

ACADEMIC REGULATIONS

COURSE STRUCTURE AND

DETAILED SYLLABUS

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

B. TECH FOUR YEAR UG COURSE

(Applicable for the batches admitted from 2022-2023)

REGULATION: R22 **(I, II, III & IV Year Syllabus)**



J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY

(UGC AUTONOMOUS)

Bhaskar Nagar, Yenkapally (V), Moinabad (M), Hyderabad – 500075,
Telangana, India

INSTITUTE-VISION AND MISSION

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:

M1: To provide world class engineering education, encourage research and development.

M2: To evolve innovative applications of technology and develop entrepreneurship.

M3: To mould the students into socially responsible and capable leaders.



DEPARTMENT-VISION AND MISSION

VISION:

To become a Centre of Excellence in AI&ML, shaping professionals obliging to the research and proficient needs of national and international organizations and to bring up innovative ideas to solve real time problems through continuous research, innovation, and industry steered curriculum.

MISSION:

M1: To transform the students into technologically proficient and help them to absorb the innovative spirit.

M2: To impart premier quality, skill-based and value-based education to the students in the field of Artificial Intelligence and Machine Learning.

M3: To identify corporate requirements and enrich the students' expertise with a strong theoretical and practical backdrop having an emphasis on hardware and software development with social ethics.



Program Educational Objectives (PEOs)

PEO1

To Formulate, analyse and solve Engineering problems with strong foundation in Mathematical, Scientific, Engineering fundamentals and modern AI&ML practices through advanced curriculum.

PEO2

Analyze the requirements, realize the technical specification and design the Engineering solutions by applying artificial intelligence and machine learning theory and principles.

PEO3

Demonstrate technical skills, competency in AI&ML and promote collaborative learning and team work spirit through multi-disciplinary projects and diverse professional activities along with imbibing soft skills and ethics.

Program Outcomes and Program Specific Outcomes of AI&ML Department (POs & PSOs)

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 analyse 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 Teamwork: 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

The ability to understand, analyse and demonstrate the knowledge of human cognition, Artificial Intelligence, Machine Learning and data science in terms of real world problems to meet the challenges of the future.

PSO2

The ability to develop computational knowledge and project development skills using innovative tools and techniques to solve problems in the areas related to Deep Learning, Machine learning, Artificial Intelligence.

JB IET Academic Regulations - R22

Applicable to

B.Tech Regular Four Year Degree Programme

(For the Batches admitted from the Academic Year 2022- 2023)

&

B.Tech (Lateral Entry Scheme)

(For the Batches admitted from the Academic Year 2023- 2024)



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Applicable to

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B.Tech (Lateral Entry Scheme)

(For the Batches admitted from the Academic Year 2023- 2024)

Offered under **Choice Based Credit System (CBCS)**

JB Institute of Engineering and Technology (hereinafter referred to as JBIET) academic regulations **JBIET - R22** are given here under. These regulations approved by the Academic Council shall be in force and applicable from the academic year 2022-23 onwards.

1.0 Under-Graduate Degree Programme in Engineering & Technology

J. B. Institute of Engineering and Technology (JBIET) offers a 4-Year (8 Semesters) Bachelor of Technology (B. Tech) Degree Programme for regular students under Choice Based Credit System (CBCS) in the following branches of Engineering with effect from the academic year 2022-23.

S. No.	Branch Code	Branch Name
1	01	Civil Engineering (CE)
2	02	Electrical and Electronics Engineering (EEE)
3	03	Mechanical Engineering (ME)
4	04	Electronics and Communication Engineering (ECE)
5	05	Computer Science and Engineering (CSE)
6	12	Information Technology (IT)
7	19	Electronics and Computer Engineering (ECM)
8	25	Mining Engineering (MIE)
9	66	Computer Science and Engineering (Artificial Intelligence and Machine Learning)-CSE(AI&ML)
10	67	Computer Science and Engineering (Data Science)-CSE(DS)
11	72	Artificial Intelligence and Data Science(AI&DS)
12	73	Artificial Intelligence and Machine Learning(AI&ML)

2.0 Eligibility for Admission

2.1. Admission to the undergraduate (UG) programme shall be made either on the basis of the merit rank obtained by the qualified student in entrance test conducted by the Telangana State Government (EAMCET) or the University or on the basis of any other order of merit approved by the College, subject to reservations as prescribed by the government from time to time.

2.2. The medium of instructions for the entire Undergraduate Programme in Engineering & Technology is English only.

3.0 Duration of the UG Program

Each Under Graduate (**UG**) Programme is of 4 Academic Years (8 Semesters) with the Academic Year divided into two Semesters of 22 weeks (≥ 90 instructional days) each. Each Semester is having "**Continuous Internal Evaluation (CIE)**" and "**Semester End Examination (SEE)**" under Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) as indicated by UGC. The guidelines issued by JNTUH, AICTE and NEP-2020 are followed while designing curriculum / course structure.

3.1 Minimum Duration: The minimum (normal) duration of the B. Tech. Programme for the student securing admission under Regular mode is *Four Academic Years (8 Semesters)* and for the student admitted under Lateral Entry Scheme is *Three Academic Years (6 Semesters)* starting from the commencement of the First Year First Semester.

3.2 Maximum Duration: A student admitted under Regular mode shall complete the B. Tech Programme in a maximum period of Eight Academic Years (16 Semesters) and the student admitted under Lateral Entry Scheme shall complete the B. Tech Programme in a maximum period of Six Academic Years (12 Semesters) starting from the date of commencement of First Year First Semester.

3.3 However, student is permitted to appear in the supplementary examinations for **two more** academic years after the Maximum Duration of course work as mentioned in **3.2** to complete backlog subjects for fulfilling the academic requirements for the completion of the programme, failing which he/she shall forfeit his / her seat in B.Tech course.

4.0 B. Tech Programme Structure

The curriculum B. Tech Programme includes various curricular components like Foundation Courses (BS, HS and ES), Core Courses (PC, PW), Elective Courses (PE & OE), Audit Courses (AC), Mandatory Courses (MC) etc. The details of these courses and typical breakup of credits for each category is mentioned in the tables given below.

4.1 Subject/ Course Classification

S. No.	Broad Course Classification	Course Group/ Category	Course Description
1	Foundation Courses (FnC)	BS – Basic Sciences	Includes Mathematics, Physics and Chemistry subjects
2		ES- Engg. Sciences	Includes fundamental engineering subjects
3		HS – Humanities and Social sciences	Includes subjects related to Humanities, Social sciences and Management
4	Core Courses (CoC)	PC– Professional Core	Includes core subjects related to the parent Discipline/ department/ branch of Engineering.
5		PW- Project Work	B. Tech project or UG project or UG major project or Project Stage I & II
6		Industrial training / Mini- project	Industrial training/ Summer Internship/ Industry Oriented Mini-project/Mini-project
7	Elective Courses (EIC)	PE – Professional Electives	Includes elective subjects related to the parent discipline/ department/ branch of Engineering.
8		OE – Open Electives	Elective subjects which include inter- disciplinary subjects or subjects in an area outside the parent discipline/ department/ branch of Engineering.
9	Seminar	Seminar	Seminar/ Colloquium based on core contents related to parent discipline/ department/ branch of Engineering.
10	Audit courses (AC)	-	Value Added Course / Audit Courses (Non-Credit)
11	Mandatory Courses(MC)	-	Mandatory Courses (Non-credit)

4.2 Typical Breakup of Credits for each Category:

S.No	Category	Breakup of Credits
1	Humanities and Social Sciences (HS)- including Management.	10
2	Basic Sciences (BS)- Courses including Mathematics, Physics and Chemistry.	23
3	Engineering Sciences (ES)-Courses including Workshop, Drawing, Basics of Electrical / Electronics / Mechanical / Computer Engineering.	22
4	Professional Core (PC)-Courses relevant to the chosen specialization / branch.	57
5	Professional Electives (PE)-Courses relevant to the chosen specialization / branch.	18
6	Open Elective (OE) - Courses from other technical and / or emerging subject areas.	15
7	Mini-project / Project Work / Internship / Industrial training / Seminar	15
8	Mandatory Courses / Audit Courses.	Non-Credit
TOTAL		160

5.0 Credit System: The student has to register for all the courses offered in a Semester. The credits assigned for each course are indicated in an L: T: P/D: C (Lecture periods: Tutorial periods: Practical/Drawing periods: Credits) pattern as follows:

- Theory Courses: One Lecture Hour (L) per week in a semester: 01 Credit
- Practical Courses: One Practical Hour (P) Per week in a semester: 0.5 Credit
- Tutorial: One Tutorial Hour (T) Per week in a semester: 01 Credit
- Mandatory Courses: No CREDIT is awarded.
- Audit Courses: No CREDIT is awarded.

For Internship and Project Work credits are assigned based on the complexity of the work to be carried out.

The four-year curriculum of any B. Tech Program of study shall have a total of 160 credits. However, the curriculum for students admitted under lateral entry shall have a total of 122 credits.

6.0 Choice Based Credit System (CBCS): Choice Based Credit System (CBCS) is introduced in line with UGC guidelines in order to promote:

- Student centred learning
- Students to learn courses of their choice
- Interdisciplinary learning

A Student has a choice of registering for courses comprising program core, professional electives, open electives, value added, Skill oriented courses etc. Besides, choice is also offered to students for registering courses to earn Minor in Engineering / Honours degree.

7.0 Course Registration

7.1. A faculty advisor or mentor shall be assigned to a group of 20 students, who can advise the students about the Programme, it's course structure and curriculum, choice/option for subjects/ courses, based on their competence, progress, pre-requisites and interest.

7.2 Before the commencement of every semester, all the students shall register for the courses offered in that semester through online registration process

7.3 A student can apply for registration, only after obtaining the 'written approval' from faculty advisor, which should be submitted to the college academic section through the Head of the Department. A copy of it shall be retained with Head of the Department, faculty advisor and the student.

7.4 If any student fails to register courses in a semester, he/she shall undergo the courses as per the course structure decided by the Head of the Department.

7.5 If any student submits ambiguous choices or multiple options or erroneous entries during registration for the subject(s) / course(s) under a given / specified course group / category as listed in the course structure, the subject / courses decided by the Head of the Department will be final.

7.6 After registering for a course, a student shall attend the classes, to satisfy the attendance requirements, earn Continuous Internal Evaluation (CIE) Marks and appear in Semester End Examinations (SEE).

7.7 Subject / course options exercised while registration is final and cannot be changed or inter- changed; further, alternate choices also will not be considered. However, if the subject / course that has already been listed for registration by the Head of the Department in a semester could not be offered due to any unforeseen or unexpected reasons, then the student shall be allowed to have alternate choice either for a new subject (subject to offering of such a subject), or for another existing subject (subject to availability of seats). Such alternate arrangements will be made by the head of the department, with due notification and time-framed schedule, within the first week after the commencement of class-work for that semester.

7.8 Open Electives: The students have to choose requisite number of open electives (as prescribed in the course structure) from the list of open electives. However, the student cannot opt for an open elective subject offered by his own (parent) department, if it is already listed under any category of the subjects offered by parent department in any semester.

7.9 Professional Electives: The students have to choose requisite number of professional electives (as prescribed in the course structure) from the list of professional electives.

7.10 Elective Courses (Professional Electives and Open Electives) shall be offered by a Department if a minimum of 30 students register for that course.

8.0. Academic Requirements

8.1 Attendance Requirements

8.1.1 A student shall be eligible to appear for the Semester End Examinations, if the student acquires a minimum of 75% of attendance in aggregate of all the subjects / courses (excluding attendance in Mandatory Courses and Audit Courses) for that semester. The attendance of Mandatory and Audit Non-Credit Courses should be maintained separately. Two periods of attendance for each theory subject shall be considered if the student appears for the mid-term examination of that subject.

8.1.2 Shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each semester may be condoned by the College Academic Committee (CAC) on genuine and valid grounds, based on the student's representation with supporting evidence.

8.1.3 Shortage of attendance below 65% in aggregate **shall in no case be condoned.**

8.1.4 A stipulated condonation fee as decided by the CAC is payable for condoning shortage of attendance.

8.1.5 Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester. They get detained and their registration for that semester shall stand cancelled. They will not be promoted to the next semester.

8.1.6 Students will not be promoted to the next semester and no grade allotments or SGPA / CGPA calculations will be done for such students for the entire semester in which they have been detained.

8.1.7 A student detained in a semester due to shortage of attendance may be readmitted in the same semester as and when offered in the forthcoming academic years for fulfilment of academic requirements. The academic regulations under which a student has been readmitted shall be applicable.

8.1.8 A student fulfilling the attendance requirement in the present semester shall not be eligible for readmission into the same class.

8.2 Credit Requirements

8.2.1. A student should earn credits allotted for each of the course by securing minimum marks designated as passing standard for that course.

8.2.2. A student shall be admitted under regular scheme, register for all 160 credits offered and has to earn all the credits (A student admitted under Lateral entry scheme shall register for all 122 credits offered and all the credits). However the

student shall be eligible to avail the benefits that the JNTUH University announces such as exemption of subjects and grace marks for batches admitted during the academic years same as these students.

8.2.3. A student shall register for all mandatory courses mentioned in the curriculum and get minimum pass marks (i.e., 40% of total marks) to get the degree. Grade points obtained in these courses will not be considered for awarding class.

9.0 Break of Study from a Program (Gap Year)

9.1 A student is permitted to go on break of study for a maximum period of two years either as *two breaks of one year each* or a *single break of two years after completion of II year II semester*.

9.2 In case, a student wishes to extend the gap year for one more consecutive year, he shall be permitted with the prior approval of the Principal on the recommendations of the Head of the Department prior to the beginning of the semester in which he has taken break of study.

9.3 The student shall apply for break of study in advance, in any case, not later than the last date of the first assessment period in a semester. The gap year concept is introduced *for start-up (or) incubation of an idea, National/International Internships, and professional Volunteering*. Student taking break of study shall submit an application to the Principal through the Head of the department. A committee shall be appointed by the Principal in this regard. Based on the recommendations of the committee, Principal shall decide whether to permit the student to avail the gap year or not.

9.4 The students permitted to rejoin the program after break of study shall be governed by the Curriculum and Regulations in force at the time of rejoining. The students rejoining in new regulations shall apply to the Principal in the prescribed format through Head of the Department, at the beginning of the readmitted semester for registering additional / equivalent courses to comply with the curriculum in-force.

9.5 The period of break of study *shall be counted in the maximum* Period of graduation (i.e the maximum period of graduation is 8 years for Regular admitted students and 6 years for Lateral Entry admitted students availing Gap Year).

9.6 If a student has not reported to the college after completion of the approved period of break of study he is deemed to be detained in that semester. Such students are eligible for readmission into the semester when offered next.

10.0. Evaluation-Distribution and Weightage of marks

10.1 The performance of a student in all theory and Laboratory courses shall be evaluated for 100 marks each, with **40 marks** allotted for **Continuous Internal Evaluation (CIE)** and **60 marks** for **Semester End-Examination (SEE)**. The details of course-wise allotment of marks are given below.

S. No.	Course	Marks	
		CIE	SEE
1	Theory courses	40	60
2	Laboratory courses	40	60
3	Mandatory courses	100	--
4	Audit Courses	--	--
5	Internship- I	50	--
6	Internship- II	50	--
7	Mini Project	50	--
8	Project Stage - I	100	--
9	Seminar	50	--
10	Project Stage - II	40	60

10.2. Continuous Internal Evaluation (CIE)

10.2.1 Theory Courses: For theory courses, during the semester there shall be 2 mid-term examinations (*internal exams of 20 marks each*), 2 quizzes of 5 marks each), 4 Unit tests of 10 marks each and 2 assignments carrying 5 marks each.

S. No	Component	Frequency of Evaluation	Marks for Each test	Final Marks (Average)
1	Mid Examinations	2	20	
2	Quiz Test	2	5	
3	Unit Tests	4	10	
4	Assignments	2	5	
Total			40	40

(a) **Quiz Examinations (5 marks):**

Each quiz examination will be of 20 minutes duration consisting of objective questions for 5 marks. The objective question paper is set with 20 questions of multiple choice, fill-in the blanks and matching type of questions. The Quiz examination shall be conducted after each spell of instructions.

(b) **Mid-term Examinations (20 marks):**

Each mid-term examination will be of 1 hour 20 minutes consisting of descriptive questions (long answer) for 20 marks. The descriptive paper is four questions of 5 marks each with either / or choice. The Mid-I shall be conducted after first spell of instructions covering the syllabus of Modules I and II. The Mid-II shall be conducted after second spell of instructions covering the syllabus of Modules III, IV and V.

(c) **Unit Tests (10 Marks):**

The Unit Tests shall be conducted by the faculty member handling the subject. The duration of Unit Test shall be 1 hour. The question paper of Unit Test shall be of descriptive type with 3 questions each of 5 marks out of which student shall answer any two. Unit Test-1 and 2 shall be conducted before I Mid Term Examination covering the syllabus of Module-1, Module-2 respectively. Unit Test-3 and 4 shall be before II Mid Term Examination covering the syllabus of Module-3, Module-4 and Module-5 respectively. The average of marks obtained from Unit Test 1,2 and the

average of marks obtained Unit Test 3,4 is to be considered for CIE-I and CIE-II respectively.

(d) **Assignments (5 marks):**

There shall be two assignments for 5 marks each. Assignment-1 shall be submitted before First mid examinations covering the topics from Module-1 and Module-2, and the Assignment-2 shall be submitted before Second mid examinations covering the topics from Module-3, Module-4 and Module-5. The assignments are used to test the student in Bloom's higher order thinking skills.

- (e) If a student is absent for any Mid-Term Examinations on medical grounds / due to any emergency / unavoidable circumstances, the student may be permitted to apply for makeup examinations within a week after completion of Mid-Term Examinations. A sub-committee with the following composition will look into such cases. Student shall pay Rs.200 per subject as registration fee in which he/she is appearing for re-examination.

S. No	Faculty Member	Designation
1	Concerned Head of the Department	Chairman
2	Faculty nominated by Principal	Member
3	Senior faculty member of the concerned Department	Member
4	Class Teacher of the class/section	Member

10.2.2 Laboratory Courses

Continuous Internal Evaluation (CIE): The continuous internal evaluation for laboratory courses is based on the following parameters:

There shall be Day-to-Day Evaluation for 30 marks which includes day to day Attendance (5 Marks), observation writing(5 Marks), Experimental setup/Program writing(5 Marks), Experiment conduction/Program Execution(5 Marks), Record writing(5 Marks), Viva Voce(5 Marks).

Internal laboratory examination (ILE) for 10 marks shall be conducted by the faculty member handling the laboratory. ILE shall be conducted after Second spell of instructions.

S.No	Component	Marks
1	Day-to-Day Evaluation	30
2	Internal Examination	10
	Total	40

10.3 Semester End Examinations (SEE)

10.3.1 Theory Courses

The semester end examinations (SEE), for theory subjects, will be conducted for 60 marks consisting of two parts viz. **i) Part- A for 10 marks, ii) Part - B for 50 marks.**

- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of five questions (numbered from 2 to 6) carrying 10 marks each. Each of these questions is from each unit and may contain sub-questions. For each question there will be an "either" "or" choice, which means that there will be two questions from each unit and the student should answer either of the two questions.
- The duration of Semester End Examination is 3 hours.

10.3.2 Laboratory Courses The performance of the student in laboratory courses shall be evaluated for **60 marks** jointly by Internal and External Examiners for 3 hours duration.

10.4 Internship

The students should undergo two Internships. Internship-I shall be carried out under the guidance of professors from Science, Basic engineering subjects, with topics having some social relevance. The Internship-I is to be taken up during the summer vacation after I Year II Semester Examination and it will be evaluated in II Year I semester for 50 marks. However, the process might be initiated before the end of I Year II Semester by the concerned department. The students admitted under Lateral Entry Scheme (LES) shall carry out internship in the area of their Diploma specialization under the guidance of a faculty member of that Department immediately in the first month, after their joining of the course.

The Internship-II is to be taken up during the summer vacation after II Year II Semester examination and it will be evaluated in III Year I semester for 50 marks. However, the process might be initiated before the end of II Year II Semester by the concerned department.

For both the Internships, the student shall submit a report on the training undergone. The internships shall be evaluated by a three-member committee constituted by the Head of Department to assess the student performance on the following parameters. There shall be no Semester End Examinations for the Internships.

Parameter	Marks
Internship report	15
Quality of work	15
Presentation	15
Viva-Voce	5
Total	50

10.5 Industry Oriented Mini Project

A student is required to undergo a Mini Project of his/her choice during the vacation after III Year II Semester Examination by applying theoretical concepts to develop a practical component /element/system that includes design/ testing/ analysis. The performance of a student in the Mini Project shall be evaluated in IV Year I Semester by a three-member committee constituted by the HoD as per the following parameters:

Parameter	Marks
Mini Project report	15
Quality of work	15
Presentation	15
Viva-Voce	5
Total	50

The performance of a student in Mini Project shall be evaluated based on two reviews, each carrying 50 marks. The average marks of these two reviews will be awarded. **There shall be no Semester End Examination** for the Industry Oriented Mini Project.

10.6 Seminar

There is a Seminar in IV Year II Semester for 50 Marks. The student shall deliver a seminar on any emerging topic of his / her choice from the core technical domain. The student shall submit a duly-certified Seminar report. A three-member committee constituted by the HoD will evaluate the Seminar report submitted by the student. **There shall be no Semester End Examination.**

If a student is absent for seminar on medical grounds / due to any emergency / unavoidable circumstances, the student may be permitted to reappear within a month.

10.7 Project Work

The student is required to undertake a Project Work by using the knowledge acquired by him / her during the course of study. The student is expected to design and build a complete system or subsystem on his / her area of interest. The Project Work consists of two parts namely, Project Stage -I (Project Survey) and Project Stage – II (Project Implementation). Project Stage – I is carried out during IV Year I Semester and the Project Stage – II during IV Year II Semester. A project work shall be taken up by a batch of students not exceeding 4 members under the guidance of a faculty supervisor.

For Project Stage – I, the Project Review Committee (PRC) consisting of Head of the Department, Project Coordinator, Project supervisor and one senior faculty member shall evaluate the Project Work for 50 marks. **There shall be no End Semester Evaluation for Project Phase-I.** 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
- (ii) Secures less than 40% marks in the CIE.

A student who has failed may reappear once for the above evaluation, when it is scheduled again; if he/she fails in such 'one reappearance' evaluation also, he/she has to reappear for the same in the next subsequent semester, as and when it is scheduled.

For Project Stage – II, Project Review Committee (PRC) consisting of Head of the Department, Project supervisor, Project Coordinator and a senior faculty member **shall evaluate for 40 marks as continuous evaluation**. The External Examiner shall **evaluate the Project work for 60 marks as Semester End Examination**. 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. 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.
- (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 student fails in such 'one reappearance' evaluation also, he/she has to reappear for the same in the next subsequent semester, as and when it is scheduled.

For conducting Viva-Voce of Project Stage – II, Principal selects the External Examiner from the list of experts in the relevant branch of engineering submitted by the concerned Head of Department.

10.8 Mandatory Courses (MC)

Mandatory courses carry "ZERO" credits. There shall be NO Semester-end examination. However, attendance in Mandatory courses shall be considered while calculating aggregate attendance in a semester. The Continuous Internal Evaluation (CIE) shall be conducted and evaluated for 40 marks similar to the Theory courses. In addition to this an internal Examination for 60 marks covering the syllabus from all five modules. The student shall be declared to have passed the mandatory courses only when he/she secures 40% marks in the internal evaluation carried out for 100 marks. If the student fails, a re-examination shall be conducted for such candidates in

the following semester before the supplementary examinations. The performance of the student shall be indicated in the grade sheets "PASS" (or) "FAIL" Only. The student should pass all the mandatory courses, for the award of B.Tech degree.

10.9 Audit Courses (AC)

Audit courses carry **zero** credits. There shall be No mid-term and Semester end examination. However, attendance in audit courses shall be considered while calculating aggregate attendance in a semester. The student should study all the audit courses. No credits will be assigned to these courses. A separate certificate will be issued by the Head of the institution on satisfactory completion of Audit Courses.

The student may be permitted to register Mandatory courses and Audit courses as MOOCs offered by SWAYAM / NPTEL / EdX / Coursera / Udacity / Udemy /upgrad/ Khan Academy / Edureka / QEEE etc. The student shall submit weekly assessment report to the faculty coordinator as mentioned in 13.1 and the same shall be considered for internal marks and attendance.

11.0 Passing Standards

11.1 A student shall be deemed to have satisfied the minimum academic requirements and earned the credits allotted to each subject/ course/ Laboratories/ Project Stage-II etc. which are having both CIE and SEE, only if he/she secures not less than **35% of marks (21 out of 60 marks)** in the semester end examination and a **minimum of 40% of marks (40 marks out of 100) in the sum total** of the *continuous internal evaluation (CIE) and semester end examination (SEE)* taken together.

11.2 A student is deemed to have fulfilled the minimum academic requirements and earned the credits allotted to subjects having only internal evaluation (CIE), such as Internships / Industry Oriented Mini Project / Seminar / Project Stage - I if the student secures not less than 40% marks in each of them. However, a student who fails to secure minimum 40% marks or abstains from such subjects, he / she will be permitted to appear in the re-examination which shall be conducted before completion of Semester End Examinations. If the student fails in such re-examination he/she has

to reappear for the same in the next subsequent semester, as and when it is scheduled.

11.3 The student shall be deemed to have failed to earn the credits allotted to subjects having only internal evaluation (CIE), if he (i) does not submit a report on Industrial Oriented Mini Project/Summer Internships, Project Stage-I or does not make a presentation of the same before the evaluation committee as per schedule, or (ii) does not present the seminar or (iii) secures less than 40% marks in Industrial Oriented Mini Project/Summer Internship and seminar evaluations.

11.4 Such failed students may reappear once for each of the above evaluations, when they are scheduled again; if the student fails in such 'one reappearance' evaluation also, the student has to reappear for the same in the next subsequent semester, as and when it is scheduled.

11.5 Recounting/Revaluation/Challenging Evaluation: Students shall be permitted to apply for Recounting /Revaluation/ Challenging Evaluation of the Semester-end examination answer scripts within a stipulated period after payment of the prescribed fee. After completion of the process of Recounting /Revaluation/Challenging Evaluation, the records are updated with changes if any, and the student shall be issued a revised grade sheet. If there are no changes, the same will be shown in the student examination portal.

11.6 Supplementary Examinations:

The supplementary examinations Odd semester shall be conducted during even semester regular/supplementary examinations and even semester supplementary examinations during Odd semester regular supplementary examinations.

Advance supplementary examinations shall be conducted to the students failed in the IV B.Tech - II Semester Regular Examinations. A notification Advance supplementary examinations shall be released after the announcement of regular results.

12.0 Promotion Rules

The students shall be deemed to have promoted to higher classes i.e. from I Year to II year , II year to III Year and III year to IV Year only after earning the below mentioned credits from theory and laboratory courses registered by him/her. The tables given in 10.1, 10.2 provide the details of the credits to be earned by the student (admitted under Regular and Laterally Entry Scheme respectively) to get promoted to higher classes.

12.1 Promotion Rules for Regular Students

S. No.	Promotion	Conditions to be fulfilled
1	First year first semester to first year second semester	Regular course of study of first year first semester.
2	First year second semester to second year first semester	(i) Regular course of study of first year second semester. (ii) Must have secured at least 19 credits out of 38 credits i.e., 50% credits up to first year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3.	Second year first semester to second year second semester	Regular course of study of second year first semester.
4	Second year second semester to third year first semester	(i) Regular course of study of second year second semester. (ii) Must have secured at least 40 credits out of 80 credits i.e., 50% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Third year first semester to third year second semester	Regular course of study of third year first semester.
6	Third year second semester to fourth year first semester	(i) Regular course of study of third year second semester. (ii) Must have secured at least 61 credits out of 122 credits i.e., 50% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
7	Fourth year first semester to fourth year second semester	Regular course of study of fourth year first semester.

12.2 Promotion Rules for Lateral Entry Students

S. No	Promotion	Conditions to be fulfilled
1	Second year first semester to second year second semester	Regular course of study of second year first semester.
2	Second year second semester to third year first semester	(i) Regular course of study of second year second semester. (ii) Must have secured at least 21 credits out of 42 credits i.e., 50% credits up to second year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
3	Third year first semester to third year second semester	Regular course of study of third year first semester.
4	Third year second semester to fourth year first semester	(i) Regular course of study of third year second semester. (ii) Must have secured at least 42 credits out of 84 credits i.e., 50% credits up to third year second semester from all the relevant regular and supplementary examinations, whether the student takes those examinations or not.
5	Fourth year first semester to fourth year second semester	Regular course of study of fourth year first semester

13.0 Massive Open Online Courses (MOOCs)

A student shall be permitted to register BOS approved list of online / self-study course in lieu of the Professional Electives; Open Electives from Massive Open Online Courses (MOOCs) offered by SWAYAM / NPTEL / EdX / Coursera / Udacity / Udemy /upgrad/ Khan Academy / Edureka / QEEE etc. However, the syllabus of the MOOC course shall be approved by the concerned BOS. No formal lectures will be delivered for a self-study course.

13.1 One faculty member for each course shall be nominated as coordinator by the Department to monitor the progress made by the student. The coordinator needs to carry out the conversion of grades awarded to the student in internal and external examinations by the MOOCs offering institution into corresponding grades of JBIET. If any student fails in successfully completing the MOOC course in the first attempt, he/she shall successfully complete it in the supplementary examination conducted by the college in the subsequent semesters. The question paper pattern and evaluation process for the examination of such subjects for MOOC courses will be similar to that of any other theory course offered under R22.

13.2 Mandatory Massive Open Online Courses (MOOCs)

A student has to undergo one mandatory MOOC course (Professional Elective-V) of 3 credit from the online MOOC platforms listed in 13.0 during IV-I semester. The department has to finalize the electives offered on MOOC platform at the end of III-I semester and take prior approval from the BOS for the MOOC course (including syllabus) to be registered by the student.

14.0 Awarding Grace Marks

A student who fails in two theory courses falling short of a few marks is eligible for 0.15% of total marks as Grace Marks.

- Grace marks addition is applicable for maximum of 2 subjects.
- Grace marks can be added only for external examinations.
- Among all the external examinations appeared by the student in a specific subject, the highest marks are considered for adding Grace Marks.
- The provision of Grace Marks is also extended for class change.

The Description of class change is given below:

- i. Class Change from 49.85 % to 50 % for Pass Class to Second Class
- ii. Class Change from 59.85 % to 60 % for Second Class to First Class
- iii. Class Change from 69.85 % to 70 % for First Class to First Class with distinction

Note: Grace marks cannot be added to internal marks.

15.0 Internal improvement examination

Student is permitted to appear for improvement of internal marks of all papers of the B. Tech in which the candidate has not passed due to the shortage of Internal Marks. Students who secured internal marks less than specified marks are only eligible to write the Internal Improvement Examination. The specified marks can be computed using the following formula.

➤ For B. Tech Course: $0.4 \times \text{Total-marks} - 0.35 \times \text{External-marks}$

- Students who have completed all semesters of their, B. Tech course work can only avail this option.
- This internal improvement option is extended up to double the duration of the course work.
- In case of Students who secure less marks in internal improvement examination than his/her previous internal marks or if the student is has registered for Internal Improvement but has not appeared / absent, the old marks will be retained.
- A separate notification shall be released by the JBIET examination branch for conduction of this examination and the students shall register for this option at the time of this notification.

16.0 Award of Degree

A student is declared to have 'qualified' for the award of B. Tech. degree by JNTUH, in the chosen branch of Engineering selected at the time of admission, if he/she fulfills the following conditions.

16.1 The student shall pursue a program of study for not less than four academic years and not more than eight academic years. In case of lateral entry students, student shall pursue a program of study for not less than three academic years and not more than six academic years.

16.2 The student shall register for 160 credits and has to secure all 160 credits (122 credits in case of lateral entry students). Marks obtained in all 160 credits shall be considered for the award of the class based on aggregate of grades. Also, the student should appear and complete all mandatory courses prescribed.

16.3 However, the students are eligible to avail the benefits such as exemption of credits that degree awarding University (JNTUH) announces to the students admitted during this period

16.4 Award of 2-Year B.Tech. Diploma Certificate

A student is declared to have 'qualified' for the award of **2-Year B.Tech. Diploma Certificate** by JNTUH, in the chosen branch of Engineering selected at the time of admission if he/she fulfils the following conditions.

1. When a student wants to exit from 4-Year B. Tech. program, He/she has to fulfil all the academic requirements and earn all the registered 80 credits (within 4 years from the date of admission) up to B. Tech. – II Year – II Semester to be eligible for **2-Year UG Diploma Certificate**.
2. The student once opted and awarded for 2-Year UG Diploma Certificate will not be permitted to Re-join in B. Tech. III Year – I Semester and continue for completion of remaining years of study for 4-Year B. Tech. Degree.

16.5 Award of Class

A student who qualifies for the award of the degree as is placed in the following classes.

- i. Students with final CGPA (at the end of the under graduate programme) ≥ 7.50 shall be placed in '**first class with distinction**'.
- ii. Students with final CGPA (at the end of the under graduate programme) ≥ 6.50 but < 7.50 , shall be placed in '**first class**'.
- iii. Students with final CGPA (at the end of the under graduate programme) ≥ 5.50 but < 6.50 , shall be placed in '**second class**'.
- iv. All other students who qualify for the award of the degree, with final CGPA (at the end of the undergraduate programme) ≥ 5.00 but < 5.50 , shall be placed in '**pass class**'.

A student with final CGPA (at the end of the undergraduate programme) < 5.00 will not be eligible for the award of the degree.

