications, life cycle of applet, types of applets, creating applets, passing parameters to applets.

Unit 2:Event Handling: Events, event sources, event classes, event listeners, delegation event model, handling mouse and key board events, adapter classes. The AWT class hierarchy, user interface components-labels, buttons, canvas, scrollbars, text components, checkbox, checkbox groups, choices, lists

Text Books:

1. Java The complete reference, 8th editon, Herbert Schildt, TMH.
2. Understanding OOP with Java, up dated edition, T.Budd, Pears on education.

Reference Books:

1. An Introduction to programming and OO design using Java, J. Nino and F.A. Hosch, John Wiley & sons.
2. An Introduction to OOP, second edition, T. Budd, Pearson education.
3. Introduction to Java programming 6th edition, Y. Daniel Liang, Pearson education.

E-Resources:

1. www.javasoft.com
2. www.w3schools.com
3. www.tutorialpoint.com
4. www.oracle.com
5. https://www.youtube.com/watch?v=-HafzawNlUo&ab_channel=SundeepSaradhiKanthety.
6. https://www.youtube.com/watch?v=7WhnYwoBY24&list=PLlhM4lkb2sEhf5NlWeYh_gdcN49pHjVP0&ab_channel=SmartProgramming.
7. https://www.youtube.com/watch?v=G_t6BbZeyUU&ab_channel=VoidRealms

Course Outcomes:

Students will be able to

1. **Familiar** with constructors and string handling
2. **Understand** inheritance and polymorphism
3. **Understand** packages and interfaces
4. **Understand** exception handling and multithreading
5. **Understand** applet programming

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**											**Program Specific Outcomes***		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	3	-	3	3	-	3	-	-	2	-	-	3	-
CO2	-	-	2	-	-	3	-	3	-	-	3	-	-	3
CO3	3	-	-	3	-	2	-	-	3	-	-	3	-	-
CO4	3	-	-	-	3	-	-	3	3	3	-	-	3	-
CO5	-	3	-	-	-	-	2	-	-	-	3	-	-	3
Average	**3.0**	**3.0**	**2.0**	**3.0**	**3.0**	**2.5**	**2.5**	**3.0**	**3.0**	**2.5**	**3.0**	**3.0**	**3.0**	**3.0**

<table>
<tr><td>AY 2020-21
onwards</td><td colspan="1">J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="3">B.Tech
III Year – I Sem</td></tr>
<tr><td>Course Code:
J31ON</td><td rowspan="2">FUNDAMENTALS OF DIGITAL LOGIC DESIGN
(Open Elective-I)</td><td>L</td><td>T</td><td>P/D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Basics of Boolean algebra

Course Objectives:
Students will learn to

1. Understand basic tools for the design of digital circuits and fundamental concepts used in the design of digital systems.
2. Understand common forms of number representation in digital electronic circuits and to be able to convert between different representations.
3. Implement simple logical operations using combinational logic circuits.
4. Design combinational logic circuits, sequential logic circuits.
5. Impart the concepts of sequential circuits, enabling them to analyze sequential systems in terms of state machines.

Module I:
Unit 1: Binary systems : digital systems, binary numbers, number base conversions, octal and hexadecimal numbers, complements, signed binary numbers, binary codes, binary storage and registers, binary logic.

Module II:
Unit 1: Boolean algebra and logic gates : basic definitions, axiomatic definition of boolean algebra, basic theorems and properties of boolean algebra, boolean functions canonical and standard forms, other logic operations, digital logic gages, integrated circuits.

Module III:
Unit 1: Gate – level minimization: the map method, four-variable map, five-variable map, product of sums simplification don't-care conditions, nand and nor implementation other two-level implementnations, exclusive – or function, hardward description language (hdl).

Module IV:
Unit 1 : Combinational logic : combinational circuits, analysis procedure design procedure, binary adder-subtractor decimal adder, binary multiplier, magnitude comparator, decoders, encoders, multiplexers, hdl for combinational circuits.

Module V:

Unit 1: Registers, shift registers, ripple counters synchronous counters, other counters, hdl for registers and counters.

Text Books:

1. Digital design – third edition ,m.morrismano, pearson education/phi.
2. Fundamentals of logic design, roth, 5th edition,thomson.

Reference Books:

1. Switching and finite automata theory by zvi. Kohavi, tatamcgraw hill.
2. Switching and logic design, c.v.s. rao, pearson education
3. Digital principles and design – donaldd.givone, tatamcgraw hill, edition.
4. Fundamentals of digital logic & micro computer design , 5th edition, m. Rafiquzzaman john wiley

E-Resources:

1. https://nptel.ac.in/courses/106/105/106105185/
2. https://www.coursera.org/learn/digital-systems

Course Outcomes:

Students will be able to

1. **Manipulate** numeric information in different forms, e.g. different bases, signed integers, various codes such as ASCII, gray, and BCD.
2. **Build** Boolean expressions using the theorems and postulates of Boolean algebra and to minimize combinational functions.
3. **Design** and analyze small combinational circuits and to use standard combinational functions/building blocks to build larger more complex circuits.
4. **Analyze** small sequential circuits and devices and to use standard sequential functions/building blocks to build larger more complex circuits.
5. **Construct** digital systems by Algorithmic State Machine Charts

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**											**Program Specific Outcomes***		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**3**	**2**	**1**									**2**	**2**	
CO2	**3**	**2**			**1**							**2**	**1**	**2**
CO3	**3**		**2**	**2**	**1**								**2**	**2**
CO4	**3**	**2**	**2**	**2**	**1**								**2**	
CO5	**2**	**2**	**2**	**1**	**1**									**2**
Average	**2.4**	**2**	**1.75**	**1.67**	**1**								**1.75**	**2**

<table>
<tr><td rowspan="1">AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech
III Year – I Sem</td></tr>
<tr><td>Course Code: J31OP</td><td rowspan="2">INTRODUCTION TO MINING TECHNOLOGY
(Open Elective-I)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course objectives:

1. To introduce the distribution of mineral deposits in India
2. To acquaint with different stages of mining process
3. To get idea about Drilling and its machinery
4. To get idea about Explosives and blasting in mines
5. To know about shaft sinking methods, precaution & lining during shaft sinking

Module 1

Unit - I: Introduction: Distribution of mineral deposits in India and other countries, mining contributions to civilization, mining terminology

Module 2

Unit - I: Stages in the life of the mine - prospecting, exploration, development, exploitation, and reclamation.

Unit - II: Access to mineral deposit- selection, location, size, and shape (incline, shaft and Adit), brief overview of underground and surface mining methods.

Module 3

Unit - I: Drilling: Types of drills, drilling methods, electric, pneumatic, and hydraulic drills, drill steels and bits, drilling rigs, and jumbos.

Module 4

Unit - I: Explosives: Classification, composition, properties and tests, fuses, detonators, blasting devices and accessories, substitutes for explosives, handling and storage, transportation of explosives.

Unit - II: Rock blasting: Mechanism of rock blasting, blasting procedure, and pattern of shot holes.

Module 5

Unit - I: Shaft sinking: Ordinary and special methods, problems, and precautions, shaft supports and lining.

Textbooks:

1. R. P. Pal, Rock blasting effect and operation, A. A. Balkema, 1st Ed, 2005.
2. D. J. Deshmukh, Elements of mining technology, Vol. 1, Central techno, 7th Ed, 2001.

Reference books:

1. C. P. Chugh, Drilling technology handbook, Oxford and IBH, 1st Ed, 1977.
2. R. D. Singh, Principles and practices of modern coal mining, New age international, 1st Ed, 1997.

E-resources:

1. https://www.cienciaviva.pt/img/upload/Introduction%20to%20mining.pdf
2. https://www.researchgate.net/publication/282572490_Basic_concept_of_mining_technology

Course outcomes:

The student will be able to:

1. **Learn** about distribution of mineral deposits in India
2. **Learn** about stages on mining process
3. **Learn** about drilling and its machinery
4. **Understand** about explosives, blasting and blasting mechanism
5. **Understand** about shaft sinking methods, precautions, and lining of shafts

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	1	-	-	-	-	-	-	-	-	-	-	-
CO5	3	1	2	-	-	-	-	-	-	-	-	-	-	-
Average	3	2	1.6	-	-	-	-	-	-	-	-	-	-	-

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech
III Year – I Sem</td></tr>
<tr><td>Course Code: J31OR</td><td rowspan="2">Numerical Solution of Ordinary Differential Equations
(Common to EEE,ECE, CSE, IT&ECM)
(Open Elective-I)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:
This course will enable students to:
1. To solve algebraic, transcendental equations and system of linear equation by various methods and find Eigen value by iteration method.
2. To Interpolate and approximate equal and unequal intervals by various formulae.
3. To discuss approximation of numerical differentiation and integration(single &double).
4. To solve Ordinary Differential Equations (ODEs) in Initial value Problems (IVPs) by various methods.
5. To solving ODEs & Partial Differential Equations (PDEs) in boundary value Problems(IVPs) by various methods

Module 1: Solution of Equations and Eigen value Problems
Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Matrix Inversion by Gauss Jordan method - Eigen values of a matrix by Power method.

Module 2 :Interpolation and Approximation
Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.

Module 3: Numerical Differentiation and Integration
Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's method - Two point and three point Gaussian quadrature formulae Evaluation of double integrals by Trapezoidal and Simpson's 1/3rules.

Module 4 : Initial Value Problems for Ordinary Differential Equations
Single Step methods - Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order equations - Multi step methods - Milne's and AdamsBash forth predictor corrector methods for solving first order equations**.**
Module 5 :Boundary Value Problems in Ordinary Differential Equations

Finite difference methods for solving two-point linear boundary value problems - Finite difference techniques for the solution of two dimensional Laplace's and Poisson's equations on rectangular domain – One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method**.**

Text Books:

1. "Higher Engineering Mathematics", B.S. Grewal ,Khanna Publications, 2017
2. "Numerical Methods for Engineers", Chapra. S.C., and Canale.R.P., Tata McGraw Hill, 5 th Edition, New Delhi,2007.

Reference Books:

1. "Advanced Engineering Mathematics", R.K.Jain& S.R.K. Iyengar, Narosa Publications, 5th Edition, 2015.
2. "Higher Engineering Mathematics", Ramana B.V., Tata McGraw Hill New Delhi,11thReprint, 2010

E - Resources:

1. http://www.brainkart.com/article/Solution-of-Equations-and-Eigenvalue-Problems_6462/
2. http://www.cs.nthu.edu.tw/~cchen/CS3331/ch6.pdf
3. http://www.vbspu.ac.in/wp-content/uploads/2016/02/Differentiation-and-Integration.pdf
4. https://link.springer.com/chapter/10.1007/978-1-4612-6390-6_4
5. http://ramanujan.math.trinity.edu/wtrench/texts/TRENCH_FREE_DIFFEQ_II.PDF

Course Outcomes:

On completion of the course, the students will be able to:

1. **understand** the basic knowledge on solution of Eigenvalues
2. **use** interpolation and approximation to solve engineering problems.
3. **discuss** the numerical differentiation and integration.
4. **apply** initial value problems for solving first order differential equation.
5. **apply** the boundary value problems in ordinary and partial differential equations.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	2	3	-	-	-	-	-	-	-	2	-	-
CO2	3	3	2	3	-	-	-	-	-	-	-	2	-	-
CO3	3	3	2	3	-	-	-	-	-	-	-	2	-	-
CO4	3	3	2	3	-	-	-	-	-	-	-	2	-	-
CO5	3	3	2	3	-	-	-	-	-	-	-	2	-	-
Average	3	3	2	3	-	-	-	-	-	-	-	2	-	-

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="1">J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B.Tech
III Year – I Sem</td></tr>
<tr><td>Course Code:
J31OR</td><td rowspan="2">Number Theory & Cryptography
(Common to CE, EEE, ME, ECE, CSE, IT, ECM& MIE)
(Open Elective-I)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:

This course will enable students to:

1. The basic definitions and theorems in number theory
2. The concept of a congruence and use various results related to congruence's including the Chinese Remainder Theorem
3. Number theory algorithms and procedures to basic problems.
4. The fundamentals of Cryptography how number theory is related to and used in cryptograph

Module 1 :Divisibility Theory And Canonical Decompositions

Division algorithm – Base – b representations – Number patterns – Prime and composite numbers – GCD – Euclidean algorithm – Fundamental theorem of arithmetic – LCM.

Module 2 :Diophantine Equations And Congruence's

Linear Diophantine equations – Congruence‘s – Linear Congruence‘s – Applications: Divisibility tests – Modular exponentiation-Chinese remainder theorem – 2 x 2 linear systems.

Module 3: Classical Theorems And Multiplicative Functions :

Wilson‘s theorem – Fermat‘s little theorem – Euler‘s theorem – Euler‘s Phifunctions**.**

Module 4: Classical Encryption Techniques

Classical encryption techniques: Symmetric chipper model – Substitution techniques – Transposition techniques – Steganography.

Module 5: Block Chippers and Public Key Encryption

Block chipper principles – block chipper modes and operations – advanced encryption standards (AES) – Public key cryptography – Principles of public key cryptosystem – The RSA algorithm – Elliptic curve arithmetic – Elliptic curve cryptosystem.

Text Books:

1. "Course on Number Theory and Cryptography", Koblitz, N. Springer Verlag, 1986
2. "Handbook of Applied Cryptography", Menezes, A, et.al. CRC Press,1996

Reference Books:

1. "An Introduction to the Theoryof Numbers", Ivan Niven, Herbert S. Zukerman, Hugh L. Montgomery.

E - Resources:

1. https://people.maths.bris.ac.uk/~mazag/nt/lecture1.pdf
2. https://www.diva-portal.org/smash/get/diva2:530204/FULLTEXT01.pdf
3. https://en.wikipedia.org/wiki/Multiplicative_function
4. https://www.slideshare.net/PrachiGulihar/elementary-cryptography
5. https://en.wikipedia.org/wiki/Public-key_cryptography

Course Outcomes:

On completion of the course, the students will be able to:

1. **Ability** to think and reason about abstract mathematics
2. **Analyze** the vulnerabilities in any computing system and hence be able to design a security solution
3. **Evaluate** security mechanisms using rigorous approaches, including theoretical
4. **Solve** problems in elementary number theory
5. **Apply** elementary number theory to cryptograpy

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	3	3	-	-	-	-	-	-	-	2	-	-
CO2	3	2	3	3	-	-	-	-	-	-	-	2	-	-
CO3	3	2	3	3	-	-	-	-	-	-	-	2	-	-
CO4	3	2	3	3	-	-	-	-	-	-	-	2	-	-
CO5	3	2	3	3	-	-	-	-	-	-	-	2	-	-
Average	3	2	3	3	-	-	-	-	-	-	-	2	-	-

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="4">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech
III Year – I Sem</td></tr>
<tr><td>Course Code: J31OS</td><td rowspan="2" colspan="4">NANOMATERIALS
(Common to CE, EEE, ME, ECE, CSE, IT& MIE)
(Open Elective-I)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:

This course will enable students to:

1. To familiarize about the various properties of nanostructures.
2. Utilizing the different physical and chemical methods in preparing nanomaterials.
3. Provide different methods of synthesis of Nano materials.
4. Bring out the distinct Quantum Structure properties of nanostructures.
5. Find out the particle size of a crystal by XRD technique.

Module 1: Introduction to Nanomaterials

Introduction to nanotechnology and materials, Nano materials, Introduction to nano sizes and properties comparison with the bulk materials, Different Shapes and Sizes and Morphology.Classification of nanomaterials.Fullerene, carbon, Nanotubes (CNT's), Nanoparticles.Physical, Chemical,Electrical, Optical, Magnetic and mechanical properties of nanomaterials.

Module 2:

Unit-1: Physical Methods: Bottom-up approach and Top-down approach, Inert gas condensation, Arc Discharge, lasers ablation, laser pyrolysis, ball milling, and electro deposition.

Unit - 2: Chemical Methods: Nanocrystals by chemical reduction, photochemical synthesis, electrochemical synthesis, Nano crystals of semiconductors.

Module 3: Synthesis of Nanomaterials

Thermolysis route – spray pyrolysis and solved metal atom dispersion, sol-gel method solvothermal and hydrothermal routes, solution combustion synthesis, CVD method, PVD method.

Module 4: Properties of Nanomaterials

Quantum Structure: 3D-Pontential Wells (Spherical & Rectangular Parallelepiped), 2D (Circular & Square, Quantum Corrals), 1D (Quantum Wires), 0D (Quantum Dots).

Module-5: X-RAY Characterization techniques

X-Ray Photoelectron Spectroscopy (XPS), Energy Dispersive X-Ray Analysis (EDAX), Principles and applications of X-Ray Diffraction, Electron Diffraction, and Electron probe microanalysis(EPMA), SEM and TEM method.

Text Books:

1. "The chemistry of Nano materials: Synthesis, Properties and Applications", C N R Rao, A Muller and A K Cheetham , John Wiley, First Edition, 2004
2. "Nano structured Materials and Nanotechnology", Hari Singh Nalwa, Academic Press, First Edition, 2002.

Reference Books:

1. "Introduction to Nanotechnology", Charles P Poole Jr, John Willey & Sons, 1st Edition, 2003
2. Nanoscience: "Nanotechnologies and Nano physics", C Dupas, P Houdy, M Lahmani, Springer-Verlag Berlin Heidelberg, 1st Edition, 2007.

E - Resources:

1. http://nptel.ac.in/courses/103103033/module9/lecture1.pdf
   http://courses.washington.edu/overney/NME498_Material/NME498_Periods/Lect Lect ure4-Overney- NP-Synthesis.pdf.
3. http://www.materialstoday.com/nanomaterials/journals/
4. https://www.journals.elsevier.com/nanoimpact
5. http://www.springer.com/materials/nanotechnology/journal/12274
6. http://nptel.ac.in/courses/118104008/
7. http://nptel.ac.in/courses/118102003/

Course Outcomes:

On completion of the course, the students will be able to:

1. **Understand** the properties of Nano-structured materials.
2. **Get** the knowledge of different physical and chemical methods of synthesis of Nano materials.
3. **Develop** basic knowledge on the properties and applications of few nanomaterials.
4. **Understand** different thermal methods of synthesis of nano materials and to learn different surface characterization techniques.
5. **Acquire** the different compositional and structural characterization techniques.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	1	-	-	-	-	-	-	-	-	-	-	1	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO4	3	2	2	-	2	-	-	-	-	-	-	-	1	-
CO5	3	2	2	-	2	-	-	-	-	-	-	-	1	-
Average	2.6	1.4	2	-	2	-	-	-	-	-	-	--	1	-

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="1">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech
III Year – I Sem</td></tr>
<tr><td>Course Code: J31OT</td><td rowspan="2">Chemistry of Engineering Materials
(Common to CE, EEE, ME, ECE, CSE, IT& MIE)
(Open Elective-I)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:
This course will enable students to
1. Learn the concept of phase rule and alloys, phase diagrams of different systems.
2. Gain the knowledge on abrasives, glass, ceramics, and adhesives.
3. Understand the basic concepts of chemistry to develop futuristic materials for high-tech. applications in the area of engineering.
4. Know the concepts of glass, ceramics and Refractories.
5. Analyze the different types of solutions.

Module 1: Phase Rule and alloys:
Phase Rule: Definition of terms: Phase, component, degree of freedom, phase rule equation. Phase diagrams-one component system-water system. Two component system Lead-Silver, cooling curves, heat treatment based on iron-carbon phase diagram - hardening, annealing and normalization. Introduction to alloys-fabrication of alloys-ferrous alloys-nonferrous alloys-industrial applications.

Module 2: Composites, Abrasives and Adhesives:
Composites: Basics of composites, composition and characteristics-types of composites – particle and fiber reinforced composites and their applications. Abrasives- natural and artificial abrasives-grinding wheels-abrasive paper and cloth. Adhesives- classification - action of adhesives- factors influencing adhesive action development of adhesive strength.

Module 3: Cement and Concrete:
Introduction-Classification of cement-natural-chemical composition of cement-Portland cement-chemical reactions involved in setting and hardening of cement-additives for cement-mortars and concretes-pre stressed concrete-post tensioning-curing-overall scenario of cement industry-Reinforced concrete, constructions-testing and decaying of cement-prevention of cement decay.

Module 4: Glass, Ceramics and Refractories:
Structure of glass-properties-Manufacturing of glass-Types of glasses-uses Ceramics-clays-methods for fabrication of ceramic ware plasticity of clays.Ceramic products-glazes. Porcelain and vitreous enamels. Requisites of a good refractory-classification, properties and applications of refractories.

Module-5: Colloids and surfactants:
Introduction to solution-types of colloids-characteristics of lyophilic and lyophobic solutions-preparation of colloids (Dispersion methods & Aggregation methods)-purification of colloids (Dialysis, Electro dialysis and Ultrafiltration).Characteristics of colloidal solutions-coagulation of colloids-origin of charge on colloids-protective colloids-emulsions-gels-applications of colloids. Introduction to surfactants-classification of surfactants-CMC (critical micelle concentration)-HLB scale-detergents-cleaning action.

Text Books:

1. "A text Book of Engineering Chemistry", P.C.Jain and Monica Jain, DhanpatRai Publications, New Delhi, 12th Edition 2006.
2. "Text Book of Engineering chemistry", B.Rama Devi, Ch.VenkataRamana Reddy and PrasanthaRath, Cengage Learning India Pvt. Ltd, 2016.
3. "Colloids and Interfaces with Surfactants and Polymers", J. Goodwin, 2nd Edition 2009.

Reference Books:

1. "Principles of Physical Chemistry", B.R.Puri, L.R.SharmaandM.S.Pathania, S.Nagin Chand &Co., New Delhi, 23rd Edition, 1993.
2. "Engineering Chemistry",M.ThirumalaChary and E.Laxminarayana, SciTech publications(INDIA) PVT Ltd, Third Edition,2016

E - Resources:

1. https://www.acs.org/content/acs/en/careers/college-to-career/chemistry-careers/materials-science.html
2. https://www.sciencedirect.com/science/article/pii/S1369702110701875
3. https://engineering.purdue.edu/MSE/aboutus/whatsmaterials
4. https://www.engineergirl.org/32721/Difference-between-chemical-and-materials-engineering
5. https://www.webpages.uidaho.edu/catalog/2013/chemical-and-materials-engineering.htm

Course Outcomes:
On completion of the course, the students will be able to:

1. **Interpret** the vitality of phase rule in metallurgy and application of phase rule to one and two component systems.
2. **Understand** the concepts of abrasives, adhesives and liquid.
3. **Know** the importance of basic constructional material, Portland cement in Civil Engineering works.
4. **Acquire** the knowledge about properties and applications of glass, ceramics and refractories.
5. **Understand** the relationships between macroscopic material properties and microscopic structures.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	-	2	1	-	-	-	-	-	-	-	2	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	2	-	-
CO3	2	-	-	-	2	-	-	-	-	-	-	2	-	-
CO4	3	1	1	-	-	-	-	-	-	-	-	1	-	-
CO5	2	2	-	-	1	-	-	-	-	-	-	2	-	-
Average	2.4	1.4	1	1	-	-	-	-	-	-	-	1.8	-	-

<table>
<tr><td>AY 2020-21
onwards</td><td colspan="1">J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B.Tech
III Year – I Sem</td></tr>
<tr><td>Course Code:
J31OU</td><td rowspan="2">TECHNICAL COMMUNICATION SKILLS
(COMMON TO ALL)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-Requisites: Nil

Course Objectives:

The students will

1. Understand the role of language as a communication
2. Employ the role of presentation skills in public speaking
3. Know the importance of body language
4. Examine the role of group discussion for getting jobs
5. Understand the importance of interview skills for getting jobs

Module -I Language as a Communication

Introduction-definition-the process of communication-types of communication-barriers of communication; language and communication-properties of language.

Module -II Presentation Skills

Nature and importance of oral presentation-planning the presentation-preparing the presentation-organizing the presentation-rehearsing the presentation and checklist for making oral presentation

Module -III Body Language

Introduction-definition-eye contact- facial expressions-gesture and posture.

Module -IV Group Discussion

Nature of GD- Characteristics and Strategies of GD-Techniques for Individual Contribution-Group Interaction Strategies.

Module -V Interview Skills

The Interview Process-Characteristics of Interview-Pre-interview preparation Techniques-interview questions-FAQ- Projecting a Positive Image and Alternative Interview Format.

References:

1) Raman, Meenakshi and Sangeeta Sharma. Technical Communication-Principles and Practice. Third Edition, New Delhi: UP., 2015.
2) Rizvi, M Ashraf. Effective Technical-Communication. New Delhi: Tata McGraw-Hill., 2005.

E-Resources:

1. https://www.ilstranslations.com/blog/language-vs-communication-theyre-not-the-same-thing/#:~:text=Language%20is%20a%20system%20of,is%20a%20tool%20of%20communication.

Course outcomes:

The students will be able to

2. Use the language skills in order to better communication
3. Learn the presentation skills and use them in conferences and seminars
4. Identify the role of presentation skills in expressing our feelings and emotions
5. Understand the role of group discussion for getting jobs
6. Know the importance of interview skills for getting jobs

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO2	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO3	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO4	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO5	-	-	-	-	-	-	-	-	2	3	-	3	-	-
Total	-	-	-	-	-	-	-	-	2	3	-	3	-	-

<table>
<tr><td>AY 2020-21
Onwards</td><td colspan="4">J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B.Tech
III Year – I Sem</td></tr>
<tr><td>Course Code:
J31OV</td><td colspan="4" rowspan="2">ENTREPRENEURSHIP
(Open Elective - I)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-Requisites: Nil

Course Objective:

The students will

1. To implore an understanding of the dimensions and traits required to become an entrepreneur.
2. To understand the Entrepreneurial process and also inspire them to be Entrepreneurs
3. To understand the Entrepreneurship and its role in the society
4. To understand the process of Entrepreneurship & preparing business plans
5. To gain knowledge about the Entrepreneurship Development Institutions of Government

Module 1:

UNIT - I:

Understanding Entrepreneurial Mindset- The revolution impact of entrepreneurship- Theevolution of entrepreneurship - Functions of Entrepreneurs – types of entrepreneurs.

UNIT - II:

Approaches to entrepreneurship- Process approach- Role of entrepreneurship in economic development- Twenty first century trends in entrepreneurship.

Module 2:

UNIT - I:

The individual entrepreneurial mind-set and Personality- The entrepreneurial journey- Stress and the entrepreneur - the entrepreneurial ego - Entrepreneurial motivations- Motivational cycle – Entrepreneurial motivational behavior – Entrepreneurial competencies.

UNIT - II:

Corporate Entrepreneurial Mindset, the nature of corporate entrepreneur- conceptualization of corporate entrepreneurship Strategy-sustaining corporate entrepreneurship.

