ACADEMIC REGULATIONS

COURSE STRUCTURE AND

DETAILED SYLLABUS

MECHANICAL ENGINEERING

CAD/CAM

M.TECH 2 YEAR PG COURSE

(Applicable for the batches admitted from 2020-2021)

REGULATION: R20

(I, & II Year Syllabus)

J.B.INSTITUTE OF ENGINEERING & TECHNOLOGY
UGC AUTONOMOUS
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J.B. INSTITUTE OF ENGIEERING & TECHNOLOGY
UGC AUTONOMOUS
Institute Vision & 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:

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

DEPARTMENT OF MECHANICAL ENGINEERING
Department Vision and Mission

Vision

To nurture excellence in the field of Mechanical engineering by imparting technical core values and instruction to the learners and to mold the department into a center for academic excellence through promoting higher education and advanced research to provide technical services at global competence.

Mission

- To impart highest quality education to the students to build their capacity and enhancing their skills to make them globally competitive mechanical engineers and maintain state of art research facilities to provide collaborative environment that stimulates faculty, staff and students with opportunities to create, analyze, apply and disseminate knowledge.

- To develop alliances with national level R&D organizations, educational institutions, industry and alumni for excellence in teaching, research and placements.

- To provide the students with academic environment of excellence, leadership, ethical, social guidelines and lifelong learning needed for a long self-employment career.

J. B. INSTITUTE OF ENGINEERING & TECHNOLOGY

UGC AUTONOMOUS

(Permanently Affiliated to JNTUH, Approved by AICTE, New Delhi and Accredited by NAAC)

Academic Regulations of M.Tech (Regular/Full Time) Programmes, 2020-21 (R20)

(CBCS)

(Effective for the students admitted into I year from the Academic Year 2020-21 and onwards)

1.0 Post-Graduate Degree Programmes in Engineering & Technology (PGP in E & T)

J. B. Institute of Engineering and Technology (JNTUH) offers **Two** Years (**Four** Semesters) full-time Master of Technology (M. Tech.) Degree programmes, under Choice Based Credit System (CBCS) in the following branches of Engineering and Technology with different specializations as mentioned below:

Computer Science & Engineering	Computer Science & Engineering
Electronics & Communication Engineering	VLSI System Design
Electrical & Electronics Engineering	Electrical Power Systems
Mechanical Engineering	CAD / CAM
Civil Engineering	Structural Engineering

2.0 Eligibility for Admissions

2.1 Admission to the PGPs shall be made subject to eligibility, qualification and specializations prescribed by the University from time to time, for each specialization under each M.Tech programme.

2.2 Admission to the post graduate programme shall be made on the basis of either the merit rank or Percentile obtained by the qualified student in the relevant qualifying GATE Examination/ the merit rank obtained by the qualified student in an entrance test conducted by Telangana State Government (PGCET) for M.Tech. programmes.

2.3 The medium of instructions for all PG Programmes will be **ENGLISH** only.

3.0 M.Tech. Programme (PGP in E & T) Structure

3.1 The M.Tech Programmes in Engineering & Technology of JBIET are of Semester pattern, with **Four** Semesters consisting of **Two** academic years, each academic year having **Two** Semesters (First/Odd and Second/Even Semesters). Each Semester shall be of 22 weeks duration (inclusive of Examinations), with a minimum of 90 instructional days per Semester.

3.3 **UGC/AICTE** specified definitions/descriptions are adopted appropriately for various terms and abbreviations used in these PG academic regulations, as listed below

3.3.1 Semester Scheme

Each Semester shall have 'Continuous Internal Evaluation (CIE)' and 'Semester End Examination (SEE)'. Choice Based Credit System (CBCS) and Credit Based Semester System (CBSS) are taken as 'references' for the present set of Regulations. The terms 'SUBJECT' and 'COURSE' imply the same meaning here and refer to 'Theory Subject', or Lab Course', or 'Design/Drawing Subject', or 'Seminar', or 'Comprehensive Viva', or 'Project', or 'Technical Paper Writing' as the case may be.

3.3.2 Credit Courses

All subjects/courses are to be registered by the student in a semester to earn credits which shall be assigned to each subject/course in an L: T: P: C (Lecture Periods: Tutorial Periods: Practical Periods: Credits) structure based on the following general pattern:

- One credit for one hour/week/semester for theory/lecture (L) courses
- One credit for two hours/ week/semester for laboratory/ practical (P) courses or tutorials (T)
- Other student activities like study tour, guest lecture, conference/workshop participations, technical paper presentations, and identified mandatory courses, if any, will not carry credits.

3.3.3 Subject Course Classification

All subjects / courses offered for the Post-Graduate Programme in E & T (M.Tech Degree Programme) are broadly classified as follows. The institute has followed in general the guidelines issued by AICTE/UGC.

S.No.	Broad Course Classification	Course Group/ Category	Course Description
1	Core Courses (CoC)	PC- Professional Core	Includes subjects related to .the parent discipline/department/ branch of Engineering.
		Project Work	M.Tech Project or PG Project or Major Project
		Seminar, Technical Paper Writing	Seminar/Colloquium based on core contents related to parent discipline/department/branch of Engineering.
		Comprehensive Viva-Voce	Viva-voce covering all the PG subjects studied during the course work and related aspects
2	Elective Courses (EıE)	PE - Program Electives	Includes elective subjects related to the parent discipline/department/branch of Engineering.
		OE - Open Electives	Elective subjects which include inter-disciplinary subjects or subjects in an area outside the parent discipline/department/ branch of Engineering.
Total number of Credits = 68			

4.0 Course Registration

4.1 A 'Faculty Advisor or Counselor' shall be assigned to each specialization, who will advise on the Post Graduate Programme (PGP), its Course Structure and Curriculum, Choice/Option for Subjects/ Courses, based on his competence, progress, pre-requisites and interest.

4.2 The Department invites 'Registration Forms' from students. Registration requests for any 'CURRENT SEMESTER' shall be completed BEFORE the commencement of SEEs (Semester End Examinations) of the 'PRECEDING SEMESTER'.

4.3 A Student can apply for Registration, ONLY AFTER obtaining the 'WRITTEN APPROVAL' from his Faculty Advisor, which should be submitted to the Department.

4.4 If the 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, only the first mentioned Subject/ Course in that Category will be taken into consideration.

4.5 Subject/ Course Options exercised through Registration are final and CANNOT be changed, nor can they be inter-changed; further, alternate choices also will not be considered. However, if the Subject/ Course that has already been listed for Registration by the Department in a Semester could not be offered due to unforeseen or unexpected reasons, then the Student will be allowed to have alternate choice either for a new Subject, if it is offered, or for another existing Subject (subject to availability of seats). Such alternate arrangements will be made by the Head of Department, with due notification and time-framed schedule, within the FIRST WEEK from the commencement of Class-work for that Semester.

4.6 **Open electives:** The students have to choose one open elective (OE-I) from the list of open electives given in II year I semester.

4.7 **Program electives:** The students have to choose 5 Program electives (PE-I to V) from the list of program electives given. (2 PEs in I Semester, 2 PEs in II Semester and 1 in III Semester)

5.0 Attendance Requirements

The programmes are offered on the basis of a unit system with each subject being considered a unit.

5.1 A student is 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) for that semester..

5.2 Shortage of attendance in aggregate up to 10% (65% and above, and below 75%) in each semester may be condoned on medical grounds.

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

5.4 Students whose shortage of attendance is not condoned in any semester are not eligible to take their end examinations of that semester.

5.5 A student fulfills the attendance requirement in the present semester, shall not be eligible for readmission into the same class.

5.6 A prescribed fee per subject shall be payable for condoning shortage of attendance.

6.0 Academic Requirements

The following academic requirements have to be satisfied, in addition to the attendance requirements mentioned in item no. 5. The performance of the candidate in each semester shall be evaluated subject-wise, with a maximum of 100 marks per subject / course (theory / practical), on the basis of Internal Evaluation and Semester End Examination.

6.1 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/course, if he secures not less than 40% of marks (28 out of 70 marks) in the End Semester Examination, and a minimum

of 50% of marks in the sum total of CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

6.2 A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to a subject/ course, if he secures not less than 50% of the total marks. The student is deemed to have failed, if he (i) does not attend the comprehensive viva-voce as per the schedule given, or (ii) does not present the seminar as required, or (iii) does not present the Technical Paper Writing as required. In such a case, he may reappear for comprehensive viva-voce in supplementary examinations and for seminar/ technical paper writing, in the subsequent semesters, as and when scheduled.

6.3 A student shall register for all subjects for total of 68 credits as specified and listed in the course structure for the chosen specialization, put in required the attendance and fulfill the academic requirements for securing 68 credits obtaining a minimum of 'B' Grade or above in each subject, and all 68 credits securing Semester Grade Point Average **(SGPA) 6.0** (in each semester) and final Cumulative Grade Point Average **(CGPA)** (i.e., CGPA at the end of PGP**) 6.0**, to complete the PGP successfully.

6.4 Marks and Letter Grades obtained in all those subjects covering the above specified 68 credits alone shall be considered for the calculation of final CGPA, which will be indicated in the Grade Card /Marks Memo of second year second semester.

6.5 If a student registers for extra subject(s) (in the parent department or other departments/ branches of Engineering) other than those listed subjects totalling to 68 credits as specified in the course structure, the performance in extra subject(s) (although evaluated and graded using the same procedure as that of the required 68 credits) will not be taken into account while calculating the SGPA and CGPA. For such extra subject(s) registered, a certificate will be issued with a letter grade indicated as a performance measure, subject to completion of the attendance and academic requirements as stated in items 5 and 6.1 - 6.3.

6.6 A student eligible to appear for the Semester End Examination in any subject, but absent from it or failed (failing to secure 'B' Grade or above), may reappear for that subject at the supplementary examination as and when conducted. In such cases, his Internal Marks assessed earlier for that subject will be carried over, and added to the marks secured in the supplementary examination, for the purpose of evaluating his performance in that subject.

6. 7 A Student who fails to earn 68 credits as per the specified course structure, and as indicated above, within **four** academic years from the date of commencement of his first year first semester, shall forfeit his seat in M.Tech. programme and his admission **shall stand cancelled.**

7.0 Evaluation - Distribution and Weightage of Marks

7.1 The performance of a student in every subject/course (including practicals) will be evaluated for 100 marks each, with 30 marks allotted for CIE (Continuous Internal Evaluation) and 70 marks for SEE (Semester End-Examination).

7.2 For theory courses, during the semester there are 2 mid-term examinations (internal exams of 25 marks each) and 2 assignments carrying 5 marks each.

7.3 Each mid-term examination will be of 1 hour 20 minutes consisting of Part-A (short answer questions) for 10 marks and Part-B (long answer) for 15 marks. Part-A consists of 5 two marks questions and Part- B consists of 4 questions carrying 5 marks each and student should answer 3 questions.

7.4 First mid-term examination is conducted for first 2 units of syllabus and second mid-term examination is conducted for remaining 3 units of syllabus.

7.5 The Continuous Internal Evaluation for theory course shall be made as average of marks obtained in CIE – I and CIE –II as detailed in the table below.

CIE – I	Marks	CIE - II	Marks
MID – I	25	MID - II	25
Assignment – I	5	Assignment - II	5
Total	30	Total	30

7.6 If a student is absent for any test/assignment, he is awarded zero marks for that test/assignment. However a candidate may be permitted on genuine grounds provided he/she has taken permission before the mid-term examination from the Head of the Department. Moreover, he/she has to apply for makeup examinations within a week after completion of mid-term examinations. A subcommittee will be constituted with the following composition to look into such cases.

Subcommittee-composition:

S.No	Faculty Member	Designation
1	Concern Head of the Department	Chairman
2	Senior faculty nominate by Principal	Member
3	One Senior faculty member of the concern department	Member
4	One faculty member of the other department	Member
5	Additional Controller of Examinations	Convener

7.7 The details of the Question Paper pattern for Semester End Examination (Theory) are given below:

The Semester End Examination will be conducted for 70 marks. It consists of two parts.
i).Part A for 20 marks, ii). Part B for 50 marks.

- Part A is compulsory and consists of 5 questions, one from each unit and carrying 4 marks each.
- Part-B consists of five questions carrying 10 marks each. Each of these questions is from one 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.

7.8 For practical subjects, 70 marks shall be awarded for performance in the Semester End Examinations and 30 marks shall be awarded as Internal Marks. Out of the 30 marks for internal evaluation, day-to-day work in the laboratory is evaluated for 20 marks and internal practical examination is evaluated for 10 marks conducted by the laboratory teacher concerned.

7.9 The semester end examination is conducted with an external examiner and the laboratory teacher. The external examiner is selected and appointed by the Principal from the list submitted by Head of the Department.

7.10 There shall be a Seminar presentation during II Year I semester. For Seminar student under the supervision of a faculty member shall collect literature on a topic and critically review the literature and submit a report to the Department. Upon acceptance of the report by the Department committee candidate shall make an oral presentation before the Department Commitee. The Department Committee comprising of Head of The Department, supervisor, and two other senior faculty members of the Department shall evaluate for 50 marks. There is no external Evaluation for the Seminar.

7.11 There shall be a mini project preferably suggested by the industry of their specialization. The mini project shall be carried out during the summer vacation between I Year II Semester and II year I Semester is evaluated for 50 marks in the II Year I Semester by the Head, Supervisor/ mentor and a senior faculty of the department. A candidate has to secure a minimum of 50% of marks (*25 out of 50*) to be declared successful. If he fails to obtain the minimum marks, he has to reappear for the same during the supplementary examinations as and when conducted, subject to item 3.2.

7.12 There shall be a dissertation/major project work of one-year duration which contributes strong weightage in the curriculum in the II year. It is expected to undertake industrially relevant problem to develop an optimal solution through extensive research work. The students and faculty can design the research project in consultation with industry preferably in the region. The planning of laboratory work/modelling/computational work with execution schedule is suggested at the beginning of the programme to ensure expected outcome. This will lead to creation of patents from the result of the programme.

7.13 Every candidate shall be required to submit a thesis or dissertation on a topic approved by the Project Review Committee.

7.14 A Project Review Committee (PRC) shall be constituted with the Head of the Department as Chairperson, Project Coordinator and one senior faculty member of the Departments offering the M. Tech. programme.

7.15 Registration of Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement in all the subjects, both theory and practicals.

7.16 After satisfying 7.15, a candidate has to present in Project Work Review I, in consultation with his Project Supervisor, the title, objective and plan of action of his project work to then Project Work Review Committee (PRC) for approval within four weeks from the commencement of Second Year First Semester. Only after obtaining the approval of the PRC can the student initiate the Project work.

7.17 If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the PRC. However, the PRC shall examine whether or not the change of topic/supervisor leads to a major change of his initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.

7.18 A candidate is permitted to submit Project Thesis only after successful completion of all theory and practical courses with the approval of PRC not earlier than 40 weeks from the date of approval of the project work. For the approval of PRC the candidate shall submit the draft copy of thesis to the Head of the Department and make an oral presentation before the PRC.

7.19 The major project work shall be carried out in two stages: Project Stage – I during II Year I Semester, Project Stage – II during II Year II Semester. Each stage will be evaluated for 100 marks. Student has to submit project work report at the end of each semester. First report includes project work carried out in II Year I semester and second report includes project work carried out in II Year I & II Semesters. SEE for both project stages shall be completed before the commencement of SEE Theory examinations.

7.20 For Project Stage – I, the Project Review Committee shall evaluate the project work for 50 marks and project supervisor shall evaluate for 50 marks. The student is deemed to have failed, if he (i) does not submit a report on Project Stage - I or does not make a presentation of the same before the evaluation committee as per schedule, or (ii) secures less than 50% marks in the sum total of the CIE and SEE taken together.