17.0 Transitory Regulations:

The transitory guidelines are applicable to the students

17.1 Who have been detained due to lack of attendance in any semester, shall be permitted to join the corresponding semester.

17.2 Students detained due to shortage of credits, shall be promoted to the next semester only after acquiring the required credits as per the corresponding regulations of his / her admission

17.3 Students who have discontinued and wish to continue the Program, are eligible for admission into the unfinished semester.

Students readmitted under conditions mentioned 16.1, 16.2 and 16.3 shall satisfy all the eligibility requirements as mentioned in 3.0

If a student readmitted to R22 Regulations, has already studied any subject with 80% of syllabus common in his / her previous regulations, that particular subject in R22 Regulations will be substituted by another subject to be suggested by the BOS concerned. If the readmitted student has not studied the pre-requisite subjects for any subject offered in R22 regulations, remedial classes shall be arranged by the concerned HoD.

18.0. Grading Procedure

18.1 Grades will be awarded to indicate the performance of students in each Theory subject, Laboratory / Practical, Seminar, Industry Oriented Mini Project, and Project Stage - I & II. Based on the percentage of marks obtained (Continuous Internal Evaluation plus Semester End Examination, both taken together) as specified in item 8 above, a corresponding letter grade is given.

18.2 As a measure of the performance of a student, a 10-point Absolute Grading System using the following letter grades (as per UGC/AICTE guidelines) and corresponding percentage of marks is followed:

% of Marks Secured in a Subject/Course (Class Intervals)	Letter Grade (UGC Guidelines)	Grade Points
Greater than or equal to 90%	O (Outstanding)	10
80 and less than 90%	A+ (Excellent)	9
70 and less than 80%	A (Very Good)	8
60 and less than 70%	B+ (Good)	7
50 and less than 60%	B (Average)	6
40 and less than 50%	C (Pass)	5
Below 40%	F (FAIL)	0
Absent	Ab	0

Credit Points (CP) = Grade Point (GP) x Credits For a course

A student passes the subject/ course only when $GP \geq 5$ ('C' grade or above).

18.3 The Semester Grade Point Average (SGPA) is calculated by dividing the sum of Credit Points ($\sum CP$) secured from all subjects/ courses registered in a semester, by the total number of Credits registered during that semester. SGPA is rounded off to two decimal places. SGPA is thus computed as given below:

$$SGPA = \frac{\sum_{i=1}^N C_i G_i}{\sum_{i=1}^N C_i} \text{ for each Semester}$$

where 'i' is the subject indicator index (takes into account all subjects in a semester), 'N' is the no. of subjects 'registered' for the semester (as specifically required and listed under the course structure of the parent department), C_i is the no. of credits allotted to the i^{th} subject, and G_i represents the grade points (GP) corresponding to the letter grade awarded for that i^{th} subject.

18.4 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student in all semesters considered for registration. The CGPA is the ratio of the total credit points secured by a student in all registered courses in all semesters, and the total number of credits registered in all the semesters. CGPA is rounded off to two decimal places. CGPA is thus computed from the I Year II Semester onwards at the end of each semester as per the formula.

$$CGPA = \frac{\sum_{j=1}^M C_j G_j}{\sum_{j=1}^M C_j} \text{ for all } S \text{ number of semesters registered}$$

(i.e., up to and inclusive of S semesters, $S \geq 2$),

where 'M' is the total no. of subjects (as specifically required and listed under the course structure of the parent department) the student has 'registered' i.e., from the 1st semester onwards up to and inclusive of the 8th semester, 'j' is the subject indicator index (takes into account all subjects from 1 to 8 semesters), C_j is the no. of credits allotted to the j^{th} subject, and G_j represents the grade points (GP) corresponding to the letter grade awarded for that j^{th} subject. After registration and completion of I Year I Semester, the SGPA of that semester itself may be taken as the CGPA, as there are no cumulative effects.

Illustration of calculation of SGPA:

Course/Subject	Credits	Letter Grade	Grade Points	Credit Points
Course 1	4	A	8	$4 \times 8 = 32$
Course 2	4	O	10	$4 \times 10 = 40$
Course 3	4	C	5	$4 \times 5 = 20$
Course 4	3	B	6	$3 \times 6 = 18$
Course 5	3	A+	9	$3 \times 9 = 27$
Course 6	3	C	5	$3 \times 5 = 15$
	21			152

$$SGPA = \frac{152}{21} = 7.24$$

Illustration of calculation of CGPA up to 3rd semester:

Semester	Course/ Subject Title	Credits Allotted	Letter Grade Secured	Correspondin g Grade Point(GP)	Credit Points(CP)
I	Course 1	3	A	8	24
I	Course 2	3	O	10	30
I	Course 3	3	B	6	18
I	Course 4	4	A	8	32
I	Course 5	3	A+	9	27
I	Course 6	4	C	5	20
II	Course 7	4	B	6	24
II	Course 8	4	A	8	32
II	Course 9	3	C	5	15
II	Course 10	3	O	10	30
II	Course 11	3	B+	7	21
II	Course 12	4	B	6	24
II	Course 13	4	A	8	32
II	Course 14	3	O	10	30
III	Course 15	2	A	8	16
III	Course 16	1	C	5	5
III	Course 17	4	O	10	40
III	Course 18	3	B+	7	21
III	Course 19	4	B	6	24
III	Course 20	4	A	8	32
III	Course 21	3	B+	7	21
	Total Credits	69		Total Credit Points	518

$$CGPA = \frac{518}{69} = 7.51$$

The above illustrated calculation process of CGPA will be followed for each subsequent semester until 8th semester. The CGPA obtained at the end of 8th semester will become the final CGPA secured for entire B.Tech. Programme.

18.5 For merit ranking or comparison purposes or any other listing, only the 'rounded off' values of the CGPAs will be used.

18.6 SGPA and CGPA of a semester will be mentioned in the semester Memorandum of Grades if all subjects of that semester are passed in first attempt. Otherwise the SGPA and CGPA is mentioned only on the Memorandum of Grades in which sitting he

passed his last exam in that semester. However, Mandatory Courses will not be taken into consideration.

19. 0 Transfer Of Students From Other Colleges / Universities

Transfer of students from other Colleges or Universities are permitted subject to the rules and regulations of Telangana State Council for Higher Education (Technical Education Department) and JNTUH in vogue.

20.0 Malpractices Rules

Disciplinary Action For / Improper Conduct in Examinations

	Nature of Malpractices/Improper conduct	Punishment
	If the student:	
1. (a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which student is appearing but has not made use of (material shall include any marks on the body of the student which can be used as an aid in the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any student or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in that subject only of all the students involved. In case of an outsider, he will be handed over to the police and a case is registered against him.

2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the student is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year.
3.	Smuggles in the answer book or additional sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all End examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
4.	Uses objectionable, abusive or offensive language in the answer paper or in letters to the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
5.	Refuses to obey the orders of the chief superintendent/ assistant superintendent / any officer on duty or misbehaves or creates disturbance	In case of students of the college, they is expelled from examination halls and cancellation of their performance in that subject and all

	<p>of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the college campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination</p>	<p>other subjects the student(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a Police case is registered against them.</p>
6.	<p>Leaves the exam hall taking away answer script or intentionally tears off the script or any part thereof inside or outside the examination hall.</p>	<p>Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that Semester/year. The student is also debarred for two consecutive semesters from class work and all End examinations. The</p>

		continuation of the course by the student is subject to the academic regulations in connection with forfeiture of seat.
7.	Possesses any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat.
8.	If student of the college, who is not a student for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeits the seat. Person(s) who do not belong to the college will be handed over to police and, a police case will be registered against them.
9.	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and project work and shall not be

		permitted for the remaining examinations of the subjects of that semester/year
10.	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the student has appeared including practical examinations and project work of that semester/year examinations.

- ❖ *If any malpractice is detected which is not covered in the above clauses 1 to 10 shall be referred to the Malpractice Committee for further action and to award suitable punishment.*



ANNEXURE-I
J.B.INSTITUTE OF ENGINEERING AND TECHNOLOGY
(UGC Autonomous)
Accredited by NBA & NAAC, Approved by AICTE & Permanently affiliated to JNTUH
Yenkapally(V), Moinabad(M), P.O. Himayat Nagar, R.R. District, Hyderabad-500075

Academic Regulations for *B. Tech. with Honours program*

1. Objectives

The key objectives of offering B. Tech. with Honours program are:

- To expand the domain knowledge of the students laterally and vertically to cope up with Education 4.0.
- To enhance the employability of undergraduate students as per Industry 4.0 standards.
- To provide an opportunity to students to pursue their higher studies in wider range of specializations.

2. Academic Regulations for B. Tech. Honours degree

- 1) The weekly instruction hours, internal & external evaluation and award of grades are on par with regular 4-Years B. Tech. program.
- 2) For B. Tech with Honours program, a student needs to earn additional 20 credits (over and above the required 160 credits for B. Tech degree). The broad guidelines for the courses of Honours program, their respective credits weightage and semester-wise break-up of the course are enclosed as Annexure. **All these 20 credits need to be completed in III year I Semester to IV year I Semester only.**
- 3) After registering for the Honours programme, **if a student is unable to pass all courses in first attempt and earn the required 20 credits, he/she shall not be awarded Honours degree.** However, if the student earns all the required 160 credits of B. Tech., he/she will be awarded only B. Tech degree in the concerned branch.
- 4) There is no transfer of credits from courses of Honours program to regular B. Tech. degree course & vice versa.

- 5) These 20 credits are to be earned from the additional courses offered by the host department in the college or from a closely related department in the college as well as from the MOOCS platform.

6) Guidelines for courses selected under MOOCs platform :

- a) Prior to registration of MOOCS courses, formal approval of the courses, by the Head of the Department is essential. Head of the Department before the issue of approval considers the parameters like the institute / agency which is offering the course, syllabus, credits, duration of the programme and mode of evaluation etc.
 - b) Department wise MOOCs finalized are to be consolidated and needs to be approved by BOS before commencement of the semester.
 - c) Minimum credits for a MOOCS course must be equal to or more than the credits specified in the Honours course structure provided by the JBIET.
 - d) Only Pass-grade/marks or above shall be considered for inclusion of grades in the Honours grade memo.
 - e) Any expenses incurred for the MOOCS courses are to be met by the students only.
- 7) The **choice to opt/take the Honours program is purely on the choice of the students.**
- 8) The student shall be given a **choice of withdrawing all the courses registered and/or the credits earned for Honours program at any time**; and in that case the student will be awarded only B. Tech. degree in the concerned branch on earning the required credits of 160.
- 9) The students of every branch can choose Honours program in their respective branches if they are eligible for the Honours program. **A student who chooses an Honours program is not eligible to choose a Minor program and vice-versa.**
- 10) Students can register for the Honours program only if they fulfill the **eligibility criteria.**
- 11) A student can graduate with Honours if he/she fulfils the requirements for his/her regular B. Tech. program as well as fulfils the requirements for Honours program.
- 12) The record of students registered and pursuing their Honours programs branch-wise is sent to JNTUH once the enrolment process is complete.

- 13) The department shall prepare the time-tables for each Honours program offered at their respective departments without any overlap/clash with other courses of study in the respective semesters.

3. Eligibility conditions of the students for the Honours degree

- a) A student can opt for B.Tech. degree with Honours, if she/he passed all subjects in first attempt in all the semesters till the results announced and **maintaining 7.5 or more CGPA.**
- b) **If a student fails in any registered course of either B. Tech. or Honours in any semester of four years program, he/she will not be eligible for obtaining Honours degree.** He will be eligible for only B. Tech. degree
- c) **Prior approval of mentor and Head of the Department for the enrolment into Honours program, before commencement of III year I Semester (V Semester), is mandatory.**
- d) If more than 30% of the students in a branch fulfil the eligibility criteria (as stated above), the number of students given eligibility is limited to 30%. The criteria to be followed for choosing 30% candidates in a branch may be the **CGPA secured by the students till II year I semester.**
- e) Successful completion of 20 credits earmarked for honours program with at least 7.5 CGPA along with successful completion of 160 credits earmarked for regular B. Tech. Program with at least 7.5 CGPA and passing all subjects in first attempt gives the eligibility for the award of B. Tech. (Honours) degree.
- f) For CGPA calculation of B. Tech. course, the 20 credits of Honours program will not be considered.

4. Registration for the course in Honours program

- a) At the beginning of each semester, just before the commencement of classes, students shall register for the courses which they wish to take in that semester.
- b) The students should choose a course from the list against each semester (from Honours course structure) other than the courses they have studied/registered for regular B.Tech programme. No course should be

identical to that of the regular B. Tech. course. The students should take the advice of faculty mentors while registering for a course at the beginning of semester.

- c) The maximum No. of courses for the Honours is limited to two in a semester along with regular semester courses.
- d) The students need to register the Honours degree by paying an registration fee of Rs. 1000/- per one credit.
- e) A fee for late registration will be imposed as per the norms of JNTUH.

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Academic Regulations for Honours degree in B. Tech. programs

S. No.	Year / Semester	Course to be chosen from/studied	Mode of Learning	No. of Credits
1	III-I	PE-1	Blended/Conventional	4
2	III-I	PE-2	Blended/Conventional	4
3	III-II	PE-3	Blended/Conventional	4
4	III-II	MOOC Platform (PE-4 or an Inter disciplinary subject)	MOOCS	2
5	IV-I	PE-5	Blended/Conventional	4
6	IV-I	MOOC Platform (PE-6 or an Inter disciplinary subject)	MOOCS	2
Total Credits				20

Note:

- The attendance and evaluation scheme for Honours degree courses will be same as the regular B. Tech. courses.
- If the blended course option is chosen, for the subjects in any semester, the learning should be partially in online mode and partially in offline mode. The Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) shall be carried out by JBIET.



Academic Regulations for *B. Tech. with Minors program*

5. Objectives

The key objectives of offering B. Tech. with Minor program are:

- To expand the domain knowledge of the students in one of the other branches of engineering.
- To increase the employability of undergraduate students keeping in view of better opportunity in interdisciplinary areas of engineering & technology.
- To provide an opportunity to students to pursue their higher studies in the inter-disciplinary areas in addition to their own branch of study.
- To offer the knowledge in the areas which are identified as emerging technologies/thrust areas of Engineering.

6. Academic Regulations for B. Tech. Minors degree

- 14) The weekly instruction hours, internal & external evaluation and award of grades are on par with regular 4-Years B. Tech. program.
- 15) For B. Tech with Minors program, a student needs to earn additional 20 credits (over and above the required 160 credits for B. Tech degree). The broad guidelines for the courses of Minors program, their respective credits weightage and semester-wise break-up of the course are enclosed as Annexure. All these 20 credits need to be completed in III year I Semester to IV year I Semester only.**
- 16) After registering for the Minors programme, **if a student is unable to pass all courses in first attempt and earn the required 20 credits, he/she shall not be awarded Minors degree.** However, if the student earns all the required 160 credits of B. Tech., he/she will be awarded only B. Tech degree in the concerned branch.
- 17) There is no transfer of credits from courses of Minors program to regular

B. Tech. degreecourse & vice versa.

- 18) These 20 credits are to be earned from the additional courses offered by the host department in the college or from a closely related department in the college as well as from the MOOCS platform.

19) Guidelines for courses selected under MOOCs platform :

- a) Prior to registration of MOOCS courses, formal approval of the courses, by the Head of the Department is essential. Head of the Department before the issue of approval considers the parameters like the institute / agency which is offering the course, syllabus, credits, duration of the programme and mode of evaluation etc.
 - b) Department wise MOOCs finalized are to be consolidated and needs to be approved by BOS before commencement of the semester.
 - c) Minimum credits for a MOOCS course must be equal to or more than the credits specified in the Minors course structure provided by the JBIET.
 - d) Only Pass-grade/marks or above shall be considered for inclusion of grades in the Minors grade memo.
 - e) Any expenses incurred for the MOOCS courses are to be met by the students only.
- 20) The **choice to opt/take the Minors program is purely on the choice of the students.**
- 21) The student shall be given a **choice of withdrawing all the courses registered and/or the credits earned for Minors program at any time;** and in that case the student will be awarded only B. Tech. degree in the concerned branch on earning the required credits of 160.
- 22) The students of every branch can choose Minors program in their respective branches if they are eligible for the Minors program. A student who chooses an Minors program is not eligible to choose a Minor program and vice-versa.**
- 23) Students can register for the Minors program only if they fulfill the eligibility criteria.**
- 24) A student can graduate with Minors if he/she fulfils the requirements for his/her regular B. Tech. program as well as fulfils the requirements for Minors program.
- 25) The record of students registered and pursuing their Minors programs

branch-wise is sent to JNTUH once the enrolment process is complete.

- 26) The department shall prepare the time-tables for each Minors program offered at their respective departments without any overlap/clash with other courses of study in the respective semesters.

7. Eligibility conditions of the students for the Minors degree

- g) A student can opt for B.Tech. degree with Minors, if she/he passed all subjects in first attempt in all the semesters till the results announced and **maintaining 7.5 or more CGPA.**
- h) **If a student fails in any registered course of either B. Tech. or Minors in any semester of four years program, he/she will not be eligible for obtaining Minors degree.** He will be eligible for only B. Tech. degree
- i) **Prior approval of mentor and Head of the Department for the enrolment into Minors program, before commencement of III year I Semester (V Semester), is mandatory.**
- j) If more than 30% of the students in a branch fulfil the eligibility criteria (as stated above), the number of students given eligibility is limited to 30%. The criteria to be followed for choosing 30% candidates in a branch may be the **CGPA secured by the students till II year I semester.**
- k) Successful completion of 20 credits earmarked for Minors program with at least 7.5 CGPA along with successful completion of 160 credits earmarked for regular B. Tech. Program with at least 7.5 CGPA and passing all subjects in first attempt gives the eligibility for the award of B. Tech. (Minors) degree.
- l) For CGPA calculation of B. Tech. course, the 20 credits of Minors program will not be considered.

8. Registration for the course in Minors program

- f) At the beginning of each semester, just before the commencement of classes, students shall register for the courses which they wish to take in that semester.
- g) The students should choose a course from the list against each semester (from Minors course structure) other than the courses they have

studied/registered for regular B.Tech programme. No course should be identical to that of the regular B. Tech. course. The students should take the advice of faculty mentors while registering for a course at the beginning of semester.

- h) The maximum No. of courses for the Minors is limited to two in a semester along with regular semester courses.
- i) The students need to register the Minors degree by paying an registration fee of Rs. 1000/- per one credit.
- j) A fee for late registration will be imposed as per the norms of JNTUH.

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Academic Regulations for Minors degree in B. Tech. programs

S. No.	Year / Semester	Course to be chosen from/studied	Mode of Learning	No. of Credits
1	III-I	PE-1	Blended/Conventional	4
2	III-I	PE-2	Blended/Conventional	4
3	III-II	PE-3	Blended/Conventional	4
4	III-II	MOOC Platform (PE-4 or an Inter disciplinary subject)	MOOCS	2
5	IV-I	PE-5	Blended/Conventional	4
6	IV-I	MOOC Platform (PE-6 or an Inter disciplinary subject)	MOOCS	2
Total Credits				20

Note:

- The attendance and evaluation scheme for Minors degree courses will be same as the regular B. Tech. courses.
- If the blended course option is chosen, for the subjects in any semester, the learning should be partially in online mode and partially in offline mode. The Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) shall be carried out by JBIET.

JBiet-R22	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech - AI&ML
B. Tech Course Structure		

I Year I Semester								
S. No	Code	Course Title	L	T	P/D	Credits	Category	common Subject (Y/N)
1	L110A	Differential Equations and Calculus	3	1	0	4	BS	y
2	L110D	Engineering Chemistry	3	0	0	3	BS	y
3	L112A	Basic Electrical and Electronics Engineering	3	1	0	4	ES	y
4	L1133	Engineering Workshop and Manufacturing Practices	1	0	4	3	ES	Y
5	L1131	Engineering Drawing	1	0	4	3	ES	y
6	L1103	Chemistry Lab	0	0	2	1	BS	y
7	L1121	Basic Electrical and Electronics Engineering Lab	0	0	4	2	ES	y
8	L11T1	Audit Course I - Functional English	2	0	0	0	AC	Y
Total			13	2	14	20		

I Year II Semester								
S. No	Code	Course Title	L	T	P	Credits	Category	common Subject (Y/N)
1	L120A	Linear Algebra and Advanced Calculus	3	1	0	4	HS	y
2	L120B	English	3	0	0	3	BS	y
3	L120C	Applied Physics	3	0	0	3	BS	y
4	L125A	Programming for Problem Solving	3	1	0	4	ES	y
5	L1202	Physics Lab	0	0	2	1	BS	y
6	L1201	English Language and Communication Skills Lab	0	0	2	1	HS	y
7	L1251	Programming for Problem Solving Lab	0	0	4	2	ES	y
8	L12T2	Audit Course II - Human Values and Professional Ethics	2	0	0	0	AC	Y
Total			14	2	8	18		

JBiet-R22	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech - AI&ML
B. Tech Course Structure		

II Year I Semester								
S. No	Code	Course Title	L	T	P	Credits	Category	common Subject (Y/N)
1	L210A	Probability and Statistics	3	1	0	4	BS	Y
2	L216A	Data Structures using C	3	0	0	3	PC	Y
3	L216C	Database Management Systems	3	0	0	3	PC	Y
4	L215D	Artificial Intelligence and its applications	3	0	0	3	PC	Y
5	L216D	Computer Networks	3	0	0	3	PC	Y
6	L2152	Database Management Systems Lab	0	0	3	1.5	PC	Y
7	L2161	Data Structures Lab	0	0	3	1.5	PC	Y
8	L21A3	Internship - I	0	0	2	1	PW	N
9	L21M1	Mandatory Course – I (Gender Sensitization)	2	0	0	0	MC	Y
Total			17	1	8	20		

JBiet-R22	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech - AI&ML
B. Tech Course Structure		

II Year II Semester								
S. No	Code	Course Title	L	T	P	Credits	Category	common Subject (Y/N)
1	L220B	Mathematics for Machine Learning and Data Science	3	0	0	3	BS	N
2	L224E	Digital Image Processing	3	1	0	4	ES	Y
3	L225F	Python Programming	3	0	0	3	PC	Y
4	L226D	Data Warehousing and Data Mining	3	0	0	3	PC	Y
5	L225C	Design and Analysis of Algorithms	3	0	0	3	PC	Y
6	L22AA	Machine Learning	3	0	0	3	PC	Y
7	L2252	Python Programming Lab	0	0	3	1.5	PC	Y
8	L22A1	Machine Learning Lab	0	0	3	1.5	PC	Y
9	L22M2	Mandatory Course- II (Environmental Science)	2	0	0	0	MC	Y
Total			20	1	6	22		

JBiet-R22	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech - AI&ML
B. Tech Course Structure		

III Year I Semester								
S. No	Code	Course Title	L	T	P	Credits	Category	common Subject (Y/N)
1	L31EA	Business Economics and Financial Analysis	3	1	0	4	HS	Y
2	L315D	Software Engineering	3	0	0	3	PC	Y
3	L31AB	Deep Learning	3	0	0	3	PC	Y
4	BTAIME1	Professional Elective – I	3	0	0	3	PE	N
5	BTAIMO1	Open Elective – I	3	0	0	3	OE	N
6	L31A2	Deep Learning Lab	0	0	4	2	PC	N
7	L3152	Software Engineering lab	0	0	2	1	PC	Y
8	L31A3	Internship - II	0	0	2	1	PW	N
9	L31M5	Mandatory Course-III (E Commerce)	2	0	0	0	MC	Y
10	L31T1	Audit Course III (Employability Skills)	2	0	0	0	AC	Y
Total			19	1	8	20		

JBiet-R22	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech - AI&ML
B. Tech Course Structure		

III Year II Semester								
S. No	Code	Course Title	L	T	P	Credits	Category	common Subject (Y/N)
1	L32DA	Data Science Through R	3	0	0	3	PC	Y
2	L326B	Automata and Compiler Design	3	0	0	3	PC	Y
3	BTAIME2	Professional Elective - II	3	0	0	3	PE	N
4	BTAIME3	Professional Elective - III	3	0	0	3	PE	N
5	BTAIMO2	Open Elective – II	3	0	0	3	OE	N
6	BTAIMO3	Open Elective – III	3	0	0	3	OE	N
7	L32D2	Data Science Through R Lab	0	0	4	2	PC	Y
8	L32M2	Mandatory Course-IV (Cyber Security)	2	0	0	0	MC	Y
9	L3201	Life Skills and Professional Skills Lab	0	0	2	2	HS	Y
10	L32T2	Audit Course IV (Foundations of Entrepreneurship)	2	0	0	0	AC	Y
Total			22	0	6	22		

JBiet-R22	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech - AI&ML
B. Tech Course Structure		

IV Year I Semester								
S. No	Code	Course Title	L	T	P	Credits	Category	common Subject (Y/N)
1	L41AA	Reinforcement Learning	3	0	0	3	PC	N
2	L415B	Computer Vision	3	0	0	3	PC	Y
3	BTAIME4	Professional Elective - IV	3	0	0	3	PE	N
4	BTAIME5	Professional Elective - V based on NPTEL Course	3	0	0	3	PE	N
5	BTAIMO4	Open Elective – IV	3	0	0	3	OE	N
6	L41A1	Reinforcement Learning Lab	0	0	4	2	PC	N
7	L4156	Computer Vision Lab	0	0	4	2	PC	Y
8	L41A2	Industry Oriented Mini Project	0	0	4	2	PW	N
9	L41A3	Project Stage – I	0	0	4	2	PW	N
10	L41M6	Mandatory Course-V (Free and Open source softwares)	2	0	0	0	MC	Y
Total			17	0	16	23		

IV Year II Semester								
S. No	Code	Course Title	L	T	P	Credits	Category	common Subject (Y/N)
1	BTAIME6	Professional Elective - VI	3	0	0	3	PE	N
2	BTAIMO5	Open Elective – V	3	0	0	3	OE	N
3	L42A1	Seminar	0	0	2	1	PW	N
4	L42A2	Project Stage – II	0	0	16	8	PW	N
Total			6	0	18	15		

JBiet-R22	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech - AI&ML
B. Tech Course Structure		

Professional Elective-I (III-I)								
S. No	Code	Course Title	L	T	P	Credits	Category	common Subject (Y/N)
1	L31DE	NoSQL Data Base	3	0	0	3	PE	N
2	L315E	Cloud Computing	3	0	0	3	PE	N
3	L315I	Design Thinking	3	0	0	3	PE	N

Professional Elective-II (III-II)								
S. No	Code	Course Title	L	T	P	Credits	Category	common Subject (Y/N)
1	L326L	Information Retrieval Systems	3	0	0	3	PE	N
2	L325A	Mobile Computing	3	0	0	3	PE	N
3	L326D	Software Architecture and Design Pattern	3	0	0	3	PE	N

Professional Elective-III (III-II)								
S. No	Code	Course Title	L	T	P	Credits	Category	common Subject (Y/N)
1	L32DE	Big Data Analytics	3	0	0	3	PE	N
2	L325K	Android Application Development	3	0	0	3	PE	N
3	L32AB	UI/UX Design	3	0	0	3	PE	N

Professional Elective-IV (IV-I)								
S. No	Code	Course Title	L	T	P	Credits	Category	common Subject (Y/N)
1	L41AE	Predictive Analytics	3	0	0	3	PE	N
2	L417G	Internet of Things	3	0	0	3	PE	N
3	L41AK	Agile Methodologies	3	0	0	3	PE	N

JB IET-R22	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech - AI&ML
B. Tech Course Structure		

Professional Elective-V (Mandatory MOOC – Tentative). (IV-I)								
S. No	Code	Course Title	L	T	P	Credits	Category	common Subject (Y/N)
1	L41AG	Natural Language Processing (NPTEL)	3	0	0	3	PE	N
2	L41AH	Social Network Analysis (NPTEL)	3	0	0	3	PE	N
3	L415K	Block Chain and its Applications (NPTEL)	3	0	0	3	PE	N

Professional Elective-VI (IV-II)								
S. No	Code	Course Title	L	T	P	Credits	Category	common Subject (Y/N)
1	L42AA	Generative Adversarial Networks	3	0	0	3	PE	N
2	L42AB	AI for Business	3	0	0	3	PE	N
3	L425B	Quantum Computing	3	0	0	3	PE	N

R22 - Open Elective-I to V (Offered by AI&ML)								
S. No	Code	Course Title	L	T	P	Credits	Year / Sem	
1.	L31OC	Introduction to Machine Learning	3	0	0	3	III / I	
2.	L32OC	Introduction to Predictive Analytics	3	0	0	3	III / II	
3.	L32OS	Introduction to Neural Networks	3	0	0	3	III / II	
4.	L41OC	Introduction to Deep Learning	3	0	0	3	(IV-I)	
5.	L42OC	Introduction to Generative Adversarial Networks	3	0	0	3	(IV-II)	

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B.Tech AI & ML I Year – I Sem			
Course Code: L110A	DIFFERENTIAL EQUATIONS AND CALCULUS (COMMON TO CE, EEE, ME, ECE, AI & ML, IT, ECM& MIE)	L	T	P	D
Credits: 4		3	1	0	0

Pre-Requisites: Nil

Course objectives:

The Student will:

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: (9L)

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: (10L)

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 , $e^{ax} \cdot V(x)$, $xV(x)$. 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: (10L)

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.

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: (9L)

UNIT I: 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 II: 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: (10L)

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

Reference Books:

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

The student 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. Analyze the improper integrals
5. Find the maxima and minimal of multivariable functions

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B.Tech AI & ML I Year – I Sem			
Course Code: L110D	ENGINEERING CHEMISTRY (COMMON TO EEE, ECE, AI & ML, IT & ECM)	L	T	P	D
Credits: 3		3	0	0	0

Pre-Requisites: Nil

Module 1: Molecular Structure and Theories of Bonding [9L]

Atomic and Molecular orbitals-Molecular orbital theory-LCAO – bonding in homo and heteronuclear diatomic molecules, molecular orbital energy level diagrams of homo nuclear di atomic molecules(N_2 , O_2 and F_2), hetero nuclear di atomic molecules(CO and NO). Crystal Field Theory (CFT), Salient Features of CFT – Crystal Field Splitting of transition metal ion d-orbitals in Tetrahedral, Octahedral complexes. Magnetic and colour properties of complexes. Band theory of solids – band diagrams for conductors, semiconductors and insulators, effect of doping on conductance.

Module 2: Water and Its Treatment [10L]

Introduction – hardness of water – Causes of hardness - Types of hardness- temporary and permanent – units of hardness-numerical problems – Estimation of hardness of water by complexometric method. Potable water and its specifications. Steps involved in potable water treatment – Disinfection of water by chlorination and ozonization-Breakpoint chlorination. Boiler feed water- scale and sludge formation--internal treatment of boiler feed water– Calgon conditioning, Phosphate conditioning and Colloidal conditioning. External treatment of water – Ion exchange process.Desalination of brackish water – Reverse osmosis.

Module 3: Electrochemistry and Corrosion [12L]

Electrochemistry[7L]

Introduction-electrode potential, standard electrode potential, Electrochemical cell-Galvanic cell –Nernst equation derivation-applications,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 (Li-MnO₂ cell) and secondary batteries (Lead – acid storage battery and Lithium ion battery).

Corrosion[5L]

Causes and effects of corrosion – chemical and electrochemical corrosion – mechanism of electrochemical corrosion, types of corrosion-galvanic, pitting and waterline corrosion-factors influencing rate of corrosion-Corrosion control methods- Cathodic protection – Sacrificial anode and impressed current cathodic methods-Surface coatings-Hot dipping(Galvanizing and Tinning).

Module 4: Chemical Fuels [8L]

Fuels: Definition, classification, characteristics of a good fuel, Calorific value (CV)-HCV and LCV. Calculation of CV using Dulong's formula, numericals.

Soild Fuels: Coal-proximate &ultimate analysis-significance.

Liquid Fuels:Composition and CV of gasoline, cracking: Fixed bed catalytic cracking method. Knocking and its significance, octane number, cetane number.

Module 5: Polymers and Nanomaterials[12L]

Polymers [8L]

Definition – 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, Nylon-6, 6 and Bakelite.Conducting Polymers-conduction in polyacetylene.

Nanomaterials[4L]

Introduction, Synthesis:Top down and bottom up approaches. Sol-gel and Chemical Vapour Deposition(CVD) methods. Properties and applications of fullerenes, carbon nanotubes.Medical applications of nanomaterials.

Text Books

1. Engineering Chemistry: P. C. Jain & M. Jain, Dhanpat Rai Publications, New Delhi.
2. Engineering Chemistry: ShashiChawla, Dhanapathrai Publications (2019), New Delhi.

Reference Books

1. Engineering Chemistry, M. Thirumalachary and Laxminarayana, Scitech Publications.
2. Text Book of Engineering Chemistry, Cengage Learning, B.Rama Devi, Ch. VenkataRamana Reddy and PrasanthRath.
3. Engineering Chemistry (NPTEL Web-book) by B.L. Tembe, Kamaluddin and M.S. Krishnan

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.youtube.com/watch?v=W0-CvvAGtEM>
5. <https://sengerandu.wordpress.com/tutorials/physical-metallurgy/engineering-materials>

Course Outcomes

At the end of the course, the student will be able to:

CO1. Understand and analyse microscopic chemistry in terms of atomic orbitals, molecular orbitals.

CO2. Recognize and select the domestic and industrial problems caused by hard water and also learn about the municipal water treatment using various methods.

CO3. Understand and interpret the important fundamental concepts of electrochemical procedures related to corrosion and its control.

CO4. Rate the fuels and suggest methods for enhancement of the quality of fuels for the required output.