Module 3:

UNIT - I:

Launching Entrepreneurial Ventures - opportunities identification- Finding gaps in themarket place – techniques for generating ideas- entrepreneurial Imagination and Creativity- the nature of the creativity process - Innovation and entrepreneurship.

UNIT - II:

Methods to initiate Ventures- Creating new ventures-Acquiring an Established entrepreneurial venture- Franchising- advantage and disadvantages of Franchising.

Module 4:

UNIT - I:

Legal challenges of Entrepreneurship - Intellectual property protection - Patents,Copyrights - Trademarks and Trade secrets - Avoiding trademark pitfalls
Feasibility Analysis - Industry and competitor analysis –

UNIT - II:

Formulation of the entrepreneurial Plan- The challenges of new venture start-ups, developing an effective business model – Sources of finance - Critical factors for new venture development - The Evaluation process.

Module 5:

UNIT - I:

Strategic perspectives in entrepreneurship - Strategic planning - Strategic actions-strategic positioning- Business stabilization - Building the adaptive firms - Understanding the growth stage – Internal growth strategies and external growth strategies, Unique managerial concern of growing ventures.

UNIT - II:

Initiatives by the Government of India to promote entrepreneurship, Social and women entrepreneurship -T-hub, J-hub

Text Books:

1. D F Kuratko and T V Rao, Entrepreneurship- A South-Asian Perspective, Cengage Learning, 2012.
2. Bruce R. Barringer/ R. Duane Ireland, Entrepreneurship Successfully launching new ventures, 4e, Pearson, 2015
3. S. S.Khanka, Entrepreneurship Development, S. Chand Publications, 2015. Stuart Read, Effectual Entrepreneurship, Routledge, 2013.

Reference Books:

1. Rajeev Roy, Entrepreneurship, 2e, Oxford publications, 2012
2. Nandan .H, Fundamentals of Entrepreneurship, PHI, 2013
3. MadhurimaLalShikhaSahai – Entrepreneurship, Excel Books.
4. S.K Mohanthy, Fundamentals of Entrepreneurship, Prentice Hall of India, New Delhi.

E-Resources:

1. Entrepreneur.com
2. BusinessOwnersToolKit.com
3. YourStory.com
4. ASmartBear.com

Course outcomes:

Upon successful completion of the course, the students should be able to

1. Understand the need and significance of Entrepreneurship in the Economy
2. Develop Entrepreneurial Competencies

3. Develop Business Plan with the required contents.
4. Understand contribution of family business and Social Entrepreneurship in the Economy.
5. Plan Strategic perspectives in entrepreneurship

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO2	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO3	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO4	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO5	-	-	-	-	-	-	-	-	2	3	-	3	-	-
Total	-	-	-	-	-	-	-	-	2	3	-	3	-	-

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="1">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech III Year – II Sem</td></tr>
<tr><td>Course Code: J32OA</td><td rowspan="2">CONSTRUCTION MANAGEMENT, CONTRACTS AND VALUATION
(Open Elective-II)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits:3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Construction Technology and Project Management, Estimation and Costing.

Course Objectives:

This course will enable students to:

1. Study the different tools and techniques for project management.
2. Explain the various types of organization and their impact on and suitability to construction projects.
3. Study the various safety concepts and requirements applied to construction industry.
4. Differentiate the different types of contracts.
5. Study purpose of valuation and types of valuation.

Module 1:

Unit 1: Concept of a Project

Characteristic features – Project Life cycle – Phases – Project Management – tools and techniques for project management – role of project managers.

Module 2:

Unit 1: Project Management Plan and Objectives

Programming – scheduling – project organization – organization and project team – role of communication in project management – controlling systems.

Module 3:

Unit 1: Safety Management Function

Importance of safety in construction industry, Line versus staff authority, Safety responsibility and accountability in construction industry, Safety organizations, Role of various parties, duties, responsibilities of top management, site managers, supervisors etc., Role of safety officers, Responsibilities of general employees, Safety administration.

Module 4:

Unit 1: Types of contract documents

Essentials of contract agreement – legal aspects, penal provisions on breach of contract. Definition of the terms – Tender, earnest money deposit, security deposit, tender forms, documents, and types. Acceptance of contract documents. Termination of contract, completion certificate, quality control, right of contractor, refund of deposit. Administrative approval – Technical sanction. Nominal muster roll, measurement books – procedure for recording and checking measurements – preparation of bills.

Module 5:

Unit 1: Valuation

Types of value, purposes of valuation factors affecting value. Different methods of valuation for different types of assets such as land and building, horticulture, historical places. Valuation Report, contents, standard formats, Case study of any one Report.

Text Books:

1. "Construction Technology" by Subira K. Sarkar, SubhajitSaraswathi / Oxford University Press, 3rd edition, Apr 2009.
2. "Project management- strategic Financial Planning, Evaluation and Control" by B M Patel, Vikas Publishing House Pvt. Ltd. New Delhi, 2nd edition oct 2000.

Reference Books:

1. "Total Construction Project Management" by George J.Ritz , McGraw-Hill Inc, 2nd edition Jan 2013.
2. "Construction Project Management Planning, Scheduling and Control" by K KChitkara

E-Resources:

1. https://nptel.ac.in/courses/105/103/105103093/
2. https://nptel.ac.in/courses/105/103/105103023/

Course Outcomes:

On completion of the course, the students will be able to:

1. **Describe** the different approaches for successful handling of the project.
2. **Apply** different plans and schedules for the development of the project.
3. **Describe** the importance of safety management in construction industry.
4. **List** out the different tenders and contract document for a construction project.
5. **Evaluate** the different types of reports for different construction projects.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	1	-	-	2	1	-	-	2	-	3	1	1	-
CO2	2	1	2	-	-	-	-	-	-	-	2	2	2	-
CO3	2	1	-	-	-	3	-	-	-	-	-	1	1	-
CO4	2	1	-	-	-	2	-	-	-	-	3	-	1	-
CO5	2	2	-	-	-	-	-	-	-	-	2	-	1	-
Average	2	1.4	0.4	-	0.4	1.2	-	-	0.4	-	2	0.8	1.4	-

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech III Year – II Sem</td></tr>
<tr><td>Course Code: J32OB</td><td rowspan="2">ENERGY AUDIT & GREEN BUILDINGS
(Open Elective-II)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits:3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:
This course will enable students to:
1. Study the various energy scenarios and energy auditing methodology.
2. Explain various renewable and non-renewable sources of energy.
3. Describe the best green building practices adopted along with cost/benefit and life-cycle analysis of green buildings.
4. Explain the efficient use of waste materials in construction industry
5. Create awareness about the principles of green building technology and to have insight about the criteria for rating systems.

Module 1:
Unit 1: Energy Scenarios:
Energy Conservation-Energy Audit-Energy Consumption-Energy Security-Energy Strategy-Clean Development Mechanism.
Unit 2: Types of Energy Audits and Energy-Audit Methodology:
Definition of Energy Audit-Place of Audit-Energy- Audit Methodology-Financial Analysis-Sensitivity Analysis-Project Financing Options-Energy Monitoring and Training.

Module 2:
Unit 1: Environmental Audit:
Environmental Audit; Introduction-Necessity-Norms. Types: Objectives-Bases types; Liabilities Audit-Management Audit-Activities Audit-Client drive and types; regulatory external audits-independent external audit-internal environmental audit-third party audit.
Unit 2: Environmental Impact Assessment:
Introduction-EIA regulations-Steps in Environmental impact assessment process-benefits of EIA-limitations of EIA-Environmental Clearance for Civil Engineering Projects.

Module 3:
Unit 1: Energy Sources:
Renewable and Non-renewable sources of energy - Coal, Petroleum, Nuclear, Wind, Solar, Hydro, Geothermal sources, potential of these sources, hazards.
Unit 2: Energy Conservation:
Introduction-Specific objectives-need of energy conservation-LEED India rating system and Energy Efficiency.

Module 4:

Unit 1: Green Building:

Introduction-Definition-Benefits-Principles; Planning concept of Green Building-Salient features of Green Building-Environmental Design-Strategies for Building Construction-Process; Improvement in Environmental Quality in Civil Structure. Materials; Bamboo, Rice Husk Ash, Concrete, Plastic Bricks-Reuse of waste materials- Plastic, Rubber, News Paper, Wood, Non-Toxic paint, Green roofing.

Module 5:

Unit 1: Rating system for Green Building:

Leadership in Energy and Environmental Design (LEED) Criteria-Indian Green Building Council (IGBC) Green Rating-Green Rating for Integrated Habitat Assessment (GRIHA) criteria-HVAC unit in Green Building-Certification Programs (including GEM and ECBC Certifications).

Text Books:

1. "Sustainable construction: Green Building design and delivery" by Kibert, C.J(John Wiley Hoboken, New Jersey).
2. "Non-Conventional Energy resources" by Chauhan, D S Sreevasthava, S K (New Age International Publishers, New Delhi).
3. "Alternative Building Materials and Technologies" by Jagadeesh, K S, Reddy Venkatta Rama, NanjundaRao K S (New Age International Publishers, New Delhi).
4. "Green Buildings" by Gevorkian (McGraw hill publication).

Reference Books:

1. "Handbook of Green Building Design and Construction" by Sam Kubba (Butterworth-Heinemann).
2. Emerald Architecture: case studies in green buildings, The Magazine of Sustainable Design.
3. Energy Conservation Building Code 2017.

E-Resources:

1. https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-ce06
2. https://nptel.ac.in/noc/courses/noc19/SEM2/noc19-ce40

Course Outcomes:

On completion of the course, the students will be able to:

1. **Differentiate** and select best of various energy scenarios and energy auditing methodology.
2. **Identify** various Renewable and Non-renewable sources of energy.
3. **Justify** others to use the waste materials efficiently and effectively.
4. **Explain** the application of design guidelines of Green Building considering the Energy Conservation Measures.

5. **Discuss** the building codes, relevant legislation governing the consumption of resources.

CO-PO/PSO Mapping Chart (Draft) **(3/2/1 indicates strength of correlation)** **3 – Strong; 2 – Medium; 1 - Weak**														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	1	2	1	1	-	1	2	-	-	-	-	-	1	1
CO2	1	2	1	1	-	2	2	-	-	-	-	-	1	-
CO3	2	1	2	1	-	1	2	-	-	-	-	-	-	1
CO4	1	1	1	1	-	2	2	-	-	-	-	-	1	1
CO5	-	1	1	1	-	1	2	-	-	-	-	-	1	-
Average	1	1.4	1.2	1	-	1.4	2	-	-	-	-	-	0.8	0.6

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="1">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech
III Year – II Sem</td></tr>
<tr><td>Course Code: J32OC</td><td rowspan="2">HYBRID ELECTRIC VEHICLES
(Open Elective-II)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:

This course will enable students to:

1. Understand working of different configurations of electric vehicles, and its components
2. Understand hybrid vehicle configuration and performance analysis.
3. Introduce the transmission configuration and its analyze the characteristics
4. Analyze the different speed control techniques
5. Design and evaluate the sizing of components in hybrid vehicles.

MODULE -I: History of hybrid and electric vehicles – social and environmental importance of hybrid and electric vehicles – impact of modern drive-trains on energy supplies – Basics of vehicle performance, vehicle power source characterization transmission characteristics – Mathematical models to describe vehicle performance.

MODULE -II: Basic concept of hybrid traction – Introduction to various hybrid drive train topologies – power flow control in hybrid drive – train topologies-Fuel efficiency analysis.

MODULE -III: Introduction to electric components used in hybrid and electric vehicles-Configuration and control of DC motor drives-Configuration and control of introduction motor drive configuration and control of permanent magnet motor drives configuration and control of switch reluctance- motor drives, drive system efficiency.

MODULE -IV: Matching the electric machine and the internal combustion engine (ICE) Sizing the propulsion-motor, sizing the power electronics selection the energy storage technology – Communications, supporting subsystems.

MODULE -V: Introduction to energy management and their strategies used in hybrid and electric vehicle-Classification of different energy management strategies comparison of different energy management strategies implementation issues of energy strategies.

TEXT BOOKS:

1. Iqbal Husain, "Electric and Hybrid Electric Vehicles", CRC Press, 2011.
2. Wei Liu, "Hybrid Electric Vehicle System Modeling and Control", Second Edition, WILEY, 2017.
3. Sira – Raminez ,R.SilvaOrtigoza, control Design techniques in power electronics Devices, Springer.
4. Siew – Chong tan, Yuk-Ming lai Chi Kong Tse, “Sliding mode control of switching

power Converters”.

REFERENCE BOOKS:

1. James Larminie and John Lowry, "Electric Vehicle Technology Explained", Second Edition 2012.
2. Christopher D Rahn, Chao-Yang Wang, "Battery Systems Engineering", Wiley, 2013.

E - Resources:

1. https://nptel.ac.in/courses/108/103/108103009/

Course Outcomes:

The students will be able to

1. **Understand** the working of different configurations of electric vehicles, hybrid vehicles and its components.
2. **Apply**the basic conceptsofbatteriesandMotorsinthedesignofElectricandHybrid Vehicles.
3. **Differentiate** the modes of operation of Hybrid Vehicles.
4. **Analyze** the performance of hybrid vehicles.
5. **Design** the basic parameters of Electric and Hybrid Electric Vehicles.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3		2	-	-	-	2	-	-	-	-	-	3	2
CO2	3	2	3	2	-	-	2	-	-	-	-	-	2	2
CO3	3	2	3	-	-	-	-	-	-	-	-	2	2	2
CO4	2	3	2	-	-	-	-	-	-	-	-	2	3	3
CO5	2	3	3	-	-	-		2	-	-	-		2	2
Average	2.6	2.5	2.6	-	-	-	2	2	-	-	-	2	2.4	2..2

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="1">J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B.Tech
III Year – II Sem</td></tr>
<tr><td>Course Code: J32OD</td><td rowspan="2">ENERGY AUDITING CONSERVATION AND MANAGEMENTS
(Open Elective-II)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:
The students will

1. To understand the need of Energy Audit and Energy Conservation Schemes.
2. To know the necessity of conservation of energy.
3. To generalize the methods of energy management.
4. To illustrate the factors to increase the efficiency of electrical equipment.
5. To detect the benefits of carrying out energy audits.

MODULE -I: Basic Principles of Energy Audit: Energy Audit-
Unit-I: Definitions, Concept, Types of audit, Energy index, Cost index, Pie charts, Sankey diagrams.
Unit-II: Load profiles, Energy conservation schemes- Energy audit of industries- Energy saving potential, Building energy audit.

MODULE -II: Energy Management
Principles of energy management, organizing energy management program, Initiating, Planning, Controlling, Promoting, Monitoring, Reporting, Energy manger, Qualities and functions, Language, Questionnaire – Check list for top management.

MODULE -III: Energy Efficient Motors
Energy efficient motors, Factors affecting efficiency, Loss distribution, Constructional details, Characteristics - Variable speed, Variable duty cycle systems, RMS HP- Voltage variation-Voltage unbalance- Over motoring- Motor energy audit.

MODULE -IV: Power Factor Improvement, Lighting and Energy Instruments
Unit-I: Power factor – Methods of improvement, Location of capacitors, Pf with non-linear loads, Effect of harmonics on power factor.
Unit-II: Power factor motor controllers - Good lighting system design and practice, Lighting control , Lighting energy audit - Energy instruments- Wattmeter, Data loggers, Thermocouples, Pyrometers, Lux meters, Tongue testers ,Application of PLC's.

MODULE -V: Economic Aspects and Analysis
Economics analysis-Depreciation methods, Time value of money, Rate of return, Present worth method, Replacement analysis, Life cycle costing analysis- Energy efficient motors-Calculation of simple payback method, Net present worth method- Power factor correction, Lighting -Applications of life cycle costing analysis, Return on investment.

TEXT BOOKS

1. W.R. Murphy & G. Mckay, “Energy Management”, Butter worth, Heinemann Publications, Second Edition, 2009.
2. Paul o’ Callaghan, “Energy Management”, Tata Mc-Graw Hill Book Company- First Edition, 1998.
3. W.C.Turner, “Energy Management Hand Book”, CRC Press, First Edition, 2004.

REFERENCE BOOKS

1. John .C. Andreas, “Energy Efficient Electric Motors”, CRC Press, Third Edition, 1992.
2. Great Britain, “Energy Management and Good Lighting Practice: Fuel Efficiency- Booklet Volume 12-EEO, 1989.

E-Resources:

1. www.beeindia.gov.in

Course Outcomes:

On completion of the course, the students will be able to:

1. **Tell** energy audit of industries.
2. **Predict** management of energy systems.
3. **Sequence** the methods of improving efficiency of electric motor.
4. **Analyze** the power factor and to design a good illumination system.
5. **Determine** pay back periods for energy saving equipment.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	-	-	-	-	3	3	-	3	-	-	2	-	-
CO2		-	-	-	-	2	2	-	3	-	3	3	3	-
CO3	2	-	-	-	-	-	2	-	2	-	3		2	-
CO4	3	-	-	-	-	-	3	-		-	2	2	2	-
CO5	3	-	-	-	-	-	-	-	2	-	2	3	3	-
Average	2.2	-	-	-	-	1.2	2	-	2	-	2	2	2	-

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="1">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech
III Year – II Sem</td></tr>
<tr><td>Course Code: J32OE</td><td rowspan="2">FUNDAMENTALS OF OPERATIONS RESEARCH
(Open Elective-II)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Mathematics

Course Objectives:
This course will enable students to
1. Get the basic knowledge of Linear Programming and its applications to engineering problems and able to formulate a problem in LP model, and solve it using graphical method and Simplex method.
2. Be taught about the variants of the LP problem such as Transportation, Assignment, and Sequencing problems
3. Learn to find the optimal replacement time of capital cost equipment, and application of Group Replacement strategy
4. Learn the importance of maintaining optimal inventory in any industry, and be familiarized with the intricacies of waiting line models faced in real world situations
5. Understand the basics of Network analysis (CPM and PERT) and Project Cost Analysis; Learn Simulation and its applications.

Module 1
Unit 1: Introduction: Development – Definition – Scope, Characteristics and Phases – Types of Operations Research models – applications.
Unit 2: Allocation: Linear Programming Problem - Formulation – Graphical solution – Simplex method – Artificial variables techniques: Two–phase method, Big-M method; Duality Principle.

Module 2
Unit 1: Transportation Models: Formulation – Optimal solution, unbalanced transportation problem – Degeneracy
Unit 2: Assignment problem – Formulation – Optimal solution - Variants of Assignment Problem; Traveling Salesman problem.

Module 3
Unit 1: Sequencing: Introduction – Flow-Shop sequencing – ‘n’ jobs through two machines – ‘n’ jobs through three machines – Job-shop sequencing – two jobs through ‘m’ machines
Unit 2: Replacement: Introduction – Replacement of capital cost items that deteriorate with time – when money value is not counted and counted – Replacement of items that fail suddenly and completely- Group Replacement.

Module 4

Unit 1: Inventory: Introduction – Single item, Deterministic models – Types - Purchase inventory models with one price break and multiple price breaks – inventory models with and without shortage cost. Stochastic models – demand discrete variable or continuous variable – Single Period model with no setup cost.

Unit 2: Waiting lines: Introduction – Terminology - Single Channel – Poisson arrivals and Exponential Service times – with infinite population and finite population models.

Module 5

Unit 1: Network analysis (CPM and PERT): Basic Concepts of Network Analysis - Network diagram - Critical Path Method - Terminology in CPM 804 – Float – Limitations of CPM - PERT - Project Cost Analysis - Comparison between CPM and PERT.

Unit 2: Simulation: Definition – types of simulation models- applications, advantages and disadvantages - Brief introduction of simulation languages – simple problems on inventory and queuing using random numbers.

Text Books:

1. J. K. Sharma, “Operations Research”, MacMillan Publishers India Ltd, 4th Edition 2009.
2. A.C.S. Kumar, “Operations Research (Quantitative Analysis for Business Decisions)”, Yes Dee Publishers, 1st Edition, 2015.

Reference Books:

1. Maurice Saseini, ArhurYaspan, and Lawrence Friedman, “Operations Research: Methods and Problems”, Literary Licensing Publisher, 2013
2. A. M. Natarajan, P. BalaSubramani and A. Tamilarasi “Operations Research” Pearson Education, 4th Edition, 2009.
3. Wagner H. M, “Principles of Operations Research”, PHI Publications, 2nd Edition, 2006.
4. Hillier / Libermann “Introduction to Operations Research”, MacMillan Publishers, 10th Edition, 2017.

E - Resources:

1. https://rb.gy/1ckbxh
2. https://rb.gy/gev0g5
3. https://nptel.ac.in/courses/112/106/112106134/
4. https://nptel.ac.in/courses/111/107/111107128/

Course Outcomes:

On completion of the course, the students will be able to:

1. **Allocate** optimally the resources in any industry to maximize the overall effectiveness parameter, determine the number of each item to be produced

2. **Find** the optimal number of units to be transported such that the total transportation cost will be minimum, and Assign the required men / machines to perform the given tasks in an optimal way
3. **Schedule** and sequence production runs by proper allocation of machines and men to get maximum gain and Compute the economic order quantity. Find the optimal replacement period for capital cost items
4. **Decide** the optimal inventory to be maintained under different situations involving different types of demand and inventory costs, find how to strike a balance between the waiting time cost and service facility cost for different waiting line models
5. **Apply** the techniques of Network Analysis like CPM and Pert for Project Cost Analysis. Apply Simulation methods to inventory and queuing problems

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	3	2	-	-	2	-	-	-	-	-	2		
CO2	3	3	3	-	-	2	-	-	-	-	-	2		
CO3	2	3	2	-	-	1	-	-	-	-	-	2		
CO4	3	3	2	-	-	2	-	-	-	-	-	2		
CO5	2	3	1	-	-	1	-	-	-	-	-	2		
Average	2.4	3	2	-	-	1.6	-	-	-	-	-	2		

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="1">J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B. Tech:
III Year – II Sem</td></tr>
<tr><td>Course Code:J32OG</td><td rowspan="2">SOFTWARE DEFINED RADIO
(Open Elective-II)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Prerequisite: Digital Signal Processing, TCP / IP

Course Objectives:

The objectives of this course is

1. To provide fundamentals and state of the art concepts in software defined radio.
2. To Analyze the analog RF components as front end block in implementation of SDR.
3. To Visualize digital hardware architectures and development methods.
4. To Understand the radio recourse management in heterogeneous networks.
5. To Remember the object oriented representation of radio and network resources.

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Module -I:

Unit-1

Introduction: The Need for Software Radios, what is Software Radio, Characteristics and benefits of software radio- Design Principles of Software Radio, RF Implementation issues the Purpose of RF Front – End, Dynamic Range- The Principal Challenge of Receiver Design

Unit-2

RF Receiver Front- End Topologies- Enhanced Flexibility of the RF Chain with Software Radios- Importance of the Components to Overall Performance- Transmitter Architectures and Their Issues- Noise and Distortion in the RF Chain, ADC and DACDistortion.

Module -II:

Unit-1

Profile and Radio Resource Management: Communication Profiles- Introduction, Communication Profiles, Terminal Profile, Service Profile, Network Profile, User Profile, Communication Profile Architecture, Profile Data Structure

Unit-2

XML Structure, Distribution of Profile Data, Access to Profile Data, Management of Communication Profiles, CommunicationClass marks, Dynamic Class marks for Reconfigurable Terminals,Compression and Coding, Meta Profile Data

Module -III:

Unit-1

Radio Resource Management in Heterogeneous Networks: Introduction, Definition of Radio Resource Management, Radio Resource Units over RRM Phases, RRM Challenges andApproaches, RRM Modelling and Investigation Approaches, Investigations of JRRM in Heterogeneous Networks

Unit-2

Measuring Gain in the Upper Bound Due to JRRM, Circuit Switched System, Packet-Switched System, Functions and Principles of JRRM, General Architecture of JRRM, Detailed RRM Functions in Sub-Networks and Overall Systems

Module -IV:

Unit-1

Reconfiguration of the Network Elements: Introduction, Reconfiguration of Base Stations and Mobile Terminals, Abstract Modelling of Reconfigurable Devices, the Role of Local Intelligence in Reconfiguration, Performance Issues, Classification and Rating of Reconfigurable Hardware, Processing Elements, Connection Elements, Global Interconnect Networks, Hierarchical Interconnect Networks

Unit-2

Installing a New Configuration, Applying Reconfiguration Strategies, Reconfiguration Based on Comparison, Resource Recycling, Flexible Workload Management at the Physical Layer, Optimized Reconfiguration, Optimization Parameters and Algorithms, Optimization Algorithms, Specific Reconfiguration Requirements, Reconfiguring Base Stations, Reconfiguring Mobile Terminals

Module -V:

Unit-1

Object – Oriented Representation of Radios and Network Resources: Networks- Object-oriented Programming- Object Brokers- Mobile Application Environments- Joint Tactical Radio System.

Unit-2

Case Studies in Software Radio Design: Introduction and Historical Perspective, SPEAKeasy- JTRS, Wireless Information Transfer System, SDR-3000 Digital TransceiverSubsystem, Spectrum Ware, CHARIOT.

TEXT BOOKS:

1. Software Defined Radio Architecture System and Functions- Markus Dillinger, KambizMadani, WILEY 2003
2. Software Defined Radio: Enabling Technologies- Walter Tuttle Bee, 2002, WileyPublications.

REFERENCE BOOKS:

1. Software Radio: A Modern Approach to Radio Engineering - Jeffrey H. Reed, 2002, PEAPublication.
2. Software Defined Radio for 3G - Paul Burns, 2002, Artech House.
3. Software Defined Radio: Architectures, Systems and Functions - Markus Dillinger,KambizMadani, Nancy Alonistioti, 2003, Wiley.
4. Software Radio Architecture: Object Oriented Approaches to wireless System Engineering– Joseph Mitola, III, 2000, John Wiley & Sons.

Course Outcomes:

On completion of this course, the students:

1. **Understand** the design principles of software defined radio.
2. **Analyze** the analog RF components as front end block in implementation of SDR.
3. **Visualize** digital hardware architectures and development methods.
4. **Understand** the radio recourse management in heterogeneous networks.
5. **Remember** the object oriented representation of radio and network resources.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1	-	-	-	-	-	-	-	-	-	2	-	1
CO2	3	2	1	1	-	-	-	-	-	2	2	2	-	2
CO3	2	1	-	-	-	-	-	-	-	-	-	2	-	1
CO4	2	2	2	-	-	2	-	-	-	-	2	3	-	2
CO5	2	1	-	-	-	-	-	-	-	-	-	2	-	1
Average	2	1.4	0.6	0.2	-	0.4	-	-	-	0.4	0.8	2.2	-	1.4

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B.Tech: III Year – II Sem			
Course Code: J32OH	BASICS OF IC TECHNOLOGY (Open Elective-II)	L	T	P	D
Credits: 3		3	0	0	0

Pre-requisite: Electronic devices and circuits Switching Theory & Logic Design, Pulse & Digital Circuits

Course Objectives:

The students will

1. To introduce the basic building blocks of linear integrated circuits.
2. To teach the linear and non – linear applications of operational amplifiers.
3. To introduce the theory and applications of analog multipliers and PLL.
4. To introduce the concepts of waveform generation and introduce some special function ICs.
5. To understand and implement the working of basic digital circuits

MODULE 1:

Unit 1: Introduction to Linear Integrated Circuits

Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, Features of 741 Op-Amp, Modes of Operation - Inverting, Non-Inverting.