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

7.21 For Project Stage – II, the external examiner shall evaluate the project work for 50 marks and the project supervisor shall evaluate it for 50 marks. The student is deemed to have failed, if he (i) does not submit a report on Project Stage - II, or does not make a presentation of the same before the external examiner as per

schedule, or (ii) secures less than 50% marks in the sum total of the CIE and SEE taken together. For conducting viva-voce of project stage – II, Principal selects an external examiner from the panel of experts in the relevant branch submitted by the HOD.

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

7.22 After approval from the PRC, the soft copy of the thesis should be submiitted to the Department for ANTI-PLAGIARISM for the quality check and the plagiarism report should be included in the final thesis. If the copied information is less than 30%, then only thesis will be accepted for submission.

7.23 Three copies of the Project Thesis certified by the supervisor shall be submitted to the College, after submission of a research paper related to the project work in a UGC approved journal. A copy of the submitted research paper shall be attached to thesis.

7.24 The Project Viva-Voce External examination marks must be submitted to the Exam Branch on the same day of the examination.

8.0 Re-Admission/Re-Registration

8.1 Re-Admission for Discontinued Student

A student, who has discontinued the M.Tech. degree programme due to any reason whatsoever, may be considered for '**readmission'** into the same degree programme (with the same specialization) with the academic regulations of the batch into which he gets readmitted, with prior permission from the authorities concerned, subject to item 6.6.

9.0 Examinations and Assessment - The Grading System

9.1 Grades will be awarded to indicate the performance of each student in each Theory Subject, or Lab/Practicals, or Seminar, or Technical Paper Writing or Project, etc., based on the % of marks obtained in CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Item 7 above, and a corresponding Letter Grade shall be given.

9.2 As a measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades (UGC Guidelines) and corresponding percentage of marks shall be followed:

% of Marks Secured in a subject/Course (Class Intervals)	Letter Grade (UGC Guidelines)	Grade Points
90% and above (≥90% , ≤ 100%)	O (Outstanding)	10
Below 90% but not less than 80% (≥80% , <90%)	A^+ (Excellent)	9
Below 80% but not less than 70%	A	8
(≥ 70% , <80%)	(Very Good)	
Below 70% but not less than 60% (≥60% , <70%)	B^+ (Good)	7
Below 60% but not less than 50% (≥50% , <60%)	B (above Average)	6
Below 50% (< 50%)	F (FAIL)	0
Absent	**Ab**	**0**

9.3 A student obtaining F Grade in any Subject is deemed to have 'failed' and is required to reappear as 'Supplementary Candidate' for the Semester End Examination (SEE), as and when conducted. In such cases, his Internal Marks (CIE Marks) in those subjects will remain as obtained earlier.

9.4 If a student has not appeared for the examinations, 'Ab' Grade will be allocated to him for any subject and shall be considered 'failed' and will be required to reappear as 'Supplementary Candidate' for the Semester End Examination (SEE), as and when conducted.

9.5 A Letter Grade does not imply any specific marks percentage; it is only the range of percentage of marks.

9.6 In general, a student shall not be permitted to repeat any Subject/ Course (s) only for the sake of 'Grade Improvement' or 'SGPA/ CGPA Improvement'.

9.7 A student earns Grade Point (GP) in each Subject/ Course, on the basis of the Letter Grade obtained by him in that Subject/ Course. The corresponding 'Credit Points' (CP) are computed by multiplying the Grade Point with Credits for that particular Subject/ Course.

Credit Points (CP) = Grade Point (GP) x Credits …. For a Course

9.8 The student passes the Subject/ Course only when he **gets GP $\geq$ 6 (B Grade or above).**

9.9 The Semester Grade Point Average (SGPA) is calculated by dividing the Sum of Credit Points (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 :

$$\text{SGPA} = \{ \sum_{i=1}^{N} C_i G_i \} / \{ \sum_{i=1}^{N} C_i \} \text{ .... For each semester,}$$

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 Gi represents the grade points (GP) corresponding to the letter grade awarded for that i^{th} subject.

9.10 The Cumulative Grade Point Average (CGPA) is a measure of the overall cumulative performance of a student over 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 Second Semester onwards, at the end of each Semester, as per the formula mentioned below:

$$\text{CGPA} = \{ \sum_{j=1}^{M} C_j G_j \} / \{ \sum_{j=1}^{M} C_j \} \text{ ... for all S semesters registered}$$

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

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' for from the 1^{st} Semester onwards upto and inclusive of the Semester S (obviously M > N), 'j' is the Subject indicator index (taking into account all Subjects from 1 to S Semesters), C is the no. of Credits allotted to the j^{th} Subject, and G 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 however, 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*8 = 32
Course 2	4	O	10	4*10 = 40
Course 3	4	B	6	4*6 = 24
Course 4	3	B	6	3*6 = 18
Course 5	3	A+	9	3*9 = 27
Course 6	3	B	6	3*6 = 18
	21			159

Semester	Credits	SGPA	Credits * SGPA
Semester I	24	7	24*7 = 168
Semester II	24	6	24*6 = 144
Semester III	24	6.5	24*6.5 = 156
Semester IV	24	6	24*6 = 144
	96		612
	CGPA = 612/96 = 6.37		

10.0 Award of Degree and Class

10.1 If a student who registers for all the specified Subjects/ Courses as listed in the Course Structure, satisfies all the Course Requirements, and passes the examinations prescribed in the entire PG Programme (PGP), and secures the required number of **68** Credits (with CGPA 6.0), shall be declared to have 'QUALIFIED' for the award of the M.Tech. Degree in the chosen Branch of Engineering and Technology with the specialization that he was admitted into.

10.2 Award of Class

After a student has earned the requirements prescribed for the completion of the programme and is eligible for the award of M.Tech. Degree, he shall be placed in one of the following three classes based on the CGPA:

Class Awarded	CGPA
First Class with Distinction	≥ 7.75
First Class	$6.75 \leq$ CGPA < 7.75
Second Class	$6.00 \leq$ CGPA < 6.75

A student with final CGPA (at the end of the **PGP) < 6.00** shall not be eligible for the Award of Degree.

11 Withholding of Results

If the student has not paid the dues, if any, to the Institution or if any case of indiscipline is pending against him, the result of the student will be withheld and he will not be allowed into the next semester.

12.0. Transitory Regulations

12.1 A student who has been detained in any semester of I Year of Previous Regulations due to lack of attendance, shall be permitted to join the same semester of I Year of R20 Regulations and he is required to complete the study of M.Tech programme within the stipulated period of four academic years from the date of first admission in I Year I semester. The R20 Academic Regulations under which a student has been readmitted shall be applicable to that student from that semester.

12.3 For student readmitted to R20 Regulations, the maximum credits that a student acquires for the award of the degree, shall be the sum of the total number of credits secured in previous regulations of his/her study including R20 Regulations.

12.4 If a student readmitted to R20 Regulations, has any subject with 80% of syllabus common with his/her previous regulations, that particular subject in R20 regulations will be substituted by another subject to be suggested by the Concerned Board Of Studies (BOS).

13 General

13.1 The academic regulation should be read as a whole for the purpose of any interpretation.

13.5 In case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Institution is final.

13.6 The Institution may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the Institution.

MALPRACTICE RULES

DISCIPLINARY ACTION FOR CONDUCT IN EXAMINATION

	Nature of Malpractices/Improper conduct	**Punishment**
	if the candidate:	
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 he is appearing but has not made use of (material shall include any marks on the body of the candidate 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.
1.(b)	Gives assistance or guidance or receives it from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate 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 candidates 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 candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate 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. The Hall Ticket of the candidate is to be cancelled.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate who has been impersonated, shall be cancelled in all the subjects of the examination (including

		practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all end semester examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	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 candidate 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 candidate is also debarred for two consecutive semesters from class work and all end semester examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	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.
6	Refuses to obey the orders of the Chief Superintendent/Assistant – Superintendent / any officer on duty or misbehaves or creates disturbance 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	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates 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

	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.	them.
7	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate 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 candidate is also debarred for two consecutive semesters from class work and all end semester examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
8	Possess 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 candidate 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 candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other

	connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	subjects the candidate 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 candidate 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.
10	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 candidate 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.
11	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 candidate has appeared including practical examinations and project work of that semester/year examinations.
12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Examination Result Processing Committee (ERPC) for further action to award suitable punishment.	

J.B. INSTITUTE OF ENGINEERING & TECHNOLOGY

UGC AUTONOMOUS

Bhaskar Nagar, Moinabad (M), RR Dist., Telangana – 500075

MECHANICAL ENGINEERING

CAD/CAM COURSE STRUCTURE – R20

I M. Tech – I Semester

S. No.	Code	Subject	L	T-P-D	C
1	JM11A	Advanced Computer Aided Design	3	0-0-0	3
2	JM11B	Advanced Computer Aided Manufacturing	3	0-0-0	3
3		**Program Elective – I**	3	0-0-0	3
4		**Program Elective – II**	3	0-0-0	3
5	JM11I	Advanced Computer Aided Design Lab	0	0-4-0	2
6	JM11J	Advanced Computer Aided Manufacturing Lab	0	0-4-0	2
7	JM91A	Soft skills	2	0-0-0	0
		Total	**14**	**0-8-0**	**16**

I M. Tech – II Semester

S. No.	Code	Subject	L	T-P-D	C
1	JM12A	Manufacturing Systems: Simulation modeling & Analysis	3	0-0-0	3
2	JM12B	Advanced Finite Element Methods	3	0-0-0	3
3		**Program Elective – III**	3	0-0-0	3
4		**Program Elective – IV**	3	0-0-0	3
5	JM12I	Simulation and Precision Engineering Lab	0	0-4-0	2
6	JM12J	Advanced Computer Aided Engineering Lab	0	0-4-0	2
7	JM92A	Research Methodology & Intellectual Property Rights	2	0-0-0	2
8	JM92B	Personality Development & Professional Values.	2	0-0-0	0
		Total	**16**	**0-8-0**	**18**

J.B. INSTITUTE OF ENGINEERING & TECHNOLOGY

UGC AUTONOMOUS

Bhaskar Nagar, Moinabad (M), RR Dist., Telangana – 500075

MECHANICAL ENGINEERING

CAD/CAM COURSE STRUCTURE – R20

II M. Tech – I Semester

S. No.	Code	Subject	L	T-P-D	C
1		**Program Elective – V**	3	0-0-0	3
2		**Open Elective – I**	3	0-0-0	3
3	JM13D	Mini Project	0	0-4-0	2
4	JM13E	Technical seminar	0	0-2-0	1
5	JM13F	Project Stage – I	0	0-18-0	9
		Total	**6**	**0-24-0**	**18**

II M. Tech – II Semester

S. No.	Code	Subject	L	T-P-D	C
1	JM14A	Project Stage – II	0	0-32-0	16
		Total	**0**	**0-32-0**	**16**

Note: All End Examinations (Theory and Practical) are of three hours duration.

L – Lecture, T – Tutorial, P – Practical, D – Drawing, C – Credits.

Program Elective – I

S. No.	Code	Subject	L	T-P-D	C
1	JM11C	Mechanical Behaviour of Materials	3	0-0-0	3
2	JM11D	Stress Analysis and Vibration	3	0-0-0	3
3	JM11E	Rapid Prototyping Technologies	3	0-0-0	3

Program Elective – II

S. No.	Code	Subject	L	T-P-D	C
1	JM11F	Automation in Manufacturing	3	0-0-0	3
2	JM11G	Computer Aided Process Planning	3	0-0-0	3
3	JM11H	Optimization Techniques and Applications	3	0-0-0	3

Program Elective – III

S. No.	Code	Subject	L	T-P-D	C
1	JM12C	Intelligent Manufacturing Systems	3	0-0-0	3
2	JM12D	Special Manufacturing Process	3	0-0-0	3
3	JM12E	Precision Engineering	3	0-0-0	3

Program Elective – IV

S. No.	Code	Subject	L	T-P-D	C
1	JM12F	Advanced Mechatronics	3	0-0-0	3
2	JM12G	Design and Manufacturing of MEMS and Micro systems	3	0-0-0	3
3	JM12H	Design for Manufacturing and Assembly	3	0-0-0	3

Program Elective – V

S. No.	Code	Subject	L	T-P-D	C
1	JM13A	Mechanics of Composite Materials	3	0-0-0	3
2	JM13B	Industrial Robotics	3	0-0-0	3
3	JM13C	Production and Operation Management	3	0-0-0	3

OPEN ELECTIVES

S.No.	Code	Name of the Subject
1	JM1OA	Industrial Safety
2	JM20A	Renewable Energy Technologies and Battery Storage
3	JM20B	Power Plant Engineering
4	JM3OA	Disaster Management
5	JM3OB	Precast & Prefabricated Construction
6	JM6OA	Clean Room Technology and Maintenance.
7	JM60B	Principles of Computer Communications and Networks.
8	JM7OA	Python Programming
9	JM7OB	E-Commerce

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM I Year – I Sem			
Course Code JM11A	ADVANCED COMPUTER AIDED DESIGN Core Course – I	L	T	P	D
Credits: 3		3	0	0	0

Pre-requisite: Engineering Drawing, CAD/CAM, Finite Element Methods.

Course Objectives:

This course will enable students to:

1. Learn the concept of CAD and modelling techniques.
2. Understand parametric representation of surfaces
3. Learn the solid modelling techniques
4. Learn the working of transformations in software
5. Understand the various formats of CAD files.

Module 1:

Unit 1: CAD Tools: Definition of CAD Tools, Graphics standards, Graphics software: requirements of graphics software, Functional areas of CAD, Efficient use of CAD software.

Unit 2: Basics of Geometric Modelling: Requirement of geometric modelling, Geometric models, Geometric construction methods, and modelling facilities desired

Module 2:

Unit 1: Geometric Modelling: Classification of wireframe entities, Curve representation methods, Parametric representation of analytic curves: line, circle, arc, conics.

Unit 2: Parametric representation of synthetic curves: Hermite cubic curve, Bezier curve, B-Spleen curve wire, NURBS, Curve manipulations.

Module 3:

Unit 1: Surface Modelling: Classification of surface entities, Surface representation methods, parametric representation of analytic surfaces: plane surface, ruled surface, surface of revolution, tabulated cylinder.

Unit 2: Parametric representation of synthetic surfaces: Hermite cubic surface, Bezier surface, B- Spleen surface, Blending surface, Surface manipulations.

Module 4:

Unit 1: Solid Modelling: Geometry and topology, Boundary representation, The Euler-Poincare formula, Euler operators.

Unit 2: Constructive solid geometry: CSG primitives, Boolean operators, CSG expressions, Interior, Exterior, closure, Sweeping: linear and non-linear, Solid manipulations.

Module 5:

Unit 1: Transformations: 2-D and 3-D transformations: translation, scaling, rotation, reflection, concatenation, homogeneous coordinates, Perspective projection, orthotropic projection, isometric projection, Hidden surface removal, shading, rendering.

Unit 2: Evaluation Criteria: Evaluation criteria of CAD software, Data exchange formats: GKS, IGES, PHIGS, CGM, and STEP. Dimensioning and tolerances: Linear, angular, angular dimensions, maximum material condition (MMC), least material condition (LMC), Regardless of feature size (RFS)

TEXT BOOKS:

1. Alavala, "CAD/CAM Concepts and Applications", PHI Publishers, 2009.
2. IbrhimZeid, "Mastering CAD/CAM", Tata McGraw Hill International, 2010.