CO5. Identify & recognize the role of polymers and Nanomaterials in everyday life.

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B.Tech - AI&ML I Year – I Sem			
Course Code: L112A	Basic Electrical and Electronics Engineering (Common to AIML, ECE & EEE)	L	T	P	D
Credits: 4		3	1	0	0

Pre-Requisites: Nil

Course objectives:

The Student will:

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. Study and understand magnetic circuits and transformers.
4. Understand the different types of D.C and A.C rotating electrical machine.
5. Import the knowledge of protection of electrical components and Measuring Instruments.

Module 1: DC and AC Circuits [10L]

Unit-I: DC Circuits [6L]

Electrical quantities - resistors - inductors - capacitors - Ohm's Law - Kirchhoff's Laws - series and parallel circuits - analysis of DC circuits - mesh, nodal - simple problems.

Unit-II: AC Circuits [4L]

Sinusoidal functions - phasor representation - RMS and Average values - form and peak factors - RLC series circuits - power and power factor-concept of three phase system.

Module 2: DC and AC Electrical Machines [9L]

Unit-I: DC Electrical Machines [5L]

Construction and principle of operation of DC machines – DC generator – EMF equation – Types – DC motor – Types.

Unit-II: AC Electrical Machines [4L]

Single phase transformer – Construction and operation – EMF equation - Three phase induction motor – Construction and operation.

Module 3: Measuring Instruments and Electrical Installation [8L]

Unit-I: Measuring Instruments [4L]

PMMC and MI Instruments - Construction and operation – Torque Equation - advantages and disadvantages.

Unit-II: Electrical Installation [4L]

Electrical Installation: Components of LT Switchgear - Switch Fuse Unit (SFU) – MCB – MCCB – Earthing.

Module 4: DIODES AND APPLICATIONS [12L]

Unit-I: P-N junction diode Principle of operation and characteristics of a P-N junction diode static and dynamic resistance of a diode, ideal diode, Zener Diode, Avalanche and Zener Breakdown mechanisms, V-I characteristics of Zener Diode

Unit-II: Rectifiers & Filters Diode as a Rectifier Half Wave Rectifier, Full Wave Rectifier, Bridge Rectifier, rectifier with Capacitor filter and π - Section filter, zener diode as a voltage regulator

Module 5: TRANSISTOR CHARACTERISTICS [12L]

Unit-I: Bi-Polar Junction Transistor (BJT) Principle of operation of Bi-Polar Junction Transistor (BJT), current components in a junction Transistor, V-I characteristics in CB, CE, CC configurations, determination of " α " and " β " of a transistor from the V-I characteristics.

Unit-II: Field Effect Transistors (FET) Comparison of BJT & JFET, Construction & Operation of JFET, V-I Characteristics of JFET, Determination of FET Parameters from the V-I characteristics. MOSFET Construction & Operation in Enhancement and Depletion modes, V-I Characteristics of MOSFET.

Text Books

1. V.K. Mehta, "Principles of Electrical Engineering and Electronics", S. Chand & Company Ltd, 2012
2. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
3. A. K. Sawhney, "A course in Electrical and Electronics Measurements and Instrumentation", Dhanapath Rai and Sons., 10th Edition, 2007.
4. Electronic Devices & Circuits :Millman & Halkias Mcgraw Hill
5. Integrated Electronics : Millman & Halkias Mcgraw 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.

E-Resources

1. https://onlinecourses.swayam2.ac.in/nou21_ee02/preview
2. <https://nptel.ac.in/courses/108/108/108108076/>
3. <https://www.electrical4u.com>

Course Outcomes

At the end of the course, the student will be able to:

- CO 1.** Apply the basic laws of electricity in DC and AC circuits.
- CO 2.** Describe the construction and operation of electrical machines.
- CO 3.** Explain the functioning of measuring instruments and components of LT Switchgear.
- CO 4.** Understand PN junction diode operation, characteristics and applications.
- CO 5.** Gain Knowledge on characteristics of BJT &FET in various modes of operation

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B.Tech CSE I Year – I Sem			
Course Code: L1133	ENGINEERING WORKSHOP AND MANUFACTURING PRACTICE (COMMON TO EEE, AI&ML, CSE & IT) (Common to AI&ML, AI&DS, CSE, IT)	L	T	P	D
Credits: 3		1	0	4	0

Pre-Requisites: Basic knowledge about tools and different trades

Course objectives:

The Student will:

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. it's hardware.
5. Install the operating system and perform various tasks.

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

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.

Course outcomes:**The student 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 disassemble 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.

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech: AI & ML I Year – I Sem			
Course Code: L1131	ENGINEERING DRAWING (Common to ECE, AI & ML, IT, ECM)	L	T	P / D	
Credits: 3		1	0	4	0

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:

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

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B.Tech AI & ML I Year – I Sem			
Course Code: L1103	CHEMISTRY LAB (Common to All Branches)	L	T	P	D
Credits: 1		0	0	2	0

Pre-Requisites: Intermediate basic concepts.

List of experiments(Any 10-12 experiments)

Volumetric Analysis:

1. Preparation of standard solution of oxalic acid and standardisation of NaOH.
2. Determination of total hardness of water by complexometric method using EDTA.
3. Determination of chloride content of water by Argentometry.
4. Estimation of Fe^{2+} in Mohr's salt using permanganometry.
5. Estimation of ferrous iron by dichrometry.

Instrumental methods of Analysis:

6. Estimation of an HCl by Conductometric titrations using NaOH.
7. Estimation of Acetic acid by Conductometric titrations using NaOH.
8. Estimation of HCl by Potentiometric titrations using NaOH.
9. Estimation of Fe^{2+} by Potentiometry using KMnO_4 .

Determination of Physico-Chemical Properties:

10. Determination of viscosity of a given liquid by using Ostwald's viscometer.
11. Determination of surface tension of a given liquid using stalagmometer.
12. Determination of partition coefficient of acetic acid between n-butanol and water.

Synthesis of Nanomaterials, Polymers and drug molecules:

13. Synthesis of drug molecule Aspirin.
14. Synthesis of Polymer-Bakelite.
15. Synthesis of Iron nanoparticles.

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 & 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

At the end of the course, the students will be able to:

1. Identify the basic chemical methods to analyse the substances quantitatively & qualitatively.
2. Calculate the concentration and amount of various substances using instrumental techniques.
3. Synthesize the engineering materials like nanomaterials, polymers and drug molecules.
4. Determine the physico-chemical properties like partition co-efficient, surface tension and viscosity.
5. Determine the partition coefficient of organic compound in two immiscible liquids.

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B.Tech – AI&ML I Year – I Sem			
Course Code: L1121	Basic Electrical and Electronics Engineering Lab (Common to AIML, ECE & EEE)	L	T	P	D
Credits: 2		0	0	4	0

Pre-Requisites: Nil

Course objectives:

The Student will:

1. Learn Colour coding of different components like Resistor, capacitor and Inductor.
2. Study basic electronic equipment like CRO, RPS, Function generator etc
3. Observe characteristics of electronic devices
4. Calculate various parameter of rectifier circuits
5. Get the Knowledge Frequency Response of various Amplifier circuits

List of Experiments

1. Verification of Ohms Law.
2. Determination of unknown resistance.
3. Verification of KVL and KCL.
4. Resonance in series RLC circuit.
5. Calculations and verification of impedance and current of RL, RC and RLC series circuits.
6. Measurement of voltage, current and real power in primary and secondary circuits of a single phase transformer.
7. Performance Characteristics of a DC Shunt Motor.
8. Performance Characteristics of a Three-phase Induction Motor.
9. Characteristics of PN Junction Diode & Zener diode
10. Characteristics of Transistor in CB Configuration.
11. Characteristics of Transistor in CE Configuration.
12. Half Wave Rectifier & Full Wave Rectifier without & with capacitor filter
13. FET characteristics
14. Frequency Response of CE Amplifier.

Course Outcomes

At the end of the course, the student will be able to:

1. Analyze DC Circuits using basic Laws.
2. Determine the impedance and current of RL, RC and RLC series circuits.
3. Analyze the performance characteristics of DC and AC electrical machines.

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B.Tech - AI & ML I Year – I Sem			
Course Code: L11T1	FUNCTIONAL ENGLISH (Audit Course-II) COMMON TO: ALL	L	T	P	D
Credits: 2		2	0	0	0

Pre-Requisites: Basic English Knowledge.

Module 1:FUNCTIONAL ENGLISH[6L]

Introduction - Functional Spoken English;Listening – Speaking: Do's and Don'ts; Expressing: Ability/ Admiration/ Agreement/ Anger/ Annoyance/ Appreciation/ Pleasure/ Sarcasm/ Satisfaction/ Surprise/ Approval/ Capability/ Certainty/ Condolences/ Doubt/ Fear/ Gratitude/ Possibility/ Worry; Asking for: Advice/Clarification/Direction/Information/ Permission/ Predictions/ Recommendation.

Module 2: VOCABULARY BUILDING[6L]

Vocabulary for Day-to-day Conversations; Introduction: Vegetables/ Groceries/ Fruits/ Weather; Parts of Human body/ Dresses/ Furniture/ Relations; Birds/ Cries of Animals; Food/ Hospitality/ Houses/ Rooms/ Tools; Airport/ News Paper/ Books/ Gems; Corporate Vocabulary/ Jobs/ Occupations; Diseases; Slang Words and Technical Jargon.

Module 3: FUNCTIONAL GRAMMAR - I[6L]

Introduction: Parts of Speech;Verb Forms; Phrases and Clauses; Tenses; Speeches; Voices; Degrees of Comparison;Simple, Complex and Compound Sentences.

Module 4: FUNCTIONAL GRAMMAR - II [6L]

Sentence Making for Effective Communication; Sentence Structure – 'Wh' Questions - How to Frame Questions and Give Answers; Question Tags; Spotting Errors.

Module 5:COMMUNICATION SKILLS [6L]

Polite, Courteous and Diplomatic Terms; Useful Daily Expressions; Courtesy, Good Manners and Etiquettes; Conversation Techniques; Story Telling.

Text Books

- 1.L. Adinarayana and V. Prakasam, *Spoken English*, Neelkamal Publications Pvt. Ltd., New Delhi, 2008.
- 2.Ram Bhasker Raju, *The Complete Book on Spoken English*, Goutham Buddha Publications, Hyderabad, 2002.

Reference Books

- 1.Sabina Pillai, *Spoken English for My World*, Oxford University Press, New Delhi, 2016.
- 2.K. R. Lakshminarayanan, *Speak in English*, Scitech Publications, Chennai, 2009.

E-Resources

- <https://www.britishcouncil.in/programmes/english-partnerships/state/skills-projects/AP-English-Skills>.
- <https://www.fluentu.com/blog/english/websites-to-learn-english/>

Course Outcomes

At the end of the course, the student will be able to:

- CO1.** Demonstrate knowledge of grammar and vocabulary in writing effective formal letters and e-mails.
- CO2.** Communicate effectively by applying appropriate speaking and writing techniques by examining and applying functional English.
- CO3.** Learn the transformation of sentences and use them effectively.
- CO4.** Understand making small sentences and use them in daily colloquial situation.
- CO5.** Learn the useful communication expression and use them in day-to-day life.

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B.Tech AI & ML I Year – II Sem			
Course Code: L120A	LINEAR ALGEBRA AND ADVANCED CALCULUS (Common to CE, EEE, ME, ECE, AI & ML, IT, ECM & MIE)	L	T	P	D
Credits: 4		3	1	0	0

Pre-Requisites: NIL

Module 1: Matrices and system of equations [10L]

Types of Matrices, Symmetric, Skew-symmetric, Hermitian, Skew-Hermitian, orthogonal matrices, Unitary Matrices, rank of a matrix by Echelon form and Normal form, Gauss elimination, 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 Quadratic Forms [12L]

Eigen values, Eigen vectors and their properties, Diagonalization, Cayley - Hamilton theorem (without proof), Inverse and powers of a matrix using Cayley - Hamilton theorem.

Definitions of Linear Transformation and Orthogonal Transformation, Quadratic forms, rank and nature of the quadratic forms, index and signature, reduction of quadratic forms into canonical form using Linear Transformation and Orthogonal Transformations.

Module 3: Multiple Integrals [10L]

Evaluation of double integrals, change of order of integration, change of variables, evaluation of triple integrals, change of variables.

Applications: Finding areas and volumes, centre of gravity.

Module 4: vector differential calculus [8L]

Scalar and vector fields, vector differentiation, level surfaces, gradient of a scalar field, directional derivative, divergence and curl of a vector field, Scalar potential energy, Tangent plane and normal line. Vector Identities (without proofs).

Module 5: Vector integral calculus [8L]

Line, surface and volume integrals.

Green's theorem in a plane, Gauss-Divergence theorem and Stokes theorem (without proofs).

Text Books

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

Reference Books

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

E-Resources

<https://nptel.ac.in/courses/111/108/111108098/>

https://en.wikipedia.org/wiki/Eigenvalues_and_eigenvectors

<https://nptel.ac.in/courses/111/107/111107108/>

<https://www.cheric.org/files/education/cyberlecture/e200303/e200303-301.pdf>

https://www.whitman.edu/mathematics/calculus_online/chapter16.html

Course Outcomes

At the end of the course, the student will be able to:

CO1. Solve the consistent system of linear equations.

CO2. Apply orthogonal congruent Transformations to a quadratic form.

CO3. Evaluate multiple integrals in various coordinate system.

CO4. Apply the concept of gradient, divergence and curl to formulate engineering problems.

CO5. Convert line integrals to surface integrals and surface integrals to volume integrals.

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B. Tech - AI & ML I Year – II Sem			
Course Code: L120B	ENGLISH (Common to ALL Branches)	L	T	P	D
Credits: 3		3	0	0	0

Pre-Requisites: Nil

Module 1: [8L]

The Model Millionaire-Oscar Wilde from the prescribed textbook ‘Forging Ahead’ published by Orient Black Swan.

Listening: The Listening Process-Hearing and Listening; Types of Listening.

Speaking: Narrating Personal Experiences, Expressing Opinions.

Reading: Reading for Summarizing and Paraphrasing, Facts versus Opinions.

Writing Skills: Note-making, Summarizing; Writing Formal Letters.

Vocabulary and Grammar: Subject-Verb Agreement, Noun-Pronoun Agreement; Collocations.

Module 2: [8L]

The Lotos-Eaters (extract)-Alfred Tennyson from the prescribed textbook ‘Forging Ahead’ published by Orient Black Swan.

Listening: Listening for Style-Communicative Purpose, Degree of Formality, Choice of Vocabulary Pronunciation and Syntax; Listening for Structure-Introduction, Body and Conclusion.

Speaking: Making Presentation-Preparing a Presentation, Structuring Content, Delivering the Presentation.

Reading: Reading for Meaning; Reading for Pleasure; Making Inferences; Reading Between the Lines.

Writing Skills: Writing an Appreciation of a Poem; Paraphrasing; Note-Taking.

Vocabulary And Grammar: Word Roots and Affixes; Tenses; Correcting Errors in Punctuation.

Module 3: [8L]

Continuous Transformation-Azim Premji from the prescribed textbook ‘Forging Ahead’ published by Orient Black Swan.

Listening: Listening with a Purpose-Barriers to Listening.

Speaking: Agreeing and Disagreeing with, and Defending Opinions.

Reading: Reading Methods-SQ3R Reading Technique.

Writing Skills: Writing Argumentative Essays.

Vocabulary and Grammar: Active and Passive Voice, Academic Vocabulary.

Module 4: [8L]

Steve Jobs-Sтивен Paul Jobs from the prescribed textbook ‘Forging Ahead’ published by Orient Black Swan.

Listening: Effective Listening Strategies-Ten Thumb Rules for Good Listening.

Speaking: What is a Group Discussion? GD Strategies-Type of GDs-Dos and Don'ts.

Reading: Reading Strategies-Scanning and Skimming Skills.

Writing Skills: Writing Job Application Letters and CVs.

Vocabulary and Grammar: Phrasal Verbs, Phrasal Prepositions; Technical Vocabulary.

Module 5: [8L]

How I Became a Public Speaker (extract) – **George Bernard Shaw** from the prescribed textbook 'Forging Ahead' published by Orient Black Swan.

Listening: Listening for Explicit and Implicit Information.

Speaking: Making Presentations as a Team.

Reading: Reading Strategies-Extensive and Intensive Reading Skills.

Writing Skills: Report Writing-Formats of Reports, Types of Reports.

Vocabulary and Grammar: Improving Vocabulary-Avoiding Cliches, Redundancies; Correcting Common Errors.

Text Books

1. Chitra. V.B. G.M. Sundaravalli, D.S. Kesava Rao. Ed. *Forging Ahead: A Course Book for B. Tech Students*: Orient Black Swan: Hyderabad, 2022.
2. Ashraf Rizvi. M. *Effective Technical Communication*. McGraw-Hill: New Delhi, 2010.

Reference Books

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

E-Resources

1. <https://poemanalysis.com/alfred-tennyson/the-lotos-eaters/>
2. <https://degmateng.wordpress.com/2019/11/27/ls-6-the-model-millionaire-oscar-wilde-summary/>
3. https://www.google.com/search?q=Continuous+Transformation-Azim+Premji+&rlz=1C2CHBD_enIN915IN915&sxsrf=APq-WBs4xyvTdVhFoCE_EIk0ydf4s65pmw%3A1650947439347&ei=b3VnYo7lFJqf4-EP9fqTIA&ved=0ahUKEwjO2Ki98rD3AhWazzgGHXX9BAQQ4dUDCA4&uact=5&oq=Continuous+Transformation-Azim+Premji+&gs_lcp=Cgdnd3Mtd2l6EAMyBQghEKABMgUIIRCgATIFCCEQoAFKBAhBGABKBAhGGABQAFgAYLs1aAFwAXgAgAHyAYgB8gGSAQMyLTGYAQCgAQKqAQHAAQE&sclient=gws-wiz
4. <https://www.britannica.com/biography/Steve-Jobs>
5. <http://kjtenglishnotes.blogspot.com/2015/10/how-i-became-public-speaker.html>
6. <https://www.learngrammar.net/english-grammar>

Course Outcomes

At the end of the course, the student will be able to:

CO1. Use English Language effectively in spoken and written forms.

CO2. Comprehend the given texts and respond appropriately.

CO3. Use the proper vocabulary and grammatically correct sentences.

CO4. Communicate confidently in various contexts and different cultures.

CO5. Acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B.Tech AI & ML I Year – II Sem			
Course Code: L120C	APPLIED PHYSICS (Common to EEE, ECE, AI & ML, IT & ECM)	L	T	P	D
Credits: 3		3	0	0	0

Pre-Requisites: Fundamentals of Physics.

Module-1: Quantum Mechanics [9L]

Introduction to Quantum mechanics, Black body radiation, Planck's law, Compton effect, Photoelectric effect -Einstein's photoelectric equation. de Broglie's concept of matter waves, Davisson and Germer's experiment, Heisenberg's Uncertainty Principle, Schrödinger's Time dependent and Independent Wave Equation; Physical Significance of the Wave Function, Energy of a particle in One Dimensional Infinite Potential well.

Module-2: Band Theory of Solids& Semiconductors [9L]

Band Theory of Solids: Free electron theory, Density of energy states, Quantum theory of free electron, Bloch's theorem, Kronig-Penny model (Qualitative treatment), E-K diagram, Effective mass of electrons, origin of energy bands, Classification of materials on the basis of energy bands.
Semiconductors: Intrinsic and extrinsic semiconductors, Carrier concentration, Dependence of Fermi level on carrier concentration and temperature, Hall effect.

Module-3: Light-Semiconductor Devices [9L]

Direct and indirect band gap semiconductors, Carrier generation and Recombination, Drift and Diffusion, P-N junction diode: I-V Characteristics, Zener diode: I-V Characteristics, Bipolar Junction Transistor (BJT): Construction and Principle of operation. PIN, Avalanche photodiode, LED – working principle and characteristics, Solar Cell and Photo diode.

Module-4: Lasers & Fiber Optics [9L]

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

Fiber Optics: Principle and construction of an optical fiber, Acceptance angle, Numerical aperture, Types of optical fibers (Single mode, multimode, step index, graded index), Losses in optical fibers, Optical fiber communication system with block diagram and Applications of optical fibers.

Module-5: Electromagnetism & Dielectric Properties [9L]

Electromagnetism: Laws of electrostatics, Electric current and the continuity equation, Ampere's and Faraday's laws, Maxwell's equations.

Dielectric Properties: Electric dipole, dipole moment, dielectric constant, polarizability, electric susceptibility, displacement vector, electronic, ionic and orientation polarizations (quantitative treatment), Internal fields in a solid, Clausius-Mossotti equation, Ferro-electricity and Piezo electricity.

Text Books

- 1.Engineering Physics, B.K. Pandey, S. Chaturvedi - Cengage Learning.
- 2.Physics, Halliday and Resnick, - Wiley.
- 3.A textbook of Engineering Physics, Dr.TVS Arun Murthy , Dr. M.N. Avadhanulu, Dr. P.G. Kshirsagar – Chand.

Reference Books

1. Richard Robinett, Quantum Mechanics.
2. Semiconductor Optoelectronics: Physics and Technology, J.Singh, Mc Graw-Hill inc. (1995).
3. Online Course: “Optoelectronic Materials and Devices” by Monica Katiyar and Deepak Guptha on NPTEL.
4. P.K.Palanisamy, “Engineering Physics”, Scitech Publications, Fourth edition.

E-Resources

1. <https://www.researchgate.net/publication/259574083> Lecture Notes on Engineering Physics.
2. <https://www.researchgate.net/publication/292607115> Applied Physics.
3. <http://www.springer.com/physics/theoretical%2C+mathematical+%26+computational+physics/journal/40094>
4. <http://www.springer.com/physics/journal/340> .
5. <http://nptel.ac.in/courses/113104012/>
6. https://www.youtube.com/watch?v=jnjjWI1s9_s&list=PLZJaFd3A7DZse2tQ2qUFChSiCj7jBidO0.
7. <https://www.youtube.com/watch?v=4a0FbQdH3dY>.

Course Outcomes

After completion of this course the student is able to

1. Realize the concept of uncertainty principle and to compute quantized energy levels.
2. Analyze the formation the bands thereby classification of materials on the basis of transport properties.
3. Identify the semiconductors for engineering applications.
4. Analyze working principle of lasers and to summarize its applications.
5. Formulate and solve the engineering problems on electromagnetism and dielectrics.

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B.Tech AI & ML I Year – II Sem			
Course Code: L125A	PROGRAMMING FOR PROBLEM SOLVING (Common to ECE, AI & ML, IT & ECM)	L	T	P	D
Credits: 3		3	0	0	0

Pre-Requisites:

1. Mathematical Knowledge.
2. Analytical Skills.

Course objectives:

The Student will:

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:

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.

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

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

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:

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

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

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

Preprocessor: Commonly used Preprocessor commands like include, define, undef, If, ifdef, ifndef.

Module 3:

POINTERS AND FILE HANDLING IN C:

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.

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:

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.

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

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).

Reference Books:

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

E - Resources:

1. <https://fresh2refresh.com/c-programming/>
2. <https://www.studytonight.com/c/>
3. <https://beginnersbook.com/2014/01/c-tutorial-for-beginners-with-examples/>
4. <https://www.programiz.com/c-programming>
5. http://www.gtucampus.com/uploads/studymaterials/Degree%20EngineeringSandipFundamentals_of_C.pdf
6. http://cs.indstate.edu/~cbasavaraj/cs559/the_c_programming_language_2.pdf

Course outcomes:**The student will be able to:**

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

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B.Tech AI & ML I Year – II Sem			
Course Code: L1202	PHYSICS LAB (COMMON TOEEE, ECE, AI & ML, IT & ECM)	L	T	P	D
Credits: 1		0	0	2	0

Pre-Requisites: Intermediate basic concepts.

List of Experiments:

1:Energy gap of P-N junction diode

To determine the energy gap of a semiconductor diode.

2. Solar Cell:

To study the V-I Characteristics of solar cell.

3. Light emitting diode and Laser Diode:

Plot V-I characteristics of light emitting diode and Laser diode.

4. Optical fiber:

Determination of Numerical Aperture of an optical fibre.

5. Hall effect:

To determine Hall co-efficient of a given semiconductor.

6. Photoelectric effect

To determine work function of a given material.

7. LASER

To study the Wave length of LASER Source.

8. Dielectric Constant

To determine the Dielectric constant of the given material.

9. LCR Circuit

To determine the Quality factor of LCR Circuit (Series & Parallel).

10. R-C Circuit

To determine the time constant of R-C circuit (Growth and Decay).

11.Melde's Experiment

To determine the frequency of a vibrating bar or turning fork using Melde's arrangement.

12. Torsional Pendulum

To determine the rigidity modulus of the material of the given wire using torsional pendulum.

13.Newton's Rings

To determine the radius of curvature of the lens by forming Newton's rings.

14.Diffraction Grating

To determine the number of lines per inch of the grating.

15.Sonometer

To determine the frequency of AC Supply sonometer.

Note: Any 10 experiments are to be performed.

Text Books

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

Course Outcomes

At the end of the course, students will be able to

1. Learn the experimental concepts on in LED, Electric and Electronics 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 waves, oscillations and optics.
5. Lasers and fiber optics enable the students to apply to various systems like communications, solar cell, photo cells and so on.

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B.Tech AI & ML I Year – II Sem			
Course Code: L1201	ENGLISH LANGUAGE AND COMMUNICATION SKILLS LAB (COMMON TO CE, ME, MIE & EEE)	L	T	P	D
Credits: 1		0	0	2	0

Pre-Requisites:

English Language and Communication Skills Lab (ELCS) will have two parts:

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

Module 1: [9L]

CALL Lab:

Common Indian Variants in Pronunciation-Introduction to Phonetics – Speech Sounds – Vowels and Consonants; Minimal Pairs; Pronunciation Patterns.

ICS Lab:

Ice-Breaking Activity and JAM Session- Situational Dialogues -Greetings-Taking Leave - Introducing Oneself and Others.

Module 2: [9L]

CALL Lab:

The Phoneme: The Syllable.

ICS Lab:

Features of Good Conversation - Non-verbal Communication- Telephone Etiquette-Role Plays.

Module 3: [9L]

CALL Lab:

Stress-Word and Sentence Stress- Stress Shift- Strong and Weak Forms.

ICS Lab:

Presentations Skills-Formal Presentations.

Module 4: [9L]

CALL Lab:

Intonation-Errors in Pronunciation-The Influence of Mother Tongue (MTI)-Differences in British and American Pronunciation.

ICS Lab:

Group Discussion Skills- Mock GD.

Module 5: [9L]

CALL Lab:

Listening for Specific Details-Listening Comprehension Tests.

ICS Lab:

Interview Skills-Mock Interviews.

Text Books

1. ELCS Lab Manual: A Workbook for CALL & ICS Lab Activities; Orient Black Swan.

Reference Books

1. Balasubramanian. T (2009), A Textbook of English Phonetics for Indian Students. Macmillan.
2. Bansal. R.K, Harrison J.B. (2008). Spoken English. Orient Black Swan.
3. Ashraf Rizvi M (2010). Effective Technical Communication. McGraw-Hill.

E-Resources

1. <https://bbamantra.com/listening/>
2. <https://en.wikipedia.org/wiki/Phonetics#:~:text=Phonetics%20is%20a%20branch%20of,the%20physical%20properties%20of%20speech.>
3. <https://www.innovativeteachingideas.com/blog/10-great-activities-to-break-the-ice-with-your-students>
4. <http://kjtenglishnotes.blogspot.com/2015/10/how-i-became-public-speaker.html>
5. <https://www.learngrammar.net/english-grammar>

Course Outcomes

At the end of the course, the student will be able to:

CO1. Use English Language effectively in spoken and written forms.

CO2. Comprehend the given texts and respond appropriately.

CO3. Use the proper vocabulary and grammatically correct sentences.

CO4. Communicate confidently in various contexts and different cultures.

CO5. Acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

AY 2022-23 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	B.Tech AI & ML I Year – II Sem			
Course Code: L1251	PROGRAMMING FOR PROBLEM SOLVING LAB (Common to ECE, AI & ML, IT & ECM)	L	T	P	D
Credits: 2		0	0	4	0

Pre-Requisites:

1. Mathematical Knowledge.
2. Analytical Skills.

Course objectives:

The Student will:

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
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 file name and the character are supplied as command line arguments.

5. STRINGS:

- a) Write a C program to determine if the given string is a palindrome or not (Spelled same in both directions with or without a meaning like madam, civic, noon, abcba, etc.)
- b) 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. $5 \times 1 = 5$
 - b. $5 \times 2 = 10$
 - c. $5 \times 3 = 15$
- 2) Write a program that shows the binary equivalent of a given positive number between 0 to 255.
- 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 Geometric progression: $1 + x + x^2 + x^3 + \dots + x^n$. For example: if n is 3 and x is 5, 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 atoi 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.

### **Case Study Experiments:**

- 1) Implement Hotel Management system in C with the following requirements.  
Requirements:
  - Provide the information on reserving rooms, book an event, check the features
  - Give the login for both admin and user for proper login validation
  - Add/View/Edit/Delete user records
  - Calculate the bill after checkout of customers
- 2) Implement Library management system in C with the following requirements.  
Requirements:
  - To add Book Information
  - Display Book Information
  - List all the books of the given author
  - List the title of the specified Book
  - List the count of books in the library

### **Software And Hardware Requirements:**

- SOFTWARE: C/C++ Preinstalled.
- HARDWARE: Desktop Computers with 4 GB RAM, Minimum 80 GB Hard disk with Windows System.

### **Course outcomes:**

#### **The student will be able to:**

1. Implement the algorithms for simple problems.
2. Investigate syntax errors as reported by the compilers.
3. Implement data with arrays, strings, and structures.
4. Plan the use of pointers of different function types.
5. Create, read, and write to and from simple text and binary files.

|                               |                                                                                               |                                              |          |          |          |
|-------------------------------|-----------------------------------------------------------------------------------------------|----------------------------------------------|----------|----------|----------|
| <b>AY 2022-23<br/>onwards</b> | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b>                     | <b>B.Tech: AI&amp;ML<br/>I Year – II Sem</b> |          |          |          |
| <b>Course Code:<br/>L12T2</b> | <b>Audit Course-II<br/>HUMAN VALUES AND PROFESSIONAL ETHICS<br/>(Common For All Branches)</b> | <b>L</b>                                     | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 0</b>             |                                                                                               | <b>2</b>                                     | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites: Nil**

**Objectives :** This introductory course input is intended

To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

To facilitate the development of a Holistic perspective among students towards life, profession and happiness, based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Value based living in a natural way.

To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behavior and mutually enriching interaction with Nature.

Unit I:

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education: Understanding the need, basic guidelines, content and process for Value Education. Self Exploration—what is it? - its content and process; 'Natural Acceptance' and Experiential Validation—as the mechanism for self exploration. Continuous Happiness and Prosperity- A look at basic Human Aspirations. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario. Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Unit II:

Understanding Harmony in the Human Being - Harmony in Myself! : Understanding human being as a co-existence of the sentient 'I' and the material 'Body'. Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer). Understanding the characteristics and activities of 'I' and harmony in 'I'. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Swasthya.

### Unit III:

#### Understanding Harmony in the Family and Society- Harmony in Human

- Human Relationship : Understanding harmony in the Family- the basic unit of human interaction. Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship. Understanding the meaning of Vishwas; Difference between intention and competence. Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship. Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals. Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha )- from family to world family!

### Unit IV:

Understanding Harmony in the Nature and Existence - Whole existence as Co- existence : Understanding the harmony in the Nature. Interconnectedness and mutual fulfillment among the four orders of nature-recyclability and self- regulation in nature. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space. Holistic perception of harmony at all levels of existence.

### Unit V:

Implications of the above Holistic Understanding of Harmony on Professional Ethics : Natural acceptance of human values. Definitiveness of Ethical Human Conduct. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order. Competence in professional ethics:

Ability to utilize the professional competence for augmenting universal human order, Ability to identify the scope and characteristics of people-friendly and eco- friendly production systems, Ability to identify and develop appropriate technologies and management patterns for above production systems.

Case studies of typical holistic technologies, management models and production systems. Strategy for transition from the present state to Universal Human Order: At the level of individual: as socially and ecologically responsible engineers, technologists and managers At the level of society: as mutually enriching institutions and organizations

### TEXT BOOKS

R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

Prof. KV Subba Raju, 2013, Success Secrets for Engineering Students, Smart Student Publications, 3rd Edition.

## REFERENCE BOOKS

Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA

E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.

A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.

Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991

PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.

A.N. Tripathy, 2003, Human Values, New Age International Publishers.

Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.

Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William

W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.

E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press

M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.

Relevant CDs, Movies, Documentaries & Other Literature:

Value Education website, <http://www.uptu.ac.in>

Story of Stuff, <http://www.storyofstuff.com>

Al Gore, An Inconvenient Truth, Paramount Classics, USA Charlie Chaplin, Modern Times, United Artists, USA

IIT Delhi, Modern Technology – the Untold Story

|                               |                                                                           |                                                |          |          |          |
|-------------------------------|---------------------------------------------------------------------------|------------------------------------------------|----------|----------|----------|
| <b>AY 2022-23<br/>onwards</b> | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AI &amp; ML<br/>II Year – I Sem</b> |          |          |          |
| <b>Course Code:<br/>L210A</b> | <b>PROBABILITY AND STATISTICS</b><br>(Common to AI&ML, AI&DS, CSE, IT)    | <b>L</b>                                       | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 4</b>             |                                                                           | <b>3</b>                                       | <b>1</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites:** Nil

**Course objectives:**

**The Student will:**

1. The concepts of discrete and continuous random variables, the probability distribution and density function.
2. Evaluation of marginal and conditional distribution of multiple random variables.
3. The concept of correlation and regression to find covariance.
4. Evaluation of the given data for appropriate test of hypothesis.
5. Analysing the data for variance.