Unit 2: Non-Linear Applications of OP-AMP

Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Comparators, Schmitt Trigger, Introduction to Voltage Regulators, Features of 723 Regulator.

MODULE 2:

Unit 1: Introduction to Filters

Introduction to Active Filters, Characteristics of Band pass, Band reject and All Pass Filters

Unit 2: wave form generators

Waveform Generators – Triangular, Saw tooth, Square Wave, IC555 Timer -Functional Diagram, Monostable, and Astable Operations.

MODULE 3:

Unit 1: Converters of DAC

Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC

Unit 2: Converters of ADC

Different Types of ADCs – Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications.

MODULE 4:

Unit 1: Digital Integrated Circuits

Classification of Integrated Circuits, Comparison of Various Logic Families Combinational Logic ICs – Specifications.

Unit 2: Applications of Digital ICs

Code Converters, Decoders, Demultiplexers, LED & LCD Decoders with Drivers, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Priority Generators/Checkers.

MODULE 5:

Unit 1: Combinational Circuits Using TTL 74XX ICS

Familiarity with commonly available 74XX &CMOS 40XX Series ICs – All Types of Flip-flops, Synchronous Counters, Decade Counters.

Unit 2: Memories

Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

Textbooks:

1. Op-Amps & Linear ICs – Ramakanth A. Gayakwad, PHI, 2003.
2. Digital Fundamentals – Floyd and Jain, Pearson Education, 8th Edition, 2005

Reference Books:

1. Linear Integrated Circuits –D. Roy Chowdhury, New Age International (p) Ltd, 2ndEd., 2003.
2. Op Amps and Linear Integrated Circuits-Concepts and Applications James M. Fiore,Cengage Learning/ Jaico, 2009.
3. Operational Amplifiers with Linear Integrated Circuits by K. Lal Kishore – Pearson,2009.
4. Linear Integrated Circuits and Applications – Salivahanan, MC GRAW HILL EDUCATION.
5. Modern Digital Electronics – RP Jain – 4/e – MC GRAW HILL EDUCATION, 2010.

E - Resources:

1. http://fmcet.in/ECE/EC6404_uw.pdf
2. https://www.iare.ac.in/sites/default/files/lecture_notes/LDIC%20Lecture%20Notes.pdf.
3. http://smec.ac.in/sites/default/files/lecture_notes/Course%20File%20of%20LDIC(Linear%20 and%20Digital%20IC%20Applications).pdf
4. http://crectirupati.com/sites/default/files/lecture_notes/LDICA%20Lecture%20notes%20y% 20A.Mounika.pdf
5. http://www.springer.com/engineering/electronics/journal/10470.
6. https://www.journals.elsevier.com/microelectronics-journal
7. http://nptel.ac.in/courses/117107094/
8. https://www.youtube.com/watch?v=NVj_Eu3sJL4
9. http://freevideolectures.com/Course/2915/Linear-Integrated-Circuits

10. Analog Electronic Circuits: https://swayam.gov.in/nd1_noc19_ee38/preview
11. Op-amp practical Applications: Design, Simulation and Implementation: https://onlinecourses.nptel.ac.in/noc18_ee10/preview
12. Integrated Circuits, MOSFETS, Op-Amps and their Applications: https://archive.swayam.gov.in/courses/4441-integrated-circuits-mosfets-op-amps-andtheir-applications

Course Outcomes:

On completion of the course, the students will be able to:

1. **understanding** of operational amplifiers with linear integrated circuits.
2. **Apply** the knowledge of the different families of digital integrated circuits and their characteristics.
3. **Analyse** the functioning of various design circuits using operational amplifiers for various applications.
4. **Design** various techniques to develop A/D and D/A convertors.
5. **Acquire** hands-on laboratory experience on IC based project kits in above areas according to specifications.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	-	-	-	-	-	-	-	-	-	-	2	2	2
CO2	2	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	2	2	-	2	-	-	-	-	-	-	-	2	2	-
CO4	2	2	2	2	-	-	-	-	-	-	-	2	2	2
CO5	2	-	2		-	-	-	-	-	-	-	-	2	-
Average	2.2	2	2	2	-	-	-	-	-	-	-	2	2	2

<table>
<tr><td>AY 2020-21
onwards</td><td colspan="1">J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B.Tech
III Year – II Sem</td></tr>
<tr><td>Course Code:
J32OI</td><td rowspan="2">FUNDAMENTALS OF COMPUTER NETWORKS
(Open Elective-II)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-Requisites:

1. Knowledge on “Digital Logic Design”.
2. Knowledge on “Computer Organization”.

Course objectives:

The Student will:

1. Recognize various layering approaches for networking and understand the functionalities of physical layer.
2. Identify the data link layer protocols, multi access protocols and various internetworking devices.
3. Examine design issues of network layer, services provided to above layer and routing, and congestion control protocols.
4. Examine IP protocol, addressing, various protocols like CIDR, ICMP, ARP and RARP of internet Layer and examination of transport layer services.
5. Examine Transport layer protocols like TCP, UDP and various congestion controlling mechanisms, including application layer services, protocols like HTTP, FTP, E-Mail etc.

Module 1:

Overview of the Internet: Protocol, Layering Scenario, TCP/IP Protocol Suite: The OSI Model, Comparison of the OSI and TCP/IP reference model.

Physical Layer: Guided transmission media, wireless transmission media.

Connecting Devices: Repeaters, Hubs, Switches, Gateways and Bridges.

Module 2:

Data Link Layer: Design issues, Framing, Error Detection and Error Correction, Hamming Distance, CRC, Flow control and error Control.

Protocols: Noiseless Channels, Noisy Channels,

Multi Access protocols- Random access - ALOHA, CSMA, CSMA/CD and CSMA/CA, Controlled access, Channelization.

Module 3:

Network Layer: Network layer design issues, Store and forward packet switching, connection less and connection oriented network services.

Internetworking: Protocols-IPV4 and IPV6**,** Logical Addressing-IPV4, IPV6, Tunneling and Packet Fragmentation.

Address Mapping: ARP, RARP, DHCP, ICMP and IGMP.

Routing Algorithms: Shortest Path Finding and Distance Vector Routing Algorithms.

Module 4:
Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), The TCP Connection Establishment, The TCP Connection Release, The TCP sliding window, The TCP congestion control

Module 5:
Application Layer: Introduction, services, Application layer paradigms.
Applications: DNS, WWW, HTTP, FTP, E-MAIL, TELNET, SNMP, SSH.

Text Books:
1. ComputerNetworks,5E,Peterson,Davie,Elsevier
2. Introduction to Computer Networks and CyberSecurity, Chawan -HwaWu, Irwin, CRC Publications.
3. Computer Networks and Internets with Internet Applications, Comer .

Reference Books:
1. Data Communications and Networking - Behrouz A. Forouzan, Fifth Edition TMH, 2013.
2. Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education

E - Resources:
1. https://lecturenotes.in/subject/2234/Computer_Network
2. http://nptel.ac.in/courses/106102234/
3. https://www.iitg.ernet.in/dgoswami/CN-Notes.pdf
4. http://www.coursera.org/http://ocw.mit.edu/index.htm.

Course outcomes:
The Student will be able to
1. **Demonstrate** the networking concepts, various Layering approaches and their functionalities.
2. **Understand** the protocols of Data Link layer, how a medium can be shared among multiple devices and internetworking devices used.
3. **Work** on fragmentation, assigning of logical address and judge on routing, congestion.
4. **Demonstrate** the working of IP Protocol, other protocols of internet layer and services of transport layer.
5. **Explain** the transport layer and application layer protocols, their working

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2	2	-	-	-	-	-	-	-	-	-	-	2
CO2	3	2	2	-	-	-	-	-	-	-	-	-	2	2
CO3	3	2	2	-	-	-	-	-	-	-	-	-	2	2
CO4	2	2	2	-	-	-	-	-	-	-	-	-	2	2
CO5	2	2	2	-	-	-	-	-	-	-	-	-	2	2
Average	**2.4**	**2.0**	**2.0**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2.0**	**2.0**

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech III Year – II Sem</td></tr>
<tr><td>Course Code: J32OJ</td><td rowspan="2">INTRODUCTION TO JAVA PROGRAMMING
(Open Elective-II)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-Requisites: Knowledge on Programming Language.

Course objectives:

The Student will:

1. Familiar with constructors and string handling functions
2. Explain inheritance and polymorphism
3. Familiar with packages and interfaces
4. Familiar with exception handling and multithreading
5. Familiar with applet programming and event handling.

Module 1:

Introduction: OOP concepts, history of Java, Java buzzwords, data types, variables, scope and life time of variables, arrays, operators, expressions, control statements, type conversion and casting, simple java program.

Classes and Objects: concepts of classes, objects, constructors, methods, this keyword, garbage collection, overloading methods and constructors, parameter passing, recursion.

String handling: String, String Buffer, String Tokenize.

Module 2:

Inheritance: base class object, subclass, member access rules, super uses, using final with inheritance, method overriding, abstract classes

Interfaces: defining an interface, implementing interface, differences between classes and interfaces and extending interfaces.

Packages: Defining, creating and accessing a package, importing packages, access control, exploring package - java.io

Module 3:

Exception handling: concepts of exception handling, benefits of exception handling, exception hierarchy, checked and unchecked exceptions, usage of-try, catch, throw, throws and finally, built in exceptions, creating own exception sub classes.

Module 4:

Multithreading: differences between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, daemon threads, thread groups.

Applets: concepts of applets, differences between applets and applications, life cycle of applet, types of applets, creating applets, passing parameters to applets.

Module 5:

Event Handling: events, event sources, event classes, event listeners, delegation event model, handling mouse and key board events, adapter classes. The AWT class hierarchy, user interface components-labels, buttons, canvas, scrollbars, text components, checkbox, checkbox groups, choices, lists

Text Books:

1. Java The complete reference, 8th editon, Herbert Schildt, TMH.
2. Under tanding OOP with Java, up dated edition, T.Budd, Pears on education.

Reference Books:

1. An Introduction to programming and OO design using Java, J. Nino and F.A. Hosch, John Wiley & sons.
2. An Introduction to OOP, second edition, T. Budd, pearson education.
3. Introduction to Java programming 6th edition, Y. Daniel Liang, pearson education.

E- Resources:

1. www.javasoft.com
2. www.w3schools.com
3. www.tutorialpoint.com
4. www.oracle.com

Course outcomes:

At the end of the course, students will be able to

1. **Familiar** with constructors and string handling
2. **Understand** inheritance and polymorphism
3. **Understand** packages and interfaces
4. **Understand** exception handling and multithreading
5. **Understand** applet programming

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	3	-	3	3	-	3	-	-	2	-	-	3	-
CO2	-	-	2	-	-	3	-	3	-	-	3	-	-	3
CO3	3	-	-	3	-	2	-	-	3	-	-	3	-	-
CO4	3	-	-	-	3	-	-	3	3	3	-	-	3	-
CO5	-	3	-	-	-	-	2	-	-	-	3	-	-	3
Average	**3.0**	**3.0**	**2.0**	**3.0**	**3.0**	**2.5**	**2.5**	**3.0**	**3.0**	**2.5**	**3.0**	**3.0**	**3.0**	**3.0**

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech
III Year – II Sem</td></tr>
<tr><td>Course Code: J32OK</td><td rowspan="2">COMPUTER ORGANIZATION
(Open Elective-II)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite:NIL

Course Objectives:
This course will enable students to:
1. To understand the basic operations of the computer system.
2. To know the functioning of CPU and the control unit.
3. To Analyse various algorithms for arithmetic operations in the computer.
4. To understand different hierarchical memory systems including cache memory and virtual memory.
5. Recognize different ways of communicating with input/output devices and standard I/O interfaces.

Module I
Unit 1Basic structures of Computers
Computer Types, Functional unit, Basic operational concepts, Bus structures, software, Performance, multiprocessors and multi computers.
Unit 2Data Representation
Fixed point representation, Floating point representation, Error detection codes.

Module II:
Unit 1Register Transfer and Micro operations
Register transfer language, Register transfer, Bus and memory transfers, Arithmetic micro operations, logic micro operations, shift micro operations, Arithmetic logic shift unit.
Unit 2Basic computer organization and Design
Instruction codes, computer registers, computer instructions, Timing and control, instruction cycle

Module III:
Unit 1Computer Arithmetic
Introduction, Addition and Subtraction, Multiplication Algorithms, Division Algorithms, Floating-point arithmetic operations, Decimal arithmetic unit, Decimal arithmetic operations.

Module IV:
Unit 1The Memory System
Basic concepts, Semiconductor RAM memories, Read-Only memories, speed, Size and Cost, Cache memories, performance considerations, Virtual memories, Secondary storage.

Module V:

Unit 1Input/output Organization

Accessing I/O Devices Interrupts, Interrupt hardware, Enabling and disabling interrupts, Direct memory access, Buses, interface circuits, Standard I/O interfaces.

Text Books:

1. Computer Organization-Carl Hamacher, ZvonkoVranesic, SafwatZaky, Vth Edition, McGraw Hill.
2. Computer System Architecture-M.MorisMano,IIIrdEdition,Pearson/PHI

Reference Books:

1. Computer Organization and Architecture-William Stallings, SixthEdition, Pearson/PHI
2. Structures Computer Organization-Andrew S.Tanebaum,4th Edition PHI/Pearson.

E - Resources:

1. https://nptel.ac.in/courses/106/103/106103180/
2. https://nptel.ac.in/courses/117/105/117105078/
3. https://nptel.ac.in/courses/106/105/106105163/

Course Outcomes:

On completion of the course, the students will be able to:

1. **Illustrate** basic operations of the computer system.
2. **Apply** knowledge of CPU and the control unit.
3. **Apply** various algorithms for arithmetic operations in the computer.
4. **classify** different memory systems.
5. **Produce** knowledge on input/output organization.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	-	2	-	-	-	-	-	-	-	-	-	2	-
CO4	-	2	3	-	-	-	-	-	-	-	-	-	3	-
CO5	3	-	-	2	-	-	-	-	-	-	-	-	-	-
Average	3.0	2.0	2.5	2.0	-	-	-	-	-	-	-	-	2.5	-

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B. Tech
III Year–II Sem.</td></tr>
<tr><td>Course Code: J32OL</td><td rowspan="2">FUNDAMENTALS OF
HUMAN COMPUTER INTERACTION
(Open Elective-II))</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: GUI(Windows) Working Knowledge

Course Objectives:
This course will enable students to:

1. Demonstrate an understanding of guidelines, principles, and theories influencing human computer interaction.
2. Design, implement and evaluate effective and usable graphical computer interfaces.
3. Describe and apply core theories, models and methodologies from the field of HCI.
4. Able to apply HCI principles, guidelines, methods, and techniques for human-centred information systems development.
5. Use the information sources available and be aware of the methodologies and technologies supporting advances in HCI.

Module I:
Unit 1: Introduction: Importance of user Interface – definition, importance of good design. Benefits of good design. A brief history of Screen design.
Unit 2: The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.

Module II:
Unit 1: Design process – Human interaction with computers, importance of human characteristics human consideration.
Unit 2: Human interaction speeds, understanding business junctions

Module III:
Unit 1: Screen Designing: Design goals – Screen planning and purpose, organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition.
Unit 2: amount of information – focus and emphasis, presentation of information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.

Module IV:
Unit 1: Windows – New and Navigation schemes selection of window, selection of devices based and screen based controls Components – text and messages, Icons and increases.
Unit 2: Multimedia, colors, uses problems, choosing colors.

Module V:

Unit 1: Software tools – Specification methods, interface – Building Tools. Interaction Devices – Keyboard and function keys – pointing devices.

Unit 2: speech recognition digitization and generation – image and video displays – drivers.

Text Books:

1. The essential guide to user interface design, Wilbert O Galitz, Wiley DreamTech.
2. Designing the user interface. 3rd Edition Ben Shneidermann, Pearson Education Asia.

Reference Books:

1. Human – Computer Interaction. Alan Dix, Janet Fincay, GreGoryd, Abowd, Russell Bealg, Pearson Education
2. Interaction Design Prece, Rogers, Sharps. Wiley Dreamtech.

E - Resources:

1. https://www.interaction-design.org/literature/book/the-encyclopedia-of-human-computer-interaction-2nd-ed/human-computer-interaction-brief-intro
2. https://www.interaction-design.org/literature/topics/human-computer-interaction
3. https://www.udacity.com/course/human-computer-interaction--ud400

Course Outcomes:

On completion of the course, the students will be able to:

1. **Explain** the human computer components functions regarding interaction with computer.
2. **Describe** the key design principles for user interfaces.
3. **Apply** an interactive design process and universal design principles to designing HCI systems.
4. **Use** Paradigms, HCI in the software process.
5. **Implement** Interaction design basics.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2	1	2	2	-	1	-	-	-	-	-	1	-
CO2	1	1	2	2	2	-	1	-	-	-	-	-	2	-
CO3	1	3	3	3	3	-	2	-	-	-	-	-	2	-
CO4	-	2	2	2	1	-	1	-	-	-	-	-	-	-
CO5	1	2	1	1	1	-	1	-	-	-	-	-	2	-
Average	1	2	1.8	2	1.8	-	1.2	-	-	-	-	-	1.4	-

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="3">J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="3">B.Tech
III Year – II Sem</td></tr>
<tr><td>Course Code: J32OM</td><td colspan="3" rowspan="2">INTRODUCTION TO MICROPROCESSORS AND MICRO CONTROLLERS
(Open Elective-II)</td><td>L</td><td>T</td><td>P/D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Basic Knowledge in IC **'s**

Course Objectives:
Students will learn to:
1. Study the Architecture of 8085&8086 microprocessor
2. Learn the design aspects of I/O and Memory Interfacing circuits.
3. Study the Architecture of 8051 microcontroller

Module 1:
Unit 1: 8086 Introduction: 8086 Architecture Functional diagrams, Register organization, memory segmentation, programming model, memory addresses, physical memory organization
Unit 2: 8086 Architecture: Architecture of 8086,signal descriptions of 8086-common function signals, Timing diagrams, interrupts of 8086.

Module 2:
Unit 1: Instruction set of 8086: Instruction formats, addressing modes, instruction set, assembler directives, macros.
Unit 2: Assembly language programming of 8086: Simple programs involving logical, branch and call instructions, sorting, evaluating arithmetic expressions, string manipulations.

Module 3:
Unit 1: I/O Interface: 8255 PPI, Various modes of operation and interfacing to 8086, interfacing keyboard, Display, D/A and A/D converter.
Unit 2: Interfacing with advanced devices: Memory Interfacing to 8086, Interrupt Structure of 8086, Vector Interrupt Table, Interrupt Service Routine.

Module 4:
Unit 1: Introduction to Microcontrollers: Overview of 8051 microcontrollers, architecture, I/O ports, memory organization.
Unit 2: Addressing Modes: Addressing modes and instruction set of 8051, simple programs.

Module 5:
Unit 1: 8051 Real Time control 1: Programming Time Interrupts, Programming External Hardware Interrupts.
Unit 2: 8051 Real Time control 2: Programming the serial communication interrupts, programming 8051 Timers and counters

Text Books:

1. D.V.Hall, Microprocessors and interfacing,TMGH,2 Edition 2006.
2. Kenneth.J.Ayala, The8051Microcontroler,3rdEd., C engage Learning.

Reference Books:

1. Advanced Microprocessors and Peripherals-A. K. Rayand K.M Bhurchandi, TMH, 2nd Edition 2006.
2. The 8051Microcontrollers.Architecture and programming and applications-K.UmaRao, AndhePallavi,Pearson, 2009.
3. Microcomputer system 8086/8088 family architecture. Programming and design- Du and GA Gibson, PHI 2nd Edition.

E-Resources:

1. https://nptel.ac.in/courses/106/108/106108100/
2. https://www.youtube.com/watch?v=o6W0opScrKY&list=PLuv3GM6-gsE01L9yDO0e5UhQapkCPGnY3
3. https://www.youtube.com/watch?v=liRPtvj7bFU&list=PL0E131A78ABFBFDD0

Course Outcomes:

Students will be able to:

1. **Design** programs on 8085 microprocessors.
2. **Implement** programs on 8086 microprocessors.
3. **Design** interfacing circuits with 8086.
4. **Design** and implement 8051 microcontroller based systems
5. **Understand** the concepts related to I/O and memory interfacing

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**											**Program Specific Outcomes***		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	1	-	-	-	-	-	-	-	-	-	-
CO3	2	-	2	2	-	-	-	-	-	1	1	-	-	2
CO4	2	-		2	-	-	-	-	-	-	-	-	-	-
CO5	2	-	2	1	-	-	-	-	-	-	-	-	-	-
Average	**2**	**2**	**2**	**1.5**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**-**	**-**	**2**

<table>
<tr><td>AY 2020-21
Onwards</td><td colspan="3">J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="3">B. Tech
III Year – II Sem</td></tr>
<tr><td>Course Code:
J32ON</td><td rowspan="2" colspan="3">INTERNET OF THINGS
(Open Elective – II)</td><td>L</td><td>T</td><td>P/D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td></tr>
</table>

Pre-Requisites: Nill

Course Objectives:
Students will learn to

1. Understand the basic building blocks of IoT.
2. Analyze the difference between M2M and IoT along with IoT system Management
3. Extend the knowledge in Logical Design of IoT System using Python.
4. Acquire knowledge about IoT Physical Devices and End points.
5. Identify the IoT Physical Servers and cloud offerings.

Module 1:
Unit 1 Introduction to Internet of Things:
Definition and Characteristics of IoT, Physical Design of IoT –IoT Protocols, IoT communication models, IoT Communication APIs
Unit 2 IoT enabled Technologies:
Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates, Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle.

Module 2:
Unit 1 IoT and M2M:
Software defined networks, network function virtualization, difference between SDN and NFV for IoT
Unit 2 Basics of IoT System:
Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER.

Module 3:
Unit 1 Introduction to Python:
Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling.
Unit 2 Python packages:
JSON, XML, HTTPLib, URLLib, SMTPLib.

Module 4:
Unit 1 IoT Physical Devices and Endpoints:
Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming.
Unit 2 Python program with Raspberry PI-1:
Python program with Raspberry PI with focus of interfacing external gadgets, controlling

output, reading input from pins.

Module 5:

Unit 1 Python program with Raspberry PI-2:

Python program with Raspberry PI with focus of interfacing external gadgets.

Unit 2: Controllingoutput, reading input from pins.

Text Books:

1. Internet of Things - A Hands-on Approach, ArshdeepBahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

References:

1. Internet of Things by Jeeva Bose 1st edition, Khanna publishing.

Course Outcomes:

Students will be able to

1. **Understand** the basic building blocks of IoT.
2. **Analyze** the difference between M2M and IoT along with IoT system Management
3. **Extend** the knowledge in Logical Design of IoT System using Python.
4. **Acquire** knowledge about IoT Physical Devices and End points.
5. **Identify** the IoT Physical Servers and cloud offerings

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	-	-	-	-	-	-	-	-	-	-	1	2
CO2	3	3	2	-	-	-	-	-	-	-	-	-	1	2
CO3	3	3	3	-	-	-	-	-	-	-	-	-	2	2
CO4	3	3	3	-	-	-	-	-	-	-	-	-	2	2
CO5	3	3	3	-	-	-	-	-	-	-	-	-	2	2
Average	**3.0**	**3**	**2.8**	-	-	-	-	-	-	-	-	-	**1.6**	**2.0**

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="4">J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B.Tech.
III Year – II Sem</td></tr>
<tr><td>Course Code:
J32OP</td><td rowspan="2" colspan="4">INTRODUCTION TO SURFACE MINING
(Open Elective-II)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:
The students will
1. To introduce surface mining terms and applicable conditions
2. To acquaint with different machinery used in surface mining
3. To get idea about Drilling and blasting of surface ore bodies.
4. To get idea about lighting, dust, and slopes in surface mines.
5. To know about ore and waste transportation.

Module 1
Unit - 1: Definition, Terminology, Applicability and limitations of surface mining, Classification, Advantages, and dis-advantages of surface mining.

Module 2
Unit - 1: Introduction to surface mining machinery:Equipment selection; Working with rippers, shovels, draglines, shovel-dragline combination; bucket wheel excavator. Disposal of OB/waste material

Module 3
Unit - 1: Drilling & blasting**:** Drilling mechanism, drilling patters, Drill bits Explosives, Blasting accessories, Bulk explosives, problems in blasting.

Module 4
Unit -1: Basics of Mine lighting, Sources of dust in surface mining, dust control, and slope stabilization

Module 5
Unit - 1: Methods of excavation & transportation – shovel-dumper combination, draglines, surface miner, bucket wheel excavator. Impacts on environment due to surface mining

Textbooks:

1. D.J. Deshmukh, Elements of Mining Technology, Vol 1, Central Techno, 7th Edition, 2001.
2. Principles & Practices of Coal Mining, R.D. Singh

Reference Books:

1. Surface Mining Technology, by Prof S.K. Das, Lovely Prakashan, Dhanbad

E-Resources:

1. https://www.researchgate.net/publication/282572490_Basic_concept_of_mining_technology
2. http://www.eolss.net/sample-chapters/c05/e6-37-06-01.pdf

Course Outcomes:

The student will be able to:

1. **Understand** about surface mining terms and conditions of applicability
2. **Learn** about different machinery used in surface mining
3. **Learn** drilling and blasting in surface mining
4. **Understand** mine lighting, dust, and slopes in surface mining
5. **Understand** the transportation of ore and waste in surface mining.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	1	-	-	-	-	-	-	-	-	-	-	-
CO5	3	1	2	-	-	-	-	-	-	-	-	-	-	-
Average	3	2	1.6	-	-	-	-	-	-	-	-	-	-	-

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech III Year – II Sem</td></tr>
<tr><td>Course Code: J32OR</td><td rowspan="2">Numerical Solution of Partial Differential Equations
(Common to CE, EEE,ME,ECE,CSE,IT, ECM& MIE)
(Open Elective-II)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:
This course will enable students to:
1. solve large number of algebraic linear equation by various methods
2. solve one Dimensional Parabolic Equations by numerical methods.
3. solve two Dimensional Parabolic Equations by numerical methods.
4. solve hyperbolic equations by numerical methods by using various methods.
5. solve elliptic equations by numerical methods by various methods

Module 1 : Linear Systems of Equations
Iterative methods for solving large linear systems of algebraic equations: Jacobi, Gauss-seidel and S.O.R methods - Conditions for convergence of them - Methods for accelerating convergence: Lyusternite's& Aitken's methods - Optimum acceleration parameter for S.O.R method.
.