REFERENCES:

1. P.N.Rao, "CAD/CAM Principles & applications", Tata McGraw Hill International, 2010.
2. Groover M.P, "CAD/CAM", Pearson Education, 2012.
3. Radhakrishnan and Subramanian, "CAD / CAM / CIM", NewAge Publishers.
4. FaridAmirouche, "Principles of Computer Aided Design and Manufacturing", Pearson Edition.
5. Warren SSeames, "Computer Numerical Control Concepts and programming", TMH

E - Resources:

1. https://rb.gy/2rnapl
2. http:// nptel.ac.in/courses/112102101/
3. http://nptel.ac.in/courses/112102103
4. https://nptel.ac.in/courses/112/102/112102101/

Course Outcomes:

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

1. Apply the cad concepts in the design field
2. Analyze the different CAD tools and geometric modeling
3. Apply the concept of surface modeling.
4. Apply the concept of Solid modeling.
5. Differentiate various types CAD file formats

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM I Year – I Sem			
Course Code JM11B	ADVANCED COMPUTER AIDED MANUFACTURING	L	T	P	D
Credits: 3	Core Course – II	3	0	0	0

Pre-requisite: Machine Tools, CAD/CAM

Course Objectives:

This course will enable students to:

1. Understand the fundamentals of numerical control, Fundamentals of N/C Machine control and CNC Machine Elements
2. Acquire knowledge of Tooling systems for CNC Machines and features of NC Part Programming
3. Get exposure to the basics of DAPP post processer problems
4. To Know the latest developments in CNC and its Maintenance
5. Learn about Micro Controllers, their Hardware components, Programming Logic Controllers, basic structure, principle of operation & Applications in CNC Machines.

Module 1:

Unit 1: Computer-Aided Programming: General information, APT programming, Examples Apt programming problems (2D machining only). NC programming on CAD/CAM systems

Unit 2: Design and implementation of post processors, Introduction to CAD/CAM software, Automatic Tool path generation

Module 2:

Unit 1: Tooling for CNC Machines: Interchangeable tooling system, preset and qualified tools, coolant fed tooling system, modular featuring, and quick change tooling system. Automatic head changers, automatic pallet change, Automatic pallet storage and tool resetting system

Module 3:

Unit 1: Post Processors for CNC: Introduction to Post Processors: The necessity of a Post Processor, the general structure of a Post Processor, the functions of a Post Processor.

Unit 2: DAPP based Post Processor: Communication channels and major variables in the DAPP — based Post Processor, the creation of a DAPP — Based Post Processor.

Module 4:

Unit 1: Micro Controllers: Introduction, Hardware components, I/O pins, ports, external memory: counters, timers and serial data I/O interrupts. Selection of Micro Controllers Embedded Controllers, Applications and Programming of Micro Controllers.

Unit 2: Programming Logic Controllers (PLC' s): Introduction, Hardware components of PLC, System, basic structure, principle of operations, Programming mnemonics timers, Internal relays and counters, Applications of PLC's in CNC Machines

Module 5:

Unit 1: Computer Aided Process Planning: Hybrid CAAP System, Computer Aided Inspection and quality control, Coordinate Measuring Machine, Limitations of CMM, Computer Aided Testing, and Optical Inspection Methods.

Unit 2: Artificial Intelligence and expert system: Artificial Neural Networks, Artificial Intelligence in CAD, Experts systems and its structures.

Text Books:

1. Alavala, "CAD/CAM Concepts and Applications", PHI Publishers.
2. P. N. Rao, "CAD/CAM Principles and Applications", TMH.

Reference Books:

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

E - Resources:

1. https://rb.gy/flcfru
2. https://rb.gy/tmwegw
3. https://rb.gy/8oteqs
4. https://nptel.ac.in/courses/112/102/112102103/

Course Outcomes:

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

1. Get exposure to the design considerations of NC machine tools and CNC Machine Elements

2. Analyze the Tooling system of CNC and utilize the basic knowledge of NC Part Programming for simple jobs
3. Acquire knowledge of DAPP concepts.
4. Apply the knowledge gained about the features and operating principles of Micro Controllers, Embedded Controllers, and Programming Logic Controllers in CNC Machines.
5. Acquire complete knowledge about CAPP Systems and Lear latest advancements in CNC system,

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM I Year – I Sem			
Course Code: JM11C	MECHANICAL BEHAVIOUR OF MATERIALS	L	T	P	D
Credits: 3	Program Elective – I	3	0	0	0

Pre-requisite: Materials Engineering, Strength of Materials.

Course Objectives:

This course will enable students to

6. Understand the concept of stresses, strains and its application.
7. Develop the ability to understand the importance of Elasticity Theory and Plastic Deformation
8. Acquired the knowledge of crystals and their defects in Microscopic view of plastic deformation.
9. Evaluate the importance of Design based on fracture mechanics.
10. Analyze the Deformation under cyclic load and at High temperature.

Module 1:

Unit 1: Concept of stresses and strains, engineering stresses and strains, Different types of loading and temperature encountered in applications.

Unit 2: Tensile Test - stress-strain response for metal, ceramic and polymer, elastic region, yield point, plastic deformation, necking and fracture, bonding and Material Behaviour, theoretical estimates of yield strength in metals and ceramics

Module 2:

Unit 1: Elasticity Theory: The State of Stress and strain, stress and strain tensor, tensor transformation, principal stress and strain, elastic stress-strain relation, anisotropy, elastic behavior of metals, ceramics and polymers.

Unit 2: Yielding and Plastic Deformation: Hydrostatic and Deviatoric stress, Octahedral stress, yield criteria and yield surface, texture and distortion of yield surface, Limitation of engineering strain at large deformation, true stress and true strain, effective stress, effective strain, flow rules, strain hardening, RambergOsgood equation, stress - strain relation in plasticity, plastic deformation of metals and polymers

Module 3:

Unit 1: Microscopic view of plastic deformation: crystals and defects, classification of defects, thermodynamics of defects, geometry of dislocations, slip and glide, dislocation generation - Frank Read and grain boundary sources, stress and strain field around dislocations, force on dislocation - self-stress, dislocation interactions, partial dislocations, twinning, dislocation movement and strain rate.

Unit 2: Deformation behavior of single crystal, critical resolved shear stress (CRSS), deformation of poly-crystals - Hall-Petch and other hardening mechanisms, grain size effect - source limited plasticity, Hall-Petch breakdown, dislocations in ceramics and glasses.

Module 4:

Unit 1: Fracture: fracture in ceramics, polymers and metals, different types of fractures in metals, fracture mechanics - Linear fracture mechanics -KIC, Elasto-plastic fracture mechanics - JIC, Measurement and ASTM standards.

Unit 2: Design based on fracture mechanics, effect of environment, effect of microstructure on KIC and JIC, application of fracture mechanics in the design of metals, ceramics and polymers

Module 5:

Unit 1: Deformation under cyclic load - Fatigue: S-N curves, Low and high cycle fatigue, Life cycle prediction, Fatigue in metals, ceramics and polymers

Unit 2: Deformation at High temperature: Time dependent deformation - creep, different stages of creep, creep and stress rupture, creep mechanisms and creep mechanism maps, creep under multi-axial loading, micro-structural aspects of creep and design of creep resistant alloys, high temperature deformation of ceramics and polymers

Text Books:

1. Krishan Kumar Chawla, “Mechanical Behavior of Materials”, Cambridge University Press, 2018.

Reference Books:

1. G.E. Dieter, "Mechanical Metallurgy", TataMcGraw Hill, 2001.
2. R.W. Hertzberg, "Deformation and Fracture Mechanics of Engineering Materials", John Wiley and Sons, 2010.

E - Resources:

1. https://rb.gy/9jla1c
2. https://rb.gy/uizlma

Course Outcomes:

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

1. Develop a fundamental understanding of the mechanical behavior of engineering materials
2. Evaluate the concept of Elasticity Theory and Plastic Deformation to understands the behavior of materials.

3. Apply knowledge of mathematics, physics and materials science to solve engineering problems.
4. Understand the different mechanisms of material failures.
5. Develop the techniques and skills necessary for metallurgical practice.

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM I Year – I Sem			
Course Code JM11D	STRESS ANALYSIS AND VIBRATION Program Elective – I	L	T	P	D
Credits: 3		3	0	0	0

Pre-requisite: Engineering Mechanics, Strength of Materials, Theory of Machines

Course Objectives:

This course will enable students to:

1. Recall facts and basic concepts of theory of elasticity.
2. Understand Stress analysis of symmetric bodies and contact stresses.
3. Learn Damping applications, Free and forced vibrations.
4. Recognise transient vibrations of different degree of freedom systems.
5. Understand Free and forced vibrations of strings bars and Beams, Principle of orthogonality.

Module 1:

Introduction of theory of elasticity: Two dimensional elasticity theories in Cartesian coordinates. Plane stress problem in polar coordinates thick cylinders, rotating discs, stress concentration

Module 2:

Stress analysis of symmetric bodies and contact stresses: Torsion of non-circular prismatic sections, rectangular and axi-symmetric, Circular plates.
Introduction to shell theory, contact stresses

Module 3:

Free and forced vibrations: Single degree freedom, two degree freedom system without and with damping, Free and forced vibrations.

Module 4:

Transient vibrations: Transient vibrations of single and two degree and multi-degree of freedom systems, Applications of matrix methods.

Module 5:

Continuous systems: Free and forced vibrations of strings bars and Beams, Principle of orthogonality - classical and energy methods

Text Books:

1. S.P.Timoshenko, J. N. Goodier, “Theory of Elasticity”, Mc Graw Hill, 3rd Edition, 1970.
2. J. P. Den Hartog, “Mechanical Vibrations”, Dover Publications, 1st Edition, 2013.

Reference Books:

1. W.T.Thomson, “Theory of Vibrations with Applications”, CBS Publishing, 3rd Edition, 2013.
2. S. S. Rao, “Mechanical Vibrations”, Addison Wesley Longman.

E - Resources:

1.https://www.elsevier.com/books/modern-practice-in-stress-and-vibration-analysis/mottershead/978-0-08-037523-6
2. http://nptel.ac.in/courses/112106068/

Course Outcomes:

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

1. Apply the knowledge of theory of elasticity.
2. Relate Stress analysis of symmetric bodies and contact stresses in the field of Design
3. Differentiate Free and forced vibrations.
4. Apply the knowledge of different Transient vibrations methods
5. Apply the knowledge of continuous systems in various design fields.

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM I Year – I Sem			
Course Code JM11E	RAPID PROTOTYPING TECHNOLGIES Program Elective – I	L	T	P	D
Credits: 3		3	0	0	0

Pre-requisite: Manufacturing Technology, CAD/CAM**.**

Course Objectives:

This course will enable students to:

1. Learn fundamental concepts of Rapid prototyping technologies.
2. Understand the importance of Liquid-based Rapid Prototyping Systems, Solid ground curing (SGC), Solid-based Rapid Prototyping Systems
3. Identify the various Powder Based Rapid Prototyping Systems and Rapid Tooling.
4. Describe Rapid Prototyping Data Formats, Rapid Prototyping Software's.
5. Understand the RP Applications, RP Medical and Bioengineering Applications.

Module 1:

Unit 1: Introduction: Prototyping fundamentals, historical development, fundamentals of rapid prototyping, advantages and limitations of rapid prototyping, commonly used terms.

Unit 2: Classification of RP process: rapid prototyping process chain: Fundamental automated processes, process chain.

Module 2:

Unit 1: Liquid-based Rapid Prototyping Systems: Stereo lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies.

Unit 2: Solid ground curing (SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies

Unit 3: Solid-based Rapid Prototyping Systems: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

Module 3:

Unit 1: Powder Based Rapid Prototyping Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and

Disadvantages, Case studies. Three dimensional Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

Unit 2: Rapid Tooling: Introduction to Rapid Tooling (RT), Conventional Tooling Vs. RT, Need for RT. Rapid Tooling Classification: Indirect Rapid Tooling Methods: Spray Metal Deposition, RTV Epoxy Tools, Ceramic tools, Investment Casting, Spin Casting, Die casting, Sand Casting, 3D Keltool process. Direct Rapid Tooling: Direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3D Printing.

Module 4:

Unit 1: Rapid Prototyping Data Formats: STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Other Translators, Newly Proposed Formats.

Unit 2: Rapid Prototyping Software's: Features of various RP software's like Magic's, Mimics, Solid View, View Expert, 3 D View, Velocity 2 , Rhino, STL View 3 Data Expert and 3 D doctor.

Module 5:

Unit 1: RP Applications: Application – Material Relationship, Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewelry Industry, Coin Industry, GIS application, Arts and Architecture.

Unit 2: RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customized Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visualization of Bio-molecules.

TEXT BOOKS:

1.Chua C.K., Leong K.F, LIM C.S, "Rapid prototyping: Principles and Applications", World Scientific publications, 3 rd Edition, 2010.

REFERENCES:

1. D.T Pham, S. S. Dony, "Rapid Manufacturing", Springer, 1 st Edition, 2001.
2. Paul F Jacobs, "Rapid Prototyping & Manufacturing", Wohlers Associates, 2000 ASME Press, 1st Edition, 1996.

E - Resources:

1. https://books.google.co.in/books?id=4OYcyiDUpsQC&redir_esc=y
2.http://store.elsevier.com/Direct-Write-Technologies-for-Rapid-Prototyping-Applications/isbn- 9780121742317/
3. https://nptel.ac.in/courses/112/104/112104265/

4. https://onlinecourses.nptel.ac.in/noc20_me50/preview
5. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-me24/

Course Outcomes:

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

1. Recall fundamental concepts of Rapid prototyping technologies in production.
2. Explain the importance of Liquid-based Rapid Prototyping Systems, Solid ground curing (SGC), Solid-based Rapid Prototyping Systems.
3. Demonstrate the various Powder Based Rapid Prototyping Systems and Rapid Tooling.
4. Indentify the Rapid Prototyping Data Formats,Rapid Prototyping Software's.
5. Implementing in the RP Medical and Bioengineering Applications

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM I Year – I Sem			
Course Code JM11F	AUTOMATION IN MANUFACTURING Program Elective – II	L	T	P	D
Credits: 3		3	0	0	0

Pre-requisite: Manufacturing Technology and Industrial Engineering.

Course Objectives:

This course will enable students to:

1. Understand the basic principles of automation and tool transfer,
2. Implementation of automated flow line.
3. Understand ways of improving line balance and solving line balancing problems
4. Understand design aspects and analysis of material handling system.
5. Understand Concurrent Engineering concepts.

Module 1:

Unit 1: Over View of Manufacturing and Automation: Production systems, Automation in production systems, Automation principles and strategies, Manufacturing operations, production facilities.

Unit 2: Basic elements of an automated system, levels of automation; Hardware components for automation and process control, programmable logic controllers and personal computers

Module 2:

Material Handling and Identification Technologies: Material handling, equipment, Analysis. Storage systems, performance and location strategies, automated storage systems, AS/RS, types, automatic identification methods, Barcode technology, RFID

Module 3:

Manufacturing Systems and Automated Production Lines: Manufacturing systems: components of a manufacturing system, Single station manufacturing cells.

Manual Assembly lines, line balancing Algorithms, Mixed model Assembly lines, Alternative Assembly systems. Automated production lines, Applications, Analysis of transfer lines

Module 4:

Automated Assembly Systems: Fundamentals, Analysis of Assembly systems, cellular manufacturing, part families, cooling and production flow analysis

Group Technology and flexible Manufacturing systems, Quantitative Analysis.

Module 5:

Quality Control and Support Systems: Quality in Design and manufacturing, inspection principles and strategies, automated inspection, contact Vs non contact, CMM.

Manufacturing support systems. Quality function deployment, computer aided process planning, concurrent engineering, shop floor control, just in time and lean production.

Text Books:

1. Automation production systems and computer integrated manufacturing/ Mikell. P Groover/PHI/3rd edition/2012.
2. Automation, Production Systems and CIM/ Mike P.Grower/PHI
3. CAD/CAM/CIM/ P. Radha Krishnan & S. Subrahamanyarn and Raju/NewAge International Publishers/2003.