**Module 1:**

**Single Random Variables:**

Introduction to probability, Random Variables, Discrete and Continuous. Probability distributions, mass function/ density function of a probability distribution, mathematical expectation, moments about origin, central moments. Moment generating function of probability distribution.

**Module 2:**

**Probability Distributions:**

Binomial, Poisson, Normal, exponential distributions -their Properties. Moment generating functions of the above distributions and hence find the mean and variance. Joint probability distributions- Joint probability mass /density function, Marginal probability, mass / density functions.

**Module 3:**

**Correlation & Regression Sampling Distributions**

**UNIT I : Correlation:** Types of Correlation, Coefficient of correlation, the rank correlation, Covariance of two random variables. Regression- Regression Coefficient, The lines of regression and multiple correlation & regression

**UNIT II: Sampling:** Definitions of population, sampling, statistic, parameter. Types of sampling, Expected values of Sample mean and variance, sampling distribution, Standard error, Sampling distribution of means ,sampling distribution of variance and sampling distribution of proportions Parameter estimation- Point estimation and interval estimation

**Module 4:**

**Testing of Hypothesis – I**

**UNIT I: Testing of hypothesis:** Null hypothesis, Alternate hypothesis, Type I& Type II errors – critical region, confidence interval, and Level of significance. One sided test, Two sided test.

**UNIT II: Large sample tests:**

- (i) Test of Equality of means of two samples, equality of sample mean and population mean (cases of known variance & unknown variance, equal and unequal variances)
- (ii) Tests of significance of difference between sample S.D and population S.D.
- (iii) Tests of significance difference between sample proportion and population proportion, difference between two sample proportions

**Module 5:****Testing of Hypothesis – II:**

Student t-distribution, its properties and applications, test of significance sample mean and population mean, difference between means of two small samples. Snedecor's F- distribution and its properties. Test of equality of two population variances. Chi-square distribution, its properties, Chi-square test of goodness of fit, Chi-square test for independence & applications of attributes

**Text Books:**

1. S.C.Gupta and V.K.Kapoor : Fundamentals of Mathematical Statistics, 2006
2. Kantiswarup, P.K.Gupta and Manmohan Singh : Operations Research, S.Chand& Co, 2010.

**Reference Books:**

1. R. A. Johnson: Miller and Freund's Probability and Statistics for Engineers, Pearson Publishers, 9th Edition, 2017
2. Freund: Modern elementary statistics, PHI, 2006
3. Probability and Statistics for Engineers by Richard Arnold Johnson, Irwin Miller and John E. Freund, New Delhi, Prentice Hall

**E-resources:**

1. <https://nptel.ac.in/courses/117/104/117104117/>
2. [https://en.wikipedia.org/wiki/Probability\\_distribution](https://en.wikipedia.org/wiki/Probability_distribution)
3. <http://www.randomservices.org/random/sample/Covariance.html>
4. [https://nptel.ac.in/content/storage2/courses/103106120/LectureNotes/Lec3\\_1.pdf](https://nptel.ac.in/content/storage2/courses/103106120/LectureNotes/Lec3_1.pdf)
5. <https://www.smartbugmedia.com/blog/hypotheses-worth-testing-on-your-website>

**Course outcomes:****The students will be able to**

1. Identify the concept of probability and statistics.
2. Assess the mean and variance of a given probability distribution.
3. Identify the coefficient of correlation and lines of regression.
4. Implement and test the hypothesis for large samples.
5. Implement and test the hypothesis for small samples.



|                               |                                                                           |                                               |          |          |          |
|-------------------------------|---------------------------------------------------------------------------|-----------------------------------------------|----------|----------|----------|
| <b>AY 2022-23 onwards</b>     | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech AI &amp; ML<br/>II Year – I Sem</b> |          |          |          |
| <b>Course Code:<br/>L216A</b> | <b>DATA STRUCTURES USING C<br/>(Common to AI&amp;ML, IT, AI&amp;DS)</b>   | <b>L</b>                                      | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>             |                                                                           | <b>3</b>                                      | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites:** Programming for Problem Solving.

### **Module I**

#### **Unit I: Introduction & Recursion**

Data Representation (Integer, Real Number and Character), Data Types – primitive and non-primitive, Abstract Data Type, Algorithm Specification, Time complexity & space complexity and their notations.

#### **Unit II: Recursion**

What is Recursion, Why Recursion, Format of a Recursive function, Recursion and memory, Recursion Vs Iteration, Examples.

### **Module II**

#### **Unit I: Introduction to Data Structures**

Types of Data Structures, Linear & Non-Linear, Representation of arrays and Array Representation of Sparse Matrix, Dynamic Storage management, Structures and self-referential structures.

#### **Unit II: Linked Lists**

Single linked list, double linked list, circular linked list, and operations on linked lists.

### **Module III**

#### **Unit I: Stacks**

Definition, operations: array implementation, linked list implementation and applications.

#### **Unit II: Queues**

Definition, operations: array implementation, linked list implementation and applications, Circular Queue.

### **Module IV**

#### **Unit I: Trees**

Introduction- Terminology, representation of trees, properties of binary trees, binary tree representation, binary tree traversals (In order, pre order, post order). Binary Heap.

#### **Unit II: Binary Search Trees**

Binary search trees Definition, searching BST, insert into BST, delete from a BST, Height of a BST. AVL Tree-Operations and Rotations. B-Tree.

### **Module V**

#### **Unit I : Graphs**

The Graph ADT Introduction, definition, graph representation, elementary graph operations BFS, DFS, Minimum Spanning Tree – only: Prim's and Kruskal's MST.

#### **Unit II : Hashing & Sorting**

Hashing, Hashing Functions, Collision-Resolution Techniques, Heap Sort, Radix Sort

**Text Books:**

1. *Data Structures and Algorithm Analysis in C*, Mark Allen Weiss, Second Edition, 2002, Pearson.
2. *Introduction to Algorithms*, Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, Third Edition, 2010, PHI.
3. *Data Structures and Algorithms Made Easy* by Narasimha Karumanchi, 2020, CareerMonk Publications.

**Course Outcomes:****The students will:**

- 1) Apply the basic concepts of algorithm complexities and recursion.
- 2) Apply suitable Linear Data Structures to solve the Problems.
- 3) Analyze and construct algorithms using suitable Data Structure.
- 4) Differentiate various search trees.
- 5) Solve problems using Graphs.

|                           |                                                                            |                                                |          |          |          |
|---------------------------|----------------------------------------------------------------------------|------------------------------------------------|----------|----------|----------|
| <b>AY 2022-23 onwards</b> | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b>  | <b>B.Tech: AI &amp; ML<br/>II Year – I Sem</b> |          |          |          |
| <b>Course Code: L216C</b> | <b>DATABASE MANAGEMENT SYSTEMS</b><br>(Common to AI & ML, AI&DS, CSE & IT) | <b>L</b>                                       | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>         |                                                                            | <b>3</b>                                       | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites:** Data Structures.

**Course objectives:**

**The Student will:**

1. Understanding of the architecture and functioning of database management systems as well as associated tools and techniques.
2. Understand and apply the principles of data modeling using entity relationship and develop a good database design.
3. Understand the use of structured query language (SQL) and its syntax.
4. Apply normalization techniques to normalize a database.
5. Understand the need of database processing and learn techniques for controlling the consequences of concurrent data access.

### **Module 1:**

#### **Unit I: Introduction**

Database System Applications, Database Systems Vs File Systems, View of Data-Data Abstraction, Instances and Schemas. Data Models – The ER Model, Relational Model, Other Data 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.

#### **Unit 2: Database Design and ER-Diagrams**

Beyond ER Design, Entities, Attributes and Entity Sets, Relationships and Relationship Sets, Additional Features of ERModel, Conceptual Design with the ER Model.

### **Module 2:**

#### **Unit 1: The Relational Model**

Introduction to the Relational Model, Integrity Constraints Over Relations, Enforcing Integrity Constraints, Querying Relational Data, Logical Database Design, Introduction to Views, Destroying /Altering Tables and Views.

#### **Unit 2: Relational Algebra and Calculus**

Relation Algebra-Selection and Projection, Set Operations, Renaming, Joins, Division, More Examples of Algebra Queries. Relational Calculus – Tuple Relational Calculus, Domain Relational Calculus, Expressive Power of Algebra and Calculus.

### **Module 3:**

#### **Unit 1: SQL Queries**

Form of Basic SQL Query, Examples of Basic SQL Queries, Union, Intersect and Except. Introduction to Nested Queries, Correlated Nested Queries, Set-Comparison Operators. Aggregative Operators, Null Values, Comparison Using Null Values, Logical Connectives AND, OR and NOT, Impact on SQL Constructs, Outer Joins, Disallowing Null Values. Complex Integrity Constraints in SQL, Triggers and Active Databases.

**Unit 2: Schema Refinement:** Problems Caused by Redundancy, Decompositions, Problem Related to Decomposition, Reasoning about FDs. Normal Forms-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:**

##### **Unit 1: Transaction Management**

Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, testing for Serializability. Lock –Based Protocols, Timestamp- Based Protocols, Validation- Based Protocols, Multiple Granularity.

##### **Unit 2: Recovery System**

Failure Classification, Storage Structure, Recovery and Atomicity, Log- Based Recovery, Recovery with Concurrent Transactions, Buffer Management, Failure with Loss of Nonvolatile Storage, Advance Recovery Techniques, Remote Backup Systems.

#### **Module 5**

##### **Unit 1: Storage and Indexing**

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.

##### **Unit 2: Tree Structured Indexing**

Intuitions for Tree Indexes, Indexed Sequential Access Methods (ISAM), B+ Trees: A Dynamic Index Structure.

#### **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**, Elmasri Navrate Pearson Education
3. **Introduction to Database Systems**, C.J.Date Pearson Education.

#### **E - Resources:**

1. <https://nptel.ac.in/noc/courses/noc18/SEM1/noc18-cs15/>
2. <https://www.alljntuworld.in/download/database-management-system-dbms-materials-notes/>

#### **Course outcomes:**

The Students will be able to:

1. Identify the basic concepts of database system.
2. Design a data model and schemas in RDBMS.
3. Implement RDBMS for developing industry applications.
4. Investigate the use of structured query language SQL.
5. Analyze functional dependencies for designing a robust database.

|                                   |                                                                                       |                                                |          |          |          |
|-----------------------------------|---------------------------------------------------------------------------------------|------------------------------------------------|----------|----------|----------|
| <b>AY 2022-23<br/>onwards</b>     | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b>             | <b>B.Tech: AI &amp; ML<br/>II Year – I Sem</b> |          |          |          |
| <b>Course<br/>Code:<br/>L215D</b> | <b>ARTIFICIAL INTELLIGENCE &amp; ITS<br/>APPLICATIONS</b><br>(Common to AI&ML, AI&DS) | <b>L</b>                                       | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>                 |                                                                                       | <b>3</b>                                       | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites: NIL**

**Course objectives:**

**The student will:**

1. The primary objective of this course is to introduce the basic principles, techniques and applications of Artificial Intelligence.
2. To become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
3. To Investigate applications of AI techniques in intelligent agents, expert systems, artificial neural networks, and other machine learning models.
4. To explore the current scope, potential, limitations, and implications of AI Based systems.

**UNIT – I** Introduction to AI Problems, Problem Spaces and Search: Defining the Problem as a State space Search, Production Systems, Problem Characteristics, Production system characteristics, Issues in the Design of Search Programs.

Heuristic Search Techniques: Generate-and-test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.

**UNIT – II** Knowledge Representation Using Predicate Logic, Representing Simple Facts in logic, Representing Instance and Isa Relationships, Computable Functions and Predicates, Resolution

Representing Knowledge Using Rules: Procedural versus Declarative Knowledge, Logic Programming, forward versus Backward Reasoning, Matching, Control Knowledge.

**UNIT – III** Slots and Filler Structures Weak slot and-filler structures: Semantic Nets, Frames, Strong slot-and-filler structures: Conceptual dependency, Scripts.

Symbolic reasoning under uncertainty, Nonmonotonic reasoning, Statistical reasoning.

**UNIT – IV** Game Playing Min Max search Procedure, adding alpha beta cutoffs, additional refinements, iterative deepening. Goal stack planning, nonlinear planning, hierarchical planning, representation for planning, partial order planning algorithm, understanding: What makes understanding hard, understanding as constraint satisfaction

Learning Concepts: rote learning, learning by taking advices, learning by problem solving, learning from examples, learning by analogy, explanation based learning, neural nets, genetic algorithms.

**UNIT – V** Natural Language Processing Syntactic processing, semantic analysis, discourse and programmatic processing, statistical natural language processing, spell checking, Introduction to Expert Systems

Architecture of expert systems, Roles of expert systems - Knowledge Acquisition –Meta knowledge, Heuristics. Expert systems Case Studies - MYCIN, DART, XOON.

**Text Books:**

1. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, 3rd Edition, Pearson, 2017.
2. Dan W Patterson, Introduction to Artificial Intelligence and Expert Systems, 1st Edition, PHI.,2015

**References:**

1. Patrick Henry Winston, Artificial Intelligence, Pearson Education, 2003.
2. G. Luger, W. A. Stubblefield, Artificial Intelligence, Third Edition, Addison-Wesley, 2007.
3. Elaine Rich & Kevin Knight, Artificial Intelligence, 3rd Edition, Tata McGraw Hill Edition, Reprint, 2008.
4. Russel and Norvig, Artificial Intelligence, Pearson Education, PHI, 2009

**Course Outcomes:**

At the end of this course, the students will be able to

1. Understand basic principles of AI in solutions that require problem solving, inference, knowledge representation and learning.
2. Understand knowledge representation using logic and rules
3. Analyze various AI techniques in expert systems, artificial neural networks and other machine learning models.
4. Apply Min-Max Search procedures, iterative deepening, and learning in game playing
5. Analyze the main approaches to natural language processing and expert systems.

|                                   |                                                                           |                                                 |          |          |          |
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| <b>AY 2022-23<br/>onwards</b>     | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B. Tech: AI &amp; ML<br/>II Year – I Sem</b> |          |          |          |
| <b>Course<br/>Code:<br/>L216D</b> | <b>COMPUTER NETWORKS</b><br>(Common to AI&ML, CSE & IT)                   | <b>L</b>                                        | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>                 |                                                                           | <b>3</b>                                        | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites: Data Structures.**

**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, Ethernet technologies 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, RPC 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, Internet history standards and administration; Comparison of the OSI and TCP/IP reference model.

**Physical Layer:** Guided transmission media, wireless transmission media.

#### **Module 2:**

**Data Link Layer:** design issues, Framing, Error Detection and Error Correction, Block Coding, Hamming Distance, CRC, Flow control and error Control.

**Protocols:** Noiseless Channels, Noisy Channels, HDLC, Point to Point Protocols.

**Connecting Devices:** Repeaters, Hubs, Switches, Gateways and **Bridges** - Learning and Spanning tree bridges.

**Multi Access protocols-** Random access - ALOHA, CSMA, CSMA/CD and CSMA/CA, Controlled access, Channelization. Ethernet IEEE 802.3, IEEE 802.5, IEEE 802.11

#### **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, Crash recovery, The TCP sliding window, The TCP congestion control, Improving Quality of Service Techniques: Leaky Bucket Algorithm.

#### **Module 5:**

**Application Layer:** Introduction, services, Application layer paradigms.

**Applications:** DNS, WWW, HTTP, FTP, E-MAIL, TELNET, SNMP, SSH.

**Text Books:**

1. Data Communications and Networking - Behrouz A. Forouzan, Fifth Edition TMH, 2013.
2. Computer Networks - Andrew S Tanenbaum, 4th Edition, Pearson Education.

**Reference Books:**

1. “ComputerNetworks”,5E, Peterson, Davie, Elsevier
2. “Introduction to Computer Networks and Cyber Security”,Chawan -HwaWu, Irwin, CRC Publications.
3. “Computer Networks and Internets with Internet Applications”, Comer.

**E - Resources:**

1. [https://lecturenotes.in/subject/2234/Computer\\_Network](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/>
5. <http://ocw.mit.edu/index.htm>.

**Course outcomes:**

**The Student will be able to:**

1. Recommend the networking concepts, various Layering approaches, functionalities, and some protocols of Link layer.
2. Identify how a medium can be shared among multiple devices, Ethernet technologies and internetworking devices used.
3. Identify how to do fragmentation, assigning of logical address and judge on routing, congestion.
4. Illustrate the working of IP Protocol, other protocols of internet layer and services of transport layer.
5. Investigate the transport layer and application layer protocols.



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| <b>AY 2022-23 onwards</b>     | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b>     | <b>B.Tech: AI &amp; ML<br/>II Year – I Sem</b> |          |          |          |
| <b>Course Code:<br/>L2152</b> | <b>DATABASE MANAGEMENT SYSTEMS LAB</b><br>(Common to AI&ML, AI&DS, CSE & IT ) | <b>L</b>                                       | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 1.5</b>           |                                                                               | <b>0</b>                                       | <b>0</b> | <b>3</b> | <b>0</b> |

**Pre-Requisites: Data Structures Lab.**

**Course objectives:**

**The Student will:**

1. Familiarize with the nuances of database environments towards an information- oriented data-processing oriented framework.
2. Gain a good formal foundation on the relational model of data present sql and procedural interfaces to Sql comprehensively.
3. Gain an introduction to systematic database design approaches covering conceptual design, logical design and an overview of physical design and to motivate the Student to relate all these to one or more commercial product environments as they relate to the developer tasks.
4. Present the concepts and techniques relating to query processing by sql engines and present the concepts and techniques relating to ODBC and its implementations.
5. Introduce the concepts of transactions and transaction processing and to present the issues and

**Experiment – 1.**

**E-R Model:** Analyze the Problem with the entities which identify data persisted in the database which contains entities, attributes.

**Experiment – 2.**

Concept design with E-R Model

**.Experiment – 3.**

Relational Model

**Experiment – 4.**

Normalization

**Experiment - 5.**

Installation of Mysql and Practicing DDL and DML commands

**Experiment – 7**

Querying using Aggregate functions, GROUP BY,HAVING and creation and dropping of views

**Experiment – 8.**

Create tables for the following schema. Student(snum: integer, sname: string, major: string, level: string, age: integer) Class(name: string, meets at: time, room: string, fid: integer) Enrolled(snum: integer, cname: string) Faculty(fid: integer, fname: string, deptid: integer)

**Experiment – 9.Querying**

1. Find the names of all Juniors (Level = JR) who are enrolled in a class taught by I. Teacher.
2. Find the age of the oldest student who is either a History major or is enrolled in a course

- taught by I. Teacher.
3. Find the names of all classes that either meet in room R128 or have 5 or more **Student** enrolled.
  4. Find the names of all **Student** who are enrolled in two classes that meet at the same time.
  5. Find the names of faculty members who teach in every room in which some class is taught.
  6. Find the names of faculty members for whom the combined enrolment of the courses that they teach is less than 5
  7. Print the Level and the average age of **Student** for that Level, for each Level.
  8. Print the Level and the average age of **Student** for that Level, for all Levels except JR. 9
  9. Print the Level and the average age of **Student** for that Level, whose average age is greater than 20.
  10. Find the names of **Student** who are enrolled in the maximum number of classes.
  11. Find the names of **Student** who are not enrolled in any class.
  12. Count the number of junior level **Student**.
  13. Display all the **Student** whose names starts with the letter “p”.
  14. Display all the teachers whose names contain letter ‘a’ or ‘I’ in their names.

### **Experiment – 10. Procedures**

### **Experiment – 11. CASE STUDY E-R MODEL: GENERAL HOSPITAL**

#### **Software And Hardware Requirements:**

- SOFTWARE: My SQL server.
- HARDWARE: Desktop Computers with 4 GB RAM, Minimum 80 GB Hard disk with Windows System.

#### **Course outcomes:**

##### **The student will be able to:**

1. Identify the underlying concepts of database technologies.
2. Design and implement a database schema for a given problem-domain.
3. Apply Normalization to a database.
4. Implement the query for a database using SQL DML/DDL commands.
5. Identify, declare and enforce integrity constraints on a database using a state-of-the-art RDBMS.

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| <b>AY 2022-23 onwards</b>     | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AI&amp; ML<br/>II Year – I Sem</b> |          |          |          |
| <b>Course Code:<br/>L2161</b> | <b>DATA STRUCTURES USING C LAB</b><br>(Common to AI&ML, AI&DS, CSE, IT)   | <b>L</b>                                      | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 1.5</b>           |                                                                           | <b>0</b>                                      | <b>0</b> | <b>3</b> | <b>0</b> |

**Pre-Requisites:**

**1. Programming for Problem Solving.**

**List of Experiments**

- 1) Demonstrate recursive algorithms with examples.
- 2) Implement and perform different operations on Single, Double and Circular Linked Lists.
- 3) Develop a program to perform operations of a Stack using arrays and linked Lists.
- 4) Develop programs to implement Stack applications.
- 5) Develop a program to perform operations of Linear Queue using arrays and linked Lists.
- 6) Implement Circular Queues
- 7) Develop a program to represent a tree data structure.
- 8) Develop a program to demonstrate operations on Binary Search Tree.
- 9) Develop a Program to implement DFS.
- 10) Develop a Program to implement BFS.
- 11) Implement Heap Sort Technique.

**Course Outcomes:**

**The students will:**

- 1) Apply the basic concepts of algorithm complexities and recursion.
- 2) Apply suitable Linear Data Structures to solve the Problems.
- 3) Analyze and construct algorithms using suitable Data Structure.
- 4) Differentiate various search trees.
- 5) Solve problems using Graphs.

|                               |                                                                           |                                               |          |          |          |
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| <b>AY 2022-23<br/>onwards</b> | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech AI &amp; ML<br/>II Year – I Sem</b> |          |          |          |
| <b>Course Code:<br/>L21M1</b> | <b>GENDER SENSITIZATION</b><br>(Common to CSE, IT, ECE, & ECM)            | <b>L</b>                                      | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 0</b>             |                                                                           | <b>2</b>                                      | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites: NIL**

### **Module 1: UNDERSTANDING GENDER [6L]**

**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 2: GENDER AND BIOLOGY [6L]**

**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 3: GENDER AND LABOUR [6L]**

**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 4: ISSUES OF VIOLENCE-I [6L]**

**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.

### **Module 5 ISSUES OF VIOLENCE-II [6L]**

**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.

### Text Books

1. *“Towards a World of Equals: A Bilingual Textbook on Gender”* written by A.Suneetha, Uma Bhrugubanda, Duggirala Vasanta, Rama Melkote, Vasudha Nagaraj, Asma Rasheed, Gogu Shyamala, Deepa Sreenivas and Susie Tharu.

### Reference Books

1. Raj Paul Singh, Anupama Singh. Gender Sensitization: Issues and Challenges: Raj Publications: 2019.

### E-Resources

- <https://www.medicalnewstoday.com/articles/232363>
- <https://web.stanford.edu/~eckert/PDF/Chap1.pdf>
- <https://open.lib.umn.edu/sociology/chapter/11-1-understanding-sex-and-gender/>

### Course Outcomes

At the end of the course, the student will be able to:

- CO1.** develop a better understanding of important issues related to gender in contemporary India.
- CO2.** sensitize 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.
- CO3.** attain a finer grasp of how gender discrimination works in our society and how to counter it.
- CO4.** acquire insight into the gendered division of labour and its relation to politics and economics.
- CO5.** be better equipped to work and live together as equals.

|                               |                                                                           |                                                |          |          |          |
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| <b>AY 2022-23 onwards</b>     | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech AI &amp; ML<br/>II Year – II Sem</b> |          |          |          |
| <b>Course Code:<br/>L220B</b> | <b>MATHEMATICS FOR MACHINE LEARNING<br/>AND DATA SCIENCE</b>              | <b>L</b>                                       | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>             |                                                                           | <b>3</b>                                       | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites :**

**1. Probability & Statistics.**

**Course Objectives:**

**The Student will:**

- Finding a basis of vector space
- Determine orthogonality in inner product spaces.
- Able to reduce the computation time on matrix operations and make the system easier to solve.
- To predict the value of dependent variable based on an independent variable
- To study the basic components of an optimization problem

**MODULE-I: Linear Algebra:**

System of linear equations-matrices-solving systems of linear equations-vector spaces-linear independence-Basis and rank- linear mappings-Affine spaces

**MODULE-II: Analytic Geometry**

Norms-Inner product spaces-lengths and distances-angles and orthogonality-Orthonormal Basis-Orthogonal component-Inner product of functions-orthogonal projections.

**MODULE-III : Matrix Decomposition**

Determinant and trace-Eigen values and Eigen vectors-Cholesky Decomposition-Eigen decomposition and Diagonalization-singular value decomposition-matrix approximation-matrix phylogeny

**MODULE-IV : Linear Regression**

Problem Formulation-parameter estimation-Bayesian linear regression-Maximum likelihood as orthogonal projection

**MODULE-V: Optimization:**

Unconstrained optimization; Necessary and sufficiency conditions for optima; Gradient descent methods; Constrained optimization, KKT conditions; Introduction to non-gradient techniques; Introduction to least squares optimization; Optimization view of machine learning. Introduction to Data Science Methods: Linear regression as an exemplar function approximation problem; Linear classification problems.

**TEXT BOOKS:**

1. David G. Luenberger . Optimization by Vector Space Methods, John Wiley & Sons (NY), 1969.
2. Mathematics for machine learning, Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong

**REFERENCES:**

1. G. Strang . Introduction to Linear Algebra, Wellesley-Cambridge Press, Fifth edition, USA, 2016
2. Advanced Engineering Mathematics by Jain and S.R.K. Iyengar, Narosa Publications G. Strang . Introduction to Linear Algebra, Wellesley-Cambridge Press, Fifth edition, USA, 2016.
3. Bendat, J. S. and A. G. Piersol. Random Data: Analysis and Measurement Procedures. 4th Edition. John Wiley & Sons, Inc., NY, USA, 2010
4. Montgomery, D. C. and G. C. Runger. Applied Statistics and Probability for Engineers. 5th Edition. John Wiley & Sons, Inc., NY, USA, 2011.

**Course outcomes:**

At the end of this course

The students will be able to

1. Find the basis of vector space.
2. Analysing Inner products are used to help better understand vector spaces of infinite dimension and to add structure to vector spaces.
3. Analysing the linear regression model and its limitations.
4. Estimate the relationship between two variables.
5. Applying the theory of *optimization* methods and algorithms to develop and for solving various types of *optimization* problems.

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| <b>AY 202-23<br/>onwards</b>  | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B. Tech: AI&amp;ML<br/>II Year / II Sem</b> |          |          |          |
| <b>Course Code:<br/>L224E</b> | <b>DIGITAL IMAGE PROCESSING<br/>(Common to AI&amp;ML, AI&amp;DS)</b>      | <b>L</b>                                       | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 4</b>             |                                                                           | <b>3</b>                                       | <b>1</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites: NIL.**

**Course Objectives:** The student will

1. Understand fundamental concepts of digital image processing.
2. Analyze images in frequency domain using various transforms.
3. Evaluate the techniques for image enhancement and image Restoration.
4. Learn the fundamental DIP algorithms and implementation.
5. Gain experience in applying image processing algorithms to real problems.

### **Module-I DIGITAL IMAGE FUNDAMENTALS:**

What is Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Elements of Visual Perception. Point Spread Function(PSF), Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels, Linear and Nonlinear Operations.

### **Module-II IMAGE TRANSFORMS:**

Two-dimensional Orthogonal & Unitary Transforms, Properties of Unitary Transforms, Two Dimensional Discrete Fourier Transform. Discrete Cosine Transform, Sine Transform, Hadamard Transform, Haar Transform, Slant Transform, KL transform.

### **Module-III IMAGE ENHANCEMENT:**

Image enhancement in Spatial Domain, Some Basic Gray Level transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations. Image Filters, Smoothing, Frequency Domain Filters in frequency domain, Sharpening, Homomorphic Filtering.

### **Module-IV Model of Image Degradation/Restoration Process:**

Noise Models, Restoration in the Presence of Noise, Spatial Filtering. Periodic Noise Reduction by Frequency Domain Filtering, Linear Position- Invariant Degradations, Inverse Filtering, Minimum Mean Square Error (Weiner) Filtering.

### **Module-V Color Fundamentals:**

Color Models, Pseudo Color Image Processing, Basics of Full Color Image Processing, Color Transformations. Smoothing and Sharpening, Image Segmentation Based on Color, Noise in Color Images, Color Image Compression.



**TEXT BOOKS:**

1. “Digital Image Processing”, Rafael C.Gonzalez, Richard E. Woods, et al , TMH, 2ndEdition.

**REFERENCE BOOKS:**

1. “Fundamentals of Digital Image Processing”, Anil K. Jain, Pearson Education, 2001.
2. “Digital Image Processing and Analysis”, B. Chanda and D. Dutta Majumdar, PHI,2003.

**Course Outcomes:**

The student will be able to:

1. Identify the basic concepts of two-dimensional signal acquisition, sampling, and quantization.
2. Analyze 2D Fourier transform concepts, including the 2D DFT and FFT, and their use in frequency domain filtering.
3. Interpret the Human Visual System (HVS) and its affect on image perception and understanding.
4. Assess the fundamental image enhancement algorithms such as histogram modification, contrast manipulation, and edge detection.
5. Analyze programming skills in digital image processing related problem.

|                               |                                                                           |                                                 |          |          |          |
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| <b>AY 2022-23<br/>onwards</b> | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AI &amp; ML<br/>II Year – II Sem</b> |          |          |          |
| <b>Course Code:<br/>L225F</b> | <b>PYTHON PROGRAMMING</b><br>(Common to AI&ML, CSE, IT, AI&DS)            | <b>L</b>                                        | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>             |                                                                           | <b>3</b>                                        | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites: NIL**

**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.

**Set:** operations and methods, **Frozenset:** operations and methods

### **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.

**Inheritance:** Basic Inheritance: extending built-ins, overriding and super; Multiple inheritance: the diamond problem;

#### **Module 4:**

**Exceptions:** raising exceptions, handling exceptions, exception hierarchy.

**Regular Expressions,** match, search & replace function, Regular Expression modifiers, Special Character Classes, Repetition Cases, Non-greedy repetition grouping with Parentheses Back-references Anchors.

#### **Module 5:**

Files handling and Exceptions: Text files, writing variables, Directories, Pickling;

Database Programming in Python: Connection module, connect MySQL Data base, perform DDL, DML and DQL operations.

Introduction to Machine Learning With Python ,Tasks in Machine Learning Using Python, Applications of Python Machine Learning.

#### **Text Books:**

1. **Python 3 Object Oriented Programming**, Dusty Phillips, Packet Publishing, 2010.
2. **Programming in Python 3 - A complete Introduction to the Python Language-** Second Edition, Mark Summerfield, Addison-Wesley 2010.
3. Introduction to Machine Learning with Python: A Guide for Data Scientists Book by Andreas C. Müller and Sarah Guido Publisher(s): O'Reilly Media, Inc.

#### **Reference Books:**

1. **Programming Python- 4<sup>th</sup> 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 Student will be able to:**

1. Identify the basic principles of Python programming language
2. Analyze the use of lists, tuples, and dictionaries in Python programs.
3. Implement object-oriented concepts in Python, and how to use exception handling in Python applications for error handling.
4. Investigate how to achieve reusability using inheritance, interfaces and packages.
5. Assess how to read and write files in Python and evaluate different database operations.

|                           |                                                                           |                             |          |          |          |
|---------------------------|---------------------------------------------------------------------------|-----------------------------|----------|----------|----------|
| <b>AY 2022-23 onwards</b> | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B. Tech: AI &amp; ML</b> |          |          |          |
| <b>Course Code: L226D</b> | <b>DATA WAREHOUSING AND DATA MINING</b><br>(Common to AI&ML, CSE & IT)    | <b>L</b>                    | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>         |                                                                           | <b>3</b>                    | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites: NIL**

**Course objectives:**

**The Student will:**

1. Introduce the basic concepts and techniques in building a Data Warehouse.
2. Apply Preprocessing techniques for any given raw data.
3. Implement and apply basic algorithms for finding frequent patterns in transactional databases.
4. Implement and apply basic algorithms for supervised and unsupervised learning.
5. Discuss an overview of mining complex types of data.

**Module 1:**

**Unit 1 Introduction:**

Fundamentals of data mining, Data Mining Functionalities, Classification of Data Mining systems, Data Mining Task Primitives, Integration of a Data Mining System with a Database or a Data Warehouse System, Major issues in Data Mining.

**Unit 2 Data Preprocessing:**

Need for Preprocessing the Data, Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and Concept Hierarchy Generation.

**Module 2:**

**Unit 1 Data Warehouse and OLAP Technology for Data Mining:**

Data Warehouse, Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, From Data Warehousing to Data Mining.

**Unit 2 Data Cube Computation and Data Generalization:**

Efficient Methods for Data Cube Computation and Data Generalization, Attribute-Oriented Induction.

**Module 3:**

**Unit 1 Mining Frequent Patterns:**

Basic Concepts, Efficient and Scalable Frequent Item set Mining Methods

**Unit 2 Associations and Correlations:**

Mining various kinds of Association Rules, From Association Mining to Correlation Analysis, Constraint-Based Association Mining.

**Module 4:**

**Unit 1 Classification:**

Issues Regarding Classification and Prediction, Classification by Decision Tree Induction, Bayesian Classification, Rule-Based Classification, Classification by Back propagation, Support Vector Machines.