Module 2 : One Dimensional Parabolic Equations
Explicit and Crank-Nicolson Schemes for - Weighted average approximation - Derivative boundary conditions - Truncation errors - Consistency, Stability and convergence - Lax Equivalence theorem

Module 3: Matrix Norms & Two Dimensional Parabolic Equation
Vector and matrix norms - Eigenvalues of a common tridiagonal matrix - Gerischgorin's theorems- Stability by matrix and Fourier-series methods - A.D.I. methods.

Module 4: Hyperbolic Equations
First order quasi-linear equations and characteristics - Numerical integration along a characteristic - Lax- Wendroff explicit method - Second order quasi-linear hyperbolic equation - Characteristics - Solution by the method of characteristics.

Module 5: Elliptic Equations
Solution of Laplace and Poisson equations in a rectangular region - Finite difference in Polar coordinate Formulas for derivatives near a curved boundary when using a square mesh - Discretisation error - Mixed Boundary value problems.

Text Books:

1. "Numerical Methods for Engineers", Chapra. S.C., and Canale.R.P., Tata McGraw Hill, 5 th Edition, New Delhi,2007.
2. "The Finite Difference Methods in Partial Differential Equations", Mitchel A.R. and Griffiths S.D.F., John Wiley and sons, New York,1980.

Reference Books:

1. "Numerical Solutions of Partial Differential Equations", Morton K.W., Mayers, D.F., Cambridge University Press, Cambridge,2002.
2. "Numerical Solution of P.D.E.",SmithG.D., Oxford University Press, New 2. York,1995.
3. "A first course in the Numerical Analysis of Differential Equations", Iserles A., Cambridge University press, New Delhi, 2010. xx t u u□

E - Resources:

1. https://www.purplemath.com/modules/systlin1.htm
2. https://nptel.ac.in/courses/111/107/111107063/
3. https://www.researchgate.net/publication/227760098_Numerical_solution_of_two-dimensional_parabolic_equation_subject_to_nonstandard_boundary_specifications_using_the_pseudospectral_Legendre_method
4. https://link.springer.com/chapter/10.1007/978-3-662-09207-1_2
5. https://www.researchgate.net/publication/310744390_Numerical_Solutions_of_Elliptic_Partial_Differential_Equations_by_Using_Finite_Volume_Method

Course Outcomes:

On completion of the course, the students will be able to:

1. Know the knowledge of solving large number of algebraic linear equation.
2. Understand the knowledge of solving one dimensional parabolic equations by numerical methods
3. Recognize the knowledge of solving two dimensional parabolic equations by numerical methods.
4. Apply and understand the knowledge of solving hyperbolic equation by numerical methods.
5. Know the knowledge of solving elliptic equations by numerical methods.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	1	3	-	-	-	-	-	-	-	2	-	-
CO2	3	3	2	3	-	-	-	-	-	-	-	3	-	-
CO3	3	3	2	3	-	-	-	-	-	-	-	3	-	-
CO4	3	3	1	3	-	-	-	-	-	-	-	2	-	-
CO5	3	3	2	3	-	-	-	-	-	-	-	3	-	-
Average	3	3	2	3	-	-	-	-	-	-	-	2	-	-

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="4">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech III Year – II Sem</td></tr>
<tr><td>Course Code: J32OS</td><td rowspan="2">ADVANCED PHYSICS FOR ENGINEERS
(Common to CE, EEE, ME, ECE, CSE, IT, ECM& MIE)
(Open Elective-II)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:
This course will enable students to:

1. To distinguish between Newtonian Mechanics and special theory of relativity and develop the relationship of length contraction, time dilation and Einstein energy mass relation and to apply the concepts of special theory of relativity in various field of physics and engineering.
2. To understand the importance of hologram.
3. To introduce the fundamental concepts of film deposition.
4. To make the students acquainted with the concepts of photonic crystals.
5. To understand the fundamental concepts of Solar cell Physics.

Module 1: Special Theory of Relativity
Introduction, Concept of theory of relativity, Frames of reference-Inertial, noinertial; Galilean transformation equations, Michelson-Morley experiment, Einstein theory of relativity, Lorentz transformation of space and time, Length contraction, Time dilation, Variation of mass with velocity, Relativistic relation between energy and momentum.

Module 2: Holography
Introduction, Basic principle, Construction and Reconstruction of Hologram, Properties of Hologram, Types of Holograms, Applications- Holographic Interferometry, Acoustic Holography, Holographic Microscopy.

Module 3: Thin films Synthesis
Introduction, Deposition techniques-Pulsed Laser Deposition (PLD), Spray Pyrolysis; Nucleation and growth of the thin films, properties (Mechanical, Electrical, Magnetic and Optical).

Module 4: Photonic Crystals
Important features of photonic crystals, Presence of photonic band gap, anomalous group velocity dispersion, Micro cavity, effects in Photonic Crystals, fabrication of photonic Crystals, Dielectric mirrors and interference filters, PBC based LEDs, Photonic crystal fibers (PCFs), Photonic crystal sensing.

Module-5: Solar cell Physics

Single, poly and amorphous silicon, GaAs, CdS, Cu_2S, CdTe; Origin of photovoltaic effect, Homo and hetero junction, working principle of solar cell, Evaluation of Solar cell parameters, I-V, C-V and C-f characteristics.

Text Books:

1. "Engineering Physics" ,R K Gaur and SL Gupta, DhanpatRai Publications, 8th revised Edition, 2006.
2. "Engineering Physics",B K Pandey and S Chaturvedi, Cengage Learning India, Revised Edition, 2014.

Reference Books:

1. "Hand Book of Technologies for Films and coating",R F Bun shah, Noyes publishers,1st Edition, 1996.
2. "Fundamentals of Photonics",B E A Saleh and A C Tech, John Wiley and Sons, New York, 1st Edition, 1993.

E - Resources:

1. http://physics.mq.edu.au/~jcresser/Phys378/LectureNotes/SpecialRelativityNotes. pdf
2. http://www.kfupm.edu.sa/centers/CENT/AnalyticsReports/KFUPM-TFSCDec20.pdf
3. https://www.journals.elsevier.com/solar-energy-materials-and-solar-cells
4. https://www.journals.elsevier.com/journal-of-alloys-and-compounds/
5. http://aip.scitation.org/journal/apl
6. http://nptel.ac.in/courses/115101011/
7. http://nptel.ac.in/courses/117103066/11.

Course Outcomes:

On completion of the course, the students will be able to:

1. **Explain** special theory of relativity and apply its concepts in various fields of physics and engineering.
2. **Analyze** the basic concepts of Holography and applications.
3. **Identify** different concepts of film deposition.
4. **Develop** basic knowledge on the photonic crystals.
5. **Apply** the basic concepts of solar cell physics.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	1	-
CO3	3	1	1	-	1	1	-	-	-	-	-	-	1	-
CO4	2	1	1	-	-	-	-	-	-	-	-	-	1	-
CO5	3	2	1	-	3	2	2	-	-	-	-	-	2	-
Average	2.6	1.6	1	-	2	1.5	2	-	-	-	-	--	1.25	-

<table>
<tr><td>AY 2020-21
onwards</td><td>J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B.Tech
III Year – II Sem</td></tr>
<tr><td>Course Code:
J32OT</td><td rowspan="2">Green Chemistry
(Common to CE, EEE, ME, ECE, CSE, IT, ECM& MIE)
(Open Elective-II)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:

This course will enable students to:

1. Acquire knowledge of issues in sustainability as they relate to business and industry internationally and nationally.
2. Examine and evaluate case studies of sustainable practices in business and industry.
3. Knowledge on Non-conventional energy sources.
4. Study the Green synthetic method.
5. Understand and analyse the interconnectivity of global concerns.

Module 1:Green Chemistry - An Overview:

Introduction: Definition, the twelve basic principles of green chemistry. Green synthetic methods.

Module 2:Materials for green chemistry and technology:

Catalysis, environmental friendly catalysts, Biocatalysis, biodegradable polymers, alternative solvents, ionic liquids.

Module 3: Nonconventional energy sources:

Thermo-chemical conversion; direct combustion, gasification, pyrolysis and liquefaction, Bioenergy, Bio photolysis: Hydrogen generation from algae biological pathways; Storage and transportation; Applications.

.

Module 4:Green Synthetic Methods & Catalysis:

The design and development of environmentally friendly chemical pathways, Microwave synthesis, electro-organic synthesis, Supercritical fluids (SCFs): examples and properties, Extraction with SCFS.

Module-5: Green Chemistry & Sustainable development:

Green chemistry in batteries, production and recycling, Fuel cell and electric vehicles, Solar energy and hydrogen production, biodiesel, bio-hydrogen, Anaerobic digestion, alcohol production from biomass; Chemical conversion process: hydrolysis and hydrogenation; Best practices in Green Chemistry for sustainable development with suitable examples.

Text Books:

1. "Green Chemistry an Introductory Text", Lancaster, M., Royal Society of Chemistry, Cambridge, UK 2002.
2. "Real World Cases in Green Chemistry", Cann M.C.; Connelly, M.E. American Chemical Society: Washington DC. 2000.

Reference Books:

1. "Green Chemistry: Theory and Practice", Anastas, P.; Warner, J. Oxford University Press: London, 1998.
2. "The 12 Principles of Green Engineering as a Foundation for Sustainability" in Sustainability Science and Engineering: Principles. Zimmerman, J.B.; Anastas, P.T. Ed. Martin Abraham, Elsevier Science. available 2005.
3. "Design through the Twelve Principles of Green Engineering," Anastas, P.; Zimmerman, J. Environmental Science and Technology, 37, 94A - 101A, 2003.
4. "Green Chemistry Challenging Perspectives" ,Tundro, P.; Anastas, P., Oxford Press, Oxford, 2000.
5. "Introduction to Green Chemistry", Matlack, A.S., Marcel Dekker, Inc., New York, 2001.

E - Resources:

1. https://pubs.rsc.org/en/journals/journalissues/gc#!recentarticles&adv
2. https://www.sciencedirect.com/topics/chemistry/green-chemistry
3. https://www.intechopen.com/books/green-chemistry/introductory-chapter-principles-of-green-chemistry
4. https://www.sigmaaldrich.com/chemistry/greener-alternatives/green-chemistry.html
5. https://science.sciencemag.org/content/367/6476/397

Course Outcomes:

On completion of the course, the students will be able to:

1. **Understand** of Green Chemistry & Green Eng. Principles.
2. **Know** the applications of green routes for synthesis of chemicals.
3. **Use** better awareness about global environmental concerns and green remedies to address these concerns.
4. **Appraise** about tenets of sustainable development and its integration with Green practices.
5. **Realise** about reflections of Green Chemistry on sustainable development initiatives.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 – Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	1	-	1	-	-	-	-	-	-	-	2	-	-
CO2	1	2	-	-	-	-	-	-	-	-	-	1	1	-
CO3	1	1	-	-	-	-	-	-	-	-	-	2	1	-
CO4	2	2	-	-	-	-	-	-	-	-	-	1	1	-
CO5	2	-	1	-	-	-	-	-	-	-	-	2	2	-
Average	1.6	1.2	1	1	-	-	-	-	-	-	-	1.2	1.25	-

<table>
<tr><td>AY 2020-21
onwards</td><td colspan="4">J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B.Tech
III Year – II Sem</td></tr>
<tr><td>Course Code:
J32OU</td><td rowspan="2" colspan="4">TECHNICAL WRITING SKILLS
(COMMON TO ALL)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-Requisites: Nil

Course Objectives:
The students will
1. Know the elements of effective writing
2. Understand the letter writing and resume writing
3. Classify the types and styles of report writing
4. Understand the proposal writings
5. Examine the research papers and research articles

Module-I Elements of Effective Writing
Introduction-Characteristics of Good Writing-words, phrases, sentences and developing effective paragraphs.

Module -II Academic Writing
Letter writing and Job Application: Introduction-types of letter writing-the seven C's of letter writing- significance- purpose-structure-layout-principles-planning a letter and cover letter.
Resume writing: Introduction-Resume design- parts of a Resume-Resume Styles and final tips

Module -III Technical Report Writing
Introduction-importance of Reports-Objectives of Reports-Categories of Reports-Formats-prewriting-structures of reports-types of reports- short reports- long reports-research and writing the report-first draft-revising, editing, and proofreading.

Module -IV Technical Proposals
Introduction-definition and purpose-types-characteristics-structure of proposals-style and appearance-evaluation of proposals.

Module -V Writing Research Papers and Articles
Introduction-writing strategies-nature and significance-types of research papers and articles-journal articles-conference papers-review and research articles and elements of articles.

References:

1. Raman, Meenakshi and Sangeeta Sharma. Technical Communication-Principles and Practice. Third Edition, New Delhi: UP., 2015.

2. Rizvi, M Ashraf. Effective Technical-Communication. New Delhi: Tata McGraw-Hill., 2005.

3. Butterfield, Jeff. Soft Skills for Everyone. Delhi: Cenege., 2010.

4. Cooper, Donald R. Pamela S Schindler. Business Research Methods. New Delhi: Tata McGraw-Hill, 2006

E-Resources:

1.https://clickhelp.com/clickhelp-technical-writing-blog/11-skills-of-a-good-technical-writer/

Course outcomes:

At the end of this course students will be able to

1. Use the characteristics of good writing like words, phrases, sentences and paragraphs.
2. Understand the role of letters and resumes getting jobs.
3. Utilize the report writing skills in business environment
4. Define the style, appearance, and evaluation of proposals.
5. Write the academic and research papers and articles

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 – Weak														
Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO2	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO3	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO4	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO5	-	-	-	-	-	-	-	-	2	3	-	3	-	-
Average	-	-	-	-	-	-	-	-	2	3	-	3	-	-

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B.Tech
III Year – II Sem</td></tr>
<tr><td>Course Code: J32OV</td><td rowspan="2">RESEARCH METHODOLOGY
(Open Elective - II)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-Requisites: Nil

Course Objectives: To Understand the

1. Concept / fundamentals of research and their types
2. Practical application of various research techniques
3. Importance of measurement techniques and sampling techniques
4. Importance of coding, editing, tabulation and analysis in doing research
5. Applying the concept of statistical analysis which includes various parametric test and non-parametric test and ANOVA technique and understand technique of report writing

Module 1:

Research— concepts – research methodology – approaches to business research – scientific methods – types of research – research design.

Module 2:

Formulation and planning of research - selection of research problem – literature review - setting of objectives - formulation of hypotheses – measurement of variables – research plan — conducting the research

Module 3:

Data collection– methods and techniques of primary data & secondary data – interviews – surveys – census and sample surveys – Editing, classification and codification of data – using computer packages.

Module 4:

Data Analysis – qualitative data analysis – descriptive quantitative data analysis – tests of measurement and quality – using computer packages

Module 5:

Writing and presenting the report—planning report writing —report format – footnotes and bibliography - references and citations presentation

Text Books:

1. Mathew David & Carole D. Sutton, Social Research: The Basics, Sage Publications, New Delhi

2. O.R. Krishnaswami, Methodology of Research in Social Sciences, Himalaya Publishing House, Mumbai.
3. Ajai S. Gaur and Sanjaya S. Gaur: Statistical methods for practice and Research, Sage Publishers.
4. Deepak Chawla&NeenaSondhi, Research Methodology, Vikas Publishers, 2011

Reference Books:

1. Naval Bajpai, Business Research Methods, Pearson, 2013
2. CR Kothari, Research Methods and Techniques, New Age International, New Delhi.

E-Resources:

1. https://nptel.ac.in/courses/121/106/121106007/

Course outcomes:

Students should be able to

1. **Gain** Knowledge of concept / fundamentals for different types of research
2. **Apply** relevant research techniques
3. **Basics** of Research Methodology and Research Design
4. **Apply**Data Collection methods and the tools for analysis and interpretation
5. **Know** the importance of presentation of data analysis and report writing including referencing style.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 – Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO2	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO3	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO4	-	-	-	-	-	-	-	-	2	3	-	3	-	-
CO5	-	-	-	-	-	-	-	-	2	3	-	3	-	-
Average	-	-	-	-	-	-	-	-	2	3	-	3	-	-

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech IV Year – I Sem</td></tr>
<tr><td>Course Code: J41OA</td><td rowspan="2">WASTE MANAGEMENT
(Open Elective-III)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits:3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:

This course will enable students to:

1. Study about handling of solid waste from cradle to grave.
2. Explain the design and construction of the solid waste treatment system.
3. Study the residue disposed of in an environmentally sound way.
4. Study the design and maintenance of different techniques
5. Discuss about waste minimization.

Module 1:

Unit-1 Introduction

Definition of solid waste, garbage, rubbish-Sources and Types of solid wastes Municipal waste, industrial waste, plastic waste, electronic waste, bio-medical waste and hazardous waste - Characteristics of Solid Wastes: Physical, chemical and biological characteristics-Problems due to improper disposal of solid waste.

Module 2:

Unit 1: Functional Elements of Solid Waste Management

Waste generation and handling at source-onsite storage-Collection of solid wastes Collection methods and services-storage of solid waste- guidelines for collection route layout.

Module 3:

Unit 1: Transfer and Transport of Wastes

Transfer station-types of vehicles used for transportation of solid waste-Processing and segregation of the solid waste- various methods of material segregation. Processing and Transformation of Solid Wastes. Recycling and recovery principles of waste

Unit 2: Management- Composting: definition methods of composting-advantages of composting- Incineration: Definition, methods of Incineration, advantages and disadvantages of incineration.

Module 4:

Unit 1: Treatment and Disposal of Solid Waste

Volume reduction, Open dumping, land filling techniques, Landfills: Classification, Design and Operation of landfills, Land Farming, Deep well injection.

Module 5:

Unit 1: **Waste Minimization**

Introduction to waste minimization, waste minimization techniques-5R (refuse, reduce, reuse, recover, recycle), municipal waste minimization.

Text Books

1. “Integrated Solid Waste Management” by Tchobanognous, Theissen& Vigil
2. McGraw Hill Publication, 3rd Edition, 2014.
3. “Solid and hazardous waste management” by M.N.Rao and Razia sultana, BS publications.
4. Environmental Engineering by Howard S.Peavy, Donald R.Rowe and George Tchobanognous

Reference Books

1. Environmental engineering by Y.Anjaneyulu, B.Spublication.
2. Environmental Pollution Control Engineering by C.S. Rao; Wiley Eastern Ltd.,New Delhi.
3. Environmental engineering by GeradKiley, Tata McGrawHill

E-Resources

1. https://nptel.ac.in/courses/105/105/105105160/
2. https://nptel.ac.in/courses/105/106/105106056/
3. https://nptel.ac.in/courses/105/103/105103205/

Course Outcomes

On completion of the course, the students will be able to:

1. **Recall** the components of solid waste management and the laws governing it
2. **Discuss** design, operation and maintenance of landfills, incinerators and composting units.
3. **Explain** the waste minimization.
4. **Discuss** the Reuse of materials as practicable.
5. **Discuss** about Recycle of waste that cannot be used and recovery of resources.

CO-PO/PSO Mapping Chart (Draft) (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	-	-	-	-	2	2	3	-	-	-	-	2	1
CO2	-	3	3	-	-	-	2	1	-	-	-	-	2	1
CO3	-	-	-	-	-	2	3	2	-	-	-	-	1	1
CO4	-	-	-	-	-	2	3	2	-	-	-	-	2	2
CO5	-	1	-	-	-	3	2	1	-	-	-	-	2	2
Average	-	0.6	0.6	-	-	1.8	1.2	1.8	-	-	-	-	1.8	1.4

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech IV Year – I Sem</td></tr>
<tr><td>Course Code: J41OB</td><td rowspan="2">ROAD SAFETY ENGINEERING
(Open Elective-III)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits:3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:
This course will enable students to:
1. Study the Fundamentals of Traffic Engineering
2. Explain the Accident Situations
3. Discuss Statistical measures of accident data
4. Explain different parameters responsible for providing road safety
5. Study about Accident prevention.

Module 1:
Unit-1: Fundamentals of Traffic Engineering
Road User Characteristics, Vehicular Characteristics, Applications of Traffic Control Devices, Traffic signs, Road Marking,

Module 2:
Unit-1: Introduction to Road Safety:
Accident Situation in India, International Comparison of Accident Data, Standard Definitions by IRC, Collection of Accident Data, Collision and Condition Diagrams,

Module 3:
Unit-1: Statistical Methods and Analysis of Accident Data:
Methods in Analysis of accident Data, Regression Method, Poisson Distribution, Chi-Squared Distribution, Statistical Comparisons, Black Spot Identification & Investigations,

Module 4:
Unit-1: Road & its Effect on Accidents:
Factors Causing Accidents, Skidding, Factors Determining Skid Resistance, Pedestrian Safety, Measures to Increase Pedestrian Safety, Safety Improvement Strategies, Case Studies

Module 5:
Unit-1: Mitigation Measures:
Accident prevention by better planning, Accident prevention by Better design of roads, Highway operation and accident control measures, Highway Safety Measures during construction, Highway geometry and safety.

Text Books:

1. "Transport planning and Traffic Engineering" by Dr. L. R. Kadiyali, Khanna Publications 9th Edition (2017
2. 'Principles of Transportation Engineering'' by ParthaChakroborty&Aminesh Das; Prentice Hall of India, 2nd edition (October 2017).

Reference Books:

1. Fundamentals of Traffic Engineering, Richardo G Sigua
2. Road Safety by NCHRP.

E-Resources:

1. https://nptel.ac.in/courses/105/101/105101087/

Course Outcomes:

On completion of the course, students will be able to:

1. **Explain** the Traffic characteristics
2. **Analyze** Collision and Condition Diagrams.
3. **Analyze** Statistical Methods for accident data
4. **Describe** Road & its Effect on Accidents
5. **Explain** Accident preventions.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 – Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	1	1	1	-	-	-	-	-	-	-	-	-	1	1
CO2	1	1	1	-	-	3	2	-	-	-	-	-	2	2
CO3	1	1	1	-	-	3	1	-	-	2	-	2	1	1
CO4	1	1	1	-	-	2	-	-	-	-	-	2	1	2
CO5	1	1	1	-	-	2	-	-	-	-	-	2	1	1
Average	1	1	1	-	-	2	0.6	-	-	0.4	-	1.2	1.2	1.4

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B.Tech IV Year – I Sem			
Course Code: J41OC	**ELECTRICAL ENGINEERING MATERIALS** (Open Elective-III)	**L**	**T**	**P**	**D**
Credits: 3		3	0	0	0

Pre-requisite: Basic Electrical and Electronics Engineering

Course Objectives:
The students will

1. To understand the importance of various materials used in electrical engineering.
2. To obtain a qualitative analysis of their behaviour and applications.
3. To understand Conducting and resistor materials, and their engineering application.
4. To understand Semiconducting materials, their properties and applications.
5. To understand Magnetic materials, Soft and hard magnetic materials and applications; Superconductors

MODULE - I

Unit-I: Dielectric Materials: Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics.

Unit-II: Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyro electric materials.

MODULE – II

Magnetic Materials: Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy, Magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermet permanent magnets, ageing of magnets. Factors effecting permeability and hysteresis.

MODULE – III

Semiconductor Materials: Properties of semiconductors, Silicon wafers, integration techniques, Large and very large scale integration techniques (VLSI).

MODULE – IV

Unit-I:Materials for Electrical Applications: Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetals fuses, soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials.

Unit-I: Solid, Liquid and Gaseous insulating materials, Effect of moisture on insulation.

MODULE – V

Unit-I: Special Purpose Materials: Refractory Materials, Structural Materials, Radioactive Materials, Galvanization and Impregnation of materials, Processing of electronic materials.

Unit-II: Insulating varnishes and coolants, Properties and applications of mineral oils, Testing of Transformer oil as per ISI.

TEXT BOOKS:

1. "R K Rajput", "A course in Electrical Engineering Materials", Laxmi Publications, 2009.
2. "T K Basak", "A course in Electrical Engineering Materials", New Age Science Publications 2009.

REFERENCE BOOKS:

1. TTTI Madras, "Electrical Engineering Materials", McGraw Hill Education, 2004.
2. "AdrianusJ.Dekker", Electrical Engineering Materials, PHI Publication, 2006.
3. S. P. Seth, P. V. Gupta "A course in Electrical Engineering Materials", DhanpatRai& Sons, 2011.

E - Resources:

1. https://nptel.ac.in/courses/112/108/112108150/

Course Outcomes:

After completion of this course, the student will be able to

1. **Understand** various types of dielectric materials, their properties in various conditions.
2. **Evaluate** magnetic materials and their behaviour.
3. **Evaluate** semiconductor materials and technologies.
4. **Acquire** Knowledge on Materials used in electrical engineering and applications
5. **Acquire** Knowledge on Smart materials: Sensors and actuators, piezoelectric, magnetostrictive and electrostrictive materials.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	-	-	-	-	2	3	-	-	-	-	3	-	3
CO2	2	3	3	-	-	-	2	-	-	-	-	2	-	3
CO3	2	3	3	-	-	-	2	-	-	-	-	2	-	2
CO4	2	2	2	-	-	-	2	-	-	-	-	3	-	3
CO5	3	2	2	-	-	-	2	-	-	-	-	2	-	3
Average	2.4	2.5	2.5	-	-	2	2.2	-	-	-	-	2.4	-	2.8

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B.Tech
IV Year – I Sem</td></tr>
<tr><td>Course Code:
J41OD</td><td rowspan="2">NON CONVENTIONAL ENERGY SOURCES
(Open Elective-III)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:
The students will

1. elucidate the fundamentals of various sources of Non-Conventional Energy such as Wind, Solar, Biomass, Geo thermal and other renewable energy sources.
2. impart a thorough knowledge about the application of different types of Non-Conventional Energy systems.
3. inculcate the students on feasibility and limitations of various Non-Conventional Energy Systems.
4. Analyze the principle and operation of direct energy conversion.
5. Apply the renewable energy sources to real world electrical and electronics problems.

MODULE –I: WIND ENERGY

Unit-I: Introduction to energy sources-Renewable and non-renewable energy sources – energy consumption as a measure of Nation's development – Strategy for meeting the future energy requirement – Global and national level energy scenarios –Prospects of renewable energy sources.

Unit-II: Basic principles of wind energy conversion –site selection consideration – types of wind mills – basic components of wind energy conversion systems (WECS) – types of WECS – applications of wind energy – safety system – environmental aspects.