Reference Books:

1. System Approach to Computer Integrated Design and Manufacturing/Singh/John
2. Computer Aided Manufacturing/Tien-Chien Chang, Richard A. Wyskand Hsu-PinWang/ Pearson/2009.
3. Manufacturing and Automation Technology / R Thomas Wright and Michael Berkeihiser / GoodHeart/Willcox Publishers.

E - Resources:

1. https://nptel.ac.in/courses/112/102/112102011/
2. https://nptel.ac.in/courses/112/103/112103293/
3. https://www.automationmag.com/4721-ebook/
4. https://www.springer.com/gp/book/9781461295860
5. https://www.researchgate.net/publication/2289564_Automation_in_Manufacturing

Course Outcomes:

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

1. Implement concepts of a productive system in automation.
2. Apply the concepts of automated flow lines and design technologies.
3. Apply it in material handling systems for balancing assembly lines.
4. Implement of material handling system.
5. Applying Concurrent Engineering concepts

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM I Year – I Sem			
Course Code JM11G	COMPUTER AIDED PROCESS PLANNING Program Elective – II	L	T	P	D
Credits: 3		3	0	0	0

Pre-requisite: Manufacturing Process CAD/CAM.

Course Objectives:

This course will enable students to:

1. Understand process planning techniques.
2. Understand Manufacturing tolerances in design and manufacturing process.
3. Learn the process planning techniques.
4. Understand the concept of computer aided process planning.
5. Learn to integrate in various systems

Module 1:

Introduction: The Place of Process Planning in the Manufacturing cycle-Process planning and production planning, Process planning and Concurrent Engineering, CAPP, Group Technology

Module 2:

Part Design Representation: Design Drafting-Dimensioning-Conventional Tolerance-Geometric Tolerance-CAD-input/output devices-Topology.

Geometric transformation- Perspective transformation-Data Structure-Geometric modeling for process planning--GT Coding-The OPITZ system-The MICLASS System

Module 3:

Process Engineering and Process Planning: Experience based planning-Decision table and Decision trees-Process capability analysis. Process planning-Variant process planning- Generative approach-Forward and backward planning, Input format

Module 4:

Computer Aided Process Planning Systems: Logical Design of process planning-Implementation considerations-Manufacturing system components. Production Volume, Number of production families - CAM-I, CAPP, MIPLAN, APPAS, AUTOPLAN and PRO, CPPP.

Module 5:

An Integrated Process Planning Systems: Totally integrated process planning systems-An Overview.

Modulus structure-Data Structure-Operation-Report Generation, Expert process planning.

Text Books:

1. Gideon Halevi and Roland D. Weill, "Principle of process planning- A Logical Approach", Chapman &Hall,1995
2. Chang T. C. & Richard A. Wysk, "An Introduction to automated process planning systems", Prentice Hall 1985

Reference Books:

1. Chang, T. C., "An Expert Process Planning System",PrenticeHall, 1985
2. Nanua Singh, "Systems Approach to Computer Integrated Design and Manufacturing", JohnWiley&Sons,1996
3. Rao P.N., "Computer Aided Manufacturing", Tata McGraw Hill Publishing Co.,2000

E - Resources:

1. https://nptel.ac.in/courses/112/104/112104188/
2. https://www.coursera.org/lecture/mbse/manufacturing-planning-activities-AQ6Zi
3. https://www.pdfdrive.com/computer-aided-process-planning-capp-e19667856.html

Course Outcomes:

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

1. Apply the concept of computer aided process planning.
2. Design appropriate tolerances in design and manufacturing and tool paths.
3. Apply process planning techniques.
4. Implement techniques of CAPP.
5. Integrate various systems with CAPP techniques

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM I Year – I Sem			
Course Code JM11H	OPTIMIZATION TECHNIQUES AND APPLICATIONS	L	T	P	D
Credits: 3	Program Elective – II	3	0	0	0

Pre-requisite: Engineering Mathematics, Operations Research.

Course Objectives:

This course will enable students to:

1. Enumerate the fundamental knowledge of Linear Programming and Dynamic Programming problems.
2. Learn classical optimization techniques and non linear unconstrained optimization.
3. Know the basics of different evolutionary algorithms.
4. Explain Integer programming techniques and apply different optimization
5. Learn the techniques to solve various models arising from engineering areas.

Module 1:

Unit 1: Single Variable Non-Linear Unconstrained Optimization: Elimination methods: Uni- Model function-its importance, Fibonacci method & Golden section method.

Unit 2: Interpolation methods: Quadratic & Cubic interpolation methods.

Module 2:

Unit 1: Multi variable non-linear unconstrained optimization: Direct search methods – Univariant method, Pattern search methods – Powell's, Hook – Jeeves, Rosen brock search methods.

Unit 2: Gradient methods: Gradient of function& its importance, Steepest descent method, Conjugate direction methods: Fletcher-Reeves method & variable metric method.

Module 3:

Unit 1: Linear Programming: Formulation, Simplex method & Artificial variable optimization techniques: Big M & Two phase methods.

Unit 2: Sensitivity analysis: Changes in the objective coefficients, constants& coefficients of the constraints. Addition of variables, constraints. Simulation – Introduction – Types- steps – applications: inventory & queuing – Advantages and disadvantages

Module 4:

Unit 1: Integer Programming: Introduction – formulation – Geometry cutting plane algorithm – Zero or one algorithm, branch and bound method

Unit 2: Stochastic Programming: Basic concepts of probability theory, random variables- distributions-mean, variance, correlation, co variance, joint probability distribution. Stochastic linear programming: Chance constrained algorithm.

Module 5:

Unit 1: Geometric Programming: Polynomials – Arithmetic - Geometric inequality – unconstrained G.P- constrained G.P (≤type only)

Unit 2: Non Traditional Optimization Algorithms: Genetics Algorithm-Working Principles, Similarities and Differences between Genetic Algorithm & Traditional Methods. Simulated Annealing-Working Principle-Simple Problems. Introduction to Particle Swarm Optimization (PSO) (very brief)

Text Books:

1. Optimization theory & Applications by S.S.Rao, NewAge International.
2. Optimization for Engineering Design by Kalyanmoy Deb, PHI

Reference Books:

1. Operations Research by S.D. Sharma
2. Operation Research by H.A.Taha, TMH
3. Optimization in operations research by R.LRardin

E - Resources:

1. https://rb.gy/l6evdb
2. https://rb.gy/xeygcc

Course Outcomes:

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

1. Assessing the fundamental knowledge of Linear Programming and Dynamic Programming problems.
2. Apply classical optimization techniques and non linear unconstrained optimization.
3. Categorized the basics of different evolutionary algorithms.
4. Explain Integer programming techniques and apply different optimization
5. Execute the techniques to solve various models arising from engineering areas.

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM I Year – I Sem			
Course Code JM11I	ADVANCED COMPUTER AIDED DESIGN LAB	L	T	P	D
Credits: 2		0	0	4	0

Pre-requisite: CAD/CAM

Course Objectives:

This course will enable students to:

1. Learn various drawing commands in the CAD software.
2. Draw the sketch of the components.
3. Create the 3D components of the various parts.
4. Understand the assembly of the machine parts.
5. Learn to create engineering drawing details.

List of Exercises

Experiment 1: Understanding of various CAD commands and creating simple objects

Experiment 2: Understanding of holes, cuts and model tree relations

Experiment 3: Creation shafts, rounds, chamfers and slots

Experiment 4: Sketch Tools & Datum planes

Experiment 5: Creation of objects by revolved features, patterns and copies, sweeps and blends

Experiment 6: Understand the various commands related to surface modelling and solid modelling

Experiment 7: Create components using the modelling commands

Experiment 8: Understand the various commands related to sheet metal modeling

Experiment 9: Create components using sheet metal modelling and understand the significance of sheet metal components

Experiment 10: Creation of engineering drawing details such as dimensioning, sectional views, adding esthetics

Experiment 11: Assembling of part models using constraints, part modifications, adding another assembly features – display

E - Resources:

1. https://rb.gy/al67cc

Course Outcomes:

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

1. Execute the 2D drawing
2. Apply the commands for developing new parts.
3. Execute the surface and solid modeling.
4. Analyze the parts of intersection.
5. Execute the assembly of the machine

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM I Year – I Sem			
Course Code JM11J	ADVANCED COMPUTER AIDED MANUFACTURING LAB	L	T	P	D
Credits: 2		0	0	4	0

Pre-requisite: CAD/CAM

Course Objectives:

This course will enable students to:

1. Learn the G codes and M codes.
2. Write part program for CNC operation.
3. Perform the machining operations in the CNC machine
4. Learn the simulation process by software
5. Study the robotic motions

List of Experiments

Experiment 1: Facing, turning, step turning, taper turning, contouring etc. on CNC lathe machine.

Experiment 2: Tool path simulation using any CAM software.

Experiment 3: Demonstration of manufacturing of simple parts on CNC machine.

Experiment 4: Practice in part programming and operation of CNC turning machines, subroutine techniques and use of cycles.

Experiment 5: Practice in part programming and operating a machining center, tool planning and selection of sequences of operations, tool setting on machine.

Experiment 6: Programming for simulation of integrating various machines, robots and material handling equipment using plant layout simulation software like FlexSim/Arena/Promodeletc

Experiment 7: Pocketing and contouring on CNC milling machine using any CAM software

Experiment 8: Practice in Robot programming and its languages.

Experiment 9: Robotic simulation using software

E - Resources:

1. https://rb.gy/al67cc

Course Outcomes:

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

1. Develop the part program for new products.
2. Execute the machining operations on the CNC lathe.
3. Execute the machining operations on the CNC milling.
4. Plan the process of the production.
5. Apply the robotics in automated manufacturing system

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM I Year – II Sem			
Course Code JM12A	MANUFACTURING SYSTEMS: SIMULATION MODELLING AND ANALYSIS	L	T	P	D
Credits: 3	Core Course – III	3	0	0	0

Pre-requisite: Nil

Course Objectives:

This course will enable students to:

1. Define the basics of simulation modeling and replicating the practical situations in organizations
2. Develop simulation model using heuristic methods.
3. Generate random numbers and random varieties using different techniques.
4. Analysis of Simulation models using input analyzer and output analyzer
5. Explain Verification and Validation of simulation model.

Module 1:

Unit 1: System – ways to analyze the system – Model - types of models – Simulation – Definition – Types of simulation models – steps involved in simulation – Advantages & Disadvantages.

Unit 2: Parameter estimation – estimator – properties – estimate – point estimate – confidence interval estimates – independent – dependent – hypothesis – types of hypothesis- steps – types 1& 2 errors – Framing – strong law of large numbers.

Module 2:

Unit 1: Building of Simulation model – validation – verification – credibility – their timing – principles of valid simulation Modeling – Techniques for verification – statistical procedures for developing credible model.

Unit 2: Modeling of stochastic input elements – importance – various procedures – theoretical distribution – continuous – discrete – their suitability in modeling.

Module 3:

Unit 1: Generation of random variates – factors for selection – methods – inverse transform – composition – convolution – acceptance – rejection – generation of random variables – exponential – uniform – weibull – normal Bernoullie – Binomial – uniform – Poisson.

Unit 2: Simulation languages – comparison of simulation languages with general purpose languages – Simulation languages vs Simulators – software features – statistical capabilities – GPSS – SIMAN- SIMSCRIPT –Simulation of M/M/1 queue – comparison of simulation languages.

Module 4:

Unit 1: Output data analysis – Types of Simulation w.r.t output data analysis – warm-up period- Welch algorithm

Unit 2: Approaches for Steady State Analysis – replication – Batch means methods – comparisons

Module 5:

Unit 1: Output data analysis – Types of Simulation w.r.t output data analysis – warm-up period- Welch algorithm

Unit 2: Approaches for Steady State Analysis – replication – Batch means methods – comparisons

Text Books:

1. Simulation Modelling and Analysis by Law, A.M. & Kelton, McGraw Hill, 2nd Edition, NewYork, 1991.
2. Discrete Event System Simulation by Banks J. & Carson J.S., PH, Englewood Cliffs, NJ, 1984.

Reference Books:

1. Simulation of Manufacturing Systems by Carrie A., Wiley, NY,1990
2. A Course in Simulation by Ross, S.M., McMillan, NY, 1990.
3. Simulation Modelling and SIMNET by Taha H.A., PH, Englewood Cliffs,1987

E - Resources:

1. https://rb.gy/sdtqto

Course Outcomes:

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

1. Describe the role of important elements of discrete event simulation and modelling paradigm.
2. Conceptualize real world situations related to systems development decisions, originating from source requirements and goals.
3. Develop skills to apply simulation software to construct and execute goal-driven system models.
4. Analyse the output data using different methods and techniques
5. Interpret the model and apply the results to resolve critical issues in a real world environment.

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM I Year – II Sem			
Course Code JM12B	ADVANCED FINITE ELEMENT METHODS Core Course – IV	L	T	P	D
Credits: 3		3	0	0	0

Pre-requisite: Engineering Mechanics, Strength of Materials.

Course Objectives:

This course will enable students to:

1. Equip the students with the Finite Element Analysis fundamentals and formulations.
2. Enable the students to formulate the truss, beam problems.
3. Enable the students to formulate 2D problems with special cases and use of numerical integration.
4. Enable the students to formulate 3D problems and one dimensional dynamic problem.
5. Enable the students to formulate heat transfer problems and perform engineering simulations using Finite Element Analysis software

Module 1:

Unit 1: Introduction to FEM, basic concepts, historical back ground, applications of FEM, general description, comparison of FEM with other methods, variational approach, Glerkin's Methods. Co-ordinates, basic element shapes, interpolation function, Virtual energy principle, Rayleigh – Ritz method.

Unit 2: Properties of stiffness matrix, treatment of boundary conditions, solution of system of equations, shape functions and characteristics, Basic equations of elasticity, strain- displacement relations.

Module 2:

Unit 1: 1-D Structural Problems: Axial bar element – stiffness matrix, load vector, temperature effects, Quadratic shape functions and problems.

Unit 2: Analysis of Trusses: Plane Trusses and Space Truss elements and problems. Analysis of BEAM: Hermite shape functions- stiffness matrix - Load vector- Problems

Module 3:

Unit 1: 2-D problems: CST, LST, force terms, Stiffness matrix and load vectors, boundary conditions, Iso-parametric elements – quadrilateral element, shape functions – Numerical Integration.

Unit 2: Finite element modeling of Axi-symmetric solids subjected to Axi-symmetric loading with triangular elements. **Problems**: Tetrahedran element – Jacobian matrix – Stiffness matrix.

Module 4:

Unit 1: Scalar Field Problems: 1-D Heat conduction-Slabs – fins. 2-D heat conduction problems – Introduction to Torsional problems.

Module 5:

Unit 1: Dynamic considerations, Dynamic equations – consistent mass matrixEigen Values, Eigen vector, natural frequencies – mode shapes – modal analysis.

Text Books:

1. Finite Element Methods: Basic Concepts and applications, Alavala, PHI.
2. Finite Element Method – Zincowitz / McGrawHill

Reference Books:

1. The Finite Element Methods in Engineering / SS Rao/Pergamon.
2. Introduction to Finite Elements in Engineering, Chandrupatla, Ashok and Belegundu, Prentice–Hall
3. Introduction to Finite element analysis- S. Md. Jalaludeen, Anuradha Publications, 2012

E - Resources:

1. https://nptel.ac.in/courses/112/104/112104116/
2. https://nptel.ac.in/courses/112/104/112104193/
3. https://rb.gy/azoihu
4. https://www.pdfdrive.com/finite-element-analysis-e24706861.html

Course Outcomes:

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

1. Apply FE method for solving field problems using Virtual work and Potential energy formulations.
2. Analyze axial bar, truss and beam problems using FEM.
3. Analyze 2D structural problems using CST element and analyze plane stress, plane strain and axis symmetric problems and
4. Formulate 3D elements and Apply the concepts of numerical integration in FE modeling
5. Solve linear 1D and 2D heat conduction and convection heat transfer problems, apply finite element analysis to estimate natural frequencies for stepped bar and beam.