**Unit 2 Prediction:**

Simple linear regression, Logistic Regression, Accuracy and Error measures, Evaluating the accuracy of a Classifier or a Predictor, Ensemble Methods.

**Module 5:****Unit 1 Cluster Analysis Introduction:**

Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Model-Based Clustering Methods, Outlier Analysis.

**Unit 2 Mining Complex Types of Data:**

Mining Spatial Databases, Mining Multimedia Databases, Mining Time-Series and Sequence Data, Mining Text Data and Mining the World Wide Web.

**Applications and Trends in Data Mining:** Data Mining Applications, Data Mining System Products and Research Prototypes.

**Text books:**

1. Data Mining – Concepts and Techniques - Jiawei Han & Micheline Kamber, Morgan Kaufmann Publishers, Elsevier, 2nd Edition, 2006.
2. Introduction to Data Mining – Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Pearson education.

**Reference book:**

1. Data Mining Techniques – Arun K Pujari, 2<sup>nd</sup> edition, Universities Press.
2. Data Warehousing in the Real World – Sam Aanhory & Dennis Murray Pearson Edn Asia.
3. Insight into Data Mining, K.P.Soman, S.Diwakar, V.Ajay, PHI, 2008.

**E-Resources:**

1. <https://drive.google.com/file/d/1KwbqxsxL-R3PoRyf8o4Ewdjm98MOKFJv/view>
2. <https://onlinecourses.nptel.ac.in/noc18>
3. [www.vssut.ac.in/lecture\\_notes/lecture1428550844.pdf](http://www.vssut.ac.in/lecture_notes/lecture1428550844.pdf)
4. [www.vssut.ac.in/lecture\\_notes/lecture1428550844.pdf](http://www.vssut.ac.in/lecture_notes/lecture1428550844.pdf)

**Course outcomes:****The Student will be able to:**

1. Assess raw input data, and process it to provide suitable input for a range of data mining algorithms.
2. Identify a data warehouse for an organization.
3. Apply Data mining techniques such as characterization, comparison, association.
4. Apply an appropriate data Mining algorithms for classification and clustering from large databases.
5. Assess the various complex types of data in data mining.

|                               |                                                                           |                                                 |          |          |          |
|-------------------------------|---------------------------------------------------------------------------|-------------------------------------------------|----------|----------|----------|
| <b>AY 2022-23 onwards</b>     | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AI &amp; ML<br/>II Year – II Sem</b> |          |          |          |
| <b>Course Code:<br/>L225C</b> | <b>DESIGN AND ANALYSIS OF ALGORITHMS</b><br>(Common to AI&ML, CSE & IT)   | <b>L</b>                                        | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>             |                                                                           | <b>3</b>                                        | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites:** Data structures.

**Course objectives:**

**The Student will:**

1. Realize the time and space complexities, asymptotic notations, union and find algorithms, connected components and bi-connected components.
2. Assess divide and conquer and greedy methods of problem solving.
3. Increase skills in exploring and inferring dynamic programming predicaments.
4. Familiar with working out backtracking challenges.
5. Resolve the branch and bound complications and ascertain the NP-Hard and NP-Complete Problems

### **Module 1:**

#### **Introduction to algorithms**

Algorithm, Pseudo Code for expressing Algorithms, Performance Analysis: Space Complexity, Time Complexity, asymptotic Notations: Big-oh Notation, Omega Notation, Theta Notation, Little-oh Notation.

**Disjoint Sets:** Disjoint Set Operations, Union and Find Algorithms, Spanning Trees, Connected Components and Biconnected Components.

### **Module 2:**

#### **Divide and Conquer**

General Method, Applications: Binary Search, Quick Sort, Merge Sort, Strassen's Matrix Multiplication.

#### **Greedy Method**

General Method Applications: Job Sequencing with Deadlines, 0/1 Knapsack Problem, Minimum Cost Spanning Trees: Prim's and Kruskal's Algorithms, Single Source Shortest Path Problem, Huffman Codes.

### **Module 3:**

#### **Dynamic Programming**

General Method, Principle of Optimality, Applications: Multistage Graphs, Matrix Chain Multiplication, Optimal Binary Search Trees, 0/1 Knapsack Problem, All Pairs Shortest Path Problem, Travelling Sales Person Problem, Reliability Design.

### **Module 4:**

#### **Backtracking**

General Method, Applications: N-Queen Problem, Recursive Permutation Generator, Sum of Subsets Problem, Graph Coloring, Hamiltonian Cycles.

## **Module 5:**

### **Branch and Bound**

General Method, Applications: Travelling Sales Person Problem, 0/1 Knapsack Problem, LC Branch and Bound Solution, FIFO Branch and Bound Solution.

**NP-Hard and NP-Complete Problems:** Basic Concepts, Non-Deterministic Algorithms, NP-Hard and NP-Complete Classes, Cook's Theorem.

### **Text Books:**

1. Fundamentals of Computer Algorithms-Ellis Horowitz, Satraj Sahni and Rajasekharam, Galgotia Publications Pvt. Ltd.
2. Introduction to Algorithms-T.H.Cormen, C.E.Leiserson, R.L.Rivest and C.Stein, 2nd Edition, Pearson Education, PHI Pvt. Ltd.

### **Reference Books:**

1. Algorithm Design: Foundations, Analysis and Internet Examples-M.T.Goodrich and R.Tomassia, John Wiley and Sons.
2. Introduction to Design and Analysis of Algorithms A strategic Approach-R.C.T.Lee, S.S.Tseng, R.C.Chang and T.Tsai, Mc-Graw Hill.
3. Design and analysis of Algorithms-S. Sridhar, Oxford Higher Education.

### **E - Resources:**

1. <https://nptel.ac.in/courses/106/106/106106131/>
2. [https://onlinecourses.nptel.ac.in/noc19\\_cs47/preview](https://onlinecourses.nptel.ac.in/noc19_cs47/preview)
3. <http://www.cse.iitd.ernet.in/~ssen/csl356/notes/root.pdf>
4. [https://www.tutorialspoint.com/design\\_and\\_analysis\\_of\\_algorithms/design\\_and\\_analysis\\_of\\_algorithms\\_tutorial.pdf](https://www.tutorialspoint.com/design_and_analysis_of_algorithms/design_and_analysis_of_algorithms_tutorial.pdf)
5. [https://mrcet.com/downloads/digital\\_notes/IT/Design%20and%20Analysis%20Algorithms.p  
df](https://mrcet.com/downloads/digital_notes/IT/Design%20and%20Analysis%20Algorithms.pdf)

### **Course outcomes:**

#### **The Student will be able to:**

1. Analyze time complexity and space complexity as well as asymptotic notations for a given algorithm, union and find algorithms, connected components and bi-connected components.
2. Apply divide and conquer method for solving sorting and searching problems and greedy method to solve variety of problems.
3. Make use of dynamic programming to solve a collection of problems.
4. Utilize backtracking to solve different types of problems.
5. Choose branch and bound to unravel diverse forms of predicaments.

|                               |                                                                           |                                                 |          |          |          |
|-------------------------------|---------------------------------------------------------------------------|-------------------------------------------------|----------|----------|----------|
| <b>AY 2022-23<br/>onwards</b> | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AI &amp; ML<br/>II Year – II Sem</b> |          |          |          |
| <b>Course Code:<br/>L22AA</b> | <b>MACHINE LEARNING</b><br>(Common to AI&ML, AI&DS, CSE)                  | <b>L</b>                                        | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>             |                                                                           | <b>3</b>                                        | <b>0</b> | <b>0</b> | <b>0</b> |

### Pre-Requisites:

1. Data Structures
2. Design and Analysis of Algorithms
3. Python Programming
4. Probability & Statistics
5. Mathematics for Machine Learning

### Course objectives:

#### The student will:

1. Introduce the fundamental concepts of machine learning and its applications.
2. Learn the classification, clustering, regression-based machine learning algorithms
3. Understand the deep learning architectures.
4. Understand the methods of solving real life problems using the machine learning techniques.
5. Understand the limitations of machine learning algorithms.

### Module 1:

**Introduction:** Programming Vs Learning-Types of Learning- Statistical Decision Theory – Regression-Classification- Bias Variance-Linear Regression- Multivariate Regression- Subset Selection- Shrinkage Methods

Principal Component Regression- Partial Least squares- Linear Classification- Logistic Regression- Linear Discriminant Analysis-Perceptron- Support Vector Machines

### Module 2:

**Neural Networks**-Introduction- Early Models- Perceptron Learning- Backpropagation- Initialization- Training & Validation- Parameter Estimation – Maximum Likelihood Estimation (MLE)- Maximum Likelihood Estimation (MAP)-Bayesian Estimation

**Decision Trees**- Regression Trees- Stopping Criterion & Pruning loss functions- Categorical Attributes- Multiway Splits- Missing Values- Decision Trees – Instability Evaluation Measures



### **Module 3:**

**Ensemble Learning**-Bootstrapping & Cross Validation-Class Evaluation Measures- ROC curve- Minimum Description Length- Ensemble Methods – Bagging- Committee Machines and Stacking- Boosting

Gradient Boosting- Random Forests- Multi-class Classification- Naive Bayes- Bayesian Networks

### **Module 4:**

Undirected Graphical Models- Hidden Markov Model- Variable Elimination-Belief Propagation- Partitional Clustering, Hierarchical Clustering

BIRCH (Balanced iterative reducing and clustering using hierarchies) Algorithm- CURE (Clustering Using Representatives) Algorithm-Density-based Clustering- Gaussian Mixture Models-Expectation Maximization

### **Module 5:**

Introduction and Basics of Reinforcement Learning-Defining RL Framework and Markov Decision Process- Policies, Value Functions and Bellman Equations- Exploration vs. Exploitation

Dynamic Programming and Monte Carlo-Temporal-Difference learning methods- Q-Learning Deep Q-networks - Duelling Deep Q Networks (DDQN)

### **Text Books:**

1. The Elements of Statistical Learning, by Trevor Hastie, Robert Tibshirani, Jerome H. Friedman (2009). Springer-Verlag.
2. Pattern Recognition and Machine Learning, by Christopher Bishop, Springer 2006
3. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An introduction", Second Edition, MIT Press, 2019
4. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014.

### **Reference Books:**

1. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
2. Francois Chollet, "Deep Learning with Python, Manning Publications, Shelter Island, New York, 2018.
3. Navin Kumar Manaswi, Deep Learning with Applications using Python, Apress, New York, 2018.

### **Course outcomes:**

#### **The student will be able to:**

1. Implement the basic concepts of machine learning.
2. Investigate the various classification, clustering, and regression algorithms.
3. Apply the deep learning architectures for real world problems.
4. Implement a method for solving real life problem using a suitable machine learning technique.
5. Identify the merits of various Machine Learning algorithms.

|                               |                                                                           |                                                 |          |          |          |
|-------------------------------|---------------------------------------------------------------------------|-------------------------------------------------|----------|----------|----------|
| <b>AY 2022-23<br/>onwards</b> | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AI &amp; ML<br/>II Year – II Sem</b> |          |          |          |
| <b>Course Code:<br/>L2252</b> | <b>PYTHON PROGRAMMING LAB</b><br>(Common to AI & ML, AI&DS, CSE & IT )    | <b>L</b>                                        | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 1.5</b>           |                                                                           | <b>0</b>                                        | <b>0</b> | <b>3</b> | <b>0</b> |

**Pre-Requisites: NIL**

**Course objectives:**

**The Student will:**

1. Implement Basic input /output operations with various Data Types supported by python.
2. Develop functions for code reusability and experiment string manipulation operations with the use of inbuilt functions.
3. Create a python program for experimenting list, tuple and dictionary
4. Demonstrate Class and objects to make use of object oriented programming concepts.
5. Implement File handling operations to access the contents of file

**Experiment 1.**

- i. Write a python program to obtain user input data (int, float, string) and display.
- ii. Write a python program to find the roots of a quadratic equation
- iii. Write a python program to perform arithmetic operations (+, -, \*, /, %) for given input values and printout the result values.

**Experiment 2.**

- i. Write a python programs that use both recursive and non-recursive functions to find the factorial of a given integer
- ii. Operators and Operands in Python: (Arithmetic, relational and logical operators), operator precedence, Expressions and Statements.
- iii. (Assignment statement); Taking input (using raw input () and input ()) and displaying output (print statement); Putting Comments.

**Experiment 3.**

- i. Write python programs to perform operation on Strings using following functions: len, capitalize, find, isalnum, isalpha, isdigit, lower, islower, isupper, upper, lstrip, rstrip, isspace, istitle, partition, replace, join, split, count, decode, encode, swapcase.
- ii. Enter the details of 5 **Student** and display the details sequentially.

**Experiment 4.**

- i. Write python programs to perform List operators: (joining, list slices)
- ii. Write python programs to perform List functions: len, insert, append, extend, sort, remove, and reverse, pop.
- iii. Write python programs to check whether the string is palindrome or not?

**Experiment 5.**

- i. Write python programs to perform Tuple functions: cmp(), len(), max(), min(), tuple()
- ii. Write python programs to check whether the word is present in the tuple or not?
- iii. Write python programs to Take a string as ("1234567890") and create a pair {(1,2),(3,4),(5,6),(7,8),(9,0)} using tuple.

**Experiment 6.**

- i. Write python programs to perform Dictionary functions & Methods: cmp, len, clear (), get(), has\_key(), items(),keys(), update(), values() .
- ii. Write python programs to Create a list of animal using dictionary variable "animal" and find out if the specific animal present in the list or not?

**Experiment 7.**

- i. Write a python program to create a class, its objects and accessing attributes.
- ii. Create a Customer class and check the balance and withdraw and deposit some amount.

**Experiment 8.** Write a python script to implement exception handling.

- i. Check whether the input no is integer or not.
- ii. Handel the exceptions that are come at the time of division.

**Experiment 9.** Write a python script to perform inheritance.**Experiment 10.** Write a python script to perform various FILE handling operations.

Open, close, read, write, copy.

**Experiment 11.**

- i. Write a python script to connect to the database and perform DDL operations.
- ii. Create table, insert data into table and display the table data.

**Experiment 12.** Write a python script to connect to the database and perform various DML and DQL operations.**Text Books:**

1. **Programming in Python 3-** A complete Introduction to the Python Language- Second Edition, Mark Summerfiels, Addison-Wesley 2010.
2. **Programming Python-** 4th Edition, Mark Lutz, O'Reilly, 2011.

**Reference books:**

1. **Object-Oriented Programming in Python**, Michael H, Goldwasser, David Letscher, Pearson Prentice Hall, 2008.

**E - Resources:**

1. [https://www.tutorialspoint.com/python3/python\\_strings.htm](https://www.tutorialspoint.com/python3/python_strings.htm)
2. <https://www.youtube.com/watch?v=yCH9CUiXrP0>
3. <https://www.youtube.com/watch?v=RS187lqOXDE>
4. <https://www.youtube.com/watch?v=bSZtsYYwFS0>

**Course outcomes:****The Student will be able to:**

1. Apply Basic input /output operations for working with different data types in python.
2. Design functions for achieving code reusability and string manipulations.
3. Create a python program for implementing list, tuple dictionary.
4. Categorize Class and objects.
5. Implement the various File handling operations.

|                                   |                                                                           |                                                 |          |          |          |
|-----------------------------------|---------------------------------------------------------------------------|-------------------------------------------------|----------|----------|----------|
| <b>AY 2022-23<br/>onwards</b>     | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AI &amp; ML<br/>II Year – II Sem</b> |          |          |          |
| <b>Course<br/>Code:<br/>L22A1</b> | <b>MACHINE LEARNING LAB</b><br>(Common to AI & ML, AI&DS, CSE)            | <b>L</b>                                        | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>                 |                                                                           | <b>3</b>                                        | <b>0</b> | <b>0</b> | <b>0</b> |

### **Pre-Requisites:**

1. Data Structures
2. Design and Analysis of Algorithms
3. Python Programming Lab
4. Mathematics for Machine Learning

### **Course objectives:**

#### **The student will:**

1. Understand the usage of .csv files for organising data in the form of datasets.
2. Design and Analyze the performance of various machine learning algorithms.
3. Identify the real-world problems that can be solved by applying machine learning algorithms.
4. Identify suitable machine learning algorithms for solving real world problems.
5. Understand the limitations of machine learning algorithms.

### **Lab Experiments:**

1. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in python classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Python ML library classes/API.

8. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Python ML library classes/API in the program.
9. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Python ML library classes can be used for this problem.
10. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
11. **Case Study:** You are owing a supermarket mall and through membership cards , you have some basic data about your customers like Customer ID, age, gender, annual income, and spending score. Spending Score is something you assign to the customer based on your defined parameters like customer behaviour and purchasing data.

### **Problem Statement**

By being the managing director of your Supermarket Mall, You wanted to understand the customers like who can be easily converge [Target Customers] so that the sense can be given to marketing team and plan the strategy accordingly.

After carrying out this case study, answer the questions given below.

- 1- How to achieve customer segmentation using machine learning algorithm (KMeans Clustering) in Python in simplest way.
- 2- Who are your target customers with whom you can start marketing strategy [easy to converse]
- 3- How the marketing strategy works in real world?

### **Software And Hardware Requirements:**

- SOFTWARE: Python pre-installed, Anaconda Navigator with all python libraries.
- HARDWARE: Desktop Computers with 4 GB RAM, Minimum 80 GB Hard disk with Windows System.

### **Course outcomes:**

#### **The student will be able to:**

1. Create .csv files for organising data in the form of datasets.
2. Implement and compare the performance metrics of various machine learning algorithms.
3. Investigate the real-world problems into a well posed learning problem that can be solved by a suitable machine learning algorithm.
4. Recommend suitable machine learning algorithms for solving real world problems.
5. Prioritize the various machine learning algorithms.

|                               |                                                                           |                                                  |          |          |          |
|-------------------------------|---------------------------------------------------------------------------|--------------------------------------------------|----------|----------|----------|
| <b>AY 2022-23 onwards</b>     | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B. Tech: AI &amp; ML<br/>II Year – II Sem</b> |          |          |          |
| <b>Course Code:<br/>L22M2</b> | <b>ENVIRONMENTAL SCIENCES<br/>(Common to ALL Branches)</b>                | <b>L</b>                                         | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 0</b>             |                                                                           | <b>2</b>                                         | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites:** Nil

**Course objectives:**

**The Student will:**

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, Green house 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. Text Book Of Environmental Science and Technology by M.Anji Reddy 2007
2. Principles of Environmental Science and Engineering by P.Venugopal Rao.
3. Introduction to Environmental Studies by K.Mukkanti
4. Text book of Environmental studies by Kaushik&Anubha kaushik

**Reference Books:**

1. Tata McGrawHill : Introduction to Environmental Studies by Benny Joseph
2. Environmental Studies by Erach Bharucha 2005, University Grants Commission, University Press.

**E - Resources:**

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

**Course outcomes:****The Student will be able to:**

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

|                                        |                                                                                          |                                                 |          |          |          |
|----------------------------------------|------------------------------------------------------------------------------------------|-------------------------------------------------|----------|----------|----------|
| <b>AY 2022-23<br/>onwards</b>          | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b>                | <b>B.Tech: AI &amp; ML<br/>III Year – I Sem</b> |          |          |          |
| <b>Course<br/>Code:<br/><br/>J31EA</b> | <b>MANAGERIAL ECONOMICS AND<br/>MANAGEMENT SCIENCE<br/><br/>(CE, ME, MIE &amp; EEE )</b> | <b>L</b>                                        | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 4</b>                      |                                                                                          | <b>3</b>                                        | <b>1</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites:** Nil

**Course objectives:**

**The Student will:**

1. Learn principles and practices of the organization.
2. Learn preparation of balance sheet and accounting standards.
3. Understand the principles of management.
4. Gain knowledge on graphical presentation of improving the quality.
5. Understand the importance of inventory control in the organization.

**Module 1:**

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

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

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

**Module 2:**

**Market Structures:** Different types of Markets.

**Pricing:** Methods of pricing and Strategies, Skimming and Penetration pricing.

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

**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:**

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

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



**Human Recourse Management:** Recruitment, Selection, Training and Development and Performance.

#### **Module 4:**

**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.

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

#### **Module 5:**

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

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

#### **Text books:**

1. Managerial Economics & Financial Accounting – Prentice Hall of India: Dr. M. Kasi Reddy, Dr. S. Saraswathi
2. Varshney & Maheswari: Managerial Economics, Sulthan Chand, 2009.
3. P. Subba Rao: Human Recourse Management.

#### **Reference books:**

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

#### **E-resources:**

1. <https://nptel.ac.in/courses/110/101/110101005/>
2. <https://sites.google.com/site/economicsbasics/>
3. <http://www.whatishumanresource.com/system/app/pages/search?scope=search-site&q=Compensation+and+Reward+Management>

#### **Course outcomes:**

##### **The Student will be able to:**

1. Develop analytical skills for investigating and analysing quality management issues in the industry and suggest implementable solutions to those.
2. Develop in-depth understanding on continuous process improvement & benchmarking process
3. Learn the applications of quality tools and techniques in both manufacturing and service Industry.
4. Develop in-depth knowledge on various tools and techniques of quality management.
5. Develop analytical skills for investigating and analysing quality management issues in the industry and suggest implementable solutions to those.

|                                   |                                                                         |                                               |          |          |          |
|-----------------------------------|-------------------------------------------------------------------------|-----------------------------------------------|----------|----------|----------|
| <b>AY 2022-23<br/>onwards</b>     | <b>J.B.Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AI&amp; ML<br/>III Year– I Sem</b> |          |          |          |
| <b>Course<br/>Code:<br/>L315D</b> | <b>SOFTWARE ENGINEERING<br/>(Common to AI&amp;ML, CSE)</b>              | <b>L</b>                                      | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits:3</b>                  |                                                                         | <b>3</b>                                      | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites:** Nil

**Course objectives:**

**The Student will:**

1. Analyze basic Software engineering methods.
2. Describe software engineering layered technology and Process frame work.
3. Design software architecture and UML modeling
4. Recognize testing approaches such as unit testing and integration testing.
5. Demonstrate software evolution and related issues such as version and risk management

#### **Module - I:**

**Introduction to Software Engineering:** The evolving role of Software, changing nature of Software, Software Myths.

**A Generic view of process:** Software engineering- A layered technology, a process framework, The Capability Maturity Model Integration (CMMI), Process patterns, process assessment, personal and team process models.

**Process models:** The waterfall model, Incremental process models, Evolutionary process models, The Unified process.

#### **Module - II:**

**Software Requirements:** Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document.

**Requirements Engineering Process:** Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management.

**System Analysis Models:** Context models, behavioral models, data models, object models, structured methods

#### **Module - III:**

**Design Engineering:** Design process and Design quality, Design concepts, the design model.

**Creating an architectural design:** Software architecture, Data design, Introduction to UML, Importance of modeling, Principle of modeling, Concepts of modeling and architecture.

**Object-Oriented Design:** Objects and object classes, An Object-Oriented design process, Design evolution.

**Performing User interface design:** Golden rules, User interface analysis and design, interface analysis, interface design steps, Design evaluation.

#### **Module - IV:**

**Testing Strategies:** A strategic approach to software testing, test strategies for conventional software, Black-Box and White-Box testing, Validation testing, System testing, the art of Debugging.

**Product metrics:** Software Quality, Metrics for Analysis Model, Metrics for Design Model, Metrics for source code, Metrics for testing, Metrics for maintenance.

**Metrics for Process and Products:** Software Measurement, Metrics for software quality.

#### **Module - V:**

**Risk management:** Reactive vs. Proactive Risk strategies, software risks, Risk identification, Risk projection, Risk refinement, RMMM, RMMM Plan.

**Quality Management:** Quality concepts, Software quality assurance, Software Reviews, Formal technical reviews, Statistical Software quality Assurance, Software reliability, The ISO 9000 quality standards.

#### **TEXT BOOKS:**

1. Software Engineering A Practitioner's Approach, Roger S Pressman, 6th edition. McGraw-Hill International Edition.
2. Software Engineering, Ian Sommerville, 7th edition, Pearson education.

#### **REFERENCE BOOKS:**

1. The Unified Modeling Language, User Guide by Grady Booch, James Rumbaugh, IvarJaccobson.
2. Software Engineering, A Precise Approach, PankajJalote, Wiley India, 2010.
3. Software Engineering: A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008

#### **Course outcomes:**

##### **The Student will be able to:**

1. Compare and Analyse the different Process models
2. Analyse the Requirement Engineering process and System Modeling
3. Apply the systematic procedure for Software design and deployment
4. Compare the various testing and maintenance methods.
5. Evaluate Projects with various Quality standards

|                                        |                                                                           |                                                 |          |          |          |
|----------------------------------------|---------------------------------------------------------------------------|-------------------------------------------------|----------|----------|----------|
| <b>AY 2022-23<br/>onwards</b>          | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AI &amp; ML<br/>III Year – I Sem</b> |          |          |          |
| <b>Course<br/>Code:<br/><br/>L31AB</b> | <b>DEEP LEARNING</b><br><br>(Common to AI&ML, AI&DS, CSE(AI&ML))          | <b>L</b>                                        | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>                      |                                                                           | <b>3</b>                                        | <b>0</b> | <b>0</b> | <b>0</b> |

### Pre-Requisites:

1. Probability Statistics, linear algebra. Machine learning .

### Course Objectives:

#### The Student will:

1. Get introduced to various learning techniques of machine learning and understand differences between machine learning and deep learning
2. Understand and analyse optimization techniques and improvements in learning methods
3. Appreciate, understand and apply neural networks as tools for complete learning problems
4. Investigate and deploy/club multi-layer neural networks for learning related to images, text and speech sequences.
5. Appreciate, understand and implement Deep learning in real world practical problems

### Module 1:

#### Introduction to Deep Learning

Introduction to Deep Learning, Brief History of Deep Learning, AI, Machine Learning and Deep Learning, Statistical Learning,

Bayesian Learning, Decision Surfaces, Success stories of Deep Learning

### Module 2:

#### Linear Classifiers

Linear Classifiers, Linear Machines with Hinge Loss, Optimization Techniques, Gradient Descent, Batch Optimization,

Revisiting Gradient Descent, Momentum Optimizer, RMS Prop, Adam.

### Module 3:

#### Neural Network

Introduction to Neural Network, Multilayer Perceptron, Back Propagation Learning, Unsupervised Learning with Deep Network, Auto encoders, Convolutional Neural Network, Building blocks of CNN, Transfer Learning, LSTM Networks, NN in python

## **Module 4:**

### **Deep Neural Net**

Effective training in Deep Net- early stopping, Dropout, Batch Normalization, Instance Normalization, Group Normalization,

Recent Trends in Deep Learning Architectures, Residual Network, Skip Connection Network, Fully Connected CNN, CNN in Python

## **Module 5:**

### **Practical areas of Deep Learning**

Classical Supervised Tasks with Deep Learning, Image Denoising, Semantic Segmentation, Object Detection, Generative Modeling with Deep Learning,

Variational Auto encoder, Generative Adversarial Network, Object recognition with Python.

### **Text Books:**

1. Deep Learning- Ian Goodfellow, Yoshua Benjio, Aaron Courville, The MIT Press
2. Pattern Classification- Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley & Sons Inc.

### **Reference Books:**

1. Deep Learning: A Practitioner's Approach by Josh Patterson & Adam Gibson, O'Reilly Press
2. Python Deep Learning: Exploring deep learning techniques and neural network architectures with PyTorch, Keras, and TensorFlow, 2nd Edition by Ivan Vasilev, Pakt Publication.

### **E - Resources:**

1. <https://nptel.ac.in/courses/106/105/106105215/>
2. <https://www.slideshare.net/LuMa921/deep-learning-a-visual-introduction>
3. <https://yiqiaoyin.files.wordpress.com/2018/02/deep-learning-notes.pdf>

### **Course Outcomes:**

#### **The student will be able to:**

1. Identify tools of machine learning and deep learning, appropriate to any problems
2. Apply optimization techniques to improve the quality of various learning solutions.
3. Apply and investigate, neural network for complete learning problems.
4. Deploy deep learning methods in the area of multidimensional and sequential inputs.
5. Investigate the scope of implementation of various deep learning techniques in any real world problem.

|                               |                                                                          |                                               |          |          |          |
|-------------------------------|--------------------------------------------------------------------------|-----------------------------------------------|----------|----------|----------|
| <b>AY 2022-23 onwards</b>     | <b>J.B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AI&amp; ML<br/>III Year– I Sem</b> |          |          |          |
| <b>Course Code:<br/>L31A2</b> | <b>DEEP LEARNING LAB</b>                                                 | <b>L</b>                                      | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 2</b>             |                                                                          | <b>0</b>                                      | <b>0</b> | <b>4</b> | <b>0</b> |

### Pre-Requisites:

1. Python Programming
2. Mathematics for Machine Learning
3. Machine Learning

### Course objectives:

#### The student will:

1. Design and analyse the performance of various deep learning architectures
2. Investigate and deploy/club multi-layer neural networks for learning related to image categorization, object detection and segmentation.
3. Understand how optimization techniques can be incorporated to improve performance of deep learning techniques
4. Visualize the results obtained in Intermediate/hidden layers of neural nets.
5. Familiarise with cloud-based computing tools like google colab.

### Lab Experiments:

1. Basic image processing operations : Histogram equalization, thresholding, edge detection, data augmentation, morphological operations
2. Implement Support Vector Machines (SVM) /SoftMax classifier for CIFAR-10 dataset: (i) using KNN, (ii) using 3 layer neural network
3. Study the effect of batch normalization and dropout in neural network classifier
4. Familiarization of image labelling tools for object detection, segmentation
5. Image segmentation using Mask Regional Convolutional Neural Network(Mask RCNN), UNet, semantic segmentation model(SegNet)
6. Object detection with single-stage and two-stage detectors (Yolo, SSD, FRCNN, etc.)
7. Image Captioning with Vanilla Recurrent neural network(RNNs)
8. Image Captioning with Long Short-Term Memory(LSTMs)
9. Network Visualization: Saliency maps, Class Visualization
10. Generative Adversarial Networks
11. Chatbot using bi-directional Long Short-Term Memory(LSTMs)
12. Familiarization of cloud-based computing like Google Colab.

**Software And Hardware Requirements:**

- SOFTWARE: Python pre-installed, Anaconda Navigator with all python libraries, Online Google collab.
- HARDWARE: Desktop Computers with 4 GB RAM, Minimum 80 GB Hard disk with Windows System.

**Course outcomes:****The student will be able to:**

1. Implement and compare the performance metrics of various deep learning architectures.
2. Implement multi-layer neural networks for learning related to image categorization, object detection and segmentation.
3. Apply optimization techniques to improve performance of deep learning techniques
4. Interpret the results obtained in intermediate/hidden layers of neural nets.
5. Use google collab to accelerate training speed of deep learning algorithms.

|                               |                                                                         |                                               |          |          |          |
|-------------------------------|-------------------------------------------------------------------------|-----------------------------------------------|----------|----------|----------|
| <b>AY 2022-23 onwards</b>     | <b>J.B.Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AI&amp; ML<br/>III Year– I Sem</b> |          |          |          |
| <b>Course Code:<br/>L3152</b> | <b>SOFTWARE ENGINEERING LAB</b><br>(Common to AI & ML, CSE)             | <b>L</b>                                      | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 1</b>             |                                                                         | <b>0</b>                                      | <b>0</b> | <b>2</b> | <b>0</b> |

### **Course Objectives:**

#### **The student will:**

1. Analyze problem statement and develop software requirements sheet for system.
2. Describe the functional oriented diagrams: Data flow diagram
3. Design test plan document and specification of a system
4. Describe the test cases for web application
5. Demonstrate the use of selenium with different browsers.

#### **Experiment1.**

Write down the problem statement for a suggested system of relevance

#### **Experiment2.**

Do requirement analysis and develop software requirement specification sheet for any system.

#### **Experiment3.**

Draw the e-r diagram for the suggested system

#### **Experiment4.**

Top form the function- oriented diagram: Data Flow Diagram (DFD)

#### **Experiment5.**

Create a test plan document for any application (e.g. Library Management System).

#### **Experiment6.**

Study the specifications of ATM System and Write functional test cases

#### **Experiment7.**

Study the specification of different type of insurance policies, write the functional test cases.

#### **Experiment8.**

Write the test cases for any Web application.

#### **Experiment9.**

- a) Write the test cases for java program using relational operators.
- b) Write the test cases for java program using string compressions.



**Experiment10.**

- a) Write the test cases for java program using multi-dimensional array.
- b) Write the test cases for java program using method overloading.

**Experiment11.**

Write a program to launch selenium tool with different browsers

**Case Study Experiment:****Experiment 12.**

Study any Web Application using Selenium ID.

**Software And Hardware Requirements:**

- SOFTWARE: Argo UML, Dia, Selenium preinstalled using Tomcat.
- HARDWARE: Desktop Computers with 4 GB RAM, Minimum 80 GB Hard disk with Windows System.

**Course outcomes:****The Student will be able to:**

1. Apply software principles and techniques for software requirement specification.
2. Design data flow diagram
3. Apply different test plan cases.
4. Construct programs for various testing scenarios.
5. Use selenium for web applications.

|                               |                                                                          |                                             |   |   |   |
|-------------------------------|--------------------------------------------------------------------------|---------------------------------------------|---|---|---|
| <b>AY: 2022-23</b><br>Onwards | <b>J. B. Institute of Engineering and Technology</b><br>(UGC Autonomous) | <b>B. Tech CSE</b><br><b>III Year-I Sem</b> |   |   |   |
| Course Code:                  | <b>EMPLOYABILITY SKILLS</b><br>(Audit Course-III)                        | L                                           | T | P | D |
| Credits: 0                    | COMMON TO: AI & ML, CE, EEE, ME, ECE, and MIE                            | 2                                           | 0 | 0 | 0 |

### Pre-Requisites:

#### Module 1: SOFT SKILLS [6L]

Introduction - What are Soft Skills? - Importance of Soft Skills - Marketing Your Soft Skills - Negotiating - Exhibiting Your Soft Skills - Identifying Your Soft Skills - Improving Your Soft Skills - Top 60 Soft Skills.