MODULE –II: SOLAR ENERGY

Solar radiation - Physical principles of conversion of solar radiation into heat –Solar constant – Solar energy collectors - flat plate collector – collector efficiency –concentrating collector: focusing type – advantages of focusing collectors –cylindrical parabolic concentrating collector – selective absorber coatings – central receiver tower solar power plant – solar energy storage systems –types – solar driers – solar water heaters - principle of solar photo voltaic cell – solar photo voltaic power generation – MPPT (Maximum Power Point Tracking) – solar pump – solar
hydrogen energy.

MODULE –III: ENERGY FROM BIO-MASS

Bio mass conversion technologies - Bio gas generation principle – types of bio- gas plants – applications of bio-gas plants – bio-mass as a source of energy – energy plantation – thermal gasification of bio mass – energy from agricultural waste – agro thermal power plant – Bio gas-based cogeneration programme – integrated waste management – advantages and disadvantages.

MODULE –IV: GEO-THERMAL AND OCEAN ENERGY

Unit-I: Nature of geo-thermal energy – geo-thermal sources – prime movers for geo-thermal energy conversion – advantages and disadvantages of geo-thermal energy – application of geo-thermal energy.

Unit-II: Principle of ocean thermal energy conversion (OTEC) – open cycle OTEC system – closed cycle – hybrid cycle – prospects of OTEC in India -applications – basic principle and components of tidal power plant – single basin and double basin tidal power plants -site requirements – storage –advantages and limitations of tidal power generation – ocean wave energy conversion devices.

MODULE –V: OTHER ENERGY SOURCES

Unit-I: Basic principle and components of a fuel cell – types of fuel cell –conversion efficiency of fuel cell - advantages and disadvantages of fuel cell – conversion energy and application of fuel cell – basic battery theory – batteries applied for bulk energy storage.

Unit-II: Hydrogen fuel – hydrogen production – methods - storage – transportation and utilization – hydrogen as alternative fuel for motor vehicle – safety management.

TEXT BOOKS:

1. Rai, G.D., 'Non-Conventional Energy Sources', Khanna Publishers, New Delhi, 4th Edition, 2004.
2. Gupta, B.R., 'Generation of Electrical Energy', S.Chand& Co. Ltd, New Delhi, 5th Edition, 2014.

REFERENCE BOOKS:

1. Agarwal, M.P., 'Future Sources of Electrical Power', S.Chand& Co. Ltd, New Delhi, 1999.
2. Hassan and D.K. Sharma 'Non-Conventional Energy Resources, S.K. Kataria and Sons Ltd, 2009
3. S.P. Sukhatme, 'Solar Energy: Principles of Thermal Collection and Storage,' Tata McGraw Hill, 2015.
4. B.K. Bansal 'Non-Conventional Energy Resources' Vikas Publishing Ltd, 2014.

E - Resources:

1. https://nptel.ac.in/courses/121/106/121106014/
2. http://ethesis.nitrkl.ac.in/218/1/Thesis.pdf

Course Outcomes:

The student will be able to

1. **Understand** the need of utilization of alternate energy resources & fundamentals of various non-conventional energy Systems.
2. **Analyse** the knowledge of Biomass and Geothermal energy sources

3. **Describe** the collection of solar energy, storage of solar energy and its applications.
4. **Illustrate** the potential of Wind and bio mass as a renewable source.
5. **Understand** the potential of geothermal energy and ocean energy as a renewable source.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**3**	**-**	**-**	**-**	**-**	**2**	**3**	**-**	**-**	**-**	**-**	**3**	**-**	**3**
CO2	**2**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**3**
CO3	**2**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**2**
CO4	**2**	**2**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**3**	**-**	**3**
CO5	**3**	**2**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**3**
Average	**2.4**	**2.5**	**2.5**	**-**	**-**	**2**	**2.2**	**-**	**-**	**-**	**-**	**2.4**	**-**	**2.8**

<table>
<tr><td>AY 2020-21
onwards</td><td colspan="1">J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B.Tech:
IV Year – I Sem</td></tr>
<tr><td>Course Code:
J41OE</td><td rowspan="2">BASICS OF ROBOTICS
(Open Elective-III)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Mathematics

Course Objectives:
This course will enable students to:

1. Understand the theoretical aspects of Robotics
2. Acquire practical experience in the field of Robotics through design projects and case studies.
3. Understand the importance of robots in various fields of engineering.
4. Understand trajectory planning and types of motion
5. Expose to various robots and their operational details.

Module 1:
Unit 1: Introduction: Robotics-Introduction-classification with respect to geometrical configuration (Anatomy), Controlled system & chain type: Serial manipulator & Parallel Manipulator.

Unit 2: Components of Industrial robotics - precession of movement - resolution, accuracy & repeatability – Dynamic characteristics- speed of motion, load carrying capacity & speed of response-Sensors-Internal sensors: Position sensors & Velocity sensors, External sensors: Proximity sensors, Tactile Sensors, & Force or Torque sensors.

Module 2:
Unit 1: Grippers - Mechanical Gripper-Grasping force – Engelberger-g-factors-mechanisms for actuation, Magnetic gripper, vacuum cup gripper-considerations in gripper selection &design. Industrial robots specifications. Selection based on the Application.

Module 3:
Unit 1: Kinematics-Manipulators Kinematics, Rotation Matrix, Homogenous Transformation Matrix, D-H transformation matrix, D-H method of assignment of frames. Direct and Inverse Kinematics for industrial robots

Module 4:
Unit 1: Trajectory planning: Joint space scheme- Cubic polynomial fit-Obstacle avoidance in operation space-cubic polynomial fit with via point, bleding scheme. Introduction Cartesian space scheme. Control- Interaction control, Rigid Body mechanics, Control architecture- position, path velocity, and force control systems, computed torque control, adaptive control, and Servo system for robot control.

Module 5:

Unit 1: Programming of Robots and Vision System-Lead through programming methods-Teach pendent- overview of various textual programming languages like VAL etc.

Unit 2: Introduction to Mobile Robots: A brief history of mobile robotics, applications and market. Recent advances in the mobile robotics for RISE (Risky Intervention and Surveillance Environment) applications.

Text Books:

1. Industrial Robotics / Groover M P /McGraw Hill
2. Introduction to Robotics / John J. Craig/ Pearson

Reference Books:

1. Theory of Applied Robotics /Jazar/Springer.H. Asada and J. J. E. Slotine, "Robot Analysis and Intelligence", Wiley Inter-Science. 1986
2. Robotics / Ghosal / Oxford

E - Resources:

1. https://rb.gy/dw0rkv
2. https://rb.gy/iayh9d
3. https://nptel.ac.in/courses/112/105/112105249/
4. https://nptel.ac.in/courses/112/101/112101098/

Course Outcomes:

On completion of the course, the students will be able to:

1. **Apply** the basic components of robots.
2. **Differentiate** types of robots and robot grippers.
3. **Model** forward and inverse kinematics of robot manipulators.
4. **Analyze** forces in links and joints of a robot.
5. **Programme** a robot to perform tasks in differential applications.

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	2	2	2	-	-	-	-	-	-	2		
CO2	3	3	2	2	2	-	-	-	-	-	-	1		
CO3	3	2	2	2	2	-	-	-	-	-	-	1		
CO4	3	2	2	1	1	-	-	-	-	-	-	2		
CO5	1	2	1	2	2	-	-	-	-	-	-	2		
Average	2.6	2	1.8	1.8	1.8	-	-	-	-	-	-	1.6		

<table>
<tr><td>AY 2020-21
onwards</td><td>J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B.Tech
IV Year – I Sem</td></tr>
<tr><td>Course Code:
J41OG</td><td rowspan="2">DIGITAL SYSTEMS USING VHDL
(Open Elective-III)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>1</td><td>0</td><td>0</td></tr>
</table>

Prerequisites: Nil

Course Objectives:
The students will
1. Learn how a Hardware Description Language (HDL) is used to describe and implement hardware.
2. Learn how to simulate and test that hardware and optimise their designs.
3. Learn in-depth study of combinatorial and sequential hardware systems and the use of finite state machines in the design of sequential systems.
4. To understand concept of Programmable Devices, PLA, PAL, CPLD and FPGA and implement digital system using VHDL.
5. To implement combinational and sequential circuits using VHDL.

Module 1
Unit I
Review of Logic Design Fundamentals: Combinational Logic, Boolean Algebra and Algebraic Simplification, Karnaugh maps, Designing with NAND and NOR Gates, Hazards in Combinational Networks, Flip-flops and latches, Mealy Sequential Network, Equivalent States and reduction of State Tables, Sequential Network Timing, Setup and Hold Times, Synchronous Design, Tristate Logic and Buses.

Module 2
Unit I
Introduction to VHDL: VHDL Description of Combinational Networks, Modeling Flip-flops using VHDL Process, VHDL Models for a Multiplexer, Compilation and Simulation of VHDL Code, Modeling a Sequential Machine, Variables, Signals and Constants, Arrays, operators, Functions, Procedures, Packages and Libraries, VHDL Model for a 74163 Counter.

Module 3
Unit I
Designing with Programmable Logic Devices: Read-Only Memories, Programmable Logic Arrays (PLAs), Programmable Array Logic (PALs) , Other Sequential Programmable Logic devices(PLDs),Design of a Keypad Scanner.
Unit II
Design of Networks for Arithmetic Operations: Design of a Serial Adder with Accumulator, State Graphs for Control Networks, Design of a Binary Multiplier, Multiplication of Signed Binary Numbers, Design of a Binary Divider.

Module 4

Unit I

Digital Design with SM Charts: State Machine Charts, Derivation of SM Charts, Realization of SM Charts, Implementation of the Dice Game, Alternative Realizations for SM Charts using Microprogramming, Linked State Machine.

Unit II

Designing with Programmable gate Arrays and Complex Programmable Logic Devices: Xilinx 3000 Series FPGAs, Designing with FPGAs, Xilinx 4000 Series FPGAs, Using a One-Hot State Assignment, Altera Complex Programmable Logic Devices(CPLDs),Altera FLEX 10K Series CPLDs

Module 5

Unit I

Floating-Point Arithmetic: Representation of Floating-Point Numbers, Floating-point Multiplication, Other Floating-Point Operations.

Unit II

Hardware Testing and Design for Testability: Testing Combinational Logic, Testing Sequential Logic, Scan Testing, Boundary Scan, Build-In Self-Test**.**

Text Books:

1. Charles H,Roth ,"Digital system design using VHDL" , 2nd Edition, PWS publishing co.
2. ZainalabedinNavabi, "VHDL analysis and modeling of digital systems",2nd Edition, MGH, 2004.

References Books:

1. Stphen Brown, "Fundamental of Digital logic with VHDL Design", Tata McGraw Hill, 2008.
2. J.Bhaskar ,"A VHDL primer",3rd edition 2004, Prentice Hall of India Limited.
3. Michael D.Ciletti, "Advanced Digital design with Verilog HDL", 2nd Edition, PHI Ltd, 2005.

E - Resources:

1. https://nptel.ac.in/courses/111/102/111102111/

Course Outcomes:

Upon successful completion of this course, the students will be able to:

1. **develop** a digital logic and apply it to solve real life problems.
2. **practice** combinational and sequential digital circuits using different styles of modeling of VHDL.
3. **analyze**, design and implement sequential logic circuits.
4. **employ** digital system design using PLD.
5. **simulate and implement** combinational and sequential circuits using VHDL systems.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	1	-	-	-	-	-	-	-	-	-	1	1	-
CO2	2	2	2	-	-	-	-	-	-	-	-	-	2	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	1	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-	1	-
Average	2.2	2	2	-	-	-	-	-	-	-	-	1	1.2	-

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech
IV Year – I Sem</td></tr>
<tr><td>Course Code: J41OH</td><td rowspan="2">MATLAB PROGRAMING LANGUAGE
(Open Elective-III)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Prerequisites: Nil

Course Objectives:
The students will
1. To understand the basic principles of programming and of implementing mathematical concepts in MATLAB.
2. To write numerical algorithms with MATLAB Programming language.
3. To evaluate the computational results using graphical representations.
4. To gain knowledge about advanced MATLAB Programming methods.
5. To gain knowledge on Simulink used in MATLAB.

Module-1
Unit-I: Introductionto MATLAB
Historical Background, Applications, Scope of MATLAB, Importance of MATLAB for Engineers, Features, MATLAB Windows (Editor, Work Space, Command History, Command Window).
Unit-2
Operations with Variables, Naming and Checking Existence, Clearing Operations, Commands, Data types, Operators.

Module-2
Unit-I: **Data Flow in MATLAB**
Vectors, Matrix Operations & Operators, Reshaping Matrices, Arrays, Colon Notations, Numbers, Strings, Functions, File Input-Output, Importing and Exporting of data.

Module-3
Unit-I: MATLAB Programming
Conditional Statements, Loops, Writing Script Files, Error Correction, Saving Files, Worked out Examples.

Module-4
Unit-I: **MATLAB Advanced**
Plotting, Graphics, Creating Plot & Editing Plot, GUI (Graphical User Interface).
Matlab- Algebra, Calculus, Differential, Integration, Polynomials, solving a system of linear equations.

Module-5

Unit-1: SIMULINK

Introduction, Importance, Model Based Design, Tools, Mathematical Modeling, Converting Mathematical Model into Simulink Model, Running Simulink Models, Importing Exporting Data, Solver Configuration, Masking Block/Model.

TEXT BOOKS:

1. Getting Started WithMatlab: A Quick Introduction For Scientists And Engineers (English) by RudraPratap, OXFORD University Press.
2. MATLAB Programming by Y. Kirani Singh, B.B. Chaudhuri, PHI Publication.

REFERENCE BOOKS:

1. MATLAB® Programming For Engineers, Fourth edition by Stephen J. Chapman.
2. Applied Numerical Methods Using MATLAB 1st Edition by Won Y. Yang ,Wenwu Cao, Tae-Sang Chung, John Morris.

Course Outcomes:

By the end of this course, the student will be able to

1. **translate** mathematical methods to MATLAB code.
2. **generalize** results and represent data visually.
3. **apply** computer methods for solving a wide range of engineering problems.
4. **utilize** computer skills to enhance learning and performance in other engineering and science courses.
5. **acquire** knowledge of Advanced Matlab programming methods and Simulink.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	1	-	-	-	-	-	-	-	-	-	1	1	-
CO2	2	2	-	2	-	-	-	-	-	-	-	-	2	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	1	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-	1	-
Average	2.2	2	-	2	-	-	-	-	-	-	-	1	1.2	-

<table>
<tr><td rowspan="1">AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech
IV Year – I Sem</td></tr>
<tr><td>Course Code: J41OI</td><td rowspan="2">INTRODUCTION TO PYTHON PROGRAMMING
(Open Elective-III)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-Requisites:
1. Need basic knowledge about computer.
2. Need Basic understanding of Programming language.

Course objectives:
The Student will:
1. Design and program Python applications.
2. Use lists, tuples, and dictionaries in Python programs.
3. Learn to identify Python object types, Components, decision statements, pass arguments in Python.
4. Build and package Python modules for reusability, design object oriented programs with Python classes, use class inheritance in Python for reusability.
5. Use exception handling in Python applications for error handling.

Module:1
Programming paradigms; Structured programming vs object-oriented programming, OOPs fundamentals- class, object, abstraction, encapsulation, polymorphism, and inheritance; Introduction to Python Getting started to Python- an interpreted high-level language, interactive mode and script mode. Variables, Expressions and Statements Values and types, Variables and keywords, statements, evaluating expressions, operators and operands, order of operations, composition. Functions function calls, type conversion, type coercion, pre-defined functions, composition, user define functions, flow of execution, passing parameters, function parameters and scope. Conditionals and recursion modulus operator, Boolean expression, logical operators, conditional execution, alternative execution, chained and nested conditionals, return statement; Recursion, infinite recursion.

Module 2:
Python data structures Strings Creating, initializing, and accessing the elements; String operators, comparing strings using relational operators; String functions and methods.
Lists: Concept of mutable lists, creating, initializing, and accessing the elements, traversing, appending, updating, and deleting elements; List operations; List functions and Methods, list parameters, nested lists, Matrices.

Dictionaries
Concept of key-value pair, creating, initializing, and accessing the elements in a dictionary, dictionary operations traversing, appending, updating, and deleting elements, Dictionary functions and methods.

Tuples

Mutability and tuples, Immutable concept, creating, initializing, and accessing the elements in a tuple, Tuple functions.

Module 3:

Object oriented programming using Python: creating python classes, classes and objects: user defined compound types, objects are mutable, copying; Access modifiers, classes and functions: pure function, modifiers, Classes and methods: object oriented features, optional arguments, initialization method, operator overloading and polymorphism.

Module 4:

Inheritance: Basic Inheritance: extending built-ins, overriding and super; Multiple inheritance: the diamond problem.

Module 5:

Files handling and Exceptions: Text files, writing variables, Directories, Pickling. Exceptions: raising exceptions, handling exceptions, exception hierarchy.

Text Books:

1. Python Object Oriented Programming, Dusty Phillips, Packet Publishing, 2010.
2. Programming in Python 3 - A complete Introduction to the Python Language- Second Edition, Mark Summerfields, Addison-Wesley 2010.

Reference Books:

1. Programming Python- 4th Edition, Mark Lutz, O'Reilly, 2011.
2. Object-Oriented Programming in Python, Michael H, Goldwasser, David Letscher, Pearson Prentice Hall, 2008.

E - Resources:

1. https://www.youtube.com/watch?v=MLP1v80yU14
2. https://pythonprogramming.net/functions-python-3-basics-tutorial/
3. https://www.youtube.com/watch?v=QGLNQwfTO2w
4. https://www.youtube.com/watch?v=ZDa-Z5JzLYM
5. https://www.youtube.com/watch?v=M-t4ILRHnxE

Course Outcomes:

The students will be able to

1. Describe to design and program Python applications.
2. Analyse and conversion of to use lists, tuples, and dictionaries in Python programs.
3. Explain the concept to identify Python object types, Components, decision statements, pass arguments in Python.
4. Apply decision for building and package Python modules for reusability, design object-oriented programs with Python classes, use class inheritance in Python for reusability.
5. Apply file handling and Exception handling Concepts in real world using python.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	2	1	-	-	-	-	-	-	-	-	-	2
CO2	3	2	-	3	-	-	-	-	-	-	-	-	2	2
CO3	3	2	2	3	-	-	-	-	-	-	-	-	1	2
CO4	3	2	1	2	-	-	-	-	-	-	-	-	-	3
CO5	3	2	2	2	-	-	-	-	-	-	-	-	-	3
Average	**3.0**	**2.0**	**1.8**	**2.2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1.5**	**2.4**

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech IV Year – I Sem</td></tr>
<tr><td>Course Code: J41OJ</td><td rowspan="2">INTRODUCTION TO MOBILE APPLICATION DEVELOPMENT
(Open Elective-III)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-Requisites: Basic Knowledge on Data base

Course objectives:
The Student will:

1. Evaluate a User Interface for a mobile application using J2ME.
2. Create a small but realistic working mobile application for small computing devices.
3. Categories the challenges posed by developing mobile applications and be able to propose and evaluate and select appropriate solutions.
4. Differentiate between high and low level display screens.
5. Familiar with record management systems.

Module 1:
J2ME Overview: Java 2 Micro Edition and the World of Java, Inside J2ME, J2ME and Wireless Devices
Small Computing Technology: Wireless Technology, Radio Data Networks, Microwave Technology, Mobile Radio Networks, Messaging, Personal Digital Assistants

Module 2:
J2ME Architecture and Development Environment: J2ME Architecture, Small Computing Device Requirements, Run-Time Environment, MiDlet Programming, Java Language for J2ME, J2ME Software Development Kits, Hello World J2ME Style, Multiple MlDlets in a MIDlet Suite,J2MEWirelessToolkit J2ME Best Practices and Patterns: The Reality of Working in a J2ME World, Best Practices

Module 3:
Commands, Items, and Event Processing: J2ME User Interfaces, Display Class, The Palm OS Emulator, Command Class, Item Class, Exception Handling.

Module 4:
High-Level Display Screens: Screen Class, Alert Class, Form Class, Item Class, List Class, Text Box Class, Ticker Class. Low-Level Display Canvas: The Canvas, User Interactions, Graphics, Clipping Regions, Animation.

Module 5:
Record Management System- Record Storage, Writing and Reading Records, Record Enumeration, Sorting Records, Searching Records, Record Listener.

Text Books:

1. J2ME: The Complete Reference, James Keogh, Tata McGrawHjll.

2. Programming for Mobile and Remote Computers, G.T.Thampi, drearntec press.

Reference Books:

1. Enterprise J2ME: Developing Mobile Java Applications — Michael Juntao Yuan, Pearson Education, 2004
2. Beginning Java ME Plafform, Ray Rischpater, Apress, 2009
3. Beginning J2ME: From Novice to Professional, Third Edition, Sing Li, Jonathan B. Knudsen, Apress, 2005
4. Kicking Butt with MIDP and MSA:C,eating Great Mobile Applications, I edition, J.Knudsen, Pearson.

E - Resources:

1. https://www.smartzworld.com/notes/mobile-application-development-notes-pdf-mad-pdf-notes/
2. https://www.slideshare.net/ChromeInfotech/mobile-application-development-process
3. https://nptel.ac.in/courses/106/106/106106156/
4. http://w1236xz.website/j2ee-the-complete-reference-tata-mcgraw-hill pdf

Course outcomes:

The students will be able to

1. **Implement** a User Interface for a mobile application using J2ME.
2. **Design** a small but realistic working mobile application for small computing devices.
3. **Classify** the challenges posed by developing mobile applications and be able to propose and evaluate and select appropriate solutions.
4. **Classify** between high and low level display screens.
5. **Apply** the concepts on record management systems.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	2	-	-	-	-	-	-	-	-	2	3	2
CO2	3	2	2	-	-	-	-	-	-	-	-	2	3	2
CO3	3	2	2	-	-	-	-	-	-	-	-	2	3	2
CO4	3	2	2	-	-	-	-	-	-	-	-	2	3	2
CO5	3	2	2	-	-	-	-	-	-	-	-	2	3	2
Average	**3.0**	**2.0**	**2.0**	-	-	-	-	-	-	-	-	**2.0**	**3.0**	**2.0**

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="4">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech IV Year – I Sem</td></tr>
<tr><td>Course Code: J41OK</td><td rowspan="2">FUNDAMENTALS OF OBJECT ORIENTED PROGRAMMING THROUGH C++
(Open Elective-III)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Fundamental Knowledge of Programming in C.

Course Objectives:

The students will

1. Be able to explain the difference between object oriented programming and procedural programming.
2. Be able to program using more advanced C++ features such as composition of objects, operator overloads, inheritance
3. Be able to build C++ classes using appropriate encapsulation and design principles.
4. Improve problem solving skills.
5. Be able to apply object oriented or non-object oriented techniques to solve bigger computing problems

Module I: Introduction

Unit 1:

What is object oriented programming? Why do we need object oriented Programming characteristics of object-oriented languages

Unit 2:

C++ Programming basics: Output using cout. Directives. Input with cin. Type bool. Thesetw manipulator. Type conversions.

Module II: Functions and Pointers

Unit 1:

Returning values from functions. Reference arguments. Overloaded function. Inline function. Default arguments. Returning by reference.

Unit 2:

Addresses and pointers. The address of operator and pointer and arrays. Pointer and action pointer and C-types string. Memory management: New and Delete, pointers to objects, debugging pointers.

Module III: Classes and Objects

Unit 1:

Making sense of core object concepts (Encapsulation, Abstraction, Polymorphism, Classes, Messages Association, Interfaces) Implementation of class in C++, C++ Objects as physical object, C++ object as data types constructor.

Unit 2: Object as function arguments. The default copy constructor, returning object from function. Structures and classes. Classes objects and memory static class data. Const. and classes.

Module IV: Arrays and Strings
Unit 1:
Arrays and string arrays fundamentals. Arrays as class Member Data : Arrays of object, string, The standard C++ String class
Unit 2:
Operator overloading: Overloading unary operations. Overloading binary operators, data conversion, pitfalls of operators overloading and conversion keywords.Explicit and Mutable.

Module V: Inheritance
Unit 1:
Concept of inheritance. Derived class and based class. Derived class constructors, member function, class hierarchies.
Unit 2:
Virtual Function, friend function, Static function, Assignment and copy initialization, this pointer, dynamic type information.

Text Books:

1. Object Oriented Programming with C++ by E. Balagurusamy, McGraw-Hill Education (India)
2. ANSI and Turbo C++ by Ashoke N. Kamthane, Pearson Education.

Reference Books:

1. C++ and Object Oriented Programming – Jana, PHI Learning.
2. Object Oriented Programming with C++ - Rajiv Sahay, Oxford

E-Resources:

1. https://nptel.ac.in/courses/106/105/106105151/

Course Outcomes:
The students will be able to

1. Articulate the principles of object-oriented problem solving and programming.
2. Outline the essential features and elements of the C++ programming language.
3. Apply the concepts of class, method, constructor, instance, data abstraction, function abstraction, inheritance, overriding, overloading.
4. Program with basic data structures using array.
5. Analyze, write, debug, and test basic C++ codes using the approaches introduced in the course.

CO-Articulation Matrix														
CO-PO/PSO Mapping Chart **3/2/1 indicates the strength of the calculation** **3-Strong, 2-Medium, 1-Low**														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**P O3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**
CO1	2	1	3	-	2	-	-	-	-	-	-	-	2	2
CO2	1	2	3	-	2	-	-	-	-	-	-	-	2	2
CO3	-	2	2	-	1	-	-	-	-	-	-	-	1	1
CO4	2	1	2	-	1	-	-	-	-	-	-	-	1	1
CO5	1	2	1	-	2	-	-	-	-	-	-	-	2	1
Average	1.2	1.6	2.2	-	1.6	-	-	-	-	-	-	-	1.6	1.4

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="4">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech IV Year – I Sem.</td></tr>
<tr><td>Course Code: J41OL</td><td rowspan="2" colspan="4">FUNDAMENTALS OF DATA SCIENCE
(Open Elective-III)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Good mathematical background and programming skills.

Course Objectives:
The students will
1. To explain how math and information sciences can contribute to building better algorithms and software.
2. To develop fundamental knowledge of concepts underlying data science projects.
3. To develop applied experience with data science software, programming, applications and processes.
4. To develop practical data analysis skills, which can be applied to practical problems.
5. To develop practical skills needed in modern analytics.

Module 1:Introduction to Data Science
What is Data Science? - Big Data VS Data Science, Datafication, Current landscape of perspectives and Skill sets needed.

Module 2: Statistics in Data Science
Statistical Inference, Populations and samples, Statistical modeling, probability distributions, fitting a model.