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM I Year – II Sem			
Course Code JM12C	INTELLIGENT MANUFACTURING SYSTEMS	L	T	P	D
Credits: 3	Program Elective – III	3	0	0	0

Pre-requisite: CAD/CAM, Production and Operation Management

Course Objectives:

This course will enable students to:

1. To understand components, structures, function of CIM, computer system Architecture and data requirements
2. To know about components of knowledge-based systems
3. To analyze machine learning, Artificial Intelligence and Neural Networks and their applications in manufacturing
4. To identify process planning and its automation, equipment selection and modelling techniques and apply them in manufacturing system design
5. To define group technology algorithms and interpret knowledge Based Group Technology systems

Module 1:

Unit 1: Computer Integrated Manufacturing Systems Structure and functional areas of CIM system, - CAD, CAPP, CAM, CAQC, ASRS. Advantages of CIM

Unit 2: Manufacturing Communication Systems - MAP/TOP, OSI Model, Data Redundancy, Top- down and Bottom-up Approach, Volume of Information. Intelligent Manufacturing System Components, System Architecture and Data Flow, System Operation.

Module 2:

Unit 1: Components of Knowledge Based Systems - Basic Components of Knowledge Based Systems, Knowledge Representation.

Unit 2: Comparison of Knowledge Representation Schemes, Interference Engine, Knowledge Acquisition.

Module 3:

Unit 1: Machine Learning - Concept of Artificial Intelligence, Conceptual Learning, Artificial Neural Networks - Biological Neuron, Artificial Neuron. Types of Neural Networks, Applications in Manufacturing.

Module 4:

Unit 1: Automated Process Planning - Variant Approach, Generative Approach, Expert

Systems for Process Planning, Feature Recognition, Phases of Process planning. Knowledge Based System for Equipment Selection (KBSES) - Manufacturing system design.

Unit 2: Equipment Selection Problem, Modelling the Manufacturing Equipment Selection Problem, Problem Solving approach in KBSES, Structure ofthe KRSES.

Module 5:

Unit 1:Group Technology: Models and Algorithms Visual Method, Coding Method, Cluster Analysis Method, Matrix Formation - Similarity Coefficient Method, Sorting-based Algorithms, Bond Energy Algorithm, Cost Based method, Cluster Identification Method, Extended CI Method.

Unit 2: Knowledge Based Group Technology - Group Technology in Automated Manufacturing System. Structure of Knowledge based system for group technology (KBSCIT) — Data Base, Knowledge Base, Clustering Algorithm

Text Books:

1. Intelligent Manufacturing Systems/ AndrewKusiak / PrenticeHall.
2. Artificial Neural Networks / YagnaNarayana/PHI/2006

Reference Books:

1. Automation, Production Systems and CIM / Groover M.P. / PHI / 2007
2. Neural networks: A comprehensive foundation/ SimonHhaykin / PHI.
3. Artificial neural networks/ B. Vegnanarayana / PHI
4. Neural networks in Computer intelligence/ Li Min Fu/TMH/2003

E - Resources:

1. https://nptel.ac.in/courses/112/104/112104188/
2. https://nptel.ac.in/courses/112/102/112102011/
3. http://www.nptelvideos.in/2012/11/industrial-automation-and-control.html

Course Outcomes:

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

1. Design and develop CIM system
2. Test components of knowledge based systems
3. Apply concepts of neural networks in areas of manufacturing
4. Make use of automated process planning and knowledge based system for equipment selection for manufacturing systems
5. Analyze Group Technology models and algorithms for automated manufacturing cells

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM I Year – II Sem			
Course Code JM12D	SPECIAL MANUFACTURING PROCESSES Program Elective – III	L	T	P	D
Credits: 3		3	0	0	0

Pre-requisite: Manufacturing Technology, Composites, Rapid Prototyping

Course Objectives:

This course will enable students to:

1. Understand the various surface treatment and coating processes.
2. Understand the applications and processing of ceramics.
3. Understand the assembly of microelectronic devices.
4. Identify the techniques of e-manufacturing.
5. Understand the methodologies of rapid prototyping.

Module 1:

Unit 1: Surface Treatment: Scope, Cleaners, Methods of cleaning, Surface coating types, and ceramic and organic methods of coating, economics of coating.

Unit 2: Electro forming, Chemical vapor deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding

Module 2:

Unit 1: Processing of Ceramics: Applications, characteristics, classification. Processing of particulate ceramics, Powder preparations, consolidation, Drying, sintering, Hot compaction, Area of application, finishing of ceramics.

Unit 2: Processing of Composites: Composite Layers, Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites.

Module 3:

Unit 1: Fabrication of Microelectronic Devices: Crystal growth and wafer preparation, Film Deposition oxidation, lithography, bonding and packaging, reliability and yield.

Printed Circuit boards, computer aided design in micro electronics, surface mount technology, Integrated circuit economics.

Module 4:

Unit 1: E-Manufacturing: Nano manufacturing techniques and micromachining. High Speed Machining and hot machining

Module 5:

Unit 1: Rapid Prototyping: Working Principles, Methods, Stereo Lithography, Laser Sintering, Fused Deposition Method, Applications and Limitations. Rapid tooling, Techniques of rapid manufacturing.

Text Books:

1. Manufacturing Engineering and Technology *I* Kalpakijian /AdissonWesley,1995.
2. Process and Materials of Manufacturing / R. A. Lindburg/ 1th edition,PHI1990.

Reference Books:

1. MEMS & Micro Systems Design and manufacture / Tai — Run Hsu/TMGH
2. Advanced Machining Processes / V.K.Jain /Allied Publications.
3. Introduction to Manufacturing Processes / John A ScheyMcGraw Hill

E - Resources:

1. https://rb.gy/jydary
2. https://rb.gy/lganjf

Course Outcomes:

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

1. Analyze the various surface treatment and coating processes.
2. Identify the applications and processing of ceramics.
3. Create the assembly of microelectronic devices.
4. Apply the techniques of e-manufacturing.
5. Analyze the methodologies of rapid prototyping.

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM I Year – II Sem			
Course Code JM12E	PRECISION ENGINEERING Program Elective – III	L	T	P	D
Credits: 3		3	0	0	0

Pre-requisite: Metrology

Course Objectives:

This course will enable students to:

1. Understand the concept of Accuracy, Geometric Dimensioning and Tolerancing in CNC machines and products.
2. Evaluate the importance of datum system and its applications in designing the high precision machines.
3. Examine the basic precision engineering methodology and state-of-the-art concepts for designing high-precision CNC machines and products.
4. Develop the ability to understand the importance of achieving surface finish using different tolerance grades.
5. Apply the acquired knowledge to other design efforts and fields as well.

Module 1:

Unit 1: Concepts of Accuracy: Introduction – Concept of Accuracy of Machine Tools – Spindle and Displacement Accuracies – Accuracy of numerical Control Systems – Errors due to Numerical Interpolation Displacement Measurement System and Velocity Lags.

Unit 2: Geometric Dimensioning and Tolerancing: Tolerance Zone Conversions – Surfaces, Features, Features of Size, Datum Features – Datum Oddly Configured and Curved Surfaces as Datum Features, Equalizing Datums –Datum Feature of Representation – Form Controls, Orientation Controls – Logical Approach to Tolerancing

Module 2:

Unit 1: Datum Systems: Design of freedom, Grouped Datum Systems – different types, two and three mutually perpendicular grouped datum planes; Grouped datum system with spigot and recess, pin and hole.

Unit 2: Grouped Datum system with spigot and recess pair and tongue – slot pair – Computation of Transnational and rotational accuracy, Geometric analysis and application.

Module 3:

Unit 1: Tolerance Analysis: Process Capability, Mean, Variance, Skewness,

Kurtosis, Process Capability Metrics, C_p, C_{pk}, Cost aspects, Feature Tolerances, Geometric Tolerances.

Unit 2: Tolerance Charting Techniques: Operation Sequence for typical shaft type of components, Preparation of Process drawings for different operations, Tolerance worksheets and centrally analysis, Examples. Design features to facilitate machining; Datum Features – functional and manufacturing. Components design – Machining considerations, Redesign for manufactured, Examples

Module 4:

Unit 1: Surface finish, Review of relationship between attainable tolerance grades and different machining process. Cumulative effect of tolerances sure fit law, normal law and truncated normal law

Module 5:

Unit 1: Fundamentals of Nanotechnology: System of nanometer accuracies – Mechanism of metal Processing – Nano physical processing of atomic bit units. Nanotechnology and Electrochemical atomic bit processing.

Unit 2: Measuring systems processing: In processing or in-situ measurement of position of processing point-Post process and on- machine measurement of dimensional features and surface-mechanical and optical measuring systems

Text Books:

1. Precision Engineering in Manufacturing / murthy R. L., / New Age International (P) limited, 1996.
2. Geometric Dimensioning and Tolerancing / James D.Meadows / Marcel Dekker Inc.1995.

Reference Books:

1. Nano Technology / Norio Taniguchi / Oxford University Press, 1996
2. Engineering Design – Asystematic Approach /Matousek / Blackie & Son Ltd, London.

E - Resources:

1.https://www.google.co.in/books/edition/Precision_Engineering_in_Manufacturing/vueapsbGLc4C?hl=en&gbpv=1&dq=precision+engineering&printsec=frontcover

Course Outcomes:

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

1. Evaluate the part and machine tool accuracies.
2. Apply fits and tolerances for parts and assemblies according to ISO standards.
3. Apply selective assembly concept for quality and economic production

4. Assign tolerances using principles of dimensional chains for individual features of a part or assembly.
5. Analyse the causes for dimensional and geometrical errors prior to and during machining and suggest remedies

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM I Year – II Sem			
Course Code JM12F	ADVANCED MECHATRONICS Program Elective – IV	L	T	P	D
Credits: 3		3	0	0	0

Pre-requisite: Engineering Mathematics, Engineering Mechanics, C programming

Course Objectives:

This course will enable students to:

1. Capture the working and design process of a mechatronic system.
2. Employ the working principles of mechatronic elements to understand the applications of MEMS.
3. Detect the importance of hydraulic and pneumatic actuating systems.
4. Detail the function of controllers in digital electronic systems.
5. Trace the development of industrial automation by interfacing and dynamic analogies.

Module 1:

Unit 1: Mechatronics systems, elements, levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, microprocessor-based **Unit 2:** Controllers, advantages and disadvantages of mechatronics systems.

Sensors and transducers, types, displacement, position, proximity, velocity, motion, force, acceleration, torque, fluid pressure, liquid flow, liquid level, temperature and light sensors.

Module 2:

Solid state electronic devices, PN junction diode, BJT, FET, DIA and TRIAC. Analog signal conditioning, amplifiers, filtering. Introduction to MEMS & typical applications

Module 3:

Hydraulic and pneumatic actuating systems, Fluid systems, Hydraulic and pneumatic systems, components, control valves, electro-pneumatic, hydro-pneumatic. Electro-hydraulic servo systems: Mechanical actuating systems and electrical actuating systems, shape memory alloys.

Module 4:

Digital electronics and systems, digital logic control, micro processors and micro controllers, programming, process controllers. Programmable logic controllers, PLCs versus computers, application of PLCs for control.

Module 5:

System and interfacing and data acquisition, DAQS, SCADA, A to D and D to A conversion; Dynamic models and analogies, System response. Design of mechatronics systems & future trends, Industrial automation.

Text Books:

1. K.P. Ramachandran, G.K. VijayaRaghavan, M.S. Balasundaram "MECHATRONICS: Integrated Mechanical Electronics Systems", WILEY, 2019.
2. William Bolton, "Mechatronics: Electronics Control Systems in Mechanical and Electrical Engineering" , Pearson Education Limited, 6th edition, 2015.
3. Newton C Braga, "Mechatronics Source Book", Thomson Publication, 1st edition, 2009.

Reference Books:

1. N. Shanmugam, "Mechatronics", Anuradha Publications, 2010.
2. Devdasshetty, Richard A. Kolk, "Mechatronics System Design", 2nd edition, 2010.
3. M.D. Singh, J.G. Joshi, "Mechatronics" ,PHI Learning, 2009.

E - Resources:

1. https://nptel.ac.in/courses/112/103/112103174/
2. https://www.edx.org/course/mechatronics
3. https://www.sciencedirect.com/science/article/abs/pii/S092188909900086X
4. https://www.google.co.in/books/edition/Advanced_Mechatronics/OiBpDQAAQBAJ?hl=en&gbpv=1
5. https://www.google.co.in/books/edition/Advanced_Mechatronics_Solutions/xbzfCgAAQBAJ?hl=en&gbpv=1

Course Outcomes:

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

1. Explore the applications of sensors and transducers.
2. Ensure the suitability of mechatronic elements' applications in various electronic devices.
3. Critique the working of hydraulic and pneumatic systems in detail.
4. Elaborate the applications of logic controllers and microprocessors.
5. Depict the future trends of mechatronic systems.

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM I Year – II Sem			
Course Code JM12G	DESIGN AND MANUFACTURING OF MEMS AND MICRO SYSTEMS	L	T	P	D
Credits: 3	Program Elective – IV	3	0	0	0

Pre-requisite: Chemistry, Physics, Mechanics, Basic Electrical and Electronics Engineering.

Course Objectives:

This course will enable students to:

1. Dissect the working principles of micro electronics.
2. Recall the theory of atomic bonding, doping and diffusion process.
3. Study the application of mechanics principles to micro-systems stress analysis.
4. Recall the theory of continuum principles of laminar, incompressible fluid flows.
5. Acquire theoretical knowledge of materials and micromachining.

Module 1:

Unit 1: Overview and Working Principles of MEMS and Microsystems: MEMS & Microsystems, Evolution of Micro fabrication, Microsystems & Microelectronics, Microsystems & Miniaturization.

Unit 2: Applications of MEMS in Industries, Micro sensors, Micro actuation, MEMS with Micro actuators Micro accelerometers, Micro fluidics

Module 2:

Unit 1: Engineering Science for Microsystems Design and Fabrication: Atomic structure of Matter, Ions and Ionization.

Unit 2: Molecular Theory of Mater and Intermolecular Force, Doping of Semiconductors, The diffusion Process, Plasma Physics, Electrochemistry, Quantum Physics

Module 3:

Unit 1: Engineering Mechanics for Microsystems Design: Static Bending of thin Plates, Mechanical Vibration

Unit 2: Thermo mechanics Fracture Mechanics, Thin-Film Mechanics, Overview of Finite Element Stress Analysis

Module 4:

Unit 1: Thermo Fluid Engineering & Microsystems Design: Overview of Basics of Fluid Mechanics in Macro and Meso scales, Basic equations in Continuum Fluid dynamics, Laminar Fluid Flow in Circular Conduits, Computational Fluid Dynamics,

Incompressible Fluid Flow in Micro conduits, Fluid Flow in Sub micrometer and Nano scale.

Unit 2: Overview of Heat conduction in Solids, Heat Conduction in Multilayered Thin films and in solids in sub micrometer scale, Design Considerations, Process Design Mechanical Design, Mechanical Design using FEM, Design of a Silicon Die for a Micro pressure Sensor.

Module 5:

Unit 1: Materials for MEMS & Microsystems and Their Fabrication: Substrates and Wafers, Active substrate materials, Silicon as a substrate material, Silicon Compounds, Silicon Piezo-resistors, Gallium Arsenide, Quartz, Piezoelectric Crystals and Polymers, Photolithography.