Know Thyself/ Self – Discovery - Process of Knowing Yourself - SWOT Analysis.

#### Module 2: CAREER PLANNING [6L]

Introduction - Benefits of Career Planning - Guidelines for choosing a career - Myths about choosing a career goal - Final thoughts on career planning - Things one should know while starting career and during his/her career.

#### Module 3: ART OF SPEAKING [6L]

Introduction - What Makes Communication Important? - Defining Communication - Process of Communication - Channels of Communication - Formal and Informal Communication Network - Barriers to Communication - Tips for Effective Communication - Art of Public Speaking.

#### Module 4: ART OF WRITING [6L]

Introduction - Importance of Writing - Creative Writing - Writing Tips - Drawbacks of Written Communication - Letter Writing and Resume Writing.

#### Module 5: ETIQUETTES AND MANNERS [6L]

Introduction - Modern Etiquettes - Benefits of Etiquettes - Classification of Etiquettes.

Introduction - Practicing Good Manners - Manners at the Wheel - Professional Manners - Social Skills (Manners) - Getting Along with People - Corporate Grooming Tips.

#### Text Books

1. Dr. Alex. K. *Soft Skills: Know yourself and Know the World*. S. Chand & Company Pvt. Ltd: New Delhi: 2014.

#### Reference Books

1. Ashraf Rizvi. M. *Effective Technical Communication*. McGraw-Hill: New Delhi: 2010
2. K. R. Lakshminarayanan, *Speak in English*, Scitech Publications, Chennai, 2009.

## E-Resources

- [https://en.wikipedia.org/wiki/Soft\\_skills](https://en.wikipedia.org/wiki/Soft_skills)
- <https://www.mbaskool.com/business-concepts/human-resources-hr-terms/1779-career-development.html>

## Course Outcomes

At the end of the course, the student will be able to:

**CO1.** Learn the importance of soft skills and knowing thyself.

**CO2.** Understand how to build their (students) career.

**CO3.** Communicate effectively by applying appropriate speaking techniques.

**CO4.** Write letters and resumes effectively by applying appropriate writing techniques.

**CO5.** Learn the good manners and social etiquettes.

## CO-PO/PSO Mapping

| Course Outcomes | Program Outcomes (POs)/Program Specific Outcomes (PSOs) |      |      |      |      |      |      |      |      |       |       |       |       |       |
|-----------------|---------------------------------------------------------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|
|                 | 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 |
| <b>CO1</b>      | -                                                       | -    | -    | -    | -    | -    | -    | -    | 2    | 2     | -     | 3     | -     | -     |
| <b>CO2</b>      | -                                                       | -    | -    | -    | -    | -    | -    | -    | 2    | 2     | -     | 3     | -     | -     |
| <b>CO3</b>      | -                                                       | -    | -    | -    | -    | -    | -    | -    | 2    | 2     | -     | 3     | -     | -     |
| <b>CO4</b>      | -                                                       | -    | -    | -    | -    | -    | -    | -    | 2    | 2     | -     | 3     | -     | -     |
| <b>CO5</b>      | -                                                       | -    | -    | -    | -    | -    | -    | -    | 2    | 2     | -     | 3     | -     | -     |
| <b>Average</b>  | -                                                       | -    | -    | -    | -    | -    | -    | -    | 2    | 2     | -     | 3     | -     | -     |

**Correlation: 3–Strong; 2–Medium; 1–Weak**

|                               |                                                                          |                                              |   |   |   |
|-------------------------------|--------------------------------------------------------------------------|----------------------------------------------|---|---|---|
| <b>AY: 2022-23</b><br>Onwards | <b>J. B. Institute of Engineering and Technology</b><br>(UGC Autonomous) | <b>B. Tech CSE</b><br><b>III Year-II Sem</b> |   |   |   |
| Course Code:                  | <b>EMPLOYABILITY SKILLS</b><br>(Audit Course-III)                        | L                                            | T | P | D |
| Credits: 0                    | COMMON TO: AI & DS, CSE, IT, CSE (AIML & DS)<br>and ECM                  | 2                                            | 0 | 0 | 0 |

### Pre-Requisites:

#### Module 1: SOFT SKILLS [6L]

Introduction - What are Soft Skills? - Importance of Soft Skills - Marketing Your Soft Skills - Negotiating - Exhibiting Your Soft Skills - Identifying Your Soft Skills - Improving Your Soft Skills - Top 60 Soft Skills.

Know Thyself/ Self – Discovery - Process of Knowing Yourself - SWOT Analysis.

#### Module 2: CAREER PLANNING [6L]

Introduction - Benefits of Career Planning - Guidelines for choosing a career - Myths about choosing a career goal - Final thoughts on career planning - Things one should know while starting career and during his/her career.

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2. K. R. Lakshminarayanan, *Speak in English*, Scitech Publications, Chennai, 2009.

## E-Resources

- [https://en.wikipedia.org/wiki/Soft\\_skills](https://en.wikipedia.org/wiki/Soft_skills)
- <https://www.mbaskool.com/business-concepts/human-resources-hr-terms/1779-career-development.html>

## Course Outcomes

At the end of the course, the student will be able to:

**CO1.** Learn the importance of soft skills and knowing thyself.

**CO2.** Understand how to build their (students) career.

**CO3.** Communicate effectively by applying appropriate speaking techniques.

**CO4.** Write letters and resumes effectively by applying appropriate writing techniques.

**CO5.** Learn the good manners and social etiquettes.

|                               |                                                                           |                                           |          |          |          |
|-------------------------------|---------------------------------------------------------------------------|-------------------------------------------|----------|----------|----------|
| <b>AY 2022-23<br/>onwards</b> | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AIML<br/>III Year – II Sem</b> |          |          |          |
| <b>Course<br/>Code:</b>       | <b>AUTOMATA AND COMPILER DESIGN</b><br>(Common to AI&ML, IT)              | <b>L</b>                                  | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>             |                                                                           | <b>3</b>                                  | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites: Nil**

**Course objectives:  
The students will:**

1. Illustrate different phases of compilation.
2. Describe the steps and algorithms used by language translators and features.
3. Enumerate top down and bottom up parsing techniques used in compilation process.
4. Learn the syntax directed translation and type checking and learning the effectiveness of optimization.
5. Develop algorithms to generate code for a target machine.

#### **Module 1:**

**Formal Language and Regular Expressions:** Languages, Definition Language  
regular expressions, Finite Automata-DFA, NFA

**Conversions:** Conversion of regular expression to NFA, NFA to DFA, Epsilon NFA to NFA,  
Epsilon NFA to DFA, Phases of compilation, Lexical Analyzer generator (LEX).

#### **Module 2:**

**Top down parsers:** Context free grammars, derivation, parse trees, Ambiguity, LL (K) Grammars  
and LL (1) parsing.

**Bottom up parsers:** Bottom up parsing-SR parsing, LR Parsing-SLR, CLR and LALR Parsers,  
YACC tool.

#### **Module 3:**

**Semantics analysis:** Syntax directed translation, S-attributed and L-attributed grammars, and  
Intermediate code forms-AST, Polish notation, three address codes.

**Type checking:** Type checking, type conversions, equivalence of type expressions,

Overloading of functions and operations. Context sensitive features- Chomsky hierarchy of languages  
and recognizers.

#### **Module 4:**

**Symbol table:** Symbol table format, organization of symbol table-Linear, hashing, tree.

**Storage allocation:** Activation record, Runtime stacks and heap allocation

**Module 5:**

**Code optimization:** Principal sources of optimization, basic blocks, flow graphs, data flow analysis of flow graphs, peephole optimization.

**Code generation:** Machine dependent code generation, object code forms, generic code generation algorithm, register allocation and assignment using DAG representation of Block.

**TEXT BOOKS:**

1. Compilers Principles, Techniques & Tools, Alfred V. Aho, Monica S. Lam, Ravi Sethi and Jeffery D. Ullman, Pearson Addison Wesley Education, Second Edition.
2. Modern Compiler Implementation in C, Andrew N. Appel, Cambridge University Press.

**REFERENCE BOOKS:**

1. Lex&yacc , John R. Levine, Tony Mason, Doug Brown, O'reilly
2. Modern Compiler Design, Dick Grune, Henry E. BAL, Cariel T. H. Jacobs, Wiley dreamtech.
3. Engineering a Compiler, Cooper & Linda, Elsevier.
4. Compiler Construction, Loudon, Thomson.
5. Systems Programming and Operating Systems, D

**E - Resources:**

1. [www.tutorialpoint.com](http://www.tutorialpoint.com)
2. [www.greekforgreeks.com](http://www.greekforgreeks.com)
3. <https://www.javatpoint.com/compiler-tutorial>

**Course outcomes:****The Student will be able to:**

1. Analyze phases of compilation, particularly lexical analysis, parsing, semantic analysis and code generation.
2. Construct parsing tables for different types of parsing techniques.
3. Classify the Semantic Analysis and Intermediate code generation phase.
4. Apply code optimization techniques to different programming languages.
5. Construct object code for natural language representations.

|                                        |                                                                                                                       |                                                  |          |          |          |
|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|----------|----------|----------|
| <b>AY 2022-23<br/>onwards</b>          | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b>                                             | <b>B.Tech: AI &amp; ML<br/>III Year – II Sem</b> |          |          |          |
| <b>Course<br/>Code:<br/><br/>J32M2</b> | <b>CYBER SECURITY</b><br>(Common to ECE, CIVIL, ME & MIE in III-I) and<br>(Common to AI & ML, IT, EEE& ECM in III-II) | <b>L</b>                                         | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 0</b>                      |                                                                                                                       | <b>2</b>                                         | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites: Nil**

**Course objectives:**

**The Student will:**

1. Recognize cybercrimes and how they are planned
2. Identify the vulnerabilities of mobile and wireless devices
3. Examine the crimes in mobile and wireless devices and Acts.
4. Understand about Computer Forensics
5. Explored to Cyber Security- Organizational Implications

### **Module 1:**

**Introduction to Cyber Security:** 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, Methods of defense, Security Models, risk management, Cyber Threats-Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage, etc., Comprehensive Cyber Security Policy.

### **Module 2**

**Cyberspace and the Law & Cyber Forensics:** Introduction, Cyber Security Regulations, Roles of International Law. The INDIAN Cyberspace, National Cyber Security Policy.

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 3:**

**Cybercrime: Mobile and Wireless Devices:** 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: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.



#### **Module 4:**

**Cyber Security:** Organizational Implications: 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.

**Cybercrime and Cyber terrorism:** Introduction, intellectual property in the cyberspace, the ethical dimension of cybercrimes the psychology, mindset and skills of hackers and other cyber criminals.

#### **Module 5:**

**Privacy Issues:** Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains- medical, financial, etc.

**Cybercrime:** Examples and Mini-Cases

Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances.

**Mini-Cases:** 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, Computer Forensics 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 Group.

#### **E-Resources:**

1. <https://lecturenotes.in/subject/611/cyber-security> .
2. <https://www.slideshare.net/AvaniPatel61/ppt-on-cyber-security> .
3. [https://onlinecourses.swayam2.ac.in/ugc19\\_hs25/preview](https://onlinecourses.swayam2.ac.in/ugc19_hs25/preview)

#### **Course outcomes:**

##### **The Student will be able to:**

1. Demonstrate cybercrimes and how they are planned
2. Develop a framework to secure Mobile and wireless devices
3. Interpret crimes and Acts related to mobile and wireless devices
4. Recommend Computer Forensics and its related matters
5. Identify Cyber Security-Organizational Implications

|                               |                                                                          |                                              |   |   |   |
|-------------------------------|--------------------------------------------------------------------------|----------------------------------------------|---|---|---|
| <b>AY: 2022-23</b><br>Onwards | <b>J. B. Institute of Engineering and Technology</b><br>(UGC Autonomous) | <b>B. Tech CSE</b><br><b>III Year-II Sem</b> |   |   |   |
| Course Code:<br>L3201         | <b>LIFE SKILLS AND PROFESSIONAL SKILLS LAB</b><br>COMMON TO: ALL         | L                                            | T | P | D |
| Credits: 2                    |                                                                          | 0                                            | 0 | 2 | 0 |

### Pre-Requisites:

#### Module 1: COMMUNICATION SKILLS [8L]

Introduction- Channel of communication, Process of communication, Language as a tool of communication, levels of communication, the flow of communication, communication networks, Barriers to Communication; Body language – Eye contact, facial expressions, gestures, posture, and body movements.

#### Module 2: PRESENTATION SKILLS [8L]

Nature and Importance of Oral Presentation; Planning the Presentation-Define the Purpose, Analyze the Audience, Analyze the Occasion and Choose a suitable title; Preparing the Presentation-Develop the Central Idea, Develop the Main Ideas, Gather Supporting Material and Plan Visual Aids; Organizing the Presentation-Introduction, Body, Conclusion; Rehearsing the Presentation; Improving Delivery and Choosing Delivery Methods; Handling the Stage Fright.

#### Module 3: GROUP DISCUSSIONS [8L]

Nature of GD- What is a GD? GD and Debate, Importance of GD skills; Characteristics of successful GDs- Subject knowledge, Oral Communication skills, Leadership skills, Team Management; GD Strategies- Getting the GD Started, Contributing Systematically, Creating a Friendly Cooperative Atmosphere, Moving the Discussion along, Promoting Optimal Participation, Handling Conflict and Effecting Closure; Techniques for Individual Contribution- Topic Analysis, Discussing Problems, Discussing Case Studies; Group Interaction Strategies-Exchanging Opinions, Exchanging Suggestions and Proposals.

#### Module 4: INTERVIEW SKILLS [8L]

The Interview process; Characteristics of the Interview- Planning, Purpose, Conversation, Two-way Interaction and Informality; Pre-interview Preparation Techniques-Self-analysis, Research the Organization, Job Analysis, Revise your Subject Knowledge, Develop the Interview File; Interview Questions- Types of Interview Questions, Answering Strategies; FAQs and Practice; Projecting a positive image; Alternative Interview formats.

#### Module 5: PROFESSIONAL WRITING SKILLS [8L]

Resumes -Resume Design, Parts of Resume, Resume style; Job Applications-opening, body, and closing; E-mail writing-Format, Standard E-mail practices and E-mail writing strategies; Report writing-nature and significance, types of reports, formats of reports; Proposals- types of Proposals,

structure of Formal Proposals, parts of a formal Proposals; Technical Articles-types of Technical Articles, Journal articles and Research papers-Review and Research Articles, Elements of Technical Articles and Writing Strategies.

### Reference Books

1. Ashraf Rizvi. M. *Effective Technical Communication*. McGraw-Hill: New Delhi: 2010
2. K. R. Lakshminarayanan, *Speak in English*, Scitech Publications, Chennai, 2009. Print.
3. Dr. Alex. K. Soft Skills: *Know yourself and Know the World*. S. Chand & Company Pvt. Ltd: New Delhi: 2014. Print.
4. Raman Meenakshi and Sangeeta Sharma. *Technical Communication: Principles and Practice*. Oxford University Press: New Delhi: 2007.Print.

### E-Resources

<https://www.skillsyouneed.com/ips/communication-skills.html>  
<https://www.skillsyouneed.com/presentation-skills.html>  
<https://www.coursera.org/articles/presentation-skills>  
<https://www.javatpoint.com/group-discussion>  
<https://hbr.org/1964/01/strategies-of-effective-interviewing>  
[https://en.wikipedia.org/wiki/Professional\\_writing](https://en.wikipedia.org/wiki/Professional_writing)

### Course Outcomes

At the end of the course, the student will be able to:

**CO1.** Learn the importance of communication skills.

**CO2.** Understand how to give the presentation.

**CO3.** Participate in GDs by applying appropriate speaking techniques.

**CO4.** Know the required skills to face interviews.

**CO5.** Write letters and resumes effectively by applying appropriate writing techniques.

**CO-PO/PSO Mapping**

|                                   |                                                                         |                                               |          |          |          |
|-----------------------------------|-------------------------------------------------------------------------|-----------------------------------------------|----------|----------|----------|
| <b>AY2020-21<br/>onwards</b>      | <b>J.B.Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AI &amp; ML<br/>IV Year– I Sem</b> |          |          |          |
| <b>Course<br/>Code:<br/>L41AA</b> | <b>REINFORCEMENT LEARNING</b>                                           | <b>L</b>                                      | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits:3</b>                  |                                                                         | <b>3</b>                                      | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites:** Maths for Machine Learning, Deep Learning.

**Course objectives:**

**The Student will:**

1. Learn about Basics of Reinforcement Learning
2. Achieve knowledge in Tabular based solutions.
3. Expand their knowledge in Function approximation solutions.
4. Familiar with Model based Reinforcement Learning.
5. Realize the Meta learning.

#### **Module 1: Introduction to RL:**

RL task formulation - action space, state space, environment definition

#### **Module 2: Tabular based solutions:**

Tabular based solutions - dynamic programming, Monte Carlo, temporal-difference

#### **Module 3: Function approximation solutions**

Function approximation solutions - Deep Q-networks, Policy gradient from basic –REINFORCE, towards advanced topics - proximal policy optimization, deep deterministic policy gradient, etc.

#### **Module 4: Model-based reinforcement learning**

Model-based reinforcement learning, Imitation learning - behavioral cloning, inverse RL, generative adversarial imitation learning.

#### **Module 5: Meta-learning**

Meta-learning, Multi-agent learning, partial observable environments

#### **Text Books:**

1. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An introduction", Second Edition, MIT Press, 2019
2. Li, Yuxi. "Deep reinforcement learning." arXiv preprint arXiv:1810.06339 (2018).
3. Wiering, Marco, and Martijn Van Otterlo. "Reinforcement learning." Adaptation, learning, and optimization 12 (2012): 3.

#### **Reference Books:**

1. Russell, Stuart J., and Peter Norvig. "Artificial intelligence: a modern approach." Pearson Education Limited, 2016.
2. Goodfellow, Ian, YoshuaBengio, and Aaron Courville. "Deep learning." MIT press, 2016.
3. David Silver's course on Reinforcement Learning (link)

**E-Resources:**

1. <https://www.geeksforgeeks.org/what-is-reinforcement-learning/>
2. [https://en.wikipedia.org/wiki/Reinforcement\\_learning](https://en.wikipedia.org/wiki/Reinforcement_learning)
3. <https://www.javatpoint.com/reinforcement-learning>
4. <https://deepsense.ai/what-is-reinforcement-learning-the-complete-guide/>

**Course outcomes:**

**The Student will be able to:**

1. Design Reinforcement Learning concepts for solving different types of problems.
2. Identify Tabular based solutions for cracking glitches.
3. Apply Function approximation solutions for resolving complications.
4. Implement Model based Reinforcement Learning to unravel variety of issues.
5. Apply Meta learning to work out distinctive varieties of setbacks.

|                               |                                                                           |                                                |          |          |          |
|-------------------------------|---------------------------------------------------------------------------|------------------------------------------------|----------|----------|----------|
| <b>AY 2022-23 onwards</b>     | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AI &amp; ML<br/>IV Year – I Sem</b> |          |          |          |
| <b>Course Code:<br/>L415B</b> | <b>COMPUTER VISION</b>                                                    | <b>L</b>                                       | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>             |                                                                           | <b>3</b>                                       | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites:** Python, Machine Learning, Digital Image Processing.

**Course objectives:**

**The student will:**

1. To review image processing techniques for computer vision.
2. To understand shape and region analysis.
3. To understand Hough Transform and its applications to detect lines, circles, ellipses.
4. To understand three-dimensional image analysis techniques.
5. To understand motion analysis and study some applications of computer vision algorithms.

**MODULE I IMAGE PROCESSING FOUNDATIONS**

Review of image processing techniques – classical filtering operations – thresholding techniques

Edge detection techniques – corner and interest point detection – mathematical morphology – texture.

**MODULE II SHAPES AND REGIONS**

Binary shape analysis – connectedness – object labelling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition

Centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments.

**MODULE III HOUGH TRANSFORM**

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – Random sample consensus(RANSAC) for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection

Case study: Human Iris location – hole detection – Generalized Hough Transform (GHT) – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation.

**MODULE IV 3D VISION AND MOTION**

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape

from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations

3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – spline-based motion – optical flow – layered motion.

## **MODULE**

## **V**

## **APPLICATIONS**

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion

combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.

### **Text Books:**

1. E. R. Davies, —Computer & Machine Vision, Fourth Edition, Academic Press, 2012.
2. Mark Nixon and Alberto S. Aquado, —Feature Extraction & Image Processing for Computer Vision, Third Edition, Academic Press, 2012.
3. R. Szeliski, —Computer Vision: Algorithms and Applications, Springer 2011.
4. Simon J. D. Prince, —Computer Vision: Models, Learning, and Inference, Cambridge University Press, 2012.

### **Reference Book:**

1. D. L. Baggio et al., —Mastering OpenCV with Practical Computer Vision Projects, Packt Publishing, 2012.
2. Jan Erik Solem, —Programming Computer Vision with Python: Tools and algorithms for analyzing images, O'Reilly Media, 2012.

### **Course outcomes:**

#### **The student will be able to:**

1. Implement fundamental image processing techniques required for computer vision.
2. Synthesize shape analysis and Implement boundary tracking techniques.
3. Apply chain codes and other region descriptors.
4. Apply Hough Transform for line, circle, ellipse detections and 3D vision techniques.
5. Implement motion related techniques and applications using computer vision techniques.

|                                   |                                                                         |                                               |          |          |          |
|-----------------------------------|-------------------------------------------------------------------------|-----------------------------------------------|----------|----------|----------|
| <b>AY 2022-23<br/>onwards</b>     | <b>J.B.Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AI &amp; ML<br/>IV Year– I Sem</b> |          |          |          |
| <b>Course<br/>Code:<br/>L41A1</b> | <b>REINFORCEMENT LEARNING LAB</b>                                       | <b>L</b>                                      | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 2</b>                 |                                                                         | <b>0</b>                                      | <b>0</b> | <b>4</b> | <b>0</b> |

**Pre-Requisites:** Knowledge on Machine Learning & Deep Learning.

**Course objectives:**

**The Student will:**

1. Learn about Basics of Reinforcement Learning.
2. Achieve knowledge in Reinforcement Learning.
3. Expand their knowledge in Reinforcement Learning.
4. Familiar with Automatic Parking Policies.
5. Realize the Automatic Parking Policies.

#### **Experiment1:**

Write a short summary, in words, of the strategy that you used? Did you notice anything about the task? How do you think the rewards were generated?

#### **Experiment2:**

Using your own data (see above) inspect the data frame. What do you think the columns mean? Write a short markdown cell which summarizes it for you for future reference.

#### **Experiment3:**

Make a plot of the reward values from automatic parking policies over time. These are stored in the columns called 'reward0' and so on.

#### **Experiment4:**

Make a plot of the best resp for each trial of the task.

#### **Experiment5:**

Make a plot showing if you choose the reward "maximizing" column on each trial of the experiment. This a 0/1 column labeled 'max'. You could also create this column by checking if the chosen option (choice) is the maximum of the reward0, reward1, etc..columns(they should be about the same).



### Experiment 6:

Create a "smooth" version of the plots you made in the previous step. Adjust the window until you feel you can see the main trends in the data. What can you see? What do you know now about the design of the experiment?

### Experiment7:

Based on the way we analyzed the behavior of the Random Agent, make a similar plot for the Smarter Agent. How does it do? Why do you think the outputs look like they do? Write a few sentences describing your observations.

### Experiment8:

Below I provided a template for a Smarter Exploring Agent. This agent is similar to the one above but I have deleted the choose function and will ask you to implement that decision rule. Your code should use the parameter epsilon to decide to either choose randomly (see Random Agent) or choose the best option with the highest average reward (like Smarter Agent). After you implement it run it on the problem and see how it does. Remember you will need to provide the epsilon parameter to the choose() function in your code. You should make this number relatively small (like 0.01) but you can play with different numbers.

```
Class Smarter Exploring Agent():
```

```
def __init__(self, k):
 self.num_actions = k
 self.reward_history = [[0], [0], [0], [0]]
pass
```

```
def choose(self, epsilon):
```

```
pass
```

```
def learn(self, reward, action): # this agent doesn't learn
 self.reward_history[action].append(reward)
```

### Experiment 9:

Before we continue, let's get a little more experience with the prediction error. If you get a reward of 1, and the Q value is .6 (this is what you expect). Is this a positive or negative prediction error? What is the value of the prediction error?

### Experiment10:

Below I provided a template for a Smarter Exploring Incremental Agent. You should first implement the learn function. I have provided the first bit of code to help you update the value of the chosen q\_value. This should be 1 line of code and you are just putting the variables together like in the equation ( $self.q\_values[action] = Q(s,a)$  in the equation, reward is r, and alpha is the alpha). Next you have to adapt the choice function from above to use the q-values.

```
class SmarterExploringIncrementalAgent():
```

```
def __init__(self, k):
 self.num_actions = k
```

```

self.q_values = np.zeros(4)
pass

def choose(self, epsilon):
 # modify your choice rule from the previous agent to use the q_values
 pass

def learn(self, reward, action, alpha): # this agent doesn't learn
 # replace this line here with the q-learning equation
 self.q_values[action] = reward

```

### **Case Study Experiment:**

#### **Experiment11:**

Copy the code from above to apply this agent to the task and evaluate its performance. How does it do? How does learning change when you move around the learning rate? What happens when the learning rate is 0? What happens when the learning rate (alpha) is 1? What about as it approaches 0 or 1?

#### **Experiment 12:**

You created a bunch of agents in this exercise, each trying to be more and more similar to humans. What aspect do you think these agents still lack compared to the way you solved the problem?

#### **Experiment 13:**

The Automatic Parking Policies: In this lab you will begin by running yourself in a simple automatic parking policies experiment to see how you approach the task. Then we will attempt to model our data using some simple reinforcement learning models.

### **Software And Hardware Requirements:**

- SOFTWARE: Python pre-installed, Anaconda Navigator with all python libraries, Online Google collab.
- HARDWARE: Desktop Computers with 4 GB RAM, Minimum 80 GB Hard disk with Windows System.

### **Course outcomes:**

#### **The Student will be able to:**

1. Identify the Reinforcement Learning concepts for solving different types of problems.
2. Design Tabular based solutions for cracking glitches.
3. Apply Function approximation solutions for resolving complications.
4. Implement the Model based Reinforcement Learning to unravel variety of issues.
5. Assess Meta learning concepts to work out distinctive varieties of setbacks

|                                   |                                                                          |                                               |          |          |          |
|-----------------------------------|--------------------------------------------------------------------------|-----------------------------------------------|----------|----------|----------|
| <b>AY 2022-23<br/>onwards</b>     | <b>J.B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AI &amp; ML<br/>IV Year– I Sem</b> |          |          |          |
| <b>Course<br/>Code:<br/>L4156</b> | <b>COMPUTER VISION LAB</b>                                               | <b>L</b>                                      | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 2</b>                 |                                                                          | <b>0</b>                                      | <b>0</b> | <b>4</b> | <b>0</b> |

### Pre-Requisites:

1. Math: Linear Algebra, Calculus, Probability and Statistics
2. Data Structures
3. Python Programming

### Course objectives:

#### The student will:

1. Review image processing techniques for computer vision.
2. Understand image rotation, translation, and segmentation.
3. Understand the application of edge detection algorithms.
4. Understand Hough Transform and its applications to detect lines, circles, ellipses.
5. Understand the application of face detection and face recognition in computer vision tasks.

### Lab Experiments:

1. Write a code to read, write and to display images in python
2. Write a code to change colour spaces of the input image in python
3. Write a code to implement various interpolation and down sampling methods to resize the given input image using OpenCV in python
4. Write a code to implement various image rotation and translation schemes for the given input image using OpenCV in python
5. Implement the following functionalities using OpenCV a) Simple Image Thresholding b) Adaptive thresholding
6. Implement watershed algorithm for image segmentation using OpenCV in python
7. Implement bitwise operations on the given input image using OpenCV in Python
8. Implement Canny Edge detection in python
9. Implement Gaussian Filter using OpenCV in python to blur the given input image

10. Identify the contours in the given input image using OpenCV in Python
11. Implement Hough Transform for line detection in the given input image using OpenCV in python
12. Implement Random sample consensus (RANSAC) for straight line detection in the given input image using OpenCV in python
13. Implement Generalized Hough Transform to identify the circles or ellipses in the input image using OpenCV in python
14. Implement a python code to detect a face from the given input image using OpenCV
15. Implement a python code to recognize face with eigenfaces through Principal Component Analysis (PCA)

**Course outcomes:**

**The student will be able to:**

6. Implement fundamental image processing techniques required for computer vision.
7. Perform Image rotation, translation, segmentation
8. Apply state of art algorithms for edge detection in images.
9. Apply Hough Transform for line, circle, ellipse detections.
10. Implement a system to detect face and recognize the face using PCA.

|                               |                                                                                                          |                                                |          |          |          |
|-------------------------------|----------------------------------------------------------------------------------------------------------|------------------------------------------------|----------|----------|----------|
| <b>AY 2022-23 onwards</b>     | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b>                                | <b>B.Tech: AI &amp; ML<br/>IV Year – I Sem</b> |          |          |          |
| <b>Course Code:<br/>L41M6</b> | <b>FREE AND OPEN SOURCE SOFTWARES<br/>(Mandatory Course - V)</b><br>(Common to AI&ML, AI&DS, CSE(AI&ML)) | <b>L</b>                                       | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 0</b>             |                                                                                                          | <b>2</b>                                       | <b>0</b> | <b>0</b> | <b>0</b> |

### **Course objectives:**

#### **The student will:**

1. Be exposed to the context and operation of free and open source software (FOSS) communities and associated software projects.
2. Be familiar with participating in a FOSS project
3. Learn scripting language like Python or Perl
4. Learn programming language like Ruby
5. Learn some important FOSS tools and techniques

### **MODULE I PHILOSOPHY**

Notion of Community--Guidelines for effectively working with FOSS community--, Benefits of Community based Software Development --Requirements for being open, free software, open source software –Four degrees of freedom - FOSS Licensing Models - FOSS Licenses – GPL-AGPL-LGPL - FDL - Implications – FOSS examples.

### **MODULE II LINUX**

Linux Installation and Hardware Configuration – Boot Process-The Linux Loader (LILO) - The Grand Unified Bootloader (GRUB) - Dual-Booting Linux and other Operating System - Boot-Time Kernel Options- X Windows System Configuration-System Administration – Backup and Restore Procedures- Strategies for keeping a Secure Server.

### **MODULE III PROGRAMMING LANGUAGES**

Programming using languages like Python or Perl or Ruby

### **MODULE IV PROGRAMMING TOOLS AND TECHNIQUES**

Usage of design Tools like Argo UML or equivalent, Version Control Systems like Git or equivalent, – Bug Tracking Systems- Package Management Systems

### **MODULE V FOSS CASE STUDIES**

Open Source Software Development - Case Study – Libreoffice -Samba

**TEXT BOOK:**

1. Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, “Linux in a Nutshell”, Sixth Edition, OReilly Media, 2009.

**REFERENCES:**

1. Philosophy of GNU URL: <http://www.gnu.org/philosophy/>.
2. Linux Administration URL: <http://www.tldp.org/LDP/lame/LAME/linux-admin-made-easy/>.
3. The Python Tutorial available at <http://docs.python.org/2/tutorial/>.
4. Perl Programming book at <http://www.perl.org/books/beginning-perl/>.
5. Ruby programming book at <http://ruby-doc.com/docs/ProgrammingRuby/>.
6. Version control system URL: <http://git-scm.com/>.
7. Samba: URL : <http://www.samba.org/>.
8. Libre office: <http://www.libreoffice.org/>.

**Course Outcomes:**

The student will be able to

1. Install and run open-source operating systems.
2. Gather information about Free and Open Source Software projects from software releases and from sites on the internet.
3. Build and modify one or more Free and Open Source Software packages.
4. Use a version control system.
5. Contribute software to and interact with Free and Open Source Software development projects.

|                               |                                                                                                      |                                                 |          |          |          |
|-------------------------------|------------------------------------------------------------------------------------------------------|-------------------------------------------------|----------|----------|----------|
| <b>AY 2022-23<br/>onwards</b> | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b>                            | <b>B.Tech: AI &amp; ML<br/>III Year – I Sem</b> |          |          |          |
| <b>Course Code:<br/>L315E</b> | <b>NO SQL DATABASE<br/>(Professional Elective Course - I)<br/>(Common to AI &amp; ML, AI&amp;DS)</b> | <b>L</b>                                        | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>             |                                                                                                      | <b>3</b>                                        | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-requisites:** Basic Knowledge about DBMS

**Course Objectives:**

CO1 : Explore the emergence, requirements and benefits of a NoSQL database

CO2 : Understand the basic architecture and data models of a NoSQL database

CO3: Understand Key/value NoSQL database using MongoDB

CO4: Understand Column-oriented NoSQL database

CO5 : Understand Key/Value NoSQL database using Riak

## MODULE-I

Overview and History of NoSQL Databases. Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL Key Points.

## MODULE-II

Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column - Family Stores, Aggregate-Oriented Databases. Replication and sharding, MapReduce on databases. Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication.

## MODULE-III

NoSQL Key/Value databases using MongoDB, Document Databases, Document oriented Database Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable UseCases, EventLogging, Content Management Systems, Blogging Platforms, WebAnalytics or Real-Time Analytics, E-Commerce Applications, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.