Module 3: Exploratory Data Analysis
Basic tools (plots, graphs and summary statistics) of EDA, Philosophy of EDA, The Data Science Process.

Module 4: Liner Regression for Data Science
Simple Linear Regression, Multiple Linear Regression, other Considerations in the Regression Model,

Module 5: Classification
An Overview of Classification, Why Not Linear Regression?, Logistic Regression, Linear Discriminant Analysis, A Comparison of Classification Methods.

Text Books:
1. Practical Data Science with R". Nina Zumel, John Mount. Manning, 2014.

Reference Books:
1. Data Science for business", F. Provost, T Fawcett, 2013.

E-Resources:

1. https://www2.cs.duke.edu/courses/compsci190/fall18

Course Outcomes:

1. **Know** basic notions and definitions in data analysis.
2. **Know** standard methods of data analysis
3. **Understand** and Apply Statistical Methods for Data Analysis.
4. **formulate** the problem of knowledge extraction.
5. **translate** a real-world problem into mathematical terms.

CO-Articulation Matrix														
CO-PO/PSO Mapping Chart **3/2/1 indicates the strength of the calculation** **3-Strong, 2-Medium, 1-Low**														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**P O3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO 2**
CO1	2	2	1	1									2	1
CO2	1	2	2	1									1	2
CO3	2	2	2	2									1	1
CO4	2	2	2	2									2	2
CO5	1	2	2	2									2	1
Average	1.6	2	1.8	1.6									1.6	1.4

<table>
<tr><td>AY 2020-21
onwards</td><td colspan="4">J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B. Tech
IV Year – I Sem.</td></tr>
<tr><td>Course Code:
J41OM</td><td rowspan="2" colspan="4">INTRODUCTION TO NEURAL NETWORKS
(Open Elective-III)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nill

Course Objectives:

The students will

1. Understand the differences and similarities neural network, human brain and feedback systems
2. Learn the different learning techniques
3. Familiar with the concept of single layer perceptron and its algorithms.
4. Familiar with the concept of multilayer perceptron and its algorithms
5. Know the self-organization mapping techniques.

Module 1:

Unit 1: Introduction: What is a neural network? Human Brain, Models of a Neuron, Neural networks viewed as Directed Graphs.

Unit 2 : Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks.

Module 2:

Unit 1: Learning Process: Error Correction learning, Memory based learning, Hebbian learning, Competitive.

Unit 2 : Boltzmann learning, Credit Assignment Problem, Memory, Adaption, Statistical nature of the learning process.

Module 3:

Unit 1: Single layer perceptron's: Adaptive filtering problem, Unconstrained Optimization Techniques, Linear least square filters, least mean square algorithm, learning curves.

Unit 2 : Learning rate annealing techniques, perception-convergence theorem, Relation between perception and Bayes classifier for a Gaussian Environment.

Module 4:

Unit 1 : Multilayer Perceptron's: Back propagation algorithm XOR problem.

Unit 2 : Heuristics, Output representation and decision rule, computer experiment, feature detection

Module 5:

Unit 1: Self –Organization Maps: Two basic feature mapping models, Self-Organization maps, SOM algorithm.

Unit 2: Hopfield models: Hopfield models, computer experiment.

Text Books:

1. Neural networks A comprehensive foundation, Simon Hhaykin, PHI edition.
2. Artificial neural networks-B.Vegnanarayana Prentice Halll of India P Ltd 2005.

Reference Books:

1. Neural networks in Computer intelligence, Li Min Fu TMH 2003.
2. Neural networks James A Freeman David M S kapurapearson education 2004.

E-Resources:

1. https://towardsai.net/p/machine-learning/main-types-of-neural-networks-and-its-applications-tutorial-734480d7ec8e
2. http://neuralnetworksanddeeplearning.com/index.html
3. http://neuralnetworksanddeeplearning.com/chap2.html
4. http://neuralnetworksanddeeplearning.com/chap3.html
5. http://neuralnetworksanddeeplearning.com/chap4.html
6. http://neuralnetworksanddeeplearning.com/chap5.html
7. http://neuralnetworksanddeeplearning.com/chap6.html
8. http://neuralnetworksanddeeplearning.com/chap1.html

Course Outcomes:

Students will be able to:

1. **Know** differences and similarities between neural network, human brain and feedback systems
2. **Get** the knowledge of different learning techniques
3. **Describe** the concept of single layer perceptron and its algorithms.
4. **Describe** the concept of multilayer perceptron and its algorithms.
5. **Analyse** the self-organisation mapping techniques.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	Program Outcomes (POs)											Program Specific Outcomes*		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	-	2	2	1	-	-	-	-	-	-	-	-	-
CO2	2	-	2	2	1	-	-	-	-	-	-	-	-	-
CO3	2	-	2	2	1	-	-	-	-	-	-	-	-	-
CO4	2	-	2	2	1	-	-	-	-	-	-	-	-	-
CO5	2	-	2	2	1	-	-	-	-	-	-	-	-	-
Average	2	-	2	2	1	-	-	-	-	-	-	-	-	-

<table>
<tr><td>AY 2020-21
onwards</td><td colspan="4">J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B. Tech
IV Year – I Sem.</td></tr>
<tr><td>Course Code:
J41ON</td><td colspan="4" rowspan="2">IC APPLICATIONS
(Open Elective-III)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Electronic devices and circuits, Switching Theory & Logic Design, Pulse & Digital Circuits.

Course Objectives:
Students will learn to
1. Introduce the basic building blocks of linear integrated circuits.
2. Teach the linear and non – linear applications of operational amplifiers.
3. Introduce the theory and applications of analog multipliers and PLL.
4. Introduce the concepts of waveform generation and introduce some special function ICs.
5. Understand and implement the working of basic digital circuits

Module 1:
Unit 1: Introduction to Linear Integrated Circuits
Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, Features of 741 Op-Amp, Modes of Operation - Inverting, Non-Inverting, Differential
Unit 2: Non-Linear Applications of OP-AMP
Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Comparators, Schmitt Trigger, Introduction to Voltage Regulators, Features of 723 Regulator, Three Terminal Voltage Regulators.

Module 2:
Unit 1: Introduction to IC-555 Applications
Introduction to Active Filters, Characteristics of Band pass, Band reject and All Pass Filters, Analysis of 1st order LPF & HPF Butterworth Filters, Waveform Generators – Triangular, Saw tooth, Square Wave, IC555 Timer -Functional Diagram, Monostable, and Astable Operations, Applications.
Unit 2: Timer and Phase Locked Loops(PLL)
Applications
IC565 PLL – Block Schematic, Description of Individual Blocks, Applications.

Module 3:
Unit 1: Converters of DAC
Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC

Unit 2: Converters of ADC
Different Types of ADCs – Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications.

Module 4:
Unit 1: Digital Integrated Circuits
Classification of Integrated Circuits, Comparison of Various Logic Families Combinational Logic ICs – Specifications and Applications of TTL-74XX
Unit 2: Applications of Digital ICs
Code Converters, Decoders, Demultiplexers, LED & LCD Decoders with Drivers, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Priority Generators/Checkers, Parallel Binary Adder/Subtractor, Magnitude Comparators

Module 5:
Unit 1: Combinational Circuits Using TTL 74XX ICS
Familiarity with commonly available 74XX &
CMOS 40XX Series ICs – All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers.
Unit 2: Memories
Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static& Dynamic RAMs.

Text Books:

1. Op-Amps & Linear ICs – Ramakanth A. Gayakwad, PHI, 2003.
2. Digital Fundamentals – Floyd and Jain, Pearson Education, 8th Edition, 2005

Reference Books:

1. Linear Integrated Circuits –D. Roy Chowdhury, New Age International (p) Ltd, 2ndEd., 2003.
2. Op Amps and Linear Integrated Circuits-Concepts and Applications James M. Fiore,Cengage Learning/ Jaico, 2009.
3. Operational Amplifiers with Linear Integrated Circuits by K. Lal Kishore – Pearson,2009.
4. Linear Integrated Circuits and Applications – Salivahanan, MC GRAW HILLEDUCATION.
5. Modern Digital Electronics – RP Jain – 4/e – MC GRAW HILL EDUCATION, 2010.

E-Resources:

1. http://fmcet.in/ECE/EC6404_uw.pdf
2. https://www.iare.ac.in/sites/default/files/lecture_notes/LDIC%20Lecture%20Notes.pdf.
3. http://smec.ac.in/sites/default/files/lecture_notes/Course%20File%20of%20LDIC(Linear%20 and%20Digital%20IC%20Applications).pdf

4. Integrated Circuits, MOSFETS, Op-Amps and their Applications: https://archive.swayam.gov.in/courses/4441-integrated-circuits-mosfets-op-amps-andtheir-applications

Course Outcomes:

Students will be able to

1. **Understanding** of operational amplifiers with linear integrated circuits.
2. **Apply** the knowledge of the different families of digital integrated circuits and their characteristics.
3. **Analyse** the functioning of various design circuits using operational amplifiers for various applications.
4. **Design** various techniques to develop a/d and d/a convertors.
5. **Acquire** hands-on laboratory experience on ic based project kits in above areas according to specifications.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**-**
CO2	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
CO3	**1**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**
CO4	**1**	**2**	**1**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**2**
CO5	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**
Average	**1.6**	**2**	**1.7**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1.75**	**2.5**

<table>
<tr><td>AY 2020-21 onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech. IV Year – I Sem</td></tr>
<tr><td>Course Code: J41OP</td><td rowspan="2">INTRODUCTION TO GEOLOGY
(Open Elective-III)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:
The students will
1. To introduce rock types and their physical properties
2. To acquaint with different structures occurring in rocks
3. To get idea about Ground water, and aquifers
4. To get idea about coal formation and its stages.
5. To know about minerals occurring in India.

Module 1
Unit - 1: Introduction, Definitions, Importance of geology in mining, Types of rocks, Physical properties of rocks.

Module 2
Unit - 1: Structural Geology: Definition, terminology, and Primary and secondary structures: Bedding, lineation, foliation, cleavage, Strike and dip.
Unit - 2: Definition of faults, folds and joints and their types, Unconformities and its kinds.

Module 3
Unit - 1: Ground Water: Introduction, Hydrological Cycle, origin and occurrence of groundwater, water table.
Unit - 2: Aquifers: Types of aquifers, confined and unconfined aquifers, perched aquifers.

Module 4
Unit - 1: Coal: Stages of formation, composition, theories of formation of coal.

Module 5
Unit - 1: Occurrence and distribution of important metallic mineral deposits in India: Iron, Copper, Lead, Zinc, Manganese, Aluminum, Chromium.
Unit - 2: Occurrence and distribution of important non-metallic mineral deposits in India: Asbestos, Kyanite, Sillimanite.

Textbooks:
1. Structural Geology – Billings, M.P. Prentice Hall.
2. Engineering geology –by Dr. Chennkeshavulu.

Reference Books:

1. A Textbook of Geology: Mukherjee P.K., The World Press Pvt. Limited Calcutta.

E-resources:

1. http://www.publiclandsforthepeople.org/wp-content/uploads/2015/06/Introduction-to-Geology-and-Hard-Rock-Mining-2015.pdf
2. https://www.eolss.net/Sample-Chapters/C01/E6-15-08-03.pdf
3. https://pubs.usgs.gov/of/2001/0151/pdf/of01-151.pdf
4. https://digitalworks.union.edu/cgi/viewcontent.cgi?article=1008&context=ajes

Course Outcomes:

The student will be able to:

1. **Understand** about rocks and their properties
2. **Learn** about different structures occurring in rocks
3. **Understand** about ground water, water table and aquifers
4. **Learn** about coal and its formation theories
5. **Distinguish** metallic and non-metallic minerals.

1. CO-PO/PSO Mapping Chart

(3/2/1 indicates strength of correlation)

3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	1	-	-	-	-	-	-	-	-	-	-	-
CO5	3	1	2	-	-	-	-	-	-	-	-	-	-	-
Average	3	2	1.6	-	-	-	-	-	-	-	-	-	-	-

<table>
<tr><td>AY 2020-21
Onwards</td><td>J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B.Tech
IV Year – I Sem</td></tr>
<tr><td>Course Code:
J41ON</td><td rowspan="2">INTEGRAL TRANSFORMS AND INTEGRAL EQUATIONS
(Common to CE,EEE, ECE, ME, CSE,IT ,ECM &MIE)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Differential Equations

Course Objectives:
The students will

1. approximation of real-valued periodic functions to suitably restricted non-periodic functions f(x) defined for all real numbers
2. how to use Laplace transform methods to solve ordinary and partial differential equations
3. make them familiar with the methods of solving differential equations, partial differential equations.
4. the properties of Z-Transform and associating the knowledge of properties of ROC in response to different operations on discrete signals.
5. discretization techniques to find approximate solutions of differential equations different types of errors involved in such solutions, their measures and practical applications.

MODULE-I: Applications of Differential Equations
Basic introduction of the course using precise examples like periodic functions, signal propagation, solving mathematical models corresponding to Electrical Circuits.

MODULE-II: Laplace Transforms
UNIT-I: Laplace Transform (LT) – definition – linearity property of LT. Existence Theorem – First and Second Translation theorems. Change of scale property, LT of derivatives, multiplication by t and division by t – Initial and Final Value theorems.

UNIT-II: Inverse Laplace Transforms: definition – standard forms. First and Second shifting theorems. Change of scale property – Use of partial fractions, Inverse transforms of derivatives, Inverse Laplace Transform of integrals – definition of convolution – Convolution theorem

MODULE–III : Fourier Transforms
Fourier Transforms – Fourier integral formula, Inverse Theorem for Fourier Transform; Fourier Sine Transform, Inverse formula for Fourier Sine Transform; Fourier Cosine Transform, Inverse formula for Fourier Cosine Transform; linearity property, change of scale property, shifting property.

MODULE–IV : Z-Transforms

Definition and properties of Z-Transform, Standard functions of Z-Transform, Unit step Function. Unit Impulse function, Initial value Theorem and Final value Theorem, Inverse Z-Transform, Partial fraction method, Difference Equation using Z-Transforms.

MODULE-V: Henkel Transforms

Henkel Transforms- Henkel Transform of the derivatives of a function.- Application of Henkel Transforms in boundary value problems.

TEXT BOOKS:

1. A.R.Vashista, Dr. R.K.Gupta, Integral transforms - Krishna PrakashamMandirurray
2. .R.Spiegel, Theory and problems of Laplace transforms - Shamus Outline Series Tata Mac Grawhill

REFERENCES:

1. Brian Daries, Integral Transforms & their applications - Springers
2. L Debnath , D Bhatta, Integral Transforms & their Applications – Chapman & Hall/CRC
3. Chorafas, Integral Transforms & their Applications

E-RESOURCES

1. https://nptel.ac.in/content/storage2/courses/112104158/lecture8.pdf
2. https://tutorial.math.lamar.edu/classes/de/inversetransforms.aspx
3. http://www.thefouriertransform.com/
4. http://dsp-book.narod.ru/TAH/ch06.pdf
5. https://www.henkel-adhesives.com/in/en.html

Course outcomes:

At the end of this course students will be able to

1. understand the concepts of integral transforms
2. Determine Laplace transform of a function and understand the fundamental properties and apply Laplace transform in solving ODEs.
3. Determine Fourier and inverse Fourier transform of a function and understand the fundamental properties and apply Fourier transform in solving ODEs.
4. apply the Z transform techniques to solve second-order ordinary difference equations.
5. apply the Hankel transform in the infinite 2-dimensional plane

CO-PO/PSO Mapping Chart (Draft) (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	3	2	3	-	-	-	-	-	-	-	2	-	-
CO2	3	3	2	3	-	-	-	-	-	-	-	2	-	-
CO3	3	3	2	3	-	-	-	-	-	-	-	2	-	-
CO4	3	3	2	3	-	-	-	-	-	-	-	2	-	-
CO5	3	3	2	3	-	-	-	-	-	-	-	2	-	-
Average	3	3	2	3	-	-	-	-	-	-	-	2	-	-

<table>
<tr><td>AY 2020-21
Onwards</td><td colspan="4">J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B.Tech
IV Year – I Sem</td></tr>
<tr><td>Course Code:
J41OT</td><td colspan="4" rowspan="2">NDT and VACUUM TECHNOLOGY
(Common to CE, EEE, ME, ECE, CSE, IT, ECM& MIE)
(Open Elective-III)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:
This course will enable students to:

1. study various Non Destructive Testing and types of defects.
2. know the basics of non-destructive techniques using ultrasonic interferometer.
3. provide a basic level of understanding on Vacuum technology.
4. understand the importance Pressure gauges.
5. introduce the fundamental concepts vacuum pumps.

Module 1: Introduction to Non-destructive testing
Introduction, Objectives of Non-destructive testing, Types of defects – Cracking, Spalling, Staining, Construction and Design defects, Honey combing, Dusting, Blistering, Rain damage..

Module 2: Methods of Non-destructive Testing
Liquid penetration method, Dye penetration method, Ultrasonic Inspection method, Pulse Echo method, Radiographic testing Magnetic particle testing, Eddy current Testing.

Module 3: Introduction to Vacuum Technology
Unit-1: Definition of vacuum, Degrees of vacuum and their ranges; Review of Kinetic theory of gases; Definitions of particle flux, mono layer formation time, pressure; Elementary gas transport phenomena; Knudsen's and Reynolds' numbers; Throughput, mass flow and conductance.
Unit-2: Flow meters: Molar flow, Mass flow.
.
Module 4: Pressure gauges
Classification, Direct and indirect gauges, Indirect gauges – Pirani gauge, Thermocouple gauge, Ionization gauge, hot cathode gauge, Penning gauge.

Module-5: Vacuum Pumps
Introduction, Pumping speed, Rotary vane pump, Turbo molecular pump, Diffusion pumps.

Text Books:

1. "Engineering Physics",B K Pandey and S Chaturvedi, Cengage Learning India, Revised Edition, 2014.

2. “A User’s guide to Vacuum technology”, John. F. O’Hanlon, Wiley, 3rd Edition, 2003.

Reference Books:

1. “Physics for Engineers”, R Srinivasan, New Age international, 1st reprint, 2007.
2. “Engineering Physics”, R K Gaur and S L Gupta, Dhanpatrai, Reprint, 2006.
3. “Hand Book of Thin film deposition”, Krishna Seshan, Noyes, 2nd Edition, 2002

E - Resources:

1. http://www.enfm.net/catalog/catalog/enfm-usa.pdf
2. http://web.itu.edu.tr/~arana/ndt.pdf
3. http://www.issp.ac.ru/ebooks/books/open/Nondestructive_Testing_Methods_and_
4. New_Applications.pdf
5. https://www.journals.elsevier.com/ndt-and-e-international/https://www.journals.elsevier.com/vacuum
6. http://nptel.ac.in/courses/114106035/35
7. http://nptel.ac.in/courses/112101004/37.

Course Outcomes:

On completion of the course, the students will be able to:

1. **Describe** the Types of defects and analyze them.
2. **Analyze** the principles of NDT methods.
3. **Analyze** Vacuum technology and concepts of flow meters.
4. **Develop** pressure gauges.
5. **Understand** the concepts of different vacuum pumps.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	1	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	1	-
CO4	2	2	-	-	2	-	-	-	-	-	-	-	1	-
CO5	2	2	-	-	2	-	-	-	-	-	-	-	1	-
Average	2.6	2	-	-	2	-	-	-	-	-	-	--	1	-

AY 2020-21 Onwards	**J. B. Institute of Engineering and Technology (UGC Autonomous)**	**B. Tech IV Year – I Sem**			
Course Code: J41OT	**Nano Chemistry** (Common to CE, EEE, ME, ECE, CSE, IT, ECM& MIE) (Open Elective-III)	**L**	**T**	**P**	**D**
Credits: 3		**3**	**0**	**0**	**0**

Pre-requisite: Nil

Course Objectives:

This course will enable students to:

1. To know about the scope of Nanoscale materials and synthesis.
2. Understand the properties of Nanomaterials.
3. Give knowledge of various instrumental techniques to the analysis the Nanomaterials.
4. learn about the different applications of Nanomaterials.
5. Analyze the Nano technology in Environmental purpose.

Module 1:Synthesis of Nano materials:

Introduction -synthesis of Nanostructure materials, Bottom-up approach and Top-down approach with examples-sol-gel method-solvothermal and hydrothermal routes, Chemical Vapor Deposition and precipitation methods.

Module 2:Properties of Nano materials:

Properties of Nanomaterials-Electronic properties, Energy bands and gaps in semiconductors, Fermi Surfaces-Optical properties- Fluorescence, Photoluminescence, Electroluminescence. Magnetic properties-mechanical properties-thermal properties.

Module 3: Instrumental Analysis:

Characterization techniques- Principle and block diagram of Scanning Electron Microscopy (SEM), Electron Dispersion Spectroscopy(EDS). Principle and block diagram of Electron Microscopy (TEM), Dynamic Light Scattering (DLS) and Atomic Force Microscopy(AFM) - Illustrative examples.

Module 4:Carbon Nano structures and Applications:

Carbon Nano structures, carbon clusters, types and preparation of carbon Nano tubes-optical and telecommunication applications, Nano structured crystals (graphite), graphene, carbon fibers, fullerenes and their applications. Nano solar cells and its applications

Module-5: Environmental Nanotechnology:

Implications of Nanotechnology & Research Needs-Nanostructured Catalysts TiO_2 Nanoparticles for Water purification- Nano membranes in drinking water treatment and desalination, Nanomembranes in Sea desalination-Nano particles for treatment of Chlorinated Organic Contaminants.

Text Books:

1. "Nanotechnology a gentle introduction to the next big idea",Mark A. Ratner, D. Ratner. Pearson Education Inc., Asia, 2003.
2. "Nano: The essentials-understanding Nanoscience and Nanotechnology", Pradeep.T. Tata Mc.Graw Hill, New Delhi, 2007.

Reference Books:

1. "Nanomaterials: Synthesis, Characterization, and Applications", A. K. Haghi, Ajesh K. Zachariah, NandakumarKalariakkal. Apple Academic Press, 2013.
2. "Nanomaterials and Nanochemistry", Brechignac C., Houdy P., Lahmani M. (Eds.) (Springer,) 748p. ISBN 978-3-540-72993-8, 2007
3. "Principles of Nanotechnology", Phanikumar. SciTech Publications 2nd Edition, 2010.
4. "Environmental Nanotechnology"Preetijain, Shankar lalGarg. Lap lambert Academic publishing, 2015.

E - Resources:

1. https://www.acs.org/content/acs/en/careers/college-to-career/chemistry-careers/nanochemistry.html
2. https://www.sciencedirect.com/book/9780444519566/nanochemistry
3. https://www.researchgate.net/publication/320068992_Introduction_to_Nano-chemistry_and_Nano-materials
4. https://www.kemi.dtu.dk/english/research/organic-inorganic-chemistry/nanochemistry
5. https://www.cambridge.org/core/books/engineering-chemistry/nanochemistry/D6DB35E32E530525DD927E68CED43197

Course Outcomes:

On completion of the course, the students will be able to:

1. **Learn** the different synthetic methods of the Nano materials.
2. **Know** the student Electronic, optical and magnetic properties of Nan materials.
3. **Acquire** the knowledge various instrumental methods of analysis (TEM, EDS, SEM, DLS &AFM).
4. **Know** the carbon nanotubes, carbon Nano fibers, Nano structured catalysts and Nano solar cells.
5. **Learn** usage of Nano materials in the purification of water.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	2	1	-	-	-	-	-	-	-	2	-	-
CO2	3	-	2	-	-	-	-	-	-	-	-	1	-	-
CO3	2	2	-	1	-	-	-	-	-	-	-	2	-	-
CO4	2	2	1	-	-	-	-	-	-	-	-		-	-
CO5	1	1	-	-	-	-	-	-	-	-	-	2	-	-
Average	2.2	1.6	1.6	1	-	-	-	-	-	-	-	1.4	-	-

<table>
<tr><td>AY 2020-21
onwards</td><td colspan="4">J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B.Tech
IV Year – I Sem</td></tr>
<tr><td>Course Code:
J41OU</td><td rowspan="2" colspan="4">TEAMWORK AND TEAM BUILDING
(Open Elective-III)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-Requisites: Nil

Objectives:

The students will

1. Know the working experience in the group and team
2. Understand the process and role of the team
3. Apply the knowledge of team building
4. Understand the role of team leader.
5. Plan the meetings and understanding the role of meetings

Module -I Working in Groups and Teams

Introduction-defining Types of Groups and Teams- Understanding the role of Teams in Organization; Recognizing differences between group and Teams-ensuring team success-empowering teams- working with a distributed team- technology @work: virtual worlds.

Module -II Exploring Team Roles and Processes

Defining common team roles-selecting team members-choosing the optimal team size-establishing team rules-clarifying team objectives-making collective decisions etc.

Module -III Building and Developing Team

Understanding the benefits of working in teams-fostering Resistance-using team-building activities-creating a team identity-coping with conflict and ego-dealing with difficult team members and celebrating successes.

Module -IV Leading a Team

Pursuing team leadership-preparing to be a team leader-getting start with your team-taking a project management approach- managing a team diplomatically-being sensitive to intangibles and concluding team activities.

Module -V Managing Meetings

Scheduling meeting-developing meeting agenda- planning meetings-understanding the role of meetings-conducting meetings effectively-taking notes and publishing minutes-concluding meetings and creating action plans and solving common meeting problems.

Reference/text book:

1. Butterfield, Jeff. Soft Skills for Everyone. Delhi: Cenege., 2010.

E-Resources:

1. https://smallbusiness.chron.com/difference-between-team-building-teamwork-10981.html

Course outcomes:

1. **Recognize** differences between group and team, ensuring team success, and empowering teams.
2. **Define** common team roles, establishing team rules, selecting team members, and making collective decisions
3. **Understand** the benefits of working in teams, fostering Resistance, using team-building activities
4. **Manage** a team diplomatically, and preparing to be a good team leader.
5. **Create** action plans and solving common meeting problems

CO-PO/PSO Mapping Chart
(3/2/1 indicates strength of correlation)
3 – Strong; 2 – Medium; 1 - Weak

Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	3	2	-	3	-	-
CO2	-	-	-	-	-	-	-	-	3	2	-	3	-	-
CO3	-	-	-	-	-	-	-	-	3	2	-	3	-	-
CO4	-	-	-	-	-	-	-	-	3	2	-	3	-	-
CO5	-	-	-	-	-	-	-	-	3	2	-	3	-	-
Total	-	-	-	-	-	-	-	-	3	2	-	3	-	-

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="1">J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B.Tech
IV Year – I Sem</td></tr>
<tr><td>Course Code: J41OV</td><td rowspan="2">INTELLECTUAL PROPERTY RIGHTS
(Open Elective - III)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-Requisites: Nil

Course Objectives:

1. The main objective of the IPR is to make the students aware of their rights for the protection of their invention done in their project work.
2. To get registration in our country and foreign countries of their invention, designs and thesis or theory written by the students during their project work and for this they must have knowledge of patents, copy right, trademarks, designs and information Technology Act.
3. Further teacher will have to demonstrate with products and ask the student to identify the different types of IPR's.