Unit 2: Ion implantation, Diffusion and oxidation, chemical and physical vapor deposition, Etching, Bulk micro manufacturing, Surface Micromachining, The LIGA Process

Text Books:

1. Tai-Ran Hsu, "MEMs & Microsystems: Design & Manufacture", Tata McGraw Hill Education, 1st edition, 2017.
2. NadimMaluf, Kirt Williams, "An Introduction to Micro-electromechanical Systems Engineering", M./Artech House, Boston, 2nd edition, 2004.
3. Trim, DonalW.,"Applied Partial Differential Equations", Boston: PWS - Kent Pub. Co., 1994.

Reference Books:

1. Micro robots and Micromechanical Systems/ Trimmer, W.S.N/ Sensors & Actuators, vol 19, 1989.

E - Resources:

1. https://nptel.ac.in/courses/117/105/117105082/
2. https://www.coursera.org/lecture/sensor-manufacturing-process-control/2-mems-construction-0tHJV
3. https://www.sciencedirect.com/science/article/abs/pii/S0264127518305987
4. https://www.google.co.in/books/edition/Analysis_and_Design_Principles_of_MEMS_D/No7NNfc1pfYC?hl=en&gbpv=1
5. https://www.google.co.in/books/edition/MEMS/6HvLBQAAQBAJ?hl=en&gbpv=1

Course Outcomes:

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

1. Explain the applications of MEMS in various industries.
2. Develop basic concepts of quantum physics.

3. Discover finite element analysis for the calculation of stress of micro-systems.
4. Construct the design of micro-systems using FEM, computational fluid dynamics.
5. Enhance the quality of micro system by selecting proper material.

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM I Year – II Sem			
Course Code JM12H	DESIGN FOR MANUFACTURING AND ASSEMBLY	L	T	P	D
Credits: 3	Program Elective – IV	3	0	0	0

Pre-requisite: Engineering Materials, Manufacturing Technology, CAD/CAM

Course Objectives:

This course will enable students to:

1. Understand various steps in the product development process & significance of early phases of design for economical production
2. Identify interrelations of part geometry, tolerance &casting process
3. Recognize knowledge in metal joining process and to design for welding, forging & extruded sections
4. Learn design of products for ease of assembly & manufacture
5. Study the design of manual assembly process

Module 1:

Unit 1: Introduction: Design philosophy steps in Design process - General Design rules for manufacturability - basic principles of designing for economical production - creativity in design.

Unit 2: Materials: Selection of Materials for design Developments in Material technology - criteria for material selection - Material selection interrelationship with process selection process selection charts.

Module 2:

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

Unit 2: Metal Casting: Appraisal of various casting processes, selection of casting process, - general design considerations for casting - casting tolerances - use of solidification simulation in casting design - product design rules for sand casting.

Module 3:

Unit 1: Metal Joining: Appraisal of various welding processes, Factors in design of weldments - general design guidelines - pre and post treatment of welds - effects of thermal stresses in weld joints - design of brazed joints. Forging - Design factors for forging - Closed dies forging design - parting lines of die drop forging die design - general design recommendations.

Unit 2: Extrusion & Sheet Metal Work: Design guidelines for extruded sections - design principles for Punching, Blanking, Bending, and Deep Drawing - Keeler Goodman Forming Line Diagram - Component Design for Blanking.

Module 4:

Unit 1: Assemble Advantages: Development of the assemble process, choice of assemble method; assemble advantages social effects of automation.

Unit 2: Automatic Assembly Transfer Systems: Continuous transfer, intermittent transfer, indexing mechanisms, and operator - paced free – transfer machine.

Module 5:

Unit 1: Design of Manual Assembly: Design for assembly fits in the design process, general design guidelines for manual assembly, development of the systematic DFA methodology, assembly efficiency, and classification system for manual handling.

Unit 2: Classification system for manual insertion and fastening, effect of part symmetry on handling time, effect of part thickness and size on handling time, effect of weight on handling time, parts requiring two hands for manipulation, effects of combinations of factors, effect of symmetry effect of chamfer design on insertion operations, estimation of insertion time.

Text Books:

1. Assembly Automation and Product Design/ Geoffrey Boothroyd/ Marcel Dekker Inc., NY, 1992.
2. Engineering Design - Material & Processing Approach/ George E. Deiter/McGraw Hill Intl. 2nd Ed.2000.

Reference Books:

1. Hand Book of Product Design/ Geoffrey Boothroyd/ Marcel and Dekken,N.Y. 1990.
2. Product Design for Manufacturing and Assembly/ Geoffrey Boothroyd, Peter Dewhurst & Winston Ansthony Knight/CRC Press/2010

E - Resources:

1. https://rb.gy/u58yho
2. https://nptel.ac.in/courses/107/103/107103012/
3. https://nptel.ac.in/courses/112/101/112101005/
4. https://nptel.ac.in/content/storage2/courses/107103012/module1/lec1.pdf

Course Outcomes:

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

1. Generate alternate concepts & evaluate their functionality for a ease of production

2. Identify manufacturing based on part geometry & assembly
3. Apply the design concepts of welding, forging & extruded sections in manufacturing process
4. Analyze the assembly process for ease of manufacture
5. Implement the various concepts of DFA-Methodology for shorter insertion time

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM I Year – II Sem			
Course Code JM12I	SIMULATION AND PRECISION ENGINEERING LAB	L	T	P	D
Credits: 2		0	0	4	0

Pre-requisite: Machine Tools, Instrumentation, CAD/CAM

Course Objectives:

This course will enable students to:

1. Impart the experimental knowledge on simulation of Single Server Single Queue System, Multiple Server Single Queue System, Inventory System, Flexible Manufacturing System, Job Shop Production System.
2. understand importance of Hydraulic circuit and Pneumatic circuit.
3. Study the operation of tool and cutter grinder and operation of Centre-less grinder.
4. Impart the experimental knowledge on simulation Inspection of parts using Toolmaker's microscope
5. Develop an idea on Study of micro-controllers, programming on various CNC machine tools.

List of Experiments

1. Simulation of Single Server Single Queue System
2. Simulation of Multiple Server Single Queue System
3. Simulation of Inventory System
4. Simulation of Flexible Manufacturing System
5. Simulation of Job Shop Production System.
6. Hydraulic circuit
7. Pneumatic circuit
8. Study of operation of tool and cutter grinder
9. Study of operation of Centreless grinder
10. Inspection of parts using Toolmaker's microscope,
11. Study of micro-controllers, programming on various CNC machine tools

Software: Flexsim

Note: Processors, Operators, Conveyors, AGVS, Transporters, Racks, Robots, Cranes, Material Handling Systems, AGV Planning, ASRS Simulation, MRP, Shop Floor scheduling, JIT System, Kanban flow etc. may be used at appropriated places in the exercises.

E - Resources:

1. https://rb.gy/exsgew
2. https://jornadastorre.blogspot.com/2019/01/download-precision-engineering-in.html

Course Outcomes:

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

1. Apply the knowledge of simulation on Single Server Single Queue System, Multiple Server Single Queue System, Inventory System, Flexible Manufacturing System, Job Shop Production System.
2. Determine the practical importance of Hydraulic circuit and Pneumatic circuit.
3. Observe the Study of operation of tool and cutter grinder and operation of Centre-less grinder
4. Evaluate the Inspection of parts using Toolmaker's microscope.
5. Evaluate the performance of micro-controllers, programming on various CNC machine tools.

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM I Year – II Sem			
Course Code JM12J	ADVANCED COMPUTER AIDED ENGINEERING LAB	L	T	P	D
Credits: 2		0	0	4	0

Pre-requisite: CAD/CAM, Finite Element Methods

Course Objectives:

This course will enable students to:

1. Study Trusses, Bars of constant cross section area, tapered cross section area and stepped bar
2. Simply supported and clamped beam subjected to UDL, UVL and Point load
3. Study Stress analysis of a rectangular plate with a circular hole, axi-symmetric problems
4. Learn Buckling and Dynamic analysis
5. Learn Steady state and Transient heat transfer analysis

LIST OF EXPERIMENTS

Experiment 1: Analysis of plane truss & spatial truss with various cross sections and materials

Experiment 2: Beam analysis with different sections, different materials for different loads

Experiment 3: Static analysis of plate with a hole.

Experiment 4: Plane stress, plane strain and axi-symmetric loading on the in plane members.

Experiment 5: Static analysis of connecting rod with tetrahedron and brick elements.

Experiment 6: Static analysis of flat and curved shell due to internal pressure.

Experiment 7: Buckling analysis of plates, shells and beams to estimate BF and modes.

Experiment 8: Modal analysis of beams, plates and shells for natural frequencies and mode shapes.

Experiment 9: Harmonic analysis of a shaft and transient analysis of plate.

Experiment 10: Steady state heat transfer analysis of chimney and transient analysis of castings.

Experiment 11: Non linear analysis of cantilever beam.

Experiment 12: Coupled field analysis

Software: Ansys

Text Books:

1. Tadeusz, A. Stolarski, Y. Nakasone, S. Yoshimoto, “Engineering Analysis with ANSYS Software”, 1/e, Elsevier Butterworth-Heinemann publications, 2007.
2. ANSYS Inc., “User Manuals for Release 15.0”

Course Outcomes:

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

1. Apply basics of Theory of Elasticity to continuum problems.
2. Formulate finite elements like beam elements for linear static structural analysis.
3. Develop models for 2D and axi-symmetric finite elements and 1D heat transfer
4. Solve problems of limited complexity in buckling and dynamic analysis
5. Utilize finite element software to simulate practical problems

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM I Year – II Sem			
Course Code JM92A	RESEARCH METHODOLOGY & INTELLECTUAL PROPERTY RIGHTS	L	T	P	D
Credits: 2		2	0	0	0

Pre-requisite: NIL

Course objectives:

This course will enable students to:

1. Develop with orientation towards research related activities
2. Recognizing the ensuing knowledge as Intellectual Property.
3. It will create consciousness for Intellectual Property Rights and its constituents.
4. Learners will be able to perform documentation and administrative procedures relating to IPR in India as well as abroad.

Module 1:

Meaning of research problem, Sources of research problem, Criteria characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem

Approaches of investigation of solutions for research problem, data collections, analysis, interpretation, necessary instrumentation

Module 2:

Effective literature studies approaches, Analysis, Plagiarism, Research ethics

Module 3:

Effective technical writing, how to write report, Paper developing by research proposal, Format of research proposal. A presentation and assessment by a review committee

Module 4:

Nature of intellectual property: Patent, designs trade and copy right. Process of patentingand development: Technological research, innovation, patenting, development.
International scenario: International cooperation on intellectual property. Procedure for grants of patents, patenting under PCT

Module 5:

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology.
Patent information and data bases, Geographical indications
New Developments in IPR: Administration of patent system. IPR of Biological systems, Computer software etc. Traditional knowledge case studies, IPR and IITs

REFERENCES:

1. Stuart Melville and Wayne Goddard, Research Methodology: An introduction for science and engineering students
2. Wayne Goddard and Stuart Melville, Research methodology and introduction
3. Ranjit Kumar 2nd Edtn, Research methodology: a step by step Guide for beginners
4. Halbert, Resisting intellectual property, Taylor and Francis Ltd, 2007.
5. Mayall, Industrial design, McGrawHill, 1992.

Course Outcomes:

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

1. Understanding and formulation of research problem.
2. Analyze research related information.
3. Understand plagiarism and follow research ethics
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM II Year – I Sem			
Course Code JM13A	MECHANICS OF COMPOSITE MATERIALS	L	T	P	D
Credits: 3	Program Elective – V	3	0	0	0

Pre-requisite: Engineering Mechanics, Composite Materials

Course Objectives:

This course will enable students to

1. Understand the specifics of mechanical behavior of layered composites compared to isotropic materials.
2. Apply constitutive equations of composite materials and understand mechanical behavior at micro and macro level.
3. Determine stresses and strains in composites.
4. Apply failure criteria and critically evaluate the results.
5. Learn the analysis and bending of plates.

Module 1:

Introduction: Fibres, Matrix materials, interfaces, polymer matrix composites. Metal matrix composites, ceramic matrix composites carbon fibre composites.

Module 2:

Micromechanics of Composites: Mechanical properties-Prediction of Elastic constant, micromechanical approach, Halpin-Tsai equations, Transverse stresses. Thermal properties- Hygro thermal stresses, mechanics of load transfer from matrix to fibre

Module 3:

Macro mechanics of Composites: Elastic constants of a lamina, relations between engineering constants and reduced stiffness and compliances, variation of lamina properties with orientation, analysis of laminated composites, stresses and strains with orientation, inter- laminar stresses and edge effects. Simplified composite beam solutions, bending of laminated beams

Module 4:

Unit 1: Strength, fracture, fatigue and design: Tensile and compressive strength of unidirectional fibre composites,

Unit 2: Fracture modes in composites: Single and multiple fracture, de-bonding, fibre pullout and de-lamination failure, fatigue of laminate composites. Effect of variability of fibre strength.

Unit 3: Strength of an orthotropic lamina: Max stress theory, max strain criteria,

maximum work (Tsai-Hill) criterion, quadratic interaction criteria. Designing with composite materials

Module 5:

Analysis of plates and stress: Plate equilibrium equations, Bending of composite plates, Levy and Navier solution for plates of composite materials.

Analysis of composite cylindrical shells under axially symmetric loads

Text Books:

1. Jones, R.M., Mechanics of Composite Materials, McGraw HillCo
2. Calcote, L.R., The Analysis of Laminated Composite Structures, VanNostrand.

Reference Books:

1. Whitney, I.M. Daniel, R.B. Pipes, Experimental Mechanics of Fibre Reinforced Composite Materials, Prentice Hall,1984.
2. Hyer, M.W., Stress Analysis of Fibre Reinforced Composite Materials, McGraw Hill Co., 1998.

E- Resources:

1. https://rb.gy/hnw7zn
2. https://rb.gy/9a3o0y

Course Outcomes:

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

1. Distinguish the specifics of mechanical behaviour of layered composites compared to isotropic materials.
2. Apply constitutive equations of composite materials and understand mechanical behaviour at micro, macro and meso level.
3. Analyze stresses and strains in composites.
4. Apply failure criteria and critically evaluate the results.
5. Detect the mechanical behaviour of composites due to bending.

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM II Year – I Sem			
Course Code JM13B	INDUSTRIAL ROBOTICS Program Elective – V	L	T	P	D
Credits: 3		3	0	0	0

Pre-requisite: Engineering Mathematics, Engineering Physics, Robotics

Course Objectives:

This course will enable students to:

1. Understand the robot anatomy, different control systems and components to control the robot manipulator
2. Explain motion analysis and control and configuration of robot controller
3. Study various types of drive systems, end effectors and sensors
4. Impart knowledge in Robot Kinematics and Programming
5. Study robot cell design and industrial applications of robots

Module 1:

Unit 1: Introduction: Automation and Robotics, Robot anatomy, robot configuration, motions joint notation work volume, robot drive system, control system and dynamic performance, precision of movement.

Unit 2: Control System and Components: basic concept and modals controllers control system analysis, robot activation and feedback components. Positions sensors, velocity sensors, actuators sensors, power transmission system.

Module 2:

Unit 1: Motion Analysis and Control: Manipulator kinematics, position representation forward transformation, homogeneous transformation.

Unit 2: Manipulator path control, robot dynamics, configuration of robot controller

Module 3:

Unit 1: End Effectors: Grippers-types, operation, mechanism, force analysis, tools as end effectors consideration in gripper selection and design. SENSORS: Desirable features, tactile, proximity and range sensors, uses sensors in robotics.

