ACADEMIC REGULATIONS

COURSE STRUCTURE AND DETAILED SYLLABUS

FOR

M.Tech - CAD / CAM

(APPLICABLE FOR THE BATCHES ADMITTED FROM ACADEMIC YEAR 2015-16)

REGUALATION: R15

JB INSTITUTE OF ENGINEERING AND TECHNOLOGY

UGC AUTONOMOUS

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ACADEMIC REGULATIONS
COURSE STRUCTURE AND DETAILED SYLLABUS
FOR
M.TECH
CAD/CAM
FOR M.TECH.TWO YEAR POST GRADUATE COURSE
(APPLICABLE FOR THE BATCHES ADMITED FROM 2015-2016)

REGULATION:R15

INSTITUTE OF ENGINEERING & TECHNOLOGY
(UGC Autonomous)
(Accredited by NAAC, Approved by AICTE & Permanently Affiliated to JNTUH)

J.B.INSTITUTE OF ENGINEERING & TECHNOLOGY
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J.B.INSTITUTE OF ENGINEERING AND TECHNOLOGY
UGC AUTONOMOUS

(BHASKAR NAGAR, MOINABAD MANDAL,R.R.DIST,HYDERABAD-500075,TELANGANA,INDIA)

R 15 - ACADEMICREGULATIONS (CBCS) FORM. Tech. (REGULAR) DEGREE PROGRAMMES

Applicable for the students of M. Tech. (Regular) programme from the Academic Year ***2015-16*** andonwards

The M. Tech. Degree of Jawaharlal Nehru Technological University Hyderabad shall be conferred on candidates who are admitted to the programme and who fulfill all the requirements fortheawardoftheDegree.

1. ELIGIBILITY FORADMISSIONS

Admission to the above programme shall be made subject to eligibility, qualification and specialization as prescribed by the University from time to time.

Admissions shall be made on the basis of merit/rank obtained by the candidates at the qualifying Entrance Test conducted by the University or on the basis of any other order of merit as approved by the University, subject to reservations as laid down by the Govt. from time to time.

AWARD OFM. Tech. DEGREE

A student shall be declared eligible for the award of the M. Tech. Degree, if he pursues a course of study in not less than two and not more than four academic years. However, he is permitted to write the examinations for two more years after four academic years of course work, failing which he shall forfeit his seat in M. Tech. programme.

The student shall register forall88 creditsandsecureallthe88credits.

The minimum instruction days in each semester are90.

3.0 COURSESOFSTUDY

The following specializations are offered at present for the M. Tech. programme of study.

1. CAD / CAM
2. Computer Science and Engineering
3. Electrical Power Systems
4. Energy Systems
5. Software Engineering
6. Structural Engineering
7. VLSI System Design

3.1 Departments offering M. Tech. Programmes with specializations are noted below:

CIVIL ENGINEERING	STRUCTURAL ENGINEERING
COMPUTER SCIENCE & ENGINEERING	COMPUTER SCIENCE & ENGINEERING SOFTWARE ENGINEERING
ELECTRONICS & COMMUNICATION ENGINEERING	VLSI SYSTEM DESIGN
ELECTRICAL & ELECTRONICS ENGINEERING	ELECTRICAL POWER SYSTEMS ENERGY SYSTEMS
MECHANICAL ENGINEERING	CAD / CAM

4 Course Registration

4.1 A 'Faculty Advisor or Counselor' shall be assigned to each student, who will advise him 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 Academic Section of the College invites 'Registration Forms' from students with in 15 days from the commencement of classwork through 'ON-LINE SUBMISSIONS', ensuring 'DATE and TIME Stamping'. The ON-LINE 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 ON-LINE Registration, ONLY AFTER obtaining the 'WRITTEN APPROVAL' from his Faculty Advisor, which should be submitted to the College Academic Section through the Head of Department (a copy of it being retained with Head of Department, Faculty Advisor and the Student).

4.4 If the Student submits ambiguous choices or multiple options or erroneous entries - during ON-LINE 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 ON-LINE Registration are final and CANNOT be changed, nor can they be inter-changed; further, alternate choices will also not be considered. However, if the Subject/ Course that has already been listed for Registration (by the Head of Department) in a Semester could not be offered due to any unforeseen or unexpected reasons, then the Student shall be allowed to have alternate choice - either for a new Subject (subject to offering of such a Subject), or for another existing Subject (subject to availability of seats), which may be considered. 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.

5 ATTENDANCE

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

Attendance in all classes (Lectures/Laboratories etc.) is compulsory. The minimum required attendance in each theory / Laboratory etc. is 75% including the days of attendance in sports, games, NCC and NSS activities for appearing for the End Semester examination. A student shall not be permitted to appear for the Semester End Examinations (SEE) if his attendance is less than 75%.

Condonation of shortage of attendance in each subject up to 10% (65% and above and below75%) in each semester shall be granted by the College Academic Committee.

Shortage of Attendance below65% in each subject shall not be condoned.

Students whose shortage of attendance is not condoned in any subject are not eligible to write their end semester examination of that subject and their registration shall stand cancelled.

A prescribed fee shall be payable towards condonation of shortage of attendance.

A Candidate shall put in a minimum required attendance at least three (3) theory subjects in I Year I semester for promoting to I Year II Semester. In order to qualify for the award of the M.Tech. Degree, the candidate shall complete all the academic requirements of the subjects, as per the course structure.

A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present Semester, as applicable. They may seek readmission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for readmission in to the same class.

6 EVALUATION

The performance of the candidate in each semester shall be evaluated subject-wise, with a maximum of 100 marks for theory and 100 marks for practicals, on the basis of Internal Evaluation and End Semester Examination.

6.1 For the theory subjects 75 marks shall be awarded for the performance in the Semester End Examination and 25 marks shall be awarded for Continuous Internal Evaluation (CIE). The Continuous Internal Evaluation shall be made based on the average of the marks secured in the two Mid Term-Examinations conducted, one in the middle of the Semester and the other, immediately after the completion of Semester instructions. Each mid-term examination shall be conducted for a total duration of 120 minutes with Part A as compulsory question (10 marks) consisting of 5 sub-questions carrying 2 marks each, and Part B with 3 questions to be answered out of 5 questions, each question carrying 5 marks. The details of the Question Paper pattern for End Examination (Theory) are given below:

- The Semester End Examination will be conducted for 75 marks. It consists of two parts. i).Part-A for 25 marks, ii). Part-B for 50 marks.
- Part-A is a compulsory question consisting of 5 questions, one from each unit and carries 5 marks each.
- Part-B to be answered 5 questions carrying 10 marks each. There will be two questions from each unit and only one should be answered.

6.2 For practical subjects, 75 marks shall be awarded for performance in the Semester End Examinations and 25 marks shall be awarded for day-to-day performance as Internal Marks.

6.3 For conducting laboratory end examinations of all PG Programmes, one internal examiner and one external examiner are to be appointed by the Principal of the College and the same to be informed to the Director of Evaluation in two weeks before for commencement of the lab end

examinations. The external examiner should be selected from outside the College concerned but within the cluster. No external examiner should be appointed from any other College in the same cluster/any other cluster which is run by the same Management.

6.4 There shall be two seminar presentations during I year I semester and II semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Departmental Academic Committee consisting of Head of the Department, Supervisor and two other senior faculty members of the department. For each Seminar there will be only internal evaluation of 50marks. A candidate has to secure a minimum of 50%ofmarks to be declared successful. If he fails to fulfill minimum marks, he has to reappear during the supplementary examinations.

6.5 There shall be a Comprehensive Viva-Voce in II year I Semester. The Comprehensive Viva-Voce is intended to assess the students' understanding of various subjects he has studied during the M. Tech. course of study. The Head of the Department shall be associated with the conduct of the Comprehensive Viva-Voce through a Committee. The Committee consisting of Head of the Department, one senior faculty member and an external examiner. The external examiner shall be appointed by the Director of Evaluation. For this, the Principal of the College shall submit a panel of 3 examiners. There are no internal marks for the Comprehensive Viva-Voce and evaluates for maximum of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful. If he fails to fulfill minimum marks, he has to reappear during the supplementary examinations.

6.6 A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the Semester End Examination and a minimum aggregate of 50% of the total marks in the Semester End Examination and Continuous Internal Evaluation taken together.

6.7 In case the candidate does not secure the minimum academic requirement in any subject (as specified in 6.6) he has to reappear for the Semester End Examination in that subject.

6.8 A candidate shall be given one chance to re-register for the subjects if the internal marks secured by a candidate is less than 50% and failed in that subject for maximum of two subjects and should register within four weeks of commencement of the class work. In such a case, the candidate must re-register for the subjects and secure the required minimum attendance. The candidate's attendance in the re-registered subject(s) shall be calculated separately to decide upon his eligibility for writing the Semester End Examination in those subjects. In the event of the student taking another chance, his Continuous Internal Evaluation (internal) marks and Semester End Examination marks obtained in the previous attempt stands cancelled.

6.9 In case the candidate secures less than the required attendance in any subject, he shall not be permitted to write the Semester End Examination in that subject. He shall re-register for the subject when next offered.

1. Examinations and Assessment - The Grading System

Marks will be awarded to indicate the performance of each student in each Theory Subject, or Lab/Practicals, or Seminar, or Project, etc., based on the % marks obtained in

CIE + SEE (Continuous Internal Evaluation + Semester End Examination, both taken together) as specified in Item6above, and a corresponding Letter Grade shall be given.

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 (Class Intervals)	*Letter Grade (UGC Guidelines)*	*Grade Points*
80% and above (□ 80% . ≤ 100%)	O (Outstanding)	10
Below 80% but not less than 70% (□ 70% . < 80%)	A^+ (Excellent)	9
Below 70% but not less than 60% (□ 60% . < 70%)	A (Very Good)	8
Below 60% but not less than 55% (□ 55% . < 60%)	B^+ (Good)	7
Below 55% but not less than 50% (□ 50% . < 55%)	B (above Average)	6
Below 50% (< 50%)	F (FAIL)	0
Absent	**Ab**	**0**

7.3 A student obtaining F Grade in any Subject shall be considered 'failed' and isbe required to reappear as 'Supplementary Candidate' in the Semester End Examination (SEE), as and when offered. In such cases, his Internal Marks (CIE Marks) in those Subjects will remain the same as those he obtained earlier.

7.4 A student not appeared for examination then 'Ab' Grade will be allocated in any Subject shall be considered 'failed' and will be required to reappear as 'Supplementary Candidate' in the Semester End Examination (SEE), as and when offered.

7.5 A Letter Grade does not imply any specific Marks percentage and it will be the range of marks percentage.

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

7.7 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

7.8 The Student passes the Subject/ Course only when he **gets GP □ 6(B Grade or above).**

7.9 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 is the no. of Subjects 'REGISTERED' for the Semester . SGPA is rounded off to **TWO** decimal places. SGPA is thus computed as

$$\textbf{SGPA} = \frac{\left\{\sum_{i=1}^{N} C_i G_i\right\}}{\left\{\sum_{i=1}^{N} C_i\right\}} \quad \textbf{……. For each semester.}$$

Where **'i'** is the subject indicator index (takes into account aii subjects in a semester), 'N' is the number of subjects **'registered'** for the semester (as specially required and listed under the course structure of the department). $\mathbf{G_i}$ is the number of credits allotted to the $\mathbf{i^{th}}$ subject, and $\mathbf{G_i}$ represents the grade points (GP) corresponding to the letter grade awarded for that $\mathbf{i^{th}}$ subject.

7.10 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 tow decimal places. CGPA is thus computed from the I year II semester onwards at the end of each semester as per the formula.

$$\textbf{CGPA} = \frac{\left\{\sum_{j=1}^{M} C_j G_j\right\}}{\left\{\sum_{j=1}^{N} C_j\right\}} \quad \textbf{…….. For all S semester registered}$$

(i.e., up to and inclusive of S semester, S ≥ 2)

Where **'M'** is the total number of subjects (as specially required and listed under the course structure of the parent department) the student has **'registered'** i.e. from the first semester onwards upto and exclusive of the forth semester, "j" is the subject indicator index (takes in to account all subjects for one to four semester), C_j is the number of credits allotted to the j^{th} subject, G_i represents the grade points(GP) corresponding to the letter grade awarded for the j^{th} subject. After registration and completion of first year first semester, the SGPA of that semester itself may be taken as the CGPA, as there are no cumulative effects.

7.11 For Calculations listed in Item 7.6 – 7.10, performance in failed Subjects/ Courses (securing F Grade) will also be taken into account, and the Credits of such Subjects/ Courses will also be included in the multiplications and summations.

8. EVALUATION OF PROJECT/DISSERTATION WORK

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

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

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

8.3 After satisfying 8.2, a candidate has to submit, in consultation with his Project Supervisor, the title, objective and plan of action of his project work to the PRC for approval. Only after obtaining the approval of the PRC the student can initiate the Project work.

8.4 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.

8.5 A candidate shall submit his project status report in two stages at least with a gap of 3 months between them.

8.6 The work on the project shall be initiated at the beginning of the II year and the duration of the project is two semesters. 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 registration 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.

8.7 After approval from the PRC, the soft copy of the thesis should be submitted to the University 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 24%, then only thesis will be accepted for submission.

8.8 Three copies of the Project Thesis certified by the supervisor shall be submitted to the College/School/Institute.

8.9 For Project work Review I in II Year I Sem. there is an internal marks of 50, the evaluation should be done by the PRC for 25 marks and Supervisor will evaluate for 25 marks. The Supervisor and PRC will examine the Problem Definition, Objectives, Scope of Work, Literature Survey in the same domain. A candidate has to secure a minimum of 50% of marks to be declared successful for Project Work Review I. If he fails to fulfill minimum marks, he has to reappear during the supplementary examination.

8.10 For Project work Review II in II Year II Sem. there is an internal marks of 50, the evaluation should be done by the PRC for 25 marks and Supervisor will evaluate for 25 marks. The PRC will examine the overall progress of the Project Work and decide the Project is eligible for final submission or not. A candidate has to secure a minimum of 50% of marks to be declared successful for Project Work Review II. If he fails to fulfill minimum marks, he has to reappear during the supplementary examination.

8.11 For Project Evaluation (Viva Voce) in II Year II Sem. there is an external marks of 150 and the same evaluated by the External examiner appointed by the University. The candidate has to secure minimum of 50% marks in Project Evaluation (Viva-Voce) examination.

8.12 If he fails to fulfill as specified in 8.11, he will reappear for the Viva-Voce examination only after three months. In the reappeared examination also, fails to fulfill, he will not be eligible for the award of the degree.

8.13 The thesis shall be adjudicated by one examiner selected by the University. For this, the Principal of the College shall submit a panel of 3 examiners, eminent in that field, with the help of the guide concerned and Head of the Department.

8.14 If the report of the examiner is not favourable, the candidate shall revise and resubmit the Thesis. If the report of the examiner is unfavourable again, the thesis shall be summarily rejected.

8.15 If the report of the examiner is favourable, Project Viva-Voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the external examiner who adjudicated the Thesis.

8.16 The Head of the Department shall coordinate and make arrangements for the conduct of Project Viva- Voce examination.

9. AWARD OFDEGREEAND CLASS

9.1 A Student who registers for all the specified Subjects/ Courses as listed in the Course Sthe entire PG Programme (PGP), and secures the required number of **88** 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 specialization as he admitted.

9.2 **Award of Class**

After a student has satisfied 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≤CGPA < 7.75
Second Class	6.00≤CGPA < 6.75

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

10. WITHHOLDING OFRESULTS

If the student has not paid the dues, if any, to the University 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. His degree will be with held in such cases.

11. TRANSITORY REGULATIONS

11.1 If any candidate is detained due to shortage of attendance in one or more subjects, they are eligible for re-registration to maximum of two earlier or equivalent subjects at a time as and when offered.

11.2 The candidate who fails in any subject will be given two chances to pass the same subject; otherwise, he has to identify an equivalent subject as per R15 Academic Regulations.

12 GENERAL

12.1 **Credit**: A unit by which the course work is measured. It determines the number of hours of instructions required per week. One credit is equivalent to one hour of teaching (lecture or tutorial) or two hours of practical work/field work per week.

12.2 **Credit Point:** It is the product of grade point and number of credits for a course.

12.3 Wherever the words "he", "him", "his", occur in the regulations, they include "she", "her".

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

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

12.6 The College 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 College.

DISCIPLINARY ACTIO N FOR / IMPROPER CONDUCT IN EXAMINATIONS
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	Nature of Malpractice/Improper conduct	**Punishment**
	If the student:	
1.(a)	Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, cell phones, pager, palm computers or any other form of material concerned with or related to the subject of the examination (theory or practical) in which student is appearing but has not made use of (material shall include any marks on the body of the subject of the examination)	Expulsion from the examination hall and cancellation of the performance in that subject only.
(b)	Gives assistance or guidance or receives it from any other student orally or by any other body language methods or communicates through cell phones with any student or persons in or outside the exam hall in respect of any matter.	Expulsion from the examination hall and cancellation of the performance in the subject only of all the students involved. In case of an outsider, he will be handed over to the police and a case is registered against him.
2.	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the student is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the student has already appeared including practical examinations and UG major project and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The hall ticket of the student is to be cancelled and sent to the university.
3.	Impersonates any other student in connection with the examination.	The student who has impersonated shall be expelled from examination hall. The student is also debarred and forfeits the seat. The performance of the original student, who has been impersonated, shall be cancelled in all the subjects of the examination (including practicals and UG major project) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the student is subject to the academic regulations in connection with forfeiture of sea. If the imposter is and 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 our 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 the subject and all the other subjects the student has already appeared including practical examinations and UG major project and shall not be permitted for the remaining examinations of the subjects of that semester year. The student is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the student 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 organizers a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or writer or by signs or by 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 disruptthe orderly conduct of the examination.	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 student(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The students also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7.	Leaves the exam hall taking away answer script or intentionally tears of the script or any 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 student has already appeared including practical examinations and UG major project and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred for two consecutive semesters from class work and all university examinations. The continuation of the course by the student 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 performance in that subject and all other subjects the student has already appeared including practical examinations and UG major project and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeiture of seat.
9.	If student of the college, who is not a student for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all the other subjects the student has already appeared including practical examinations and UG major project and shall not be permitted for the remaining examinations of the subjects of that semester/year. The student is also debarred and forfeiture of 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 performance in that subject and all other subjects the student has already appeared including practical examinations and UG major project 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 performance in that subject and all other subjects the student has appeared including practical examinations and UG major project 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 university for further action to award suitable punishment.	

Malpractices identified by squad or special invigilators

1. Punishments tothecandidates aspertheaboveguidelines.
2. Punishment for institutions: (if the squad reports that the college is also involved inencouraging malpractices)
   - (i) Ashow causenoticeshall beissuedtothecollege.
   - (ii) Imposeasuitablefineonthecollege.
   - (iii) Shifting the examination centre from the college to another college for a specificperiodofnotlessthanoneyear.

J.B. INSTITUTE OF ENGINEERING AND TECHNOLOGY
M. Tech. (CAD/CAM)

COURSE STRUCTURE AND SYLLABUS

I YEAR I SEMESTER

S. No	Course Code	Course Title	L	P	C
1		**Core Course -I**	4	0	4
	DM11A	Advanced CAD			
2		**Core Course -II**	4	0	4
	DM11B	Computer Aided Manufacturing			
3		**Core Course -III**	4	0	4
	DM11C	Advanced FEM			
		Core Elective -I	4	0	4
	DM11D	Mechanical Behaviour of Materials			
	DM11E	Stress Analysis and Vibration			
4	DM11F	Rapid Prototyping Technolgies			
		Core Elective -II	4	0	4
	DM11G	Automation in Manufacturing			
	DM11H	Computer Aided Process Planning			
5	DM11 I	Performance Modeling and Analysis of Manufacturing Systems			
		Open Elective -I	4	0	4
	DMM11J	Numerical Methods for Partial Differential Equations			
6	DMM11K	Production and Operations Management			
7	DMM11L	Advanced CAD/CAM Lab	0	4	2
8	DMM11M	Seminar -I	0	4	2
		TOTAL	**24**	**8**	**28**

I YEAR II SEMESTER

S. No	Course Code	Course Title	L	P	C
1		**Core Course -IV**	4	0	4
	DM12A	Design for Manufacturing And Assembly			
2		**Core Course -V**	4	0	4
	DM12B	Flexible Manufacturing Systems			
3		**Core Course -VI**	4	0	4
	DM12C	Industrial Robotics			
		Core Elective -III	4	0	4
	DM12D	Intelligent Manufacturing Systems			
	DM12E	Special Manufacturing Process			
4	DM12F	Design Optimization			
		Core Elective -IV	4	0	4
	DM12G	Advanced Mechatronics			
5	DM12H	Design and Manufacturing of MEMS and Micro Systems			
	DM12I	Fuzzy Logic and Neural Networks			
		Open Elective -II	4	0	4
	DM12J	Engineering Research and Methodology			
6	DM12K	Quality Engineering in Manufacturing			
7	DM12L	Manufacturing Simulation & Precision Engineering Laboratory	0	4	2
8	DM12M	Seminar -II	0	4	2
		TOTAL	**24**	**8**	**28**

II YEAR I SEMESTER

S. No	Course Code	Course Title	L	P	C
1	DM13A	Comprehensive Viva-Voce	0	0	4
2	DM13B	Project work Review -I	0	24	12
		TOTAL	**0**	**24**	**16**

II YEAR II SEMESTER

S. No	Course Code	Course Title	L	P	C
1	DM14A	Comprehensive Viva-Voce	0	0	4
2	DM14B	Project work Review (Viva-Voce)	0	24	12
		TOTAL	**0**	**24**	**16**

J.B.INSTITUTE OF ENGINEERING & TECHNOLOGY

UGC AUTONOMOUS

M.Tech.: CAD /CAM	**L**	**T-P-D**	**C**
I Year - I Semester	**4**	**0-0-0**	**4**

ADVANCED CAD
(**Core Course –I)**

UNIT- I:

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

Basics of Geometric Modelling: Requirement of geometric modelling, Geometric models, Geometric construction methods, Modelling facilities desired.

UNIT- II:

Eometricmodelling: Classification of wireframe entities, Curve representation methods, Parametric representation of analytic curves: line, circle, arc, conics, Parametric representation of synthetic curves: Hermite cubic curve, Bezier curve, B-Spleen curve wire , NURBS, Curve manipulations.

UNIT- III:

Surface Modeling : Classification of surface entities, Surface representation methods, Parametric representation of analytic surfaces: plane surface, ruled surface, surface of revolution, tabulated cylinder, Parametric representation of synthetic curves: Hermite cubic surface, Bezier surface, B-Spleen surface , Blending surface, Surface manipulations.

UNIT- IV:

Solid Modelling: Geometry and topology, Boundary representation, The Euler-Poincare formula, Euler operators, Constructive solid geometry: CSG primitives, Boolean operators, CSG expressions, Interior, Exterior, closure, Sweeping: linear and non-linear, Solid manipulations.

UNIT- V:

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

Evaluation Criteria: Evaluation criteria of CAD software, Data exchange formats: GKS, IGES, PHIGS,CGM, STEP

Dimensioning and tolerances: Linear, angular, angular dimensions, maximum material condition (MMC), Least material condition (LMC), Regardless of feature size (RFS).

TEXT BOOKS:

2. CAD/CAM Concepts and Applications/ Alavala/ PHI.

3. Mastering CAD/CAM / Ibrhim Zeid / Mc Graw Hill International.

REFERENCE BOOKS:

1. CAD/CAM Principles and Applications/ P.N.Rao/TMH/3rd Edition
2. CAD/CAM /Groover M.P./ Pearson education
3. CAD / CAM / CIM, Radhakrishnan and Subramanian/ New Age
4. Principles of Computer Aided Design and Manufacturing/ Farid Amirouche/ Pearson
5. Computer Numerical Control Concepts and programming/ Warren S Seames/ Thomson.

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UGC AUTONOMOUS

M.Tech.: CAD /CAM	**L**	**T-P-D**	**C**
I Year - I Semester	**4**	**0-0-0**	**4**

COMPUTER AIDED MANUFACTURING
(Core Course –II)

UNIT - I

Compute-Aided Programming: General information, APT programming, Examples Apt programming probkms (2D machining only). NC programming on CAD/CAM systems, the design and implementation of post processors .Introduction to CAD/CAM software, Automatic Tool Path generation.

UNIT - II

Tooling for CNC Machines: Interchangeable tooling system, preset and qualified toois, coolant fed tooling system, modular fixturing, quick change tooling system, automatic head changers. DNC Systems and Adaptive Control: Introduction, type of DNC systems, advantages arid disadvantages of DNC, adaptive control with optimization, Adaptive control with constrains, Adaptive control of machining processes like turning, grinding.

UNIT - III

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

UNIT - IV

Micro Controllers: Introduction, Hardware components, I/O pins, ports, external memory:, counters, timers and serial data I/O interrupts. Selection of Micro Controllers Embedded Controllers, Applications and Programming of Micro Controllers. Programming Logic Controllers (PLC' s): Introduction, Hardware components of PLC, System, basic structure, principle of operations, Programming mnemonics timers, Internal relays and counters, Applications of PLC's in CNC Machines.

UNIT - V

Computer Aided Process Planning: Hybrid CAAP System, Computer Aided Inspection and quality control, Coordinate Measuring Machine, Limitations of CMM, Computer Aided Testing, Optical Inspection Methods, Artificial Intelligence and expert system: Artificial Neural Networks, Artificial Intelligence in CAD, Experts systems and its structures.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Computer Control of Manufacturing Systems / Yoram Koren / Mc Graw Hill. 1983.
2. Computer Aided Design Manufacturing – K. Lalit Narayan, K. Mallikarjuna Rao and M.M.M. Sarcar, PHI, 2008.
3. CAD / CAM / CIM, Radhakrishnan and Subramanian, New Age
4. Principles of Computer Aided Design and Manufacturing, Farid Amirouche, Pearson
5. Computer Numerical Control Concepts and programming, Warren S Seames, Thomson.

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UGC AUTONOMOUS

M.Tech.: CAD /CAM	**L**	**T-P-D**	**C**
I Year - I Semester	**4**	**0-0-0**	**4**

ADVANCED FINITE ELEMENT METHODS
(Core Course –III)

UNIT-I:

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

UNIT-II:

1-D Structural Problems: Axial bar element – stiffness matrix, load vector, temperature effects, Quadratic shape functions and problems.
Analysis of Trusses : Plane Trusses and Space Truss elements and problems
Analysis of BECAD/CAM : Hermite shape functions – stiffness matrix – Load vector – Problems.

UNIT-III:

2-D problems: CST, LST, force terms, Stiffness matrix and load vectors, boundary conditions, Isoparametric elements – quadrilateral element, shape functions – Numerical Integration. Finite element modeling of Axi-symmetric solids subjected to Axi-symmetric loading with triangular elements.
3-D Problems: Tetrahedran element – Jacobian matrix – Stiffness matrix.

UNIT-VI:

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

UNIT-V:

Dynamic considerations, Dynamic equations – consistent mass matrix – Eigen 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 / Mc Graw Hill

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 Fininte element analysis- S.Md.Jalaludeen,Anuradha Publications, print-2012
4. A First Course in the Finite Element Method/Daryl L Logan/Cengage Learning/5th Edition
5. Finite Element Method – Krishna Murthy / TMH
6. Finite Element Analysis – Bathe / PHI

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UGC AUTONOMOUS

M.Tech.: CAD /CAM	**L**	**T-P-D**	**C**
I Year - I Semester	**4**	**0-0-0**	**4**

MECHANICAL BEHAVIOUR OF MATERIALS
(Core Elective – I)

UNIT-I:

Introduction to Deformation Behaviour: Concept of stresses and strains, engineering stresses and strains, Different types of loading and temperature encountered in applications, 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.

UNIT-II:

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

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

UNIT-III:

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, 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.

UNIT-IV:

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, 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

UNIT-V:

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

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, microstructural aspects of creep and design of creep resistant alloys, high temperature deformation of ceramics and polymers.

TEXT BOOKS:

1. G.E. Dieter,"Mechanical Metallurgy", McGraw-Hill, 1986.

2. R.W. Hertzberg,"Deformation and Fracture Mechanics of Engineering Materials", John Wiley and Sons, 1976.

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UGC AUTONOMOUS

M.Tech.: CAD /CAM	**L**	**T-P-D**	**C**
I Year - I Semester	**4**	**0-0-0**	**4**

STRESS ANALYSIS AND VIBRATION
(Core Elective – I