Module 1:

UNIT - I:

Introduction to Intellectual Property: Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.

Module 2:

UNIT - I:

Trade Marks: Purpose and function of trademarks, acquisition of trade mark rights, protectable matter.

UNIT – II: Selecting and evaluating trade mark, trade mark registration processes.

Module 3:

UNIT - I:

Law of copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law.

UNIT - II

Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer

Module 4:

UNIT - I:

Trade Secrets: Trade secretes law, determination of trade secretes status, liability for misappropriations of trade secrets, and protection for submission, trade secretes litigation.

UNIT - II:

Unfair competition: Misappropriation right of publicity, false advertising.

Module 5:

UNIT - I:

New development of intellectual property: New developments in trade mark law; copy right law, patent law, intellectual property audits.

UNIT – II:

International overview on intellectual property, international - trade mark law, copy right law, international patent law, and international development in trade secrets law.

Text Books:

1. Intellectual property right, Deborah, E. Bouchoux, cengage learning.
2. Intellectual property right - Unleashing the knowledge economy, prabuddhaganguli, Tata McGraw Hill Publishing Company Ltd.
3. Managing Intellectual Property-The Strategic Imperative, Second Edition by Vinod V Sople, PHI.

Reference Books:

1. Intellectual Property –Copyrights, Trademarks and patents by Richard Stim, Cengage Learning.
2. NirajPandey&Khushdeep Dharani –Intellectual Property rights
3. V.K. AHUJA – Law relating to Intellectual Property

E-Resources:

1. www.Ipindia.nic.in
2. www.Iprlwawindia.org
3. www.mondaq.com

Course outcomes:

The students once they complete their academic projects, they get:

1. **Awareness** of the legal environment.
2. **Understanding** of different acts under the national and international laws.
3. **Acquiring** the patent and copyright for their innovative works.
4. **Awareness** of trade secrets and method of advertising.
5. **Knowledge** of plagiarism in their innovations which can be questioned legally.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	-	-	-	-	-	-	-	-	3	2	-	3	-	-
CO2	-	-	-	-	-	-	-	-	3	2	-	3	-	-
CO3	-	-	-	-	-	-	-	-	3	2	-	3	-	-
CO4	-	-	-	-	-	-	-	-	3	2	-	3	-	-
CO5	-	-	-	-	-	-	-	-	3	2	-	3	-	-
Total	-	-	-	-	-	-	-	-	3	2	-	3	-	-

AY 2020-21 Onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B.Tech IV Year – II Sem			
Course Code: J42OA	AIR POLLUTION & CONTROL (Open Elective-IV)	L	T	P	D
Credits:3		3	0	0	0

Pre-requisite: Environmental Science

Course Objectives:

This course will enable students to:

1. Introduce students to basic concepts of pollution.
2. understand the causes of air pollution.
3. Study about the health related to air pollution.
4. Develop skills relevant to control of air pollution.
5. understand the quality of air.

Module 1:

Unit-1:

Air Pollution – Definitions, Scope, Significance and Episodes, Air Pollutants – Classifications – Natural and Artificial – Primary and Secondary, point and Non-Point, Line and Areal Sources of air pollution- stationary and mobile sources

Module 2:

Unit-1: Effects of Air pollutants on man, material and vegetation; Global effects of air pollution – Green House effect, Heat Islands, Acid Rains, Ozone Holes etc.

Module 3:

Unit-1:

Thermodynamics and Kinetics of Air-pollution – Applications in the removal of gases like SO_x; NO_x; CO; HC etc., air-fuel ratio. Computation and Control of products of combustion. Meteorology and plume Dispersion; properties of atmosphere; Heat, Pressure, Wind forces, Moisture and relative Humidity; Influence of Meteorological phenomena on Air Quality-wind rose diagrams.

Module 4:

Unit-1: Lapse Rates, Pressure Systems, Winds and moisture plume behaviour and plume Rise Models; Gaussian Model for Plume Dispersion.

Control of particulates – Control at Sources, Process Changes, Equipment modifications, Design and operation of control.Equipment's – Settling Chambers, Centrifugal separators, filters Dry and Wet scrubbers, Electrostatic precipitators.

Module 5:

Unit-1: General Methods of Control of NO_x and SO_x emissions – In-plant Control Measures, process changes, dry and wet methods of removal and recycling.

Air Quality Management – Monitoring of SPM, SO_x; NO_x and CO Emission Standards.

Text Books:

1. Air pollution By M.N.Rao and H.V.N.Rao – Tata Mc.Graw Hill Company.
2. Air pollution by Wark and Warner.- Harper & Row, New York

Reference Books:

1. Air pollution and control By K.V.S.G. Murali Krishna, Kaushal Publishers. Kakinada

E-Resources:

1. http://mjcetenvsci.blogspot.in/2013/11/air-pollution-causes-effects-and.html
2. https://www.britannica.com/technology/air-pollution-control
3. http://www.yourarticlelibrary.com/air-pollution/5-effective-methods-to-control-air-pollution-explained-with-diagram/28360/
4. http://www.transportlinks.org/rtkb/english/Module%205%5C5_4a%20Environmental%20Impact%20Assessment.pdf

Course Outcomes:

On completion of the course, the students will be able to:

1. **Acquired** knowledge on the basic elements of causes and occurrence of the air pollution.
2. **Haveawareness** on the different causes of the air pollution.
3. **Haveawareness** about different health related problems caused due to air pollution.
4. **develop** concepts in controlling and prevention of air pollution.
5. **analyse** air quality.

CO-PO/PSO Mapping Chart (Draft) (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 – Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	1	-	-	-	-	1	2	-	-	-	-	1	-	-
CO2	-	-	-	-	-	1	2	-	-	-	-	1	-	-
CO3	-	-	-	-	-	1	2	-	-	-	-	1	-	-
CO4	-	-	-	-	-	1	2	-	-	-	-	1	-	-
CO5	-	-	-	-	-	1	2	-	-	-	-	1	-	-
Average	0.2	-	-	-	-	1	2	-	-	-	-	1	-	-

<table>
<tr><td>AY 2020-21 Onwards</td><td colspan="4">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech IV Year – II Sem</td></tr>
<tr><td>Course Code: J42OB</td><td rowspan="2">DISASTER MANAGEMENT
(Open Elective-IV)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits:3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Environmental Science

Course Objectives:
This course will enable students to:

1. Provide basic conceptual understanding the difference between the hazard and a disaster.
2. Knowledge about the various disasters and their impacts.
3. Provide basic understanding about the hazard and vulnerability profile of India.
4. Have conceptual understanding about the disaster management phases.
5. Approaches of Disaster Risk Reduction (DRR) and the relationship between vulnerability, Disasters, disaster prevention and risk reduction.

Module 1:

Unit-1: Understanding Disaster:
Concept of Disaster - Different approaches- Concept of Risk - Levels of Disasters - Disaster Phenomena and Events (Global, national and regional)

Unit-2: Hazards and Vulnerabilities:
Natural and man-made hazards; response time, frequency and forewarning levels of different hazards - Characteristics and damage potential or natural hazards; hazard assessment - Dimensions of vulnerability factors; vulnerability assessment - Vulnerability and disaster risk - Vulnerabilities to flood and earthquake hazards

Module 2:

Unit-1: Disaster Management Mechanism:
Concepts of risk management and crisis managements - Disaster Management Cycle - Response and Recovery - Development, Prevention, Mitigation and Preparedness - Planning for Relief

Module 3:

Unit-1: Capacity Building:
Capacity Building: Concept - Structural and Non-structural Measures Capacity Assessment; Strengthening Capacity for Reducing Risk - Counter-Disaster Resources and their utility in Disaster Management - Legislative Support at the state and national levels

Module 4:

Unit-1: Coping with Disaster: Coping Strategies; alternative adjustment processes - Changing Concepts of disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management.

Module 5:

Unit-1: Planning for disaster management:

Strategies for disaster management planning - Steps for formulating a disaster risk reduction plan - Disaster management Act and Policy in India - Organizational structure for disaster management in India - Preparation of state and district disaster management plans

Text Books:

1. Manual on Disaster Management, National Disaster Management, Agency Govt of India.
2. Disaster Management by MrinaliniPandey Wiley 2014. 3. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2015

Reference Books:

1. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.
2. National Disaster Management Plan, Ministry of Home affairs, Government of India (http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf)

E-Resources:

1. https://nptel.ac.in/courses/105/104/105104183/
2. https://nptel.ac.in/courses/124/107/124107010/

Course Outcomes:

On completion of the course, the students will be able to:

1. **Acquire** knowledge on various types of disasters and hazards
2. **Distinguish** between the hazard and a disaster can be analyzed
3. **Acquire** knowledge on the various approaches of Disaster Risk Reduction (DRR)
4. **Ability** to understand the relationship between vulnerability. disasters, disaster prevention and risk reduction
5. **Develop** ability to respond to different disasters

CO-PO/PSO Mapping Chart (Draft) (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 – Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	-	-	-	2	2	3	-	-	-	-	-	-
CO2	3	2	-	-	-	2	2	3	-	-	-	-	-	-
CO3	3	2	-	-	-	2	2	3	-	-	-	-	-	-
CO4	3	2	-	-	-	2	2	3	-	-	-	-	-	-
CO5	3	2	-	-	-	2	2	3	-	-	-	-	-	-
Average	3	2	-	-	-	2	2	3	-	-	-	-	-	-

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="1">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech
IV Year – II Sem</td></tr>
<tr><td>Course Code: J42OC</td><td rowspan="2">SPECIAL ELECTRICAL MACHINES
(Open Elective-IV)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Prerequisite: Basic Electrical and Electronics Engineering

Course Objectives:
This course will enable students to:

1. Introduce the concepts of permanent magnets and to study the construction, operation, characteristics & control of PMBLDC motor.
2. Study construction, operation characteristics and control of PMSM.
3. Understand the construction, operation, characteristics, power controllers and control of SRM.
4. Study the operation of stepper motor, its types, control and its applications.
5. Understand the operation & characteristics of other special machines.

MODULE 1: PERMANENT MAGNET BRUSHLESS DC MOTORS
Fundamentals of permanent magnets – types - principle of operation- magnetic circuit analysis - EMF and torque equations, Characteristics and control.

MODULE 2: PERMANENT MAGNET SYNCHRONOUS MOTORS
Principle of operation – EMF and torque equations - Phasor diagram - Power controllers – performance characteristics – Digital controllers – Constructional features, operating principle and characteristics of synchronous reluctance motor.

MODULE 3: SWITCHED RELUCTANCE MOTORS
Constructional features – Principle of operation - Torque prediction – performance Characteristics-Power controllers – Control of SRM drive - Sensor less operation of SRM – Applications.

MODULE 4: STEPPER MOTORS
Constructional features –Principle of operation –Types – Torque equation – Linear and Nonlinear analysis – Characteristics – Drive circuits – Closed loop control – Applications.

MODULE 5: OTHER SPECIAL ELECTRICAL MACHINES
Principle of operation and characteristics of Hysteresis motor – AC series motors – Linear induction motor – Applications.

TEXT BOOKS:

1. T.J.E. Miller, Brushless magnet and Reluctance motor drives, Claredon press, London, 1989.
2. R.Krishnan, Switched Reluctance motor drives, CRC press, 2001.
3. T.Kenjo, Stepping motors and their microprocessor controls, Oxford University press, New Delhi, 2000.
4. K. Venkataratnam, Special Electrical Machines, Universities Press, 2014.

REFERENCES:

1. T.Kenjo and S.Nagamori, Permanent magnet and Brushless DC motors, Clarendon press, London, 1988.
2. R.Krishnan, Electric motor drives, Prentice hall of India, 2002.
3. D.P.Kothari and I.J.Nagrath, Electric machines, Tata McGraw hill publishing company, New Delhi,Third Edition, 2004.
4. Irving L.Kosow, Electric Machinery and Transformers, Pearson Education, Second Edition, 2007.

E-RESOURCES:

1. https://nptel.ac.in/courses/108/102/108102156/
2. https://www.academia.edu/9885014/SPECIAL_ELECTRICAL_MACHINES_NPTEL_NOTES
3. https://easyengineering.net/ee6703-special-electrical-machines/

Course Outcomes:

The students will be able to:

1. **Analyze** given magnetic circuit and understand operation, characteristics and control of PMBLDC motor.
2. **Understand** the construction, operation performance characteristics of PMSM and its power controllers.
3. **Understand** the construction, operation and control of SRM drive and its power controllers.
4. **Understand** the construction, operation, characteristics and control of stepper motor.
5. **Understand** the operation & characteristics of other special electrical machines.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	1	3	3	3	-	-	-	-	-	-	-	-	3	3
CO2	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-	-	-
Average	1.8	2.2	3	3	-	-	-	-	-	-	-	-	3	3

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B.Tech IV Year – II Sem			
Course Code: J42OD	**ELECTRICAL SAFETY ENGINEERING** (Open Elective-IV)	**L**	**T**	**P**	**D**
Credits: 3		3	0	0	0

Prerequisite: Basic Electrical and Electronics Engineering

Course Objectives

The students will

1. To expose the students to electrical hazards.
2. To impart knowledge on prevention of electrical shocks.
3. To create awareness about various first aid methods.
4. To study about Hazardous zones-causes of sparks and flashovers in electrical plants
5. To study about safety management.

MODULE –I: INTRODUCTION

Unit-I: General Background-Objectives of safety and security measures-Hazards associated with electric current and voltage-principles of electrical safety- Approaches to Prevent Accidents.

Unit-II: Fire Prevention and Fire Fighting-Objectives and scope of IE act and IE rules-General requirements for electrical safety as per IE rules.

MODULE –II: ELECTRICAL SHOCKS AND THEIR PREVENTION

Unit-I: Primary and Secondary Electric Shocks- Occurrence of Electric Shock -Shocks Due to Flashovers/Spark-overs- Lightning Strokes on Overhead Transmission Lines and Outdoor Substations.

Unit-II: Safety Precautions in Small LV Installations, Residential Buildings, Shops - Safety Procedures in Electrical Plant Installation and description of Earthing System- Equipment Earthing - Substation Earthing.

MODULE –III: FIRST AID

Unit-I: Introduction- Removal of Contact with Live Conductor- First Principles of Actions after Electric Shock - Artificial Respiration - Schafer's Prone Pressure Method- Silvester's Method- Nielson's Arm-lift Back-pressure Method- Mouth to Mouth Method.

Unit-II: Use of Artificial Resuscitator- External Cardiac Massage- Cardiac Pulmonary Resuscitation-First aid treatment of Heat Exhaustion and heat stroke.

MODULE –IV: ELECTRICAL SAFETY IN HAZARDOUS AREAS

Introduction-Classification of Hazardous zones-causes of sparks and flashovers in electrical plants and machines-functional requirements of electrical equipment and installations for hazardous area/zones-classification of equipment/enclosure for hazardous locations.

MODULE –V: ELECTRICAL SAFETY MANAGEMENT

Introduction-Principles of safety management-management's safety policy-safety organization-organization charts for construction phase of a project, maintenance mode of a plant and for safety department – safety auditing-training and supervision-annual reports - motivation to managers, supervisors and employees.

TEXT BOOKS:

1. S. Rao and H.L. Saluja, "Electrical Safety, Fire Safety and Safety Management", Khanna Publishers, 2012.
2. W.F. Cooper, "
3. Electrical Safety Engineering", Butterworth and Company, London, 1998.

REFERENCE BOOKS:

1. J. Cadick, D. Neitzel and A. Winfield, "Electrical Safety Hand Book", McGraw Hill Education, 2012.
2. J. Maxwell Adams, "Electrical Safety- A Guide to the Causes and Prevention of Electric Hazards", The Institution of Electric Engineers, 3rd Reprint, 2009.
3. Martha J. Boss and Gayle Nicoll, "Electrical Safety - Systems, Sustainability and Stewardship", CRC Press, 2015.

E-Resources:

1. https://onlinecourses.swayam2.ac.in/nou20_cs08/preview
2. https://npti.gov.in/electrical-safety-industries-and-accidents-prevention
3. https://www.kopykitab.com/Electrical-Safety-Fire-Safety-Engineering-And-Safety-Management-Second-Edition-by-S-Rao-Saluja

Course Outcomes:

The students will be able to:

1. **Learn** about Electrical safety, IE act and IE rules.
2. **Understand** Electrical shocks and their prevention
3. **Acquire** knowledge about various first aid measures.
4. **Familiarize** with electrical safety in hazardous areas.
5. **Get** introduced to safety management.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	-	3	-	3	3	-	-	2	-	-	-	2	-
CO2	3	-	2	-	3	2	-	-	3	-	-	-	2	-
CO3	3	-	2	-	3	3	-	-	2	-	-	-	3	-
CO4	3	-	2	-	3	2	-	-	2	-	-	-	2	-
CO5	3	-	2	-	3	2	-	-	2	-	-	-	2	-
Average	3	-	2.2	-	3	2.4	-	-	2.2	-	-	-	2.2	-

<table>
<tr><td>AY 2020-21
onwards</td><td colspan="4">J. B. Institute of Engineering and Technology
(UGC Autonomous)</td><td colspan="4">B.Tech
IV Year – II Sem</td></tr>
<tr><td>Course Code:
J42OE</td><td colspan="4" rowspan="2">DIGITAL MANUFACTURING
(Open Elective-IV)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Engineering Drawing, Basics of CAD modelling.

Course Objectives:
This course will enable students to:
1. Understand the need of digital fabrication
2. Understand about Two dimensional layer by layer techniques
3. Know about extrusion based systems, post processing and the software issues involved in digital fabrication
4. Know the applications of digital fabrication

Module - I:
Unit-1: Introduction to additive manufacturing: Introduction to AM, AM evolution, Classification of Additive Manufacturing, Distinction between AM & CNC Machining, Advantages of AM

Module - II:
Unit-1: Two- dimensional layer- by layer techniques: Stereo-lithography (SL), Solid Foil Polymerization (SFP), Selective Laser Sintering (SLS), Selective Powder Building (SPB), Ballistic Particle Manufacturing (PM)

Module - III:
Unit-1: Extrusion based systems: Introduction, basic principles, Fused Deposition Modeling, Materials, and Limitations of FDM
Unit-2: Post processing: Introduction, Support Material Removal, Surface Texture Improvements, Accuracy Improvements, Aesthetic Improvements

Module - IV:
Unit-1: Software issues for additive manufacturing: Introduction, Preparation of CAD Models: The STL file, Problems with STL files, STL file manipulation, Beyond the STL file, Additional software to assist AM

Module - V:

Unit-1: AM applications: Applications in design, Applications in Engineering Analysis and Planning

Unit-2: Medical Applications: Customized Implants and Prosthesis, Aerospace applications and Automotive Applications

Unit-3: Other Applications: Jewelry Industry, Coin Industry, Tableware Industry.

TEXT BOOKS:

1. Ian Gibson, David W Rosen, Brent Stucker, "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer 2010.
2. ChuaaChee Kai, Leong Kah Fai, "Rapid Prototyping: Principles & Applications", World Scientific, 2010.

REFERENCES:

1. Ali K.Karmani, EmandAbouel Nasr, "Rapid Prototyping: Theory and Practice", Springer 2006.
2. Andreas Gebhardt, Understanding Additive Manufacture: Rapid Prototyping, Rapid Tooling and Rapid Manufacture, Hanser Publishers, 2013.
3. Hopkinson, N.Haque, and Dickens Rapid Manufacturing: Advanced Research in Virtual and Rapid Prototyping, Taylor and Francis, 2007.

E- Resources:

1. shorturl.at/qQT07
2. shorturl.at/etyzN
3. shorturl.at/hBOV6

Course Outcomes:

On completion of the course, the students will be able to:

1. **Understand** the importance of digital fabrication
2. **Identify** different techniques involved in two dimensional layering
3. **Analyze** the software issues involved in digital fabrication and know about extrusion based systems and post processing
4. **Apply** the knowledge gained in the digital fabrication

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	1	3	3	3	3							3		
CO2	2	2	3	3	3							3		
CO3	2	2	3	3	3							3		
CO4	1	3	3	3	3							3		
CO5	1	2	2	2	2							3		
Average	1.4	2.4	2.8	2.8	2.8							3		

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B.Tech IV Year – II Sem			
Course Code: J42OG	**CONSUMER ELECTRONICS** (Open Elective-IV)	**L**	**T**	**P**	**D**
Credits: 3		**3**	**1**	**0**	**0**

Prerequisites: Nil

Course Objectives:
The students will
1. Learn how a Consumer Product is developed
2. Learn how to simulate and test that designs.
3. Learn in-depth study of systems and the use of those.
4. To understand concept of Audio Systems.
5. To implement Television Receivers & Video Systems.

Module 1
UNIT-I
Audio Fundamentals and Devices: Basic characteristics of sound signal: level and loudness, pitch, frequency response, fidelity and linearity, Reverberation. Audio level metering, decibel level in acoustic measurement. Microphone: working principle, sensitivity, nature of response, directional characteristics.
UNIT-II
Types: carbon, condenser, crystal, electrets, tie- clip, wireless. Loud speaker: working principle, characteristic impedance, watt capacity. Types: electrostatic, dynamic, permanent magnet, woofers and tweeters. Sound recording: Optical recording, stereophony and multichannel sound, MP3 standard.

Module 2
UNIT-I
Audio systems: CD player, home theatre sound system, surround sound. Digital console: block diagram, working principle, applications.
UNIT-II
FM tuner: concepts of digital tuning, ICs used in FM tuner TDA 7021T . PA address system: planning, speaker impedance matching, Characteristics, power amplifier, Specification.

Module 3
UNIT-I
Television Systems: Monochrome TV standards, scanning process, aspect ratio,

persistence of vision and flicker, interlace scanning, picture resolution. Composite video signal: horizontal and vertical sync details, scanning sequence.

UNIT-II

Colour TV standards, colour theory, hue, brightness, saturation, luminance and chrominance. Different types of TV camera. Transmission standards: PAL system, channel bandwidth

Module 4

UNIT-I

Television Receivers and Video Systems: PAL-D colour TV receiver, block diagram, Precision IN Line colour picture tube. Digital TVs:- LCD, LED , PLASMA, HDTV, 3-D TV, projection TV, DTH receiver.

UNIT-II

Video interface: Composite, Component, Separate Video, Digital Video, SDI, HDMI Multimedia Interface), Digital Video Interface . CD and DVD player: working principles, Interfaces.

Module 5

UNIT-I

Home / Office Appliances: FAX and Photocopier. Microwave Oven: types, single chip controllers, wiring and safety instructions, technical specifications. Washing Machine: wiring diagram, electronic controller for washing machine, technical specifications, types of washing machine, fuzzy logic.

UNIT-II

Air conditioner and Refrigerators: Components features, applications, and technical specification. Digital camera and cam coder: - pick up devices - picture processing - picture storage.

Text Books:

1. Consumer Electronics, Bali S.P., Pearson Education India,2010.
2. Audio video systems : principle practices & troubleshooting, Bali R and Bali S.P., Khanna Book Publishing Co. (P) Ltd., 2010Delhi , India.

REFERENCES:

1. Intellectual Property in Consumer Electronics, Software and Technology Startups, Springer Nature; 2014th edition (24 September 2013),ISBN-10:9781461479116.
2. Consumer Electronics, B.R. Gupta , V. Singhal, S.K. Kataria& Sons; 2013th edition

E- Resources:

1. https://www.allaboutcircuits.com/videos/category/consumer-electronics/
2. https://www.youtube.com/watch?v=IttXKAGl6zE

Course Outcomes:

1. **Learn** how a Consumer Product is developed
2. **Analyze** how to simulate and test that designs.
3. **Apply** in-depth study of systems and the use of those.
4. **understand** concept of Audio Systems.
5. **Develop** Television Receivers & Video Systems.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	3	2											
CO2	2	2		2										
CO3	3	2		3										
CO4	3	1												
CO5	2	2	3	3										
Average	**2.4**	**2.0**	**2.5**	**2.6**										

<table>
<tr><td>A. Y. 2020-21 Onwards</td><td>J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech
IV Year – II Sem</td></tr>
<tr><td>Course Code: J42OH</td><td rowspan="2">NANO ELECTRONICS
(Open Elective-IV)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>1</td><td>0</td><td>0</td></tr>
</table>

Prerequisites: Basic Electronics

Course Objectives:

The student will

1. understand the basic concepts of Nanotechnology and Nano machines.
2. understand the fundamental logic devices and the need of Quantum computing.
3. mathematically represent the 'Quantum tunneling'.
4. understand the mathematical treatment for the modeling and design of the carbon nanotubes.
5. study the applications such as MEMS, RAM, Mass Storage devices etc.

Module 1

UNIT-I

Background to nanotechnology: Types of nanotechnology and nanomachines – periodic table – atomic structure – molecules and phases – energy – molecular and atomic size –surface and dimensional space – top down and bottom up; Molecular Nanotechnology: Electron microscope

UNIT-II

scanning electron microscope – atomic force microscope –scanning tunnelling microscope – nanomanipulator – nanotweezers – atom manipulation– nanodots – self assembly – dip pen nanolithography. Nanomaterials: preparation –plasma arcing – chemical vapor deposition – sol-gels – electrodeposition – ball milling –applications of nanomaterials;

Module 2

UNIT-I

Fundamentals of logic devices:- Requirements – dynamic properties – threshold gates; physical limits to computations; concepts of logic devices:- classifications – two terminal devices – field effect devices – coulomb blockade devices – spintronics – quantum cellular automata – quantum computing –

UNIT-II

DNA computer; performance of information processing systems;- basic binary operations, measure of performance processing capability of biological neurons – performance estimation for the human brain. Ultimate computation:- power dissipation limit – dissipation in reversible computation – the ultimate computer.

Module 3

Silicon MOSFETS - Novel materials and alternate concepts:- fundamentals of MOSFET Devices- scaling rules – silicon-dioxide based gate dielectrics – metal gates – junctions & contacts – advanced MOSFET concepts. Quantum transport devices based on resonant tunneling:- Electron tunneling – resonant tunneling diodes – resonant tunneling devices; Single electron devices for logic applications:- Single electron devices – applications of single electron devices to logic circuits.

Module 4

Carbon Nanotube: Fullerenes - types of nanotubes – formation of nanotubes – assemblies – purification of carbon nanotubes – electronic propertics – synthesis of carbon nanotubes – carbon nanotube interconnects – carbon nanotube FETs – Nanotube for memory applications – prospects of an all carbon nanotube nanoelectronics.