Unit 2: Machine Vision: Functions, Sensing and Digitizing-imaging, Devices, Lighting techniques, Analog to digital single conversion, image storage, Image processing and Analysis-image data reduction, Segmentation feature extraction. Object recognition, training the vision system, Robotics application.

Module 4:

Unit 1: Robot Programming: Lead through programming, Robot programming as a

path in space, Motion interpolation, WAIT, SINONAL AND DELAY commands, Branching capabilities and Limitations.

Unit 2: Robot Languages: Textual robot Languages, Generation, Robot language structures, Elements in function

Module 5:

Unit 1: Robot Cell DESGIN AND CONTROL: Robot cell layouts-Robot centered cell, In-line robot cell, Considerations in work design, Work and control, Inter locks, Error detect ion, Work wheel controller.

Unit 2: Robot Application: Material transfer, Machine loading/unloading. Processing operation, Assembly and Inspection, Feature Application

Text Books:

1. Industrial Robotics / Groover M P/Pearson Edition.
2. Introduction to Robotic Mechanics and Control by JJ Craig, Pearson, 3rd edition.

Reference Books:

1. Robotics / Fu K S/McGrawHill.
2. Robotic Engineering / Richard D. Klafter, Prentice Hall
3. Robot Analysis and Intelligence / Asada and Slotine /Wiley Inter-Science.

E- Resources:

1. https://rb.gy/cyjkv2
2. https://nptel.ac.in/courses/112/105/112105249/
3. http://www.nptelvideos.com/video.php?id=778
4. https://nptel.ac.in/courses/112/101/112101098/
5. https://nptel.ac.in/courses/108/105/108105063/

Course Outcomes:

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

1. Apply the knowledge of robot anatomy to choose the robot
2. Interpret motion analysis and control
3. Analyze robot components, kinematics, drive and control systems
4. Execute the robot Program
5. Build robot cell and choose robots for industrial applications

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM II Year – I Sem			
Course Code JM13C	PRODUCTION AND OPERATIONS MANAGEMENT	L	T	P	D
Credits: 3	Program Elective – V	3	0	0	0

Pre-requisite: Operations Research

Course Objectives:

This course will enable students to:

1. Demonstrate an understanding of production as a process of converting or transforming resources into products;
2. Learn techniques which aim at reducing the production cost.
3. Learn to achieve long-term objectives of the organization.
4. Learn to minimize the production time and cost.
5. Learn to achieve project goals by Using Techniques like PERT.

Module 1:

Unit 1: Operation Management: Definition – Objectives – Types of production systems – historical development of operations management – Current issues in operation management.

Unit 2: Product design – Requirements of good product design – product development – approaches – concepts in product development – standardization – simplification – Speed to market – Introduction to concurrent engineering.

Module 2:

Unit 1: Value Engineering: objective – types of values – function & cost – product life cycle- steps in value engineering – methodology in value engineers – FAST Diagram – Matrix Method.

Unit 2: Location – Facility location and layout – Factors considerations in Plant location-Comparative Study of rural and urban sites – Methods of selection plant layout – objective of good layout – Principles – Types of layout – line balancing.

Module 3:

Unit 1: Aggregate Planning: definition – Different Strategies – Various models of Aggregate Planning – Transportation and graphical models. Advance inventory control systems push systems – Material Requirement – Terminology – types of demands – inputs to MRP- techniques of MRP – Lot sizing methods – benefits and drawbacks of MRP.

Unit 2: Manufacturing Resources Planning (MRP –II), Pull systems – vs Push system – Just in time (JIT) philosophy Kanban System – Calculation of number of Kanbans Requirements for implementation JIT – JIT Production process – benefits of JIT.

Module 4:

Unit 1: Scheduling: Policies – Types of scheduling – Forward and Backward Scheduling – Gantt Charts

Unit 2: Flow shop Scheduling – n jobs and 2 machines, n jobs and 3 machines – job shop Scheduling – 2 jobs and n machines – Line of Balance

Module 5:

Unit 1: Project Management: Programming Evaluation Review Techniques (PERT) – three times estimation – critical path

Unit 2: Probability of completion of project – critical path method – crashing of simple nature

Text Books:

1. Operations Management/ E.S. Buffs/ John Wiley & Sons/2007
2. Operations Management Theory and Problems/ Joseph G. Monks / Macmillan / McGraw Hill /3rdEdition.

Reference Books:

1. Production and Operations Management/ Chary/ McGrawHill/2004
2. Operations Management/ Richard Chase/ McGrawHill/2006

E- Resources:

1. https://nptel.ac.in/courses/110/107/110107141/
2. https://www.coursera.org/learn/wharton-operations
3. http://www.faadooengineers.com/threads/43867-Production-and-Operations-Management-By-R-PaneerSelvam-pdf

Course Outcomes:

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

1. Understand the relationship between OM (operations management) and productivity.
2. Review the importance of developing the proper layout strategy.
3. Apply how to manage resources to achieve superior quality through statistical process control
4. Identify the principles involved in scheduling
5. Apply the principles of project management

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM II Year – I Sem			
Course Code JM13D	MINI PROJECT	L	T	P	D
Credits: 2		0	0	4	0

Guide lines:

There is a Mini Project, in collaboration with an industry of their specialization to be taken up during the vacation after I year II semester examinations. Industry Oriented Mini Project is submitted in a report form and presented before the committee in II year I semester. It is evaluated for 100 marks by the committee consisting of Head of the Department, supervisor of the Industrial Oriented mini project and a senior faculty member of the department.

a. Presentation – I will include identification of the problem based on the literature review on the topic referring to latest literature available.

b. Presentation – II should include report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individual contribution.

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM II Year – I Sem			
Course Code JM13E	TECHNICAL SEMINAR	L	T	P	D
Credits: 1		0	0	2	0

Guide lines:

For the seminar, the student shall collect the information on a specialized topic, prepare a technical report, and submit it to the department. It is evaluated by the departmental committee consisting of Head of the Department, seminar supervisor and a senior faculty member. The seminar report is evaluated for 100 internal marks. There is no semester end examination for the seminar.

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM II Year – I Sem			
Course Code JM13F	PROJECT STAGE – I	L	T	P	D
Credits: 9		0	0	18	0

Guide lines: **Phase – I: July to December**

1. After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referred literature should preferably include Springer/Science Direct. In case of Industry sponsored projects, the relevant application notes, while papers, catalogues should be referred &reported.

2. Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.

   Stage – I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, a record of continuous progress.

   Stage – I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend repeating the phase-I work.

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: CAD/CAM II Year – I Sem			
Course Code JM14A	PROJECT STAGE – II	L	T	P	D
Credits: 16		0	0	32	0

Guide lines: **Phase – II: January to June**

1. Student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences ORIP/Patents.
2. **Phase – II deliverables:** It consists of Experimental verification / Proof of concept, Design, fabrication, testing of Communication System. A dissertation report as per the specified format, developed system in the form of hardware and/or software, a record of continuous progress.
3. **Phase – II evaluation:** Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q & A. In case of unsatisfactory performance, committee may recommend for extension or repeating the work

AY 2020 – 21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: II Year – I Sem			
Course Code: JM1OA	INDUSTRIAL SAFETY Open Elective	L	T	P	D
Credits: 3		3	0	0	0

Pre-requisite: Engineering Chemistry, Probability and Statistics.

Course Objectives:

This course will enable students to:

1. Study mechanical and electrical hazards and it's preventive methods in an industry.
2. Correlate primary and secondary functions with responsibilities of maintenance department.
3. Attain basic knowledge of chemical corrosion, it's types and reduction methods.
4. Adapt to a new technology of fault tracing and decision tree.
5. Recognize the importance of periodic and preventive maintenance.

Module 1:

Unit 1: Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure.

Unit 2: Describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and fire fighting, equipment and methods, overview of OHSAS 18000 and ISO 14000.

Module 2:

Unit 1: Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department.

Unit 2: Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment, failure rate analysis, reliability of systems

Module 3:

Unit 1: Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication,

Unit 2: Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods

Module 4:

Unit 1: Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools.

Unit 2: Hydraulic, pneumatic, automotive, thermal and electrical equipment's like i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Module 5:

Unit 1: Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance.

Unit 2: Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Text Books:

1. Lindly R. Higgins, R. Keith mobley,"Maintenance Engineering Handbook", McGraw - Hill Professional, 6th edition, 2001.
2. Er. H. P. Garg, "Maintenance Engineering", S. Chand Publishing, 2010.

Reference Books:

1. Frank Duncan Graham, "Pumps hydraulics air Compressors", Theo Audel & CO publishers, 1965.
2. Hans F. Winterkom, Hsal - Yang Fang, "Foundation Engineering Handbook", Galgotia Booksource, 2010.

E- Resources:

1. https://www.google.co.in/books/edition/Industrial_Safety_and_Risk_Management/_Rr_BRvp30EC?hl=en&gbpv=1
2. https://www.google.co.in/books/edition/Industrial_Safety_Management/FDQ8DwAAQBAJ?hl=en&gbpv=1
3. https://nptel.ac.in/courses/110/105/110105094/
4. https://www.coursera.org/specializations/energy-industry
5. https://www.sciencedirect.com/bookseries/industrial-safety-series/vol/8/suppl/C

Course Outcomes:

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

1. Relate factories act with each equipment and fire prevention methods.
2. Calculate service life of an equipment with replacement economy.
3. Layout different lubrication methods to reduce wear and corrosion.
4. Infer decision tree for various Engineering equipments.
5. Construct a schedule for periodic and preventive maintenance for mechanical and electrical equipments.

AY 2020 – 21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: II Year – I Sem			
Course Code: JM20A	**RENEWABLE ENERGY TECHNOLOGIES AND BATTERY STORAGE SYSTEMS**	**L**	**T**	**P**	**D**
Credits: 3	Open Elective	**3**	**0**	**0**	**0**

Objectives:

1. To explain the concepts of Non-renewable and renewable energy systems.
2. To outline utilization of renewable energy sources for both domestic and industrial applications.
3. To analyze the environmental and cost economics of renewable energy sources in comparison with fossil fuels.
4. To enable the student to understand the need for energy storage.

Outcomes:

1. An understanding of renewable energy sources.
2. Knowledge of working principle of various energy systems.
3. A capability to carry out basic design of certain renewable energy systems.
4. Analyze the characteristics of energy from various sources and need for storage.

UNIT - I

Fundamentals of Energy: Energy consumption and standard of living, Oil crisis, Classification of energy resources, Consumption trend of primary energy resources, conventional energy sources and their distribution, Energy chain, common forms of energy, importance and salient features of nonconventional energy resources, environmental aspects of energy, Environment-economy-energy and sustainable development, Energy densities of various fuels, World energy status, Energy scenario in India.

UNIT - II

Solar energy: Solar energy basics, Sun-Earth relation spectrum, Terrestrial and extra-terrestrial radiation, spectral energy distribution of solar radiation, Depletion of solar radiation, measurement of solar radiation, solar radiation data, Solar time, Solar radiation geometry, Solar day length, Empirical equations for estimation of solar radiation on horizontal surfaces, Global, diffused and beam radiation, Solar radiation on inclined surface (Problems on energy availability on surfaces)

UNIT - III

Wind Energy: Wind origin, nature, types, Wind data and wind rose, wind speed variation, Wind siting Wind turbine classification and types of rotors, Wind turbine aerodynamics, power extraction from wind, Betz criteria, Axial thrust on the turbine, torque developed by the turbine, Dynamic matching, speed control strategies, Wind turbine operational characteristics, wind

energy conversion systems, environmental aspect, Wind energy potential and installation in India (Problems on energy Conversion)

UNIT - IV

Biomass Energy: Biomass resources and their classification**,** Biomass conversion technologies: Thermochemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion – operational parameters of biogas plants, Types of biogas Plants and biogas plant design – Alcohol production from biomass - Bio diesel production -

Urban waste to energy conversion - Biomass energy program in India (Problems on biogas plant design)

UNIT – V

Electrical Energy Storage Technologies: Characteristics of electricity, Electricity and the roles of EES, High generation cost during peak-demand periods, Need for continuous and flexible supply, Long distance between generation and consumption, Congestion in power grids, Transmission by cable.

TEXT BOOKS:

1. Renewable Energy Sources, Twidell, J.W. and Weir, A., EFN Spon Ltd., 1986.
2. Renewable Energy Engineering and Technology, Kishore VVN, Teri Press, New Delhi, 2012
3. “James M. Eyer, Joseph J. Iannucci and Garth P. Corey “, “Energy Storage Benefits and Market Analysis”, Sandia National Laboratories, 2004.

REFERENCE BOOKS:

1. Solar Energy - Principles of thermal collection and storage, S. P. Sukhatme
2. Solar Engineering of Thermal Processes, J. A. Duffie and W. A. Beckman
3. Principles of Solar Engineering, Kreith, F and Kreider, J. F., McGraw-Hill, 1978.
4. Power Plant Technology, J Wakil
5. Non-Conventional Energy Sources, G.D Rai
6. “Jim Eyer, Garth Corey”, Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide, Report, Sandia National Laboratories, Feb 2010.

AY 2020 – 21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M. Tech: II Year – I Sem			
Course Code: JM20B	**POWER PLANT ENGINEERING** Open Elective	**L**	**T**	**P**	**D**
Credits: 3		**3**	**0**	**0**	**0**

Objectives:

- To provide the knowledge on principles of solar radiation & solar energy collection & storage and applications.
- To prepare graduates to express the Knowledge on wind energy, geo-thermal energy, and ocean energy plants.
- To understand the behaviour of different power plants.

Outcomes:

- Analyze different types of steam cycles and it's efficiencies in a steam power plant.
- Describe basic working principles of gas turbine and diesel engine power plants. Define the performance characteristics and components of such power plants.
- List the principal components and types of nuclear reactors.
- List types, principles of operations, components and applications of steam turbines, steam generators, condensers, feed water and circulating water systems.
- Estimate different efficiencies associated with power plant systems.

UNIT I: Thermal power plants: Basic thermodynamic cycles, Various components of steam power plant- Layout- Pulverized coal burners- Fluidized bed combustion - Coal Handling systems - Ash handling systems - Forced draft and induced draft fans- Boilers- Feed pumps- Super heater- Regenerator - Condenser- Dearearators - Cooling tower.

UNIT II: Hydroelectric power plants: Layout- Dams -Selection of water turbines – types - Pumped storage hydel plants

UNIT III: Nuclear power plants: Principles of nuclear energy- Fission reactions - Nuclear reactor-Nuclear power plants

UNIT IV: Gas and diesel power plants: Types, Open and closed cycle gas turbine, Work output & thermal efficiency, Methods to improve performance-reheating, Inter-coolings, Regeneration-Advantage and disadvantages - Diesel engine power plant, Component and layout.

UNIT V: Non-conventional power generation: Solar energy collectors, OTEC, Wind power plants, Tidal power plants and geothermal resources, Fuel cell, MHD power generation - Principle, Thermoelectric power generation, Thermionic power generation.

TEXT BOOKS

1. Arora and Domkundwar, "A Course in Power Plant Engineering" Dhanpat Rai and Co.Pvt. Ltd., New Delhi.
2. P.K. Nag, "Power Plant Engineering", Tata McGraw Hill, Second Edition, Fourth reprint 2003.

REFERENCE BOOKS:

1. Bernhardt G.A. Skrotzki and William A. Vopat, "Power Station Engineering and Economy", Tata McGraw Hill Publishing Company Ltd., New Delhi, 20th reprint 2002.
2. G.D. Rai, "An Introduction to Power Plant Technology", Khanna Publishers, Delhi- 110 005.
3. M.M. El-Wakil, "Power Plant Technology", Tata McGraw Hill, New Delhi, 1984.