## MODULE-IV

Column-oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, Column-Family Data Store Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage.

## MODULE-V

NoSQL Key/Value databases using Riak, Key-Value Databases, Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, Relationships among Data, Multioperation Transactions, Query by Data, Operations by Sets. Graph NoSQL databases using Neo4, NoSQL database development tools and programming languages, Graph Databases, Graph Database. Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases.

### TEXTBOOKS:

1. Sadalage, P.&Fowler, *NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence*, Wiley Publications, 1<sup>st</sup> Edition, 2019.

### WEBREFERENCES:

1. <https://www.ibm.com/cloud/learn/nosql-databases>
2. <https://www.coursera.org/lecture/nosql-databases/introduction-to-nosql-VdRNp>
3. <https://www.geeksforgeeks.org/introduction-to-nosql/>
4. <https://www.javatpoint.com/nosql-databa>

### Course Outcomes:

The student will be able to

1. Compare and contrast different types of NoSQL Databases
2. Categorize RDBMS with different NoSQL databases.
3. Implement the architecture and its performance tuning of Document-oriented NoSQL databases.
4. Evaluate performance of Key-Value Pair NoSQL databases.
5. Apply NoSQL development tools on different types of NoSQL Databases.



|                               |                                                                           |                                                 |          |          |          |
|-------------------------------|---------------------------------------------------------------------------|-------------------------------------------------|----------|----------|----------|
| <b>AY 2022-23 onwards</b>     | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AI &amp; ML<br/>III Year – I Sem</b> |          |          |          |
| <b>Course Code:<br/>L315E</b> | <b>CLOUD COMPUTING<br/>(Professional Elective Course - I)</b>             | <b>L</b>                                        | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>             |                                                                           | <b>3</b>                                        | <b>0</b> | <b>0</b> | <b>0</b> |

#### **Pre-Requisites:**

1. A course on "Computer Networks".
2. A course on "Operating Systems".
3. A course on "Data base management 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:**

Principles of Parallel and Distributed Computing, Introduction to cloud computing, Cloud computing Architecture, cloud concepts and technologies, cloud services and platforms, Cloud models, cloud as a service, cloud solutions, cloud offerings, introduction to Hadoop and Mapreduce.

#### **Module 2:**

Cloud Platforms in the Industry, Understanding Scientific Applications for Cloud Environments, cloud applications.

Healthcare and education, Scientific Applications, Business and Consumer Applications.

#### **Module 3:**

Virtualization, cloud virtualization technology, deep dive: cloud virtualization, migrating in to cloud computing.

Virtual Machines Provisioning and Virtual Machine Migration Services, On the Management of Virtual Machines for cloud Infrastructure, Comet cloud, T-Systems.

**Module 4:**

Enterprise cloud computing Paradigm, Federated cloud computing Architecture, SLA Management in Cloud Computing, Developing the cloud: cloud application Design.

**Module 5:**

Cloud management, Organizational Readiness and change management in the cloud age, Cloud Security, Data security in the cloud, Legal Issues in the Cloud , Achieving Production Readiness for the cloud Services.

**Text Books:**

1. Cloud Computing: Raj Kumar Buyya , James Broberg, andrzej Goscinski, 2013 Wiley.
2. Cloud computing: Dr Kumar Saurab Wiley India 2011.

**Reference Books:**

1. Cloud Computing: Arshdeep Bahga, 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. Prioritize various marketing strategies for an online business.
5. Justify the infrastructure and multimedia concepts.

|                               |                                                                           |                                                 |          |          |          |
|-------------------------------|---------------------------------------------------------------------------|-------------------------------------------------|----------|----------|----------|
| <b>AY 2022-23<br/>onwards</b> | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AI &amp; ML<br/>III Year – I Sem</b> |          |          |          |
| <b>Course Code:<br/>L3151</b> | <b>DESIGN THINKING<br/>(Professional Elective-I)</b>                      | <b>L</b>                                        | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>             |                                                                           | <b>3</b>                                        | <b>0</b> | <b>0</b> | <b>0</b> |

### **Prerequisites**

Nil

### **Course Objectives**

1. Expose students to the design process as a tool for innovation.
2. Develop students' professional skills in client management and communication.
3. Demonstrate the value of developing a local network and assist students in making lasting connections with the business community.
4. Students develop a portfolio of work to set them apart in the job market.
5. Provide an authentic Module for students to develop teamwork and leadership skills.

### **UNIT -I Introduction to Design Thinking and Design Process**

Intro to Design Thinking and Product Design, Creativity and Creative Confidence, Creative Techniques for Design Thinking, Design Thinking and Systems Thinking, Iterative properties of Design Thinking.

Design Process, Tools of persona, Journey Map and Empathy Map and Other Design Mapping tools, Design Thinking process planning, Divergent and Convergent Phases. Introduction to Synthesis phase of Design.

### **UNIT-II Empathy: Identification of Real Requirement**

Identifying insights and opportunities) of Product, How might we help and its iterations, Challenge findings, Identifying Target audience and its real needs.

Role of Leadership in Design Thinking, Feedback, visualizing ideas, Storytelling: Techniques and importance. Seen, perceived, thought, acted equilibrium.

### **UNIT -III Ideation**

Divergent phase of Ideation, Brain Storming, Various Brain storming Techniques, Tools for idea generation, TRIZ, SCAMPER, Case Study on Ideation.

Convergent phase of selection of few ideas for Prototype. Analysis for selection, Business Model Canvas for project.

## **UNIT -IV Prototype**

Low Fidelity Prototype, Low fidelity techniques, Feedback collection process and iterative improvement, advantages, and disadvantages of low fidelity prototyping. Low Fidelity prototype in UI/UX design, Wireframe modelling.

High Fidelity Prototype, Cost vs benefit analysis for High Fidelity Prototype, Why High Fidelity prototype is not preferred, Use areas of high-Fidelity prototype, Product Launch process.

## **UNIT -V Test and Implementation**

Final Test Process, Test tools, Prelaunch, Limited Launch and Actual Launch Process. Feedback generation at Pre-launch and Limited Launch. Post implementation iterations.

### **Textbooks**

1. Design Thinking: Understanding How Designers Think and Work by Nigel Cross, Berg Publication 2011

2. Creative Confidence: Unleashing the Creative Potential Within Us, By David Kelly and Tom Kelly, William Collins, 2013

### **Reference Books**

1. Thinking Design by S. Balram, Sage Publication, 2011

2. Solving Problems with Design Thinking: Ten Stories of What Works by Jeanne Liedtka, Columbia Business School Publishing, 2013

### **Course Outcomes**

#### **The student will be able to:**

1. Construct a strong understanding of the Design Process using Journey Map, Empathy Map, and Persona and how it can be applied in a variety of business settings.
2. Invent the unique needs of a company around specific challenges performing research.
3. Compose building empathy for target audiences from different “cultures”.
4. Design and test innovative ideas through a rapid iteration cycle.
5. Create physical prototypes / a visual representation of an idea and test it.

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|-------------------------------|---------------------------------------------------------------------------|--------------------------------------------------|----------|----------|----------|
| <b>AY 2022-23<br/>onwards</b> | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AI &amp; ML<br/>III Year – II Sem</b> |          |          |          |
| <b>Course Code:<br/>L326L</b> | <b>INFORMATION RETRIEVAL SYSTEMS<br/>(Professional Elective – II)</b>     | <b>L</b>                                         | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>             |                                                                           | <b>3</b>                                         | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites:**

1. Database Management system, Probability and statistics.

**Course Objectives:**

**The Student will:**

1. Describe the domain of Information Retrieval is concerned with the extraction of relevant information from large collections of documents.
2. Select applications to proprietary retrieval systems as well as www, digital libraries and commercial recommendation systems.
3. Understand the main principles and methods underlying the domain of Information retrieval.
4. Discuss recent developments in IR such as collaborative filtering and Latent Semantic Indexing.
5. Know the concepts Multimedia Information Retrieval, Libraries.

**Module 1:**

**Introduction:** Definition, Objectives, Functional Overview, Relationship to DBMS, Digital libraries and Data Warehouses

**Information Retrieval System Capabilities** - Search, Browse, Miscellaneous.

**Module 2:**

**Cataloging and Indexing:** Objectives, Indexing Process, Automatic Indexing, Information Extraction,

**Data Structures:** Introduction, Stemming Algorithms, Inverted file structures, N-gram data structure, PAT data structure, Signature file structure, Hypertext data structure.

**Automatic Indexing:** Classes of automatic indexing, Statistical indexing, Natural language, Concept indexing, Hypertext linkages.

**Module 3:**

**Document and Term Clustering:** Introduction, Thesaurus generation, Item clustering, Hierarchy of clusters.

**User Search Techniques:** Search statements and binding, Similarity measures and ranking, Relevance feedback, Selective dissemination of information search, Weighted searches of Boolean systems, Searching the Internet and hypertext.

#### **Module 4:**

**Information Visualization:** Introduction, Cognition and perception, Information visualization technologies. **Text Search Algorithms-** Introduction, Software text search algorithms, Hardware text search systems.

**Information System Evaluation:** Introduction, Measures used in system evaluation, Measurement example – TREC results.

#### **Module 5:**

**Multimedia Information Retrieval – Models and Languages – Data Modeling, Query Languages, Indexing and Searching.**

**Libraries:** Libraries and Bibliographical systems, online IR system, OPACs, Digital Libraries.

#### **Text Books:**

1. Information Storage and Retrieval Systems: Theory and Implementation By Kowalski, Gerald, Mark T Maybury ,Springer.
2. Modern Information Retrieval By Ricardo Baeza-Yates, Pearson Education, 2007.
3. Information Retrieval: Algorithms and Heuristics By David A Grossman and Ophir Frieder, 2<sup>nd</sup> Edition, Springer.

#### **Reference Books:**

1. Information Retrieval Data Structures and Algorithms By William B Frakes, Ricardo Baeza-Yates, Pearson Education, 1992.
2. Information Storage & Retrieval By Robert Korfhage – John Wiley & Sons.
3. Introduction to Information Retrieval By Christopher D. Manning and Prabhakar Raghavan, Cambridge University Press, 2008.
4. Natural Language Processing and Information Retrieval, T. Siddiqui and U.S. Tiwary, Oxford Univ. Press.

#### **E - Resources:**

1. [https://AI & ML.iitkgp.sc.in/~pabitra/course/ir06/ir06.htm](https://AI&ML.iitkgp.sc.in/~pabitra/course/ir06/ir06.htm)
2. <https://www.coursera.org/courses?query=information%20retrieval>
3. <https://www.udemy.com/course/information-retrieval-and-mining-massive-data-sets/>
4. [https:// web.stanford.edu/class/cs276/](https://web.stanford.edu/class/cs276/)
5. [http://www.cs.ox.ac.uk/teaching/courses/2011-2012/information retrieval](http://www.cs.ox.ac.uk/teaching/courses/2011-2012/information%20retrieval)

**Course Outcomes:**

**At the end of the course, Student will be able to:**

1. Prioritize the different information retrieval techniques in various application areas.
2. Apply IR principles to locate relevant information large collections of data
3. Analyze performance of retrieval systems when dealing with unmanaged data sources
4. Synthesize various retrieval systems for web search tasks.
5. Identify the concepts of Multimedia Information Retrieval and Libraries.

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| <b>AY 2022-23<br/>onwards</b>     | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AI &amp; ML<br/>III Year – II Sem</b> |          |          |          |
| <b>Course<br/>Code:<br/>L325A</b> | <b>MOBILE COMPUTING<br/>(Professional Elective – II)</b>                  | <b>L</b>                                         | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>                 |                                                                           | <b>3</b>                                         | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites:**

1. Knowledge on computer networking.
2. Programming experience on mobile devices.

**Course objectives:**

**The Student will:**

1. Gain the knowledge the Global System for Mobile communication
2. Understand about the medium access control layer and multiplexing techniques
3. Describe the mobile IP and transport layer protocols
4. Understand about various kind of database issues
5. illustrate about routing algorithms

**Module 1:**

**GSM:** Mobile Services, System Architecture, Radio Interface, Protocols, Localization and Calling, Handover, Security, and New Data Services.

**Mobile computing (MC):** Introduction to MC, Novel Applications, Limitations and Architecture.

**Module 2:**

**(Wireless) Medium Access Control (MAC):**

Motivation for a Specialized MAC (Hidden and Exposed Terminals, Near and Far Terminals), SDMA, FDMA, TDMA, CDMA, MAC Protocols for GSM.

**Module 3:**

**Mobile IP Network Layer:**

IP and Mobile IP Network Layers, Packet Delivery and Handover Management, Registration, Tunneling and Encapsulation, Route Optimization, DHCP.



**Mobile Transport Layer:**

Conventional TCP/IP Protocols, Indirect TCP, Snooping TCP, Mobile TCP, Other Transport Layer Protocols for Mobile Networks.

**Module 4:****Database Issues:**

Database Hoarding & Caching Techniques, Client –Server Computing & Adaptation, Transactional Models, Query Processing, Data Recovery Process & QoS Issues.

**Data Dissemination and Synchronization:**

Communications Asymmetry Classification of Data Delivery Mechanisms , Data Dissemination Broadcast Models , Selective Tuning and Indexing Methods ,Digital Audio and Video Broadcasting (DAB & DVB).Data Synchronization –Introduction ,Software ,and Protocols.

**Module 5:****Mobile Ad hoc Networks (MANETs):**

Introduction, localization, MAC issues, Routing protocols, global state routing(GSR), Destination sequenced distance vector routing (DSDV), Dynamic source routing (DSR), Ad Hoc on demand distance vector routing (AODV), Temporary ordered routing algorithm (TORA), QoS in Ad Hoc Networks, Applications & Challenges of a MANET.

**Text Books:**

1. “Mobile Communications”, Jochen Schiller, Addison-Wesley, Second Edition, 2004
2. Stojmenovic and Cacute, “Handbook of Wireless Networks and Mobile Computing”, Wiley, 2002.

**E - Resources:**

1. [https://www.tutorialspoint.com/mobile\\_computing/index.htm](https://www.tutorialspoint.com/mobile_computing/index.htm)
2. <https://www.sciencedirect.com/topics/engineering/medium-access-control>
3. <https://docs.oracle.com/cd/E19455-01/806-7600/6jgfbep0v/index.html>
4. <http://www.psnacet.edu.in/courses/AI & ML/Mobilecomputing/Lecture9.pdf>
5. <http://www.faadooengineers.com/online-study/post/AI & ML/mobile-computing/185/database-hoarding>
6. <https://www.dauniv.ac.in/public/frontassets/coursematerial/mobilecomputing/MobileCompChap02DataDissSyncMobMgt.pdf>
7. <https://www.geeksforgeeks.org/introduction-of-mobile-ad-hoc-network-manet/>

**Course outcomes:****The Student will be able to:**

1. Analyze the basic concepts and principles in mobile computing on different platforms.
2. Categorize the structure and components for mobile IP, mobility management, and technologies for location-aware computing.
3. Identify positioning techniques and location-based services and applications.
4. Implement mobile applications to realize location-aware computing.
5. Design a system components and its processes as per needs and specification.

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| <b>AY 2022-23<br/>onwards</b>     | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b>          | <b>B.Tech: AI &amp; ML<br/>III Year – II Sem</b> |          |          |          |
| <b>Course<br/>Code:<br/>L326D</b> | <b>SOFTWARE ARCHITECTURE AND DESIGN<br/>PATTERN<br/>(Professional Elective-II)</b> | <b>L</b>                                         | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>                 |                                                                                    | <b>3</b>                                         | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites:** Nil

### **Course Objectives**

#### **The Student will:**

1. Understand that design patterns are standard solutions to common software design problems
2. Discuss to know how to use systematic approach that focus and describe that describe abstract systems of interaction between classes, objects and communication flow
3. Understand the architecture evaluation and design decision making
4. Understand how to apply these patterns on various platforms.
5. Understand the responsibilities for developing software.

#### **Module 1:**

Envisioning Architecture The Architecture Business Cycle, What is Software Architecture, Architectural patterns, reference models, reference architectures, architectural structures and views. Creating an Architecture Quality Attributes, Achieving qualities, Architectural styles and patterns, designing the Architecture, Documenting software architectures, Reconstructing Software Architecture.

#### **Module 2:**

Analyzing Architectures Architecture Evaluation, Architecture design decision making, ATAM, CBAM. Moving from one system to many Software Product Lines, Building systems from off the shelf components, Software architecture in future.

#### **Module 3:**

Patterns Pattern Description, Organizing catalogs, role in solving design problems, Selection and usage. Creational and Structural patterns Abstract factory, builder, factory method, prototype, singleton, adapter, bridge, composite, façade, fly weight.

#### **Module 4:**

Behavioural patterns Chain of responsibility, command, Interpreter, iterator, mediator, memento, observer, state, strategy, template method, visitor.

**Module 5:**

Case Studies A-7E –A case study in utilizing architectural structures, The World Wide Web -a case study in interoperability, Air Traffic Control –a case study in designing for high availability, Celsius Tech –a case study in product line development.

**Text books:**

1. Software Architecture in Practice, second edition, Len Bass, Paul Clements & Rick Kazman, Pearson Education, 2003.
2. Design Patterns, Erich Gamma, Pearson Education, 1995.

**Reference books:**

1. Architecture in Practice, Len Bass, Paul Clements, Rick Kazman.
2. Software Documenting Software Architectures: Views and Beyond Paul Clements, Felix Bachmann, Len Bass, David Garlen, James Ivers, Reed Little, Robert Nord, Judith Stafford.

**E - Resources:**

1. [http://en.wikibooks.org/wiki/Introduction\\_to\\_Software\\_Engineering/Architecture/Design\\_Patterns](http://en.wikibooks.org/wiki/Introduction_to_Software_Engineering/Architecture/Design_Patterns).

**Course Outcomes****The student will be able to:**

1. Apply a deeper knowledge of the principles of Object Oriented Design.
2. Identify Design patterns that are common in software applications.
3. Illustrate various patterns that are related to object –oriented design.
4. Analyze various architectural patterns.
5. Predict the various architectural patterns for developing a software.

|                               |                                                                           |                                                |          |          |          |
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| <b>AY 2022-23<br/>onwards</b> | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AI&amp;ML<br/>III Year – II Sem</b> |          |          |          |
| <b>Course Code:<br/>L32DE</b> | <b>BIG DATA ANALYTICS<br/>(Professional Elective – III)</b>               | <b>L</b>                                       | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>             |                                                                           | <b>3</b>                                       | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites:**

1. 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 HDFS File system
4. Differentiate between Hadoop and RDBMS concepts
5. Apply analytics on Structured and Unstructured Data.

**Module 1:**

**Big Data Analytics:** What is big data, History of Data Management ; Structuring Big Data ; Elements of Big Data ; Big Data Analytics; Distributed and Parallel Computing for Big Data;

**Big Data Analytics:** What is Big 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 Big Data Analytics Important; Data Science; Data Scientist; Terminologies used in Big Data Environments; Basically Available Soft State Eventual Consistency (BASE); Open source Analytics Tools

**Module 2:**

**Understanding Analytics and Big Data:** Comparing Reporting and Analysis, Types of Analytics; Points to Consider during Analysis; Developing an Analytic Team; Understanding Text Analytics;

**Analytical Approach and Tools to Analyze Data:** Analytical Approaches; History of Analytical Tools; Introducing Popular Analytical Tools; Comparing Various Analytical Tools.

### Module 3:

**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

**Introduction of HDFS:** Architecture, HDFS Files, File system types, commands, org.apache.hadoop.io package, HDFS, 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:

**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;

**HDFS (Hadoop Distributed File System):** HDFS Daemons, read,write, Replica Processing of Data with Hadoop; Managing Resources and Applications with Hadoop YARN

### Module 5:

**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;

**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 and ANALYTICS, Seema Acharya, Subhasinin Chellappan, Wiley publications.
2. BIG DATA, Black Book™ , DreamTech Press, 2015 Edition.
3. 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. Yuli Vasiliev, " 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](https://www.tutorialspoint.com/big_data_analytics/index.htm)
3. [www.upgrad.com/Big-Data](http://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. Recommend Big Data analytics Tools and its Approaches.
3. Identify Map Reduce fundamentals and HDFS Architecture.
4. Compare and Contrast Hadoop and RDBMS concepts.
5. Illustrate analytics on Structured and Unstructured Data.

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| <b>AY 2022-23<br/>onwards</b> | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AI &amp; ML<br/>III Year – II Sem</b> |          |          |          |
| <b>Course Code:<br/>L325K</b> | <b>ANDROID APPLICATION DEVELOPMENT<br/>(Professional Elective-III)</b>    | <b>L</b>                                         | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>             |                                                                           | <b>3</b>                                         | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites:**

1. Programming language JAVA.
2. Knowledge on SQL.
3. Knowledge on XML

**Course objectives:**

**The Student will:**

1. Understand Android platform and its architecture.
2. Learn activity creation and Android UI designing.
3. Familiarize with Intent, Broadcast receivers and Internet services.
4. Know how to work with SQLite Database and content providers.
5. Integrate multimedia, camera and Location based services in Android Application.

**Module 1:**

**Introduction to Android Operating System:** Android OS design and Features–Android development framework, SDK features, Installing and running applications on Eclipse platform, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools

**Android application components** – Android Manifest file, externalizing resources like values, themes, layouts, Menus etc, Resources for different devices and languages, Runtime Configuration Changes Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes

**Module 2:**

**Android User Interface:** Measurements–Device and pixel density independent measuring units Layouts–Linear, Relative, Grid and Table Layouts User Interface (UI) Components – Editable and non-editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers



**Event Handling** – Handling clicks or changes of various UI components  
**Fragments** – Creating fragments, Lifecycle of fragments, Fragment states, adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities.

### **Module 3:**

**Intents and Broadcasts:** Intent–Using intents to launch Activities, explicitly starting new Activity, Implicit Intents, passing data to Intents, getting results from Activities, Native Actions, using Intent to dial a number or to send SMS

**Broadcast Receivers** – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity, Notifications – Creating and Displaying notifications, Displaying Toasts

### **Module 4:**

**Persistent Storage:** Files–Using application specific folders and files, creating files, reading data from files, listing contents of a directory  
Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference

**Database** – Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and deleting data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update).

### **Module 5:**

**Advanced Topics:** Alarms–Creating and using alarms  
Using Internet Resources – Connecting to internet resource, using download manager

**Location Based Services** – Finding Current Location and showing location on the Map, updating location

### **Text Books:**

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox), 2012
2. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013

**Reference Books:**

1. Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013

**Course Outcomes:**

The students will be able to:

1. Identify the basic features of Android Platform and its application components.
2. Design concepts of user interface and event handling mechanisms.
3. Create and use broadcast activities for Android Application.
4. Create and use databases for Android Application
5. Implement Location based services in Android and Deploy mobile applications in various marketplaces for distribution.

|                               |                                                                                            |                                                  |          |          |          |
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| <b>AY 2022-23<br/>onwards</b> | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b>                  | <b>B.Tech: AI &amp; ML<br/>III Year – II Sem</b> |          |          |          |
| <b>Course Code:<br/>L32AB</b> | <b>UI/UX DESIGN<br/>(Professional Elective-III)<br/>(Common to AI &amp; ML, AI&amp;DS)</b> | <b>L</b>                                         | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>             |                                                                                            | <b>3</b>                                         | <b>0</b> | <b>0</b> | <b>0</b> |

### Prerequisites

Research, Collaboration, Wireframing and prototyping, writing, Visual communication, User empathy, Interaction design, Coding, Analytics and Communication skills.

### Course objectives:

The Student will:

1. Plunge into the global innovation as a systematic process of involving in relevant design.
2. Implement technologies and process space for the discovery of innovation confronts and contend with the design of creative solutions such as, an innovation new ventures, value propositions, new products or services.
3. Make use of a practical approach to this UX process will facilitate the student in the drafting, conception and early advancement of a UX process for responsive website for Mobile and its challenge that is a critical input for this innovative course.
4. Augment their foresight and insight influences in the process of UX process for responsive website identification/creation opportunity.
5. Realize UI process for responsive website for Mobile and its innovative design of an original and feasible value proposition aligned with relevant markets by the adoption/adaptation of new technologies to streamline key processes or to sort out established markets or the competitive landscape collaborating with a growth trajectory or growth platform by Android & iOS Mobile App Design.

### Unit 1: Design:

Fundamentals of Design - Principles of Design - Visual Communication Empathy & User Study - Ethnography & People Design - Service Design - Design Thinking - Information & Data Study

### Unit 2: Technologies & Process:

UI Design - Interaction Design - Design for Rural India - Design for Futuristic Technologies - Imagin 6D UX Process

### Unit 3: UX process:

UX process for responsive website for Mobile - Stakeholder Interview, User Research, Competitor Analysis, Customer Journey, Creating User Personas, Making Empathy Map, Information Architecture, User Flowchart & User Journey by making low fidelity wireframes - usability testing for your App

**Unit 4: Redesign process:**

Heuristic Usability & complete UX process for responsive website optimized for Mobile, Tab & Desktop - redesign process using Figma

**Unit 5: UI process:**

UI process for responsive website for Mobile - Platform guidelines for Android & iOS Mobile App Design - Prototypes with medium & High fidelity - Portfolio Website - UI/UX Design Tools.

**References:**

1. A Project Guide to UX Design: for user experience designers in the field or in the making, Carolyn Chandler, 2012
2. Smashing UX Design: Foundations for Designing Online User Experiences, James Chudley and Jesmond Allen, 2012
3. Universal Principles of Design, William Lidwell, Jill Butler, and Kritina Holden, Rockport, 2003
4. UX Research: practical techniques for designing better products, Brad Nunnally, David Farkas, 2016
5. Measuring the User Experience: collecting, analyzing, and presenting usability metrics, Thomas Tullis, William Albert, 2013.
6. Just enough research, Erika Hall, 2013
7. The Design of Everyday Things, Don Norman, 2013.
8. The Mom Test: how to talk to customers & learn if your business is a good idea when everyone is lying to you, Rob Fitzpatrick, 2016
9. Don't Make Me Think, Steve Krug, ISBN: 0321344758
10. The Elements of User Experience: User-Centered Design for the Web, Jesse James Garret, ISBN: 0735712026
11. Designing for the Digital Age, by Kim Goodwin, ISBN: 0470229101
12. Clout: The Art and Science of Influential Web Content, Colleen Jones, ISBN: 0321733010
13. Usability Engineering: Process, Products, and Examples, Laura Leventhal and Julie Barnes, ISBN: 0131570080
14. Interaction Design: Beyond Human - Computer Interaction (3rd edition), Yvonne Rogers, Helen Sharp, and Jenny Preece, ISBN: 0470665769

## E - Resources:

1. <https://course.ccs.neu.edu/cs5500sp17/09-UX.pdf>
2. <https://careerfoundry.com/en/blog/ux-design/the-difference-between-ux-and-ui-design-a-laymans-guide/>
3. <https://www.freecodecamp.org/news/ui-ux-design-guide/>
4. <https://aufaitux.com/blog/ui-ux-design-process/>
5. <https://www.fahmpartners.com/5-benefits-of-integrating-ui-ux-design-to-your-process/>
6. <https://webflow.com/blog/ui-ux-design-tools>
7. <https://xd.adobe.com/ideas/guides/ux-design-process-steps/#:~:text=The%20UX%20design%20process%20consists,analysis%2C%20design%2C%20and%20validation.>
8. <https://uxplanet.org/user-experience-design-process-d91df1a45916>
9. <https://www.netsolutions.com/insights/user-experience-design-process/>
10. <https://maze.co/collections/ux-ui-design/ux-design-process/>
11. <https://www.invisionapp.com/inside-design/6-stages-ux-process/>
12. <https://uxplanet.org/the-ux-redesign-process-688b4ee0d975>
13. <https://uxdesign.cc/how-to-redesign-step-by-step-guide-869379604734>
14. <https://careerfoundry.com/en/blog/ux-design/how-to-conduct-a-ux-redesign/>
15. <https://www.justinmind.com/blog/website-redesign-process-a-uxers-survival-guide/>
16. <https://spdload.com/blog/how-to-redesign-an-app-or-a-website-ux/>
17. <https://uxmag.com/articles/how-to-redesign-an-app-when-to-do-it-and-what-to-start-with>
18. <https://www.cronj.com/blog/user-interface-ui-design-process-in-graphic-design/>
19. <https://www.altexsoft.com/blog/uxdesign/ux-vs-ui-design-stages-participants-roles-and-skills/>
20. <https://maze.co/collections/ux-ui-design/ui-design/>

## Course Outcomes:

### The Student will be able to:

1. Analyze the Design concepts and principles.
2. Implement the methods, processes, technologies and tools of Design and Innovation.
3. Apply the UX process Design and Innovation approaches and models to real world situations.
4. Evaluate the role of primary and secondary research in the discovery stage of UX process Design and Innovation that includes responsive website optimized for Mobile, Tab & Desktop as well.
5. Synthesize endeavors of the UI process Design and Innovation approaches and models in evolving and leading with accomplishment

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| <b>AY 2022-23 onwards</b>     | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B. Tech: AI&amp;ML<br/>IV Year - I Sem</b> |          |          |          |
| <b>Course Code:<br/>L41AE</b> | <b>PREDICTIVE ANALYTICS<br/>(Professional Elective IV)</b>                | <b>L</b>                                      | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>             |                                                                           | <b>3</b>                                      | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites:**

Data mining, Machine Learning

**Course objectives:**

**The student will:**

1. Know the basics of predictive analytics and summarize Data, Categorize Models, and techniques
2. Know about the Decision tree, Support Vector Machine for Data Classification
3. Describe Methods such as Naïve Bayes Markov Model, Linear Regression, Neural Networks to Boost Prediction Accuracy for Data Classification.
4. Study the predictive models for various Real-Time Applications.
5. Study the Analysis and Visualized predictive Model's results using Data Visualization tools.

**Module 1:**

**INTRODUCTION TO PREDICTIVE ANALYTICS**

Introduction – Predictive Analytics in the Wild – Exploring Data types and associated Techniques - Complexities of data - Applying Models: Models and simulation, Categorizing Models, Describing, summarizing data, and decisions – Identify similarities in Data: Data Clustering, converting Raw Data into a Matrix, Identify K-groups in Data.

**Module 2:**

**DATA CLASSIFICATION – PART I**

Background – Exploring Data classification process - Using Data Classification to predict the future: Decision tree, Algorithm for generating Decision Trees, Support Vector Machine.

**Module 3:**

**DATA CLASSIFICATION – PART II**

Ensemble Methods to Boost Prediction Accuracy: Naïve Bayes Classification Algorithm, The Markov Model, Linear Regression, Neural Networks – Deep learning.

#### **Module 4:**

##### **DATA PREPARATION AND MODELLING**

Adopt predictive analytics - Processing data: identifying, cleaning, generating, reducing dimensionality of data – Structuring Data – Build predictive model: develop and test the model.

#### **Module 5:**

##### **DATA VISUALIZATION**

Introduction to visualization tool – Evaluate the data – visualize Model's Analytical Results: hidden grouping, data classification results, outliers, decision trees, prediction – Novel visualization in Predictive Analytics.

#### **Text Books:**

1. Anasse Bari, Mohamed Chaouchi, Tommy Jung, "Predictive Analytics For Dummies", Wiley Publisher, 2nd Edition, 2016.

#### **Reference Books:**

1. Bertt Lantz, Machine Learning with R: Expert techniques for predictive modeling to solve all your data analysis problems, Pack Publisher, 2nd Edition, 2015.
2. Aurelien, "Hands-On Machine Learning with Scikit-Learn & TensorFlow", O'Reilly Publisher, 5th Edition, 2017.
3. Max Kuhn, Kjell Johnson, "Applied Predictive Modeling" Springer, 2013.

#### **E - Resources:**

1. [https://vuquangnguyen2016.files.wordpress.com/2018/03/applied-predictive-modeling-max-kuhn-kjell-johnson\\_1518.pdf](https://vuquangnguyen2016.files.wordpress.com/2018/03/applied-predictive-modeling-max-kuhn-kjell-johnson_1518.pdf)
2. [https://www.researchgate.net/publication/329873035\\_Prediction\\_Modeling\\_Methodology](https://www.researchgate.net/publication/329873035_Prediction_Modeling_Methodology)
3. <https://www.coursera.org/learn/predictive-modeling-analytics>
4. <https://www.edx.org/course/predictive-analytics>

#### **Course Outcomes:**

##### **The student will be able to:**

1. Understand the basics of predictive analytics and summarize Data, Categorize Models, and techniques
2. Apply Decision tree, Support Vector Machine for Data Classification
3. Apply Methods such as Naïve Bayes Markov Model, Linear Regression, Neural Networks to Boost Prediction Accuracy for Data Classification.
4. Develop predictive models for various Real-Time Applications.
5. Analyze and Visualize predictive Model's results using Data Visualization tools.

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| <b>AY 2022-23 onwards</b>     | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b>                             | <b>B.Tech: AI &amp; ML<br/>IV Year – I Sem</b> |          |          |          |
| <b>Course Code:<br/>L417G</b> | <b>INTERNET OF THINGS<br/>(Professional Elective-IV)</b><br>(Common to AI & ML, AI&DS, CSE, IT & ECM) | <b>L</b>                                       | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>             |                                                                                                       | <b>3</b>                                       | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites: Nil**

### **Course Objectives**

**The Student will:**

1. Understand the current vision of the Internet of Things and its impact on the world
2. Classify basic concepts of IoT and M2M & IoT system management
3. Describe concepts of python language and different python packages.
4. Explain how to design IoT Physical devices with built-ins of python Programs
5. Identify the advanced concepts of IoT physical servers, cloud offerings.

### **Module 1:**

**Introduction to Internet of Things** –Introduction, Definition and Characteristics of IoT,

**Physical Design of IoT** – Things in IoT, IoT Protocols, Logical Design of IOT- IoT Functional Blocks, IoT Communication Models, IoT Communication APIs

**IoT Enabling Technologies** – Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems.

**Domain Specific IoTs** – Introduction, Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health and Lifestyle.

### **Module 2:**

**IoT and M2M** – Introduction, M2M, Difference between IOT and M2M, **SDN and NFV for IoT**-Software Defined Networking, Network Function Virtualization,

**IoT System Management with NETCONF-YANG**- Need for IoT Systems Management, Simple Network Management Protocol (SNMP), Network Operator Requirements, NETCONF, YANG, NETOPEER.

### **Module 3:**

**IoT Systems-Logical Design Using Python**-Introduction, Installing Python, Data types and Data Structures, Control Flow, Functions, Modules, Packages, File handling, Date/Time Operations, Classes.



**Python Packages of Interest for IoT-** JSON, XML, HTTPLib, URLLib, SMTPLib

#### **Module 4:**

**IoT Physical Devices and Endpoints** – What is an IoT Device, Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry PI-Interfaces (Serial, SPI, I2C), Programming

**Raspberry Pi with Python**-Controlling LED, Interfacing an LED and Switch and interfacing a light sensor with Raspberry Pi.

#### **Module 5:**

**IoT Physical Servers and Cloud Offerings** – Introduction to Cloud Storage Models and communication APIs, WAMP-AutoBahn for IoT, Xively Cloud for IoT, Python web application framework Designing a RESTful web API.

#### **Text book:**

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759

#### **Reference Books:**

1. Internet of Things by Jeeva Bose 1st edition, Khanna publishing.

#### **E - Resources:**

1. [https://www.tutorialspoint.com/internet\\_of\\_things/internet\\_of\\_things\\_tutorial.pdf](https://www.tutorialspoint.com/internet_of_things/internet_of_things_tutorial.pdf)
2. <https://nptel.ac.in/courses/106/105/106105166/>
3. <https://www.slideshare.net/MohanKumarG/internetofthings-iot-aseminar-ppt-by-mohankumarg>

#### **Course Outcomes**

##### **The Student will be able to:**

1. Analyze current vision of the Internet of Things and its impact on the world.
2. Implement the basic concepts of IoT and M2M & IoT system management.
3. Assess the concepts of python language using different python packages.
4. Design IoT Physical devices using python Programming.
5. Categorize advanced concepts of IoT physical servers, cloud offerings and Hadoop.

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| <b>AY 2022-23<br/>onwards</b> | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AI &amp; ML<br/>IV Year – I Sem</b> |          |          |          |
| <b>Course Code:<br/>L41AK</b> | <b>AGILE METHODOLOGIES<br/>(Professional Elective-IV)</b>                 | <b>L</b>                                       | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>             |                                                                           | <b>3</b>                                       | <b>0</b> | <b>0</b> | <b>0</b> |

### **Course objectives:**

#### **The Student will:**

1. To provide students with a theoretical as well as practical understanding of agile software development practices and how small teams can apply them to create high-quality software.
2. To provide a good understanding of software design and a set of software technologies and APIs.
3. To do a detailed examination and demonstration of Agile development and techniques.
4. To understand the benefits and pitfalls of working in an agile team.
5. To understand agile development and testing.

### **Module I AGILE METHODOLOGY**

Theories for Agile Management – Agile Software Development – Traditional Model vs. Agile Model - Classification of Agile Methods – Agile Manifesto and Principles – Agile Project Management – Agile Team Interactions – Ethics in Agile Teams - Agility in Design, Testing – Agile Documentations – Agile Drivers, Capabilities and Values

### **ModuleII AGILE PROCESSES**

Lean Production - SCRUM, Crystal, Feature Driven Development- Adaptive Software Development - Extreme Programming: Method Overview – Lifecycle – Work Products, Roles and Practices.

### **Module III AGILITY AND KNOWLEDGE MANAGEMENT**

Agile Information Systems – Agile Decision Making - Earl\_S Schools of KM – Institutional Knowledge Evolution Cycle – Development, Acquisition, Refinement, Distribution, Deployment , Leveraging – KM in Software Engineering – Managing Software Knowledge – Challenges of Migrating to Agile Methodologies – Agile Knowledge Sharing – Role of Story-Cards – Story-Card Maturity Model (SMM).

### **Module IV AGILITY AND REQUIREMENTS ENGINEERING**

Impact of Agile Processes in RE–Current Agile Practices – Variance – Overview of RE Using Agile – Managing Unstable Requirements – Requirements Elicitation – Agile Requirements

Abstraction Model – Requirements Management in Agile Environment, Agile Requirements Prioritization – Agile Requirements Modeling and Generation – Concurrency in Agile Requirements Generation.

#### **ModuleV      AGILITY AND QUALITY ASSURANCE**

Agile Product Development – Agile Metrics – Feature Driven Development (FDD) – Financial and Production Metrics in FDD – Agile Approach to Quality Assurance - Test Driven Development – Agile Approach in Global Software Development.

#### **TEXT BOOKS:**

1. David J. Anderson and Eli Schragenheim, —Agile Management for Software Engineering: Applying the Theory of Constraints for Business Results, Prentice Hall, 2003.
2. Hazza and Dubinsky, —Agile Software Engineering, Series: Undergraduate Topics in Computer Science, Springer, 2009.

#### **REFERENCES:**

1. Craig Larman, —Agile and Iterative Development: A Manager's Guide, Addison-Wesley, 2004.
2. Kevin C. Desouza, —Agile Information Systems: Conceptualization, Construction, and Management, Butterworth-Heinemann, 2007.

#### **Course outcomes:**

##### **The Student will be able to:**

1. Apply agile software development practices even in a small team setup to create high-quality software.
2. Prioritize software design techniques, software technologies and APIs to create user friendly GUIs in software applications.
3. Recommend Agile development and testing techniques in a software industry.
4. Categorize the merits of working in an Agile team.
5. Implement Agile development and testing methods for software development.

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| <b>AY 2022-23<br/>onwards</b> | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AI &amp; ML<br/>IV Year – II Sem</b> |          |          |          |
| <b>Course Code:<br/>L42AA</b> | <b>GENERATIVE ADVERSARIAL NETWORKS<br/>(Professional Elective - VI)</b>   | <b>L</b>                                        | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>             |                                                                           | <b>3</b>                                        | <b>0</b> | <b>0</b> | <b>0</b> |

### **Pre-Requisites:**

4. Math: Linear Algebra, Calculus, Probability and Statistics
5. Data Structures
6. Machine Learning
7. Deep Learning

### **Course objectives:**

#### **The student will:**

1. Understand the difference between generative and discriminative models.
2. Identify problems that GANs can solve.
3. Understand the roles of the generator and discriminator in a GAN system.
4. Understand the advantages and disadvantages of common GAN loss functions.
5. Identify possible solutions to common problems with GAN training.

### **Module 1:**

#### **Introduction to GANs:-**

What are GANs?- How do GANs work?- GAN Training- Reaching Equilibrium- Applications of GANs

#### **Generative Modelling with encoders:-**

Introduction to Generative Modelling- Working of Auto Encoders at high level- Auto Encoders to GAN- Usage of Auto Encoders

### **Module 2:**

#### **Convolutional Neural Networks:**

Introduction to CNN- Convolutional Filters- Parameter sharing- ConvNets Visualized.

## **Deep GAN:**

Introduction to Deep GAN- Batch Normalization- Understanding Normalization- Computing Normalization.

## **Module 3:**

### **Evaluation:**

Evaluation Framework- Inception Score- Frechet Inception Distance

### **Challenges in Training:**

Adding Network depth- Min-Max GAN- Non-Saturating GANs- When to Stop training?- Wasserstein GAN

## **Module 4:**

### **Semi Supervised GAN:**

What is Semi Supervised GAN?- Architecture- Training Process- Training Objectives- Implementation- Comparison to fully supervised Classifier

### **Conditional GAN:**

Motivation- CGAN Generator- CGAN Discriminator- Architecture- Implementation

## **Module 5:**

### **Cycle GAN:**

Image to Image Translation- Cycle Consistency Loss- Adversarial Loss- Identity Loss- Architecture- Applications of Cycle GAN

### **Applications of GAN and Ethics:**

GAN in Medicine- GAN in fashion- Ethics- GAN Innovations

**Text Books:**

1. GANs in Action, Deep learning with Generative Adversarial Networks, Jakub Langr, Vladimir Bok, Manning Publication
2. Generative Deep Learning by David Foster, O'Reilly Media, Inc.

**Reference Book:**

1. Learning Generative Adversarial Networks, Kuntal Ganguly, Packt Publishing
2. Generative Adversarial Networks Cookbook, Josh Kalin, Packt Publishing

**Course outcomes:****The student will be able to:**

1. Design generative and discriminative models.
2. Implement problems that GANs can solve.
3. Compare and contrast the roles of the generator and discriminator in a GAN system.
4. Inspect the challenges posed by common GAN loss functions.
5. Implement possible solutions to common problems with GAN training.

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| <b>AY 2022-23 onwards</b>     | <b>J.B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b>   | <b>B.Tech: AI &amp; ML<br/>IV Year– II Sem</b> |          |          |          |
| <b>Course Code:<br/>J41DB</b> | <b>ARTIFICIAL INTELLIGENCE FOR BUSINESS<br/>(Professional Elective-VI)</b> | <b>L</b>                                       | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits:3</b>              |                                                                            | <b>3</b>                                       | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites: Nil.**

**Course objectives:**

**The Student will:**

1. Learn about AI and its Promises
2. Achieve knowledge in Designing and developing Safe and ethical AI.
3. Expand their knowledge in Building ML Models.
4. Familiar with AI for Enterprise Functions.
5. Realize the Ethics of Enterprise AI.

**Unit 1:**

What Business Leaders Need To Know - Basic Terminology In Artificial Intelligence – The Machine Intelligence Continuum - The Promises Of Artificial Intelligence

**Unit 2:**

The Challenges Of Artificial Intelligence - Designing Safe And Ethical Ai - How To Develop An Enterprise Ai Strategy - Build An AI-Ready Culture

**Unit 3:**

Invest In Technical Talent - Plan Your Implementation - Collect And Prepare Data - Build Machine Learning Models

**Unit 4:**

Experiment And Iterate - AI For Enterprise Functions - Obstacles And Opportunities - General And Administrative

**Unit 5:**

Human Resources And Talent - Business Intelligence And Analytics - Software Development - Marketing - Sales - Customer Support - The Ethics Of Enterprise AI

**Text Book:**

1. Applied Artificial Intelligence: A HANDBOOK FOR BUSINESS LEADERS, Mariya Yao,

Marlene Jia, and Adelyn Zhou, 2018 by TOPBOTS Inc.

**Reference Books:**

1. Artificial Intelligence Business Applications, Bob Mather, 2021.
2. Artificial Intelligence for Business, Doug Rose, 2<sup>nd</sup> Edition, 2020.

**E - Resources:**

1. <https://hbr.org/2018/01/artificial-intelligence-for-the-real-world>
2. <https://www.simplilearn.com/how-ai-has-evolved-as-the-most-important-tool-in-business-article>
3. <https://www.nibusinessinfo.co.uk/content/examples-artificial-intelligence-use-business>
4. [https://aibusiness.com/archives.asp?section\\_id=778](https://aibusiness.com/archives.asp?section_id=778)

**Course outcomes:**

**The Student will be able to:**

1. Identify AI and its promises for solving different types of problems.
2. Assess Designing and developing Safe and ethical AI for cracking glitches.
3. Apply Building ML Models for resolving complications.
4. Implement AI for Enterprise Functions to unravel variety of issues.
5. Apply Ethics of Enterprise AI to workout distinctive varieties of setbacks.



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| <b>AY 2022-23<br/>onwards</b>     | <b>J.B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B.Tech: AI &amp; ML</b> |          |          |          |
|                                   |                                                                          | <b>IV Year – II Sem</b>    |          |          |          |
| <b>Course<br/>Code:<br/>L425B</b> | <b>QUANTUM COMPUTING<br/>(Professional Elective-VI)</b>                  | <b>L</b>                   | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits:3</b>                  |                                                                          | <b>3</b>                   | <b>0</b> | <b>0</b> | <b>0</b> |

### **Pre-Requisites:**

Knowledge on Theory of Computation, Linear algebra, Basic group theory (and generally basic abstract algebra), Basic probability and stochastic processes, Fourier transforms and basic algorithms and analysis of algorithms.

### **Course objectives:**

#### **The Student will:**

1. Learn about Basics of Quantum Theory and Quantum Systems
2. Achieve knowledge in Basic Quantum Algorithms I.
3. Expand their knowledge in Basic Quantum Algorithms II.
4. Familiar with Quantum Information and Cryptography.
5. Realize the Noise and Quantum error correction as well as Applications of Quantum Computing.

### **Module 1:Introduction to Quantum Computing**

Deterministic Systems, Probabilistic descriptions and Quantum systems, Basics of Quantum theory, Schrodinger's time dependent equation, Wave nature of Particles, state vector, operators, postulates of quantum mechanics, Dirac formalism, Stern-Gerlach experiment, electron spin, superposition of states

Quantum computing — Quantum bits, Bloch sphere, representation of a qubit, multiple qubits

Quantum Circuits: single qubit gates, multiple qubit gates, design of quantum circuits.

### **Module 2:Basic Quantum Algorithms I**

Classical computation on quantum computers.

Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm.

Basic quantum algorithms I —analysing quantum algorithms, and implementing quantum circuits via QISKIT.

### **Module 3: Basic Quantum Algorithms II**

**Basic quantum algorithms II** — Simon's problem and the Bernstein-Vazirani algorithm.

Grover's quantum search algorithm, the BBBV Theorem, and applications of Grover's algorithm. RSA, and Shor's integer factorisation algorithm.

### **Module 4: Quantum Information and Cryptography**

Introduction to quantum information (superdense coding, no cloning theorem, Entanglement and Bell theorem. quantum teleportation)

Comparison between classical and quantum information theory.

Quantum Cryptography, Introduction to quantum cryptography (post-quantum security, quantum key distribution).

Open quantum systems

Quantum programming languages, Probabilistic and Quantum computations

### **Module 5:**

**Noise and error correction:** Graph states and codes, Quantum error correction, fault-tolerant computation Applications of Quantum Computing (AI&ML, Computational Chemistry, Drug Design & Development, Cybersecurity& Cryptography, Financial Modeling, Logistics Optimization, Weather Forecasting, Quantum Money, the Elitzur-Vaidman bomb).

### **Text Books:**

1. Quantum computing for computer scientists, Noson S. Yanofsky, Mirco A. Mannucci, Cambridge University Press 2008.

### **Reference Books:**

1. Jack Hidary: Quantum computing: an applied approach.  
<https://www.springer.com/us/book/9783030239213>. The affiliated site is <https://github.com/jackhidary/quantumcomputingbook>
2. Michael A. Nielsen and Isaac L. Chuang, Quantum Computation and Quantum Information: 10<sup>th</sup> Anniversary Edition, 2010.
3. Abraham Asfaw et al, Learn Quantum Computation using Qiskit, <http://qiskit.org/textbook>, 2020.
4. Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press, 2002.
5. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific, 2004.
6. Pittenger A. O., An Introduction to Quantum Computing Algorithms 2000.
7. An Introduction to Quantum Computing, P Kaye, R Laflamme and M Mosca, 2007.
8. Quantum computing explained, David McMahon, Wiley-interscience, John Wiley & Sons, Inc. Publication 2008

**E-Resources:**

1. [https://onlinecourses.nptel.ac.in/noc21\\_cs103/preview](https://onlinecourses.nptel.ac.in/noc21_cs103/preview)
2. [https://onlinecourses.nptel.ac.in/noc19\\_cy31/preview](https://onlinecourses.nptel.ac.in/noc19_cy31/preview)
3. <https://www.ibm.com/quantum-computing/what-is-quantum-computing/>
4. <https://www.sciencealert.com/quantum-computers>
5. <https://uwaterloo.ca/institute-for-quantum-computing/quantum-101>

**Course out comes:****The Student will be able to:**

1. Investigate Quantum Computing concepts for solving different types of problems.
2. Assess Basic quantum algorithms-I for cracking glitches.
3. Implement Basic quantum algorithms-II for resolving complications.
4. Predict Quantum Programming and Quantum Cryptography to unravel variety of issues.
5. Apply Quantum Computing to workout distinctive varieties of setbacks.

|                               |                                                                           |                                             |          |          |          |
|-------------------------------|---------------------------------------------------------------------------|---------------------------------------------|----------|----------|----------|
| <b>AY 2022-23<br/>onwards</b> | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B. Tech: Common<br/>III Year / I Sem</b> |          |          |          |
| <b>Course Code:<br/>L310C</b> | <b>INTRODUCTION TO MACHINE LEARNING<br/>(Open Elective I)</b>             | <b>L</b>                                    | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>             |                                                                           | <b>3</b>                                    | <b>0</b> | <b>0</b> | <b>0</b> |

### **Pre-Requisites:**

1. Data Structures
2. Design and Analysis of Algorithms
3. Python Programming
4. Mathematics for Machine Learning

### **Course objectives:**

#### **The student will:**

1. To introduce the fundamental concepts of machine learning and its applications.
2. To learn the classification, clustering, regression-based machine learning algorithms
3. To understand the deep learning architectures.
4. To understand the methods of solving real life problems using the machine learning techniques.
5. Understand the limitations of machine learning algorithms.

### **Module 1:**

**Introduction:** Programming Vs Learning-Types of Learning- Statistical Decision Theory – Regression-Classification- Bias Variance-Linear Regression- Multivariate Regression- Subset Selection- Shrinkage Methods

Principal Component Regression- Partial Least squares- Linear Classification- Logistic Regression- Linear Discriminant Analysis-Perceptron- Support Vector Machines

### **Module 2:**

**Neural Networks**-Introduction- Early Models- Perceptron Learning- Backpropagation- Initialization- Training & Validation- Parameter Estimation – MLE- MAP-Bayesian Estimation

**Decision Trees**- Regression Trees- Stopping Criterion & Pruning loss functions- Categorical Attributes- Multiway Splits- Missing Values- Decision Trees – Instability Evaluation Measures

### **Module 3:**

**Ensemble Learning**-Bootstrapping & Cross Validation-Class Evaluation Measures- ROC curve- MDL- Ensemble Methods – Bagging- Committee Machines and Stacking- Boosting

Gradient Boosting- Random Forests- Multi-class Classification- Naive Bayes- Bayesian Networks

### **Module 4:**

Undirected Graphical Models- HMM- Variable Elimination-Belief Propagation-Partitional Clustering, Hierarchical Clustering

Birch Algorithm, CURE Algorithm, Density-based Clustering- Gaussian Mixture Models Expectation Maximization

### **Module 5:**

Introduction and Basics of Reinforcement Learning-Defining RL Framework and Markov Decision Process- Policies, Value Functions and Bellman Equations- Exploration vs. Exploitation

Dynamic Programming and Monte Carlo-Temporal-Difference learning methods- Q-Learning Deep Q-networks (DQN, DDQN)

### **Text Books:**

1. The Elements of Statistical Learning, by Trevor Hastie, Robert Tibshirani, Jerome H. Friedman (2009). Springer-Verlag.
2. Pattern Recognition and Machine Learning, by Christopher Bishop, Springer 2006
3. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An introduction", Second Edition, MIT Press, 2019
4. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014.

### **Reference Books:**

1. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
2. Francois Chollet, "Deep Learning with Python, Manning Publications, Shelter Island, New York, 2018.
3. Navin Kumar Manaswi, Deep Learning with Applications using Python, Apress, New York, 2018.

**Course outcomes:****The student will be able to:**

1. Identify the basic concepts of machine learning.
2. Predict the various classification, clustering, and regression algorithms.
3. Apply the deep learning architectures for real world problems.
4. Implement a method for solving real life problem using a suitable machine learning technique.
5. Prioritize the various Machine Learning algorithms.

|                               |                                                                           |                                              |          |          |          |
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| <b>AY 2022-23<br/>onwards</b> | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B. Tech: Common<br/>III Year / II Sem</b> |          |          |          |
| <b>Course Code:<br/>L320C</b> | <b>INTRODUCTION TO PREDICTIVE ANALYTICS<br/>(Open Elective II)</b>        | <b>L</b>                                     | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>             |                                                                           | <b>3</b>                                     | <b>0</b> | <b>0</b> | <b>0</b> |

**Pre-Requisites:**

Data mining, Machine Learning

**Course objectives:**

**The student will:**

6. Know the basics of predictive analytics and summarize Data, Categorize Models, and techniques
7. Know about the Decision tree, Support Vector Machine for Data Classification
8. Describe Methods such as Naïve Bayes Markov Model, Linear Regression, Neural Networks to Boost Prediction Accuracy for Data Classification.
9. Study the predictive models for various Real-Time Applications.
10. Study the Analysis and Visualized predictive Model's results using Data Visualization tools.

**Module 1:**

**INTRODUCTION TO PREDICTIVE ANALYTICS**

Introduction – Predictive Analytics in the Wild – Exploring Data types and associated Techniques - Complexities of data - Applying Models: Models and simulation, Categorizing Models, Describing, summarizing data, and decisions – Identify similarities in Data: Data Clustering, converting Raw Data into a Matrix, Identify K-groups in Data.

**Module 2:**

**DATA CLASSIFICATION – PART I**

Background – Exploring Data classification process - Using Data Classification to predict the future: Decision tree, Algorithm for generating Decision Trees, Support Vector Machine.

**Module 3:**

**DATA CLASSIFICATION – PART II**

Ensemble Methods to Boost Prediction Accuracy: Naïve Bayes Classification Algorithm, The Markov Model, Linear Regression, Neural Networks – Deep learning.

#### **Module 4:**

##### **DATA PREPARATION AND MODELLING**

Adopt predictive analytics - Processing data: identifying, cleaning, generating, reducing dimensionality of data – Structuring Data – Build predictive model: develop and test the model.

#### **Module 5:**

##### **DATA VISUALIZATION**

Introduction to visualization tool – Evaluate the data – visualize Model's Analytical Results: hidden grouping, data classification results, outliers, decision trees, prediction – Novel visualization in Predictive Analytics.

#### **Text Books:**

1. Anasse Bari, Mohamed Chaouchi, Tommy Jung, "Predictive Analytics For Dummies", Wiley Publisher, 2nd Edition, 2016.

#### **Reference Books:**

4. Bertt Lantz, Machine Learning with R: Expert techniques for predictive modeling to solve all your data analysis problems, Pack Publisher, 2nd Edition, 2015.
5. Aurelien, "Hands-On Machine Learning with Scikit-Learn & TensorFlow", O'Reilly Publisher, 5th Edition, 2017.
6. Max Kuhn, Kjell Johnson, "Applied Predictive Modeling" Springer, 2013.

#### **E - Resources:**

1. [https://vuquangnguyen2016.files.wordpress.com/2018/03/applied-predictive-modeling-max-kuhn-kjell-johnson\\_1518.pdf](https://vuquangnguyen2016.files.wordpress.com/2018/03/applied-predictive-modeling-max-kuhn-kjell-johnson_1518.pdf)
2. [https://www.researchgate.net/publication/329873035\\_Prediction\\_Modeling\\_Methodology](https://www.researchgate.net/publication/329873035_Prediction_Modeling_Methodology)
3. <https://www.coursera.org/learn/predictive-modeling-analytics>
4. <https://www.edx.org/course/predictive-analytics>

#### **Course Outcomes:**

##### **The student will be able to:**

1. Identify the basics of predictive analytics and summarize Data, Categorize Models, and techniques
2. Apply Decision tree, Support Vector Machine for Data Classification
3. Apply Methods such as Naïve Bayes Markov Model, Linear Regression, Neural Networks to Boost Prediction Accuracy for Data Classification.
4. Construct predictive models for various Real-Time Applications.
5. Analyze and Visualize predictive Model's results using Data Visualization tools.



|                               |                                                                           |                                              |          |          |          |
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| <b>AY 2022-23<br/>onwards</b> | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B. Tech: Common<br/>III Year / II Sem</b> |          |          |          |
| <b>Course Code:<br/>L320S</b> | <b>INTRODUCTION TO NEURAL NETWORKS<br/>(Open Elective III)</b>            | <b>L</b>                                     | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>             |                                                                           | <b>3</b>                                     | <b>0</b> | <b>0</b> | <b>0</b> |

### **Pre-Requisites:**

1. Data Structures
2. Design and Analysis of Algorithms
3. Python Programming
4. Mathematics for Machine Learning

### **Course objectives:**

#### **The student will:**

1. Become familiar with the fundamental concepts of Neural Networks and its applications.
2. Learn various learning strategies for solving real world problems.
3. Demonstrate various architectures of Artificial neural networks.
4. Summarise the limitations of the perceptron model
5. Understand the paradigms of associative memories.

### **Module 1:**

#### **INTRODUCTION TO NEURAL NETWORKS**

Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Characteristics of ANN

McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

### **Module 2:**

#### **ESSENTIALS OF ARTIFICIAL NEURAL NETWORKS**

Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN

Connectivity, Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules.

### **Module 3:**

#### **SINGLE LAYER FEED FORWARD NETWORKS**

Introduction, Perceptron Models: Discrete, Continuous and Multi-Category

Training Algorithms: Discrete and Continuous Perceptron Networks, Limitations of the Perceptron Model.

### **Module 4:**

#### **MULTI- LAYER FEED FORWARD NETWORKS**

Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP)

Training, Summary of Backpropagation Algorithm

Kolmogorov Theorem, Learning Difficulties, and Improvements.

### **Module 5:**

#### **ASSOCIATIVE MEMORIES**

Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory, Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function.

Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis. Neural network applications: Process identification, control, fault diagnosis.

### **Text Books:**

1. Laurene Fausett, "Fundamentals of Neural Networks" , Pearson Education,2004..
2. Simon Haykin, "Neural Networks- A comprehensive foundation", Pearson Education, 2003.
3. S.N.Sivanandam, S.Sumathi,S. N. Deepa "Introduction to Neural Networks using MATLAB 6.0", TATA Mc Graw Hill, 2006.

### **Reference Books:**

1. S. Rajasekharan and G. A. Vijayalakshmi pai, "Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications", PHI Publication, 2004.
2. Timothy J. Ross, " Fuzzy Logic with Engineering Applications", Tata McGraw-Hill Inc. 2000

### **Course outcomes:**

#### **The student will be able to:**

1. Analyze Neural Networks and its applications.
2. Apply learning strategies for solving real world problems.
3. Implement various architectures of Artificial neural networks.
4. Categorize the merits of various perceptron models.
5. Construct the paradigms of associative memories.

|                               |                                                                           |                                            |          |          |          |
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| <b>AY 2022-23<br/>onwards</b> | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b> | <b>B. Tech: Common<br/>IV Year / I Sem</b> |          |          |          |
| <b>Course Code:<br/>L410C</b> | <b>INTRODUCTION TO DEEP LEARNING<br/>(Open Elective IV)</b>               | <b>L</b>                                   | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>             |                                                                           | <b>3</b>                                   | <b>0</b> | <b>0</b> | <b>0</b> |

### **Pre-Requisites:**

1. Probability Statistics, linear algebra. Machine learning .

### **Course Objectives:**

#### **The Student will:**

1. Get introduced to various learning techniques of machine learning and understand differences between machine learning and deep learning
2. Understand and analyse optimization techniques and improvements in learning methods
3. Appreciate, understand and apply neural networks as tools for complete learning problems
4. Investigate and deploy/club multi-layer neural networks for learning related to images, text and speech sequences.
5. Appreciate, understand and implement Deep learning in real world practical problems

### **Module 1:**

#### **Introduction to Deep Learning**

Introduction to Deep Learning, Brief History of Deep Learning, AI, Machine Learning and Deep Learning, Statistical Learning,

Bayesian Learning, Decision Surfaces, Success stories of Deep Learning

### **Module 2:**

#### **Linear Classifiers**

Linear Classifiers, Linear Machines with Hinge Loss, Optimization Techniques, Gradient Descent, Batch Optimization,

Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam.

### **Module 3:**

#### **Neural Network**

Introduction to Neural Network, Multilayer Perceptron, Back Propagation Learning, Unsupervised Learning with Deep Network, Autoencoders, Convolutional Neural Network, Building blocks of CNN, Transfer Learning, LSTM Networks, NN in python

### **Module 4:**

#### **Deep Neural Net**

Effective training in Deep Net- early stopping, Dropout, Batch Normalization, Instance Normalization, Group Normalization,

Recent Trends in Deep Learning Architectures, Residual Network, Skip Connection Network, Fully Connected CNN, CNN in Python

### **Module 5:**

#### **Practical areas of Deep Learning**

Classical Supervised Tasks with Deep Learning, Image Denoising, Semantic Segmentation, Object Detection, Generative Modelling with Deep Learning,

Variational Autoencoder, Generative Adversarial Network, Object recognition with Python.

#### **Text Books:**

1. Deep Learning- Ian Goodfellow, YoshuaBenjio, Aaron Courville, The MIT Press
2. Pattern Classification- Richard O. Duda, Peter E. Hart, David G. Stork, John Wiley & Sons Inc.

#### **Reference Books:**

1. Deep Learning: A Practitioner's Approach by Josh Patterson & Adam Gibson, O'Reilly Press
2. Python Deep Learning: Exploring deep learning techniques and neural network architectures with PyTorch, Keras, and TensorFlow, 2nd Edition by Ivan Vasilev, Pakt Publication.

#### **E - Resources:**

1. <https://nptel.ac.in/courses/106/105/106105215/>
2. <https://www.slideshare.net/LuMa921/deep-learning-a-visual-introduction>
3. <https://yiqiaoyin.files.wordpress.com/2018/02/deep-learning-notes.pdf>

**Course Outcomes:****The student will be able to:**

1. Identify tools of machine learning and deep learning, appropriate to any problems
2. Apply optimization techniques to improve the quality of various learning solutions.
3. Apply and investigate, neural network for complete learning problems.
4. Implement deep learning methods in the area of multidimensional and sequential inputs.
5. Investigate the scope of implementation of various deep learning techniques in any real world problem.

|                               |                                                                                  |                                                 |          |          |          |
|-------------------------------|----------------------------------------------------------------------------------|-------------------------------------------------|----------|----------|----------|
| <b>AY 2022-23<br/>onwards</b> | <b>J. B. Institute of Engineering and Technology<br/>(UGC Autonomous)</b>        | <b>B.Tech: AI &amp; ML<br/>IV Year – II Sem</b> |          |          |          |
| <b>Course Code:<br/>L420C</b> | <b>INTRODUCTION TO<br/>GENERATIVE ADVERSARIAL NETWORKS<br/>(Open Elective V)</b> | <b>L</b>                                        | <b>T</b> | <b>P</b> | <b>D</b> |
| <b>Credits: 3</b>             |                                                                                  | <b>3</b>                                        | <b>0</b> | <b>0</b> | <b>0</b> |

### **Pre-Requisites:**

1. Math: Linear Algebra, Calculus, Probability and Statistics
2. Data Structures
3. Machine Learning
4. Deep Learning

### **Course objectives:**

#### **The student will:**

1. Understand the difference between generative and discriminative models.
2. Identify problems that GANs can solve.
3. Understand the roles of the generator and discriminator in a GAN system.
4. Understand the advantages and disadvantages of common GAN loss functions.
5. Identify possible solutions to common problems with GAN training.

### **Module 1:**

#### **Introduction to GANs:-**

What are GANs?- How do GANs work?- GAN Training- Reaching Equilibrium- Applications of GANs

#### **Generative Modelling with encoders:-**

Introduction to Generative Modelling- Working of Auto Encoders at high level- Auto Encoders to GAN- Usage of Auto Encoders

### **Module 2:**

#### **Convolutional Neural Networks:**

Introduction to CNN- Convolutional Filters- Parameter sharing- ConvNets

Visualized.

### **Deep GAN:**

Introduction to Deep GAN- Batch Normalization- Understanding Normalization- Computing Normalization.

### **Module 3:**

#### **Evaluation:**

Evaluation Framework- Inception Score- Frechet Inception Distance

#### **Challenges in Training:**

Adding Network depth- Min-Max GAN- Non-Saturating GANs- When to Stop training?- Wasserstein GAN

### **Module 4:**

#### **Semi Supervised GAN:**

What is Semi Supervised GAN?- Architecture- Training Process- Training Objectives- Implementation- Comparison to fully supervised Classifier

#### **Conditional GAN:**

Motivation- CGAN Generator- CGAN Discriminator- Architecture- Implementation

### **Module 5:**

#### **Cycle GAN:**

Image to Image Translation- Cycle Consistency Loss- Adversarial Loss- Identity Loss- Architecture- Applications of Cycle GAN

#### **Applications of GAN and Ethics:**

GAN in Medicine- GAN in fashion- Ethics- GAN Innovations

**Text Books:**

1. GANs in Action, Deep learning with Generative Adversarial Networks, Jakub Langr, Vladimir Bok, Manning Publication
2. Generative Deep Learning by David Foster, O'Reilly Media, Inc.

**Reference Book:**

1. Learning Generative Adversarial Networks, Kuntal Ganguly, Packt Publishing
2. Generative Adversarial Networks Cookbook, Josh Kalin, Packt Publishing

**Course outcomes:****The student will be able to:**

1. Design generative and discriminative models.
2. Implement problems that GANs can solve.
3. Compare and contrast the roles of the generator and discriminator in a GAN system.
4. Inspect the challenges posed by common GAN loss functions.
5. Implement possible solutions to common problems with GAN training.