Module 5

Electrodes & contacts – functions – molecular electronic devices – first test systems – simulation and circuit design – fabrication; Future applications: MEMS – robots – random access memory – mass storage devicesfor washing machine, technical specifications, types of washing machine, fuzzy logic.

Text Books:

1. 'Introduction to Nanoelectronics' by V. V. Mitin, V. Kochelap, Michel A Stroscio. Cambridge, 2007.
2. 'Fundamental of Nanoelectronics' by George W Hanson, Prentice Hall, 2008.

References Books:

1. Michael Wilson, KamaliKannangara, Geoff Smith, Michelle Simmons and Burkhard
2. Raguse, Nanotechnology: Basic Science and Emerging Technologies, Chapman & Hall / CRC, 2002.

E - Resources:

1. https://nptel.ac.in/courses/bjy/ab1011/102/111102111/

Course Outcomes:

1. **develop** the basic concepts of Nanotechnology and Nano machines.
2. **apply** fundamentals of logic devices and the need of Quantum computing.
3. **illustrate** the operation of Silicon MOSFETS.

4. **describe** the mathematical treatment for the modeling and design of the carbon nanotubes.
5. **understand** the applications such as MEMS, RAM, Mass Storage devices and gain knowledge on Electrodes and Contacts.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	1	-	-	-	-	-	-	-	-	-	1	1	-
CO2	2	2	2	-	-	-	-	-	-	-	-	-	2	-
CO3	1	1	-	-	-	-	-	-	-	-	-	-	1	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-	1	-
Average	2.2	2	2	-	-	-	-	-	-	-	-	1	1.2	-

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="1">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech
IV Year – II Sem</td></tr>
<tr><td>Course Code: J42OI</td><td rowspan="2">FUNDAMENTALS OF CLOUD COMPUTING
(Open Elective-IV)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-Requisites:
1. A course on “Computer Networks”.
2. A course on “operating systems”.

Course objectives:
The Student will:
1. Understand the fundamentals of the Cloud Computing and strategies in the New Economy.
2. Provide a fundamental understanding of different types of cloud computing applications.
3. Provide insights to implement virtualization techniques.
4. Understand the design of cloud and its architecture.
5. Outlines the categories and multimedia in Cloud Computing.

Module 1:
Cloud Computing **Overview**- Origins of Cloud computing cloud components - Essential characteristics - On-demand self-service Broad network access Location independent resource pooling Rapid elasticity, Measured service.

Module 2:
Cloud scenarios - Benefits: scalability. Simplicity, vendor’ssecurity. Limitations - Sensitive information application development - Security concerns - privacy concern with a third party - security level of third party - security benefitsRegularity issues: Government policies.

Module 3:
Cloud architecture: Cloud delivery model - SPI framework SPI evolution, SPI vs.traditionalITModel and Software as a Service (SaaS):SaaS service providers - Google App Engine, Salesforce. Coin, google plat form - Benefits - operational benefits Economic benefits - Evaluating SaaS Platform as a service (PaaS): PaaS service providers - Right Scale - Salesforce. Coin, Rackspace- Force .com, Services and Benefits.

Module 4:

Infrastructure as a Service (IaaS): IaaS service providers - Amazon EC2, GoGrid Microsoft soft implementation and support - Amazon EC service level agreement - Recent developments - Benefits

Cloud deployment model: Public clouds - Private clouds - Community clouds - Hybrid clouds - Advantages of cloud computing.

Module 5:

Virtualization: Virtualization and cloud computing - Need of virtualization – cost, administration. last deployment, reduce infrastructure cost - limitations

Types of hardware virtualization: Full virtualization - partial virtualization - para virtualization

Desktop virtualization: Software virtualization - Memory virtualization - Storage virtualization - Data virtualization - Network virtualization Micro soft Implementation: Microsoft Hyper V - Vmware features and infrastructure - Virtual Box.

Text Books:

1. Cloud computing a practical approach - Anthony T.Velte, Toby J. Velte Robert Elsenperer TATA McGraw- Hill, New Delhi – 2010.
2. Cloud Computing: Web-Based Application s That Change the Way You Work and Collaborate Online - Michael Miller - Que 2008.

Reference Books:

1. Cloud Computing: ArshdeepBahga, Vijay Madisetti, 2014, University Press.
2. Mastering Cloud Computing: Raj Kumar buyya, Christian Vecchiola,selvi-2013.

E - Resources:

1. https://nptel.ac.in/courses/106/105/106105167/
2. https://sjceodisha.in/wp-content/uploads/2019/09/CLOUD-COMPUTING-Principles-and-Paradigms.pdf
3. https://www.alljntuworld.in/download/cloud-computing-cc-materials-notes/
4. https://www.slideshare.net/jeetraj17/cloud-computing-it703-unit-1-5

Course outcomes:

The Student will be able to:

1. **Identify** different elements of cloud computing.
2. **Examine** the essential processes of a Cloud Computing system.
3. **Analyze** the impact of Cloud Computing on organizations and strategy.
4. **Learns** the various marketing strategies for an online business.
5. **Explain** the infrastructure and multimedia concepts.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2	-	-	-	-	-	-	-	-	-	-	2	2
CO2	2	2	-	2	2	-	-	-	-	-	-	-	2	2
CO3	2	2	2	-	2	-	-	-	-	-	-	-	-	2
CO4	2	2	2	-	1	-	-	-	-	-	-	-	-	-
CO5	2	-	-	-	-	-	-	-	-	-	-	-	2	2
Average	**2.0**	**2.0**	**2.0**	**2.0**	**1.7**	-	-	-	-	-	-	-	**2.0**	**2.0**

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B.Tech IV Year – II Sem			
Course Code: J42OJ	INTRODUCTION TO BIG DATA ANALYTICS (Open Elective-IV)	L	T	P	D
Credits: 3		3	0	0	0

Pre-Requisites: Database Management Systems, Cloud Computing.

Course objectives:

The Student will:

1. Understand the basics of Big Data and Big Data Platform
2. Attain the knowledge of Big Data analytics, Approaches and Tools
3. Describe Map Reduce fundamentals and HDFC File system
4. Differentiate between Hadoop and RDBMS concepts
5. Apply analytics on Structured and Unstructured Data.

Module 1:

UNIT-1:

Introduction to Big Data: Types of Digital Data**,** what is big data, History of Data Management; Characteristics of Data, Evolution of Big Data, Structuring Big Data; Elements of Big Data; Challenges with Big Data; Why Big Data; Traditional Business Intelligence (BI) versus Big Data.

UNIT-2:

Introduction to Data Analytics: What Big Data Analytics Isn't? Why this sudden Hype Around Big Data Analytics, Classification of Analytics, Greatest Challenges that Prevent Business from Capitalizing Big Data; Top Challenges Facing Big Data; Why is Big Data Analytics Important; Data Science; Data Scientist; Terminologies used in Big Data Environments; BASE; Few Top Analytics Tools.

Module 2:

UNIT-1:

Understanding Analytics and Big Data: Comparing Reporting and Analysis, Types of Analytics; Points to Consider during Analysis; Developing an Analytic Team; Understanding Text Analytics;

UNIT-2:

Analytical Approach and Tools to Analyze Data: Analytical Approaches; History of Analytical Tools; Introducing Popular Analytical Tools; Comparing Various Analytical Tools.

Module 3:

UNIT-1:

Understanding MapReduce Fundamentals and HBase: The MapReduce Framework; Techniques to Optimize MapReduce Jobs; Uses of MapReduce; Role of HBase in Big Data Processing; Storing Data in Hadoop

UNIT-2:

Introduction of HDFS: Architecture, HDFS Files, File system types, commands, org.apache.hadoop.io package, HDFS - High Availability; Introducing HBase, Architecture, Storing Big Data with HBase,interacting with the Hadoop Ecosystem; HBase in Operations-Programming with HBase; Installation, Combining HBase and HDFS

Module 4:

UNIT-1:

Big Data Technology Landscape and Hadoop: NoSQL, Hadoop; RDBMS versus Hadoop; Distributed Computing Challenges; History of Hadoop; Hadoop Overview; Use Case of Hadoop; Hadoop Distributors;

UNIT-2:

HDFS (Hadoop Distributed File System): HDFS Daemons, read, write, Replica Processing of Data with Hadoop; Managing Resources and Applications with Hadoop YARN.

Module 5:

UNIT-1:

Social Media Analytics and Text Mining: Introducing Social Media; Key elements of Social Media; Text mining; Understanding Text Mining Process; Sentiment Analysis, Performing Social Media Analytics and Opinion Mining on Tweets;

UNIT-2:

Mobile Analytics: Introducing Mobile Analytics; Define Mobile Analytics; Mobile Analytics and Web Analytics; Types of Results from Mobile Analytics; Types of Applications for Mobile Analytics; Introducing Mobile Analytics Tools.

Text Books:

1. BIG DATA, Black BookTM, Dreamtech Press, 2015 Edition.
2. BUSINESS ANALYTICS 5e, BY Albright |Winston

Reference Books:

1. Rajiv Sabherwal, Irma Becerra- Fernandez," Business Intelligence –Practice, Technologies and Management", John Wiley 2011.
2. Lariss T. Moss, ShakuAtre, "Business Intelligence Roadmap", Addison-Wesley It Service.
3. YuliVasiliev, "Oracle Business Intelligence: The Condensed Guide to Analysis

and Reporting", SPD Shroff, 2012.

E - Resources:

1. https://www.coursera.org/learn/big-data-introduction
2. https://www.tutorialspoint.com/big_data_analytics/index.htm
3. www.upgrad.com/Big-Data
4. https://www.javatpoint.com/what-is-big-data
5. https://www.edx.org/course/big-data-analytics-using-spark

Course outcomes:

The Student will be able to:

1. **Identify** the basics of Big Data and its environment
2. **Use** Big Data Analytics Tools and its Approaches
3. **Define** Map Reduce fundamentals and HDFC Architecture
4. **Distinguish** between Hadoop and RDBMS concepts
5. **Illustrate** analytics on Structured and Unstructured Data.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	1	-	-	3	-	-	-	-	-	-	-	-	-
CO3	1	2	2	1	2	-	-	-	-	-	1	-	2	2
CO4	1	-	1	1	-	-	-	-	-	-	-	-	-	-
CO5	1	-	1	1	-	-	-	-	-	-	-	-	-	-
Average	1.0	1.5	1.3	1.0	2.5	-	-	-	-	-	1.0	-	2.0	2.0

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech IV Year–II Sem.			
Course Code: J42OK	**FUNDAMENTALS OF E-COMMERCE** (Open Elective-IV)	**L**	**T**	**P**	**D**
Credits: 3		**3**	**0**	**0**	**0**

Pre-requisite: NIL

Course Objectives:

The students will

1. Introduction to information systems for business and management.
2. to familiarize students with organizational and managerial foundations of systems,
3. to understand the technical foundation for understanding information systems.
4. To get Electronic payment systems.
5. To familiarize with cyber laws and cyber money.

Module 1: Introduction to E Commerce

Unit 1:

E-Commerce Definitions, Business models related to E Commerce, Technical and Economical Challenges.

Unit 2:

Actors and stake holders, Fundamental Sales Process and Technological Elements**.**

Module 2: B2C Business

Unit 1:

The Process Model and its variants, Pricing Challenge, Fulfilment challenge, Payment Challenge.

Unit 2:

B2C Business and CRM, B2C Software Systems.

Module 3: B2B Business

The Process Model and its variants, B2B Software Systems.

Module 4: Impact of E-commerce and Security

Unit 1:

Ethics Morale and Technology, Ethical aspects of ICT, Overall impacts of E-Commerce, Foundations of Risk Management.

Unit 2:

Information Security Management(ISM) and Legal aspects of E-Commerce.

Module 5: Electronic Payment

Business and money, the payment challenges, payment procedures and cyber money.

Text Books:

1. Introduction to E-Commerce by Martin Kutz.

Reference Books:

1. Ravi Kalakota, Andrew B. Whinston, "Electronic Commerce-A Manager's guide", Addison-Wesley.

E-Resources:

1. https://nptel.ac.in/courses/110/105/110105083/

Course Outcomes:

The students will be able to

1. **Understand** the basic concepts and technologies used in the field of E-Commerce
2. **Have** the knowledge of the different types of Business Systems.
3. **Understand** the processes involved in E Business Systems.
4. **Be aware** of the ethical, social, and security issues.
5. **Have** knowledge with Cyber laws and EPS.

CO-Articulation Matrix														
CO-PO/PSO Mapping Chart 3/2/1 indicates the strength of the calculation 3-Strong, 2-Medium, 1-Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2	1	2	2	-	1	-	-	-	-	-	1	-
CO2	1	1	2	2	2	-	1	-	-	-	-	-	2	-
CO3	1	3	3	3	3	-	2	-	-	-	-	-	2	-
CO4	-	2	2	2	1	-	1	-	-	-	-	-	-	-
CO5	1	2	1	1	1	-	1	-	-	-	-	-	2	-
Average	1	2	1.8	2	1.8	-	1.2	-	-	-	-	-	1.4	-

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B.Tech IV Year – II Sem			
Course Code: J42OL	E-WASTE MANAGEMENT (Open Elective-IV)	L	T	P	D
Credits: 3		3	0	0	0

Pre-requisite: NIL

Course Objectives:
The students will

1. Know regarding E-Waste Management in India Global E-Waste Growth
2. Analyze the overview of WEEE.
3. Understanding scenarios for E-Waste management.
4. Visualize the basic concepts of E-Waste Regulation
5. Understand the basic concepts of Recycling technologies.

Module 1:
Unit 1:
Introduction to e-Waste Management in India Global e-waste growth, Dark shadows of digitization on Indian horizon, e-waste generation, migration, Present practice and systems, disposal methods, Present processing practices.
Unit 2:
Initiatives to manage e-waste, Strengths and weaknesses of the current system.

Module 2:
Unit 1:
WEEE (waste electrical and electronic equipment) - toxicity and health Hazardous substances in waste electrical and electronic equipment-toxicity and release.
Unit 2:
Occupational and environmental health perspectives of e-waste recycling.

Module 3:
Unit 1:
Options and Scenarios for e-Waste Management Actions to be considered to achieve goals of ewaste management, Collection/ take back system,
Unit 2:
Closing the Plastic loop: Turning the supply chain into a supply cycle by mining plastics from end-of-life electronics and other durable goods.

Module 4:
Unit 1:
E-waste legislation in the European Union and the Basel Convention. Regulating e-waste:

a review of the international and national legal framework on e-waste Extended producer responsibility: a key tool for international rules and regulations on e-waste.

Module 5:

Unit 1:

Recycling technologies for e-waste Recycling of e-scrap in a global environment opportunities and challenges.

Unit 2:

Technologies for recovery of resources from e-waste. Reuse:A Bridge from Unsustainable e-waste to sustainable e-resources.

Text Books:

1. RakeshJohri, E-waste: Implications, regulations, and management in India and current global best practices.
2. Klaus Hieronymi, RamzyKahhat, Eric Williams, E-Waste Management: from Waste to Resource

Reference Books:

1. SatishSinha, PritiMahesh,Waste Electrical and Electronic Equipment The EU and India.
2. By Ronald E. Hester, Roy M. Harrison , Electronic Waste Management.

E-Resources:

1. https://nptel.ac.in/courses/105/105/105105169/

Course Outcomes:

At the end of the course, students will be able to:

1. **Demonstrate** knowledge of E-Waste management.
2. **Implementing** environmental health perspectives of E-Waste recycling.
3. **Achieve** goals of E-Waste management.
4. **Develop** the skills in E-Waste extended producer responsibility.
5. **Describe** the technologies for recovery of resources from E-Waste.

CO-Articulation Matrix CO-PO/PSO Mapping Chart 3/2/1 indicates the strength of the calculation 3-Strong, 2-Medium, 1-Low														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes***	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	**2**	**2**	**1**	**2**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**
CO2	**1**	**1**	**2**	**2**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**-**
CO3	**1**	**3**	**3**	**3**	**3**	-	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**
CO4	**-**	**2**	**2**	**2**	**1**	-	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO5	1	**2**	**1**	**1**	**1**	-	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**-**
Average	1	2	1.8	2	1.8	-	1.2	-	-	-	-	-	1.4	-

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech IV Year –II Sem.			
Course Code: J42OM	**INTRODUCTION TO EMBEDDED SYSTEMS** (Open Elective-IV)	**L**	**T**	**P**	**D**
Credits: 3		**3**	**0**	**0**	**0**

Pre-requisite: Basics Computer Knowledge

Course Objectives:

Students will learn to

1. Understand the basic concepts of embedded systems and 8051 microcontrollers.
2. Compare and contrast the basics of assembly programming language.
3. Identify the unique characteristics of real-time systems
4. Analyze the general structure of a real-time system and define the unique design problems and challenges of real-time systems.
5. Acquaint the embedded software development tools and various advanced architectures.

Module 1:

Unit 1: Embedded Computing: Introduction, complex systems and microprocessor, the embedded system design process, formalisms for system design, design examples

Unit 2 :The 8051 Architecture: Introduction, 8051 micro controller hardware, input/output ports and circuits, external memory, counter and timers, serial data input/output, interrupts.

Module 2:

Unit 1: Basic Assembly Language Programming Concepts: The assembly language programming process, programming tools and techniques, programming the 8051.

Unit 2 : Data transfer and logical instructions, arithmetic operations, decimal arithmetic, jump and call instructions.

Module 3:

Unit 1: Introduction to Real-Time Operating Systems: Tasks and task states, tasks and data, semaphores, and shared data; message queues, mailboxes and pipes, timer functions, events, memory management, interrupt routines in an RTOS environment.

Unit 2 :Basic Design Using a Real-Time Operating System: Principles, semaphores and queues, hard real-time scheduling considerations, saving memory and power, an example RTOS like uC-OS (open source).

Module 4:

Unit 1 :Embedded Software Development Tools: Host and target machines,

linker/locators for embedded software, getting embedded software into the target system.
Unit 2 :Debugging Techniques: Testing on host machine, using laboratory tools, an example system.

Module 5:
Unit 1: Introduction to advanced Architectures: ARM and SHARC, processor and memory organization and instruction level parallelism.
Unit 2: Networked embedded systems: bus protocols, I2C bus and CAN bus; internet-enabled systems, design example-elevator controller.

Text Books:

1. Wayne Wolf (2008), Computers as Components-principles of embedded computer system design, Elseveir, New Delhi, India.
2. Kenneth J. Ayala (2008), The 8051 Microcontroller, 3rd edition, Cengage Learning, India.

Reference Books:

1. David E. Simon (1999), An Embedded Software Primer, Pearson Education, India.
2. Jean J. Labrosse (2000), Embedding System Building Blocks, 2nd edition, CMP publishers, USA.
3. Raj Kamal (2004), Embedded Systems, Tata McGraw hill, India.

E-Resources:

1. https://nptel.ac.in/courses/108/102/108102045/
2. https://www.edx.org/course/utaustinx/utaustinx-ut-6-02x-embedded-systems-4806

Course Outcomes:

Students will be able to

1. **Program** an embedded system
2. **Analyze** Interfacing with keyboard, A/D & D/A conversions, serial data Communication, LCD and LED display.
3. **Illustrate** Tasks, Semaphores, Message queues, pipes, Timer functions.
4. **Design** embedded systems and real-time systems
5. **Compare** and contrast ARM, SHARC, internet enabled systems.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	Program Outcomes (POs)												Program Specific Outcomes*	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	2	-	-	-	-	-	1	-	2	2	2	-
CO2	2	2	2	-	-	-	-	-	2	-	2	2	3	1
CO3	2	2	-	-	-	-	-	-	2	-	-	2	3	1
CO4	1	3	-	-	-	-	-	-	2	-	-	2	3	1
CO5	2	1	-	-	-	-	-	-	2	-	2	2	2	1
Average	1.8	1.8	2	-	-	-	-	-	1.8	-	2	2	2.6	1

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="1">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B. Tech
IV Year –II Sem.</td></tr>
<tr><td>Course Code: J42ON</td><td rowspan="2">INTRODUCTION TO NETWORK SECURITY
(Open Elective-IV</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:
The students will

1. Learn about Information security, security attacks, threats, services, and mechanisms and Application of each of confidentiality, integrity, and availability.
2. Know the principles of public key encryption and private key encryption and the algorithms used for both.
3. Master in E-mail security understand the algorithms PGP, MIME and S/MIME
4. Analyse IP Security architecture and understand concepts of SSL (Secure socket layer), TLS (transport layer security) and SET (secure electronic transactions)
5. Become familiar with the basic categories of threats to computers and networks.

Module 1:
Unit 1: Attacks on Computers and Computer Security:
Introduction, The need for security, Security approaches, Principles of security.
Unit 2 Security Cryptography:
Concepts and Techniques: Introduction, plain text and cipher text, substitution techniques, transposition techniques encryption and decryption, symmetric and asymmetric key cryptography, stenography, key range and key size, possible types of attacks.

Module 2:
Unit 1: Symmetric key Ciphesrs:
Block Cipher principles & Algorithms (DES, AES, Blowfish), Differential and Linear Crypt Analysis Block cipher modes of operation, Stream ciphers, RC4, Location and placement of encryption, function, Key distribution.

Unit 2: Asymmetric key Ciphers:
Principles of public key crypto systems, Algorithms (RSA, Diffie- Hellman, ECC), Key Distribution.

Module 3:
Unit 1: Message Authentication Algorithms and Hash Functions:
Authentication requirements, Functions, Message authentication codes, Hash Functions,

Secure hash algorithm, Whirlpool, HMAC, CMAC, Digital signatures, knapsack algorithm.

Module 4:

Unit 1:Data visualisation:

Introduction, Types of data visualisation, Data for visualisation:

Unit 2: Data Types and Methods :

Data types, Data encodings, Retinal variables, mapping variables to encodings, Visual encodings.

Module 5:

Unit 1:Applications:

Applications of Data Science, Technologies for visualisation, Bokeh (Python), recent trends in various data collection and analysis techniques

Unit 2:Technologies:

Various visualization techniques, application development methods of used in data science.

Text Books:

1. Cathy O'Neil, Rachel Schutt, Doing Data Science, Straight Talk from The Frontline. O'Reilly, 2013.

Reference Books:

1. Jure Leskovek, AnandRajaraman, Jeffrey Ullman, Mining of Massive Datasets. V2.1, Cambridge University Press, 2014.

Web Resources:

1. https://www.tutorialspoint.com/information_security_cyber_law/network_security.htm
2. https://www.tutorialspoint.com/information_security_cyber_law/cyber_security_strategies.htm
3. https://www.tutorialspoint.com/information_security_cyber_law/index.htm
4. https://www.tutorialspoint.com/information_security_cyber_law/cyber_law_objectives.htm
5. https://www.tutorialspoint.com/information_security_cyber_law/introduction.htm
6. https://www.tutorialspoint.com/information_security_cyber_law/intellectual_property_right.htm
7. https://www.tutorialspoint.com/information_security_cyber_law/policies_to_mitigate_cyber_risk.htm
8. https://www.tutorialspoint.com/information_security_cyber_law/information_technology_act.htm

Course Outcomes:

Students will be able to

1. **Understand** cyber-attacks and types of cybercrimes.
2. **Summarize** Cyber Laws and Cyber Forensics.
3. **Understand** frauds in Wireless era.
4. **Analyze** and evaluate the cyber security needs of an organization.
5. **Outline** Data Privacy and privacy policies.

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 – Weak														
Course Outcomes (Cos)	**Program Outcomes (Pos)**											**Program Specific Outcomes***		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	2	2	2	-	2	2	1	-	-	-	-	1		
CO2	-	-	2	-	1	2	-	-	-	-	-	1		
CO3	2	3	1	-	2	1	1	-	-	-	-	-		
CO4	2	2	2	-	-	-	1	-	-	-	-	1		
CO5	-	-	-	-	-	1	2	-	-	-	-	2		
Average	1.2	1.4	1.4	-	1	1.2	1	-	-	-	-	1		

<table>
<tr><td>AY 2020-21 onwards</td><td colspan="1">J. B. Institute of Engineering and Technology (UGC Autonomous)</td><td colspan="4">B.Tech. IV Year – II Sem</td></tr>
<tr><td>Course Code:J42OP</td><td rowspan="2">INTRODUCTION TO MINE ENVIRONMENT
(Open Elective-IV)</td><td>L</td><td>T</td><td>P</td><td>D</td></tr>
<tr><td>Credits: 3</td><td>3</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Pre-requisite: Nil

Course Objectives:
The students will

1. To introduce about atmospheric, mine air & their limitations
2. To acquaint with spontaneous heating and explosions in coal mines
3. To get idea about sources of dust, and its control in mines
4. To get idea about miners' diseases & lighting in mines
5. To know about reclamation of mines, impact of mining on environment & sustainable mining

Module 1
Unit - 1: Atmosphere and mine air composition. Origin of gases, properties, limitations of gases in underground mines

Module 2
Unit - 1: Spontaneous Combustion: Factors, control measures.
Unit - 2: Explosions: Causes of firedamp explosion, preventive measures against firedamp explosion.

Module 3
Unit - 1: Dust: Sources in underground and opencast mines, standards and control measures.

Module 4
Unit - 1: Miners diseases, Lighting standards in underground and opencast mines**.**

Module 5
Unit - 1: Reclamation, plantation of surface mines, Impact of mining on environment & sustainable mining.

Textbooks:
1. Elements of Mining Technology (VOL-2) – by D.J. Deshmukh.
2. Surface Mining – by S.K. Das.

Reference Books:
1. Mine Ventilation – by G.B. Mishra.

E-Resources:
1. https://www.ltu.se/cms_fs/1.124549!/file/rapport%20Environmental%20Aspects%20of%20mining_low.pdf
2. https://pubs.usgs.gov/pp/1802/b/pp1802b.pdf
3. https://www.elaw.org/files/mining-eia-guidebook/Chapter1.pdf

Course Outcomes:
The student will be able to:
1. **Learn** about atmospheric and mine air
2. **Learn** about spontaneous combustion and explosion in coal mines
3. **Understand** about dust sources and its control in mines
4. **Learn** about miners' diseases, mine lighting and its standards
5. **Learn** about reclamation of mines, impacts of mining on environment an sustainable mining

CO-PO/PSO Mapping Chart (3/2/1 indicates strength of correlation) 3 – Strong; 2 – Medium; 1 - Weak														
Course Outcomes (COs)	**Program Outcomes (POs)**												**Program Specific Outcomes**	
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**
CO1	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO4	2	2	1	-	-	-	-	-	-	-	-	-	-	-
CO5	3	1	2	-	-	-	-	-	-	-	-	-	-	-
Average	3	2	1.6	-	-	-	-	-	-	-	-	-	-	-