AY 2020-21 Onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech II Year – I Sem			
Course Code: JM3OA	**DISASTER MANAGEMENT (Open Elective)**	**L**	**T**	**P**	**D**
Credits:3		**3**	**0**	**0**	**0**

Pre-requisite: Environmental Science

Course Objectives:

This course will enable students to:

1. Provide basic conceptual understanding the difference between the hazard and a disaster.
2. Knowledge about the various disasters and their impacts.
3. Provide basic understanding about the hazard and vulnerability profile of India.
4. Have conceptual understanding about the disaster management phases.
5. Approaches of Disaster Risk Reduction (DRR) and the relationship between vulnerability, Disasters, disaster prevention and risk reduction.

Module 1:

Unit 1:

Understanding Disaster: Concept of Disaster - Different approaches- Concept of Risk - Levels of Disasters - Disaster Phenomena and Events (Global, national and regional)

Unit 2:

Hazards and Vulnerabilities: Natural and man-made hazards; response time, frequency and forewarning levels of different hazards - Characteristics and damage potential or natural hazards; hazard assessment - Dimensions of vulnerability factors; vulnerability assessment - Vulnerability and disaster risk - Vulnerabilities to flood and earthquake hazards

Module 2:

Unit 1: Disaster Management Mechanism: Concepts of risk management and crisis managements - Disaster Management Cycle - Response and Recovery - Development, Prevention, Mitigation and Preparedness - Planning for Relief

Module 3:

Unit 1:

Capacity Building: Capacity Building: Concept - Structural and Nonstructural Measures Capacity Assessment; Strengthening Capacity for Reducing Risk - Counter-Disaster Resources and their utility in Disaster Management - Legislative Support at the state and national levels

Module 4:

Unit 1: Coping with Disaster: Coping Strategies; alternative adjustment processes - Changing Concepts of disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management

Module 5:

Planning for disaster management: Strategies for disaster management planning - Steps for formulating a disaster risk reduction plan - Disaster management Act and Policy in India - Organizational structure for disaster management in India - Preparation of state and district disaster management plans

Text Books:

1. Manual on Disaster Management, National Disaster Management, Agency Govt of India.
2. Disaster Management by Mrinalini Pandey Wiley 2014. 3. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2015

1.

Reference Books:

1. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.
2. National Disaster Management Plan, Ministry of Home affairs, Government of India (http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf)

Web Resources:

1. https://nptel.ac.in/courses/105/104/105104183/
2. https://nptel.ac.in/courses/124/107/124107010/

2.

3. Course Outcomes:

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

1. Acquired knowledge on various types of disasters and hazards
2. Distinguish between the hazard and a disaster can be analyzed
3. Acquired knowledge on the various approaches of Disaster Risk Reduction (DRR)
4. Ability to understand the relationship between vulnerability. disasters, disaster prevention and risk reduction
5. Develop ability to respond to different disasters

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech II Year – I Sem			
Course Code: JM3OB	PRECAST & PREFABRICATED CONSTRUCTION (Open Elective)	L	T	P	D
Credits:3		3	0	0	0

Pre-requisite: STRUCTURAL ENGINEERING –I (RCC)

Course Objectives:

This course will enable students to:

1. Study the Precast Footings, Beams, Columns, Slab, Shear walls, Partition Walls.
2. Explain the precast construction methodology.
3. Discuss about the principles, materials in Prefabrication.
4. Study the behaviour of structural components of Prefabrication.
5. Describe the Positioning of Building components.
4.

Module 1:

UNIT I: Introduction to Precast Technology: Definition-Advantages-Difference between Precast and Conventional Buildings-Precast slab-wall panels-Footings-Beams-Columns-Slab-Non- Structural Precast Elements- Paver blocks, fencing poles, Manhole covers, Hollow and Solid Blocks, Door and Window frames - Connections between precast elements-Standard dimensions and tolerances.

Module 2:

UNIT I: Precast construction methodology: Casting Methods-Curing-Stacking-lifting-transportation-Construction Considerations-Sequence of Work-Procedure-Post Installation-Constraints and Solutions-Comparison between Cast-in-situ and Precast Building Designs.

Module 3:

UNIT I: Modular Co-ordination: Introduction-Aim and Basics-Modular Reference System-Positioning of Building components (Structural Components, Non-Structural Components and Finishes)

Module 4:

UNIT I: Introduction to Prefabrication: Introduction-Need for prefabrication-Principles, materials-standardization-system-production-transportation-erection.

Module 5:

UNIT I: Prefabricated components: Behaviour of structural components-Large panel construction of roof and floor slabs-wall panels-columns.

UNIT II: Prefabrication construction methods: Panelized Wood Framing, Timber Framing, Concrete Systems,Steel Framing

Text Books:

1. Precast Concrete Structures- Elliott, Kim S, CRC Press, New York; 2011.
2. Pre Engineered Steel Buildings–K.S.Vivek & P.Vaishavi– Lambert Academic Publishing; 2017
3. "Structural design manual", Precast concrete connection details, Society for the studies in the use of precast concrete, Netherland Betor Verlag, 2009.

5.

Reference Books:

1. "Manual of precast concrete construction", Vol. I, II and III, Koncz T., Bauverlag, GMBH, 1976.
2. CBRI, Building materials and components, India, 2017.

6.

Web Resources:

1. https://www.iiti.ac.in/public/storage/events/new_Short%20Term%20Course%20on%20Pre cast%20and%20Prefabricated%20Buildings.pdf

7.

Course Outcomes:

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

1. Apply the concept of prestressing and determine the losses of prestress.
2. Analyze the prestressed concrete beam and suggest the cable profile for beam.
3. Evaluate the prestressed concrete beam for flexure and shear.
4. Apply skills to satisfy the serviceability and strength provisions of the Indian Standards (IS: 1343-2012).
5. Examine the principles of design of composite sections and their advantages.

AY 2020-21 Onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech-VLSISD II Year – I Sem			
Course Code: JM6OA	CLEAN ROOM TECHNOLOGY AND MAINTENANCE (Open Elective)	L	T	P	D
Credits: 3		3	0	0	0

Pre-requisite: No Pre-requisite

Course Objectives:

1. To introduce clean room classification and its standards.
2. To gain knowledge about design of clean rooms.
3. To illustrate the clean room testing and monitoring.
4. To analyze air quantities, pressure differences and clean room disciplines.
5. To describe the clean room operation and cleaning.

Module 1

Unit-1: Introduction

Introduction, Clean room Classification Standards, Unidirectional air flow Clean room.

Unit-2: Standards

Basis of Clean room standards, Federal Standards 209, ISO standard 14644-1:1999, Clean room classification (Pharmaceutical, clean rooms).

Module 2

Unit-1: Design of Clean rooms

Design of Turbulently Ventilated and Ancillary Clean rooms, Mini environments, isolators and RABS, Containment zone, Construction and clean build.

Unit-2: Design of Unidirectional Clean rooms

Design of Unidirectional Clean rooms, High Efficiency Air filtration, Particle removal mechanisms, Testing of high efficiency filters.

Module 3

Unit-1: Clean room Testing and Monitoring

Cleanroom Testing and Monitoring, Principles of clean room testing, Testing in relation to room type and occupation state, Monitoring of clean room.

Module 4

Unit-1: Measurement in Clean Room

Measurement of Air Quantities and Pressure Differences, Air movement control, Recovery test methods, Clean room containment leak testing.

Module 5

Unit-1: Clean Room Operation

Filter Installation leak testing, Operating a clean room, Materials, equipment and machinery, Clothing, masks and gloves, Cleaning a Clean room.

Text Books:

1. William White, Clean room Technology: Fundamentals of Design, Testing and Operation, 2nd Edition, Wiley, 2010.
2. Matts Ramstorp, Introduction to Contamination Control and Clean room Technology, Wiley, 2008.

Reference Books:

1. Wani-Kai Chen (editor), The VLSI Hand book, CRI/IEEE press, 2000.

E - Resources:

1. https://nptel.ac.in/content/storage2/courses/113106062/Lec30.pdf .
2. https://www.cmmonline.com/articles/infographic-basic-cleanroom-requirements-and-classifications.
3. https://www.terrauniversal.com/blog/6-really-cool-cleanroom-videos-will-awe/.

Course Outcomes:

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

1. specify clean room standards and ancillary clean rooms.
2. identify fabrication materials and surface finishes.
3. illustrate the clean room testing and monitoring.
4. analyze air quantities, pressure differences and clean room disciplines.
5. gain knowledge about operation of clean room.

8.

AY 2020-21 onwards	J. B. Institute of Engineering and Technology (UGC Autonomous)	M.Tech-VLSISD II Year – I Sem			
Course Code: JM6OB	PRINCIPLES OF COMPUTER COMMUNICATION AND NETWORKS (Open Elective)	L	T	P	D
Credits: 3		3	0	0	0

Pre-requisite: Analog and Digital Signals concepts, Computer Networks

Course Objectives:

1. To understand the Analog and Digital Communication concepts.
2. To understand the concept of computer communication.
3. To illustrate about the networking concept, layered protocols.
4. To understand various communications concepts.
5. To gain knowledge of various networking equipments.

Module 1

Unit-1: Analog and Digital Signal Representation

Representing data as analog signals, representing data as digital signals, frequency analysis of signals.

Unit-2: Communication Concepts

Data rate and bandwidth reduction, Digital Carrier Systems.

Module 2

Unit-1: Overview of Computer Communications

Introduction to Computer Communications and Networking, Introduction to Computer Network, Types of Computer Networks.

Unit-2: Overview of Computer Networking

Network Addressing, Routing, Reliability, Interoperability and Security, Network Standards, The Telephone System and Data Communications.

Module 3:

Unit-1: Protocols and Models

Computer Applications and Application protocols, Computer Communications and Networking models, Communication Service Methods and data transmission modes.

Unit-2: Multiplexing & OSI Model

Analog and Digital Communications, Speed and capacity of a Communication Channel, Multiplexing and switching, Network architecture and the OSI reference model.

Module 4

Unit-1: Physical layer Concepts

The Physical and Electrical Characteristics of wire, Copper media, Fiber optic media, Wireless Communications.

Unit-2: Data link layer Concepts

Introduction to data link Layer, the logical link control and medium access control sub-layers.

Module 5

Unit-1: Network Hardware Components

Introduction to Connectors, Transreceivers and media convertors, repeaters, network interference cards and PC cards, bridges, switches, Switches vs Routers.

Unit 2: Application Layer

Domain name space, DNS in Internet, FTP, WWW, Electronic mail, HTTP, SNMP.

Text Books:

1. "Computer Communications and Networking Technologies", Michel A. Gallo and William H. Hancock, Thomson Brooks / Cole.
2. "Data Communications and Networking" – Behrouz A. Forouzan, Fourth Edition MC GRAW HILL EDUCATION, 2006.

Reference Books:

1. "Principles of Computer Networks and Communications", M. Barry Dumas, Morris Schwartz, Pearson.
2. "Computer Networking: A Top-Down Approach Featuring the Internet", James F. Kurose, K. W. Ross, 3rd Edition, Pearson Education.
3. "Modern Digital and Analog Communication Systems", B.P.Lathi ,3rd edition, Oxford University Press.

E - Resources:

1. https://link.springer.com/bookseries/4198.
2. https://link.springer.com/book/10.1007%2Fb101863.
3. https://learn.saylor.org/course/cs402 .

Course Outcomes:

After completion of the course, the students will be able to

1. explain the networking of computers and data transmission between computers.
2. exposure about the various communication concepts.
3. analyse about the structure and equipment of computer network structures.
4. illustrate the Physical and data link layer concepts.
5. get knowledge about network hardware components.

M.Tech. **L T P C**
II Year I-Sem **3 0 0 3**

PYTHON PROGRAMMING

(Open Elective)

Course objectives:
Student will:

1. Learn how to design and program Python applications.
2. Learn how to use lists, tuples, and dictionaries in Python programs.
3. Learn how to identify Python object types, Components, decision statements, pass arguments in Python.
4. Learn how to build and package Python modules for reusability, design object oriented programs with Python classes, use class inheritance in Python for reusability.
5. Learn how to use exception handling in Python applications for error handling

Course outcomes:
Students will abel to:

1. Describe to design and program Python applications.
2. Analyze and conversion of to use lists, tuples, and dictionaries in Python programs.
3. Explain the concept to identify Python object types, Components
4. ,decision statements, pass arguments in Python.
5. Apply decision for building and package Python modules for reusability, design object-oriented programs with Python classes,use class inheritance in Python for reusability.

UNIT - I:

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.

UNIT - II:

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.

UNIT - III:

Object oriented programming using Python: creating python classes, classes and objects: user defined compound types, attributes, instances as arguments, instances as return values, objects are mutable, copying; classes and functions: pure function, modifiers; Exceptions: raising exceptions, handling exceptions, exception hierarchy.

UNIT - IV:

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, different sets of arguments.

UNIT - V:

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.

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 Summerfiels, Addison-Wesley 2010.

Reference Books:

1. **Programming Python- 4th Edition**, Mark Lutz, O'Reilly, 2011.
2. **Object-Oriented Programming in Python**, Michael H, Goldwasser, David Letscher, Pearson Prentice Hall, 2008.

M.Tech. **L T P C**

II Year I-Sem **3 0 0 3**

E-COMMERCE
(Open Elective)

Course objectives:

At the end of the course, students will :

1. Gain knowledge of E Commerce Frame work Applications, Business Models ,
2. Learn about Consumer Oriented Applications ,Electronic Payment Systems
3. Learn about EDI Applications ,Supply Chain Management
4. Know about Document Library, Advertising and Marketing
5. Know about Consumer Search and Resource Discovery, Key Multimedia concepts.

Course outcomes:

Students will be able to:

1. Demonstrate an understanding of the foundations and importance of e-commerce.
2. Demonstrate an understanding of retailing in e-commerce by:

a. Analyzing branding and pricing strategies,

b. Using and determining the effectiveness of market research.

c. Assessing the effects of disintermediation.

3. Analyze the impact of e-commerce on business models and strategy.
4. Describe internet trading relationships including business-to-business, intra-organizational.
5. Describe the infrastructure for E-Commerce.

UNIT-I:

Introduction, Electronic Commerce Framework, The Anatomy of E-Commerce applications, E-Commerce Consumer applications, E-Commerce organization applications.

UNIT-II:

Consumer Oriented Applications, mercantile process models, mercantile models from the consumer's perspective, Mercantile from the merchant's perspective.

Types of Electronic Payment Systems, Digital Token-Based Electronic Payment Systems, Smart Cards & Electronic Payment Systems, Credit

Card- Based Electronic Payment Systems, Risk & Electronic Payment Systems, Designing Electronic Payment Systems.

UNIT-III:

Electronic Data Interchange, EDI Applications in Business, EDI implementation, MIME, and value added networks.

Intra organizational E-Commerce, Macro forces and Internal Commerce, Work flow automation and Coordination, Customization and Internal Commerce, Supply Chain Management(SCM).

UNIT-IV:

Making a business case for a Document Library, Digital document types, Corporate Data warehouses, Advertising and Marketing, the new age of Information Based Marketing, advertising on Internet, charting the Online marketing process, Market Research.

UNIT-V:

Consumer Search and Resource Discovery, information search and Retrieval, Electronic commerce catalogs or directories, Information Filtering.

Multimedia and Digital video, Key Multimedia concepts, Digital Video & Electronic Commerce, Desktop Video Processing, Desktop Video Conferencing.

Text Books

1. "Frontiers of electronic commerce" – Kalakota, Whinston, Pearson
2. "E-Commerce", S.Jaiswal – Galgotia

References

1. Ravi Kalakota, Andrew Winston, "Frontiers of Electronic Commerce", Addison- Wesley.
2. Goel, Ritendra "E-commerce", New Age International
3. Laudon, "E-Commerce: Business, Technology, Society", Pearson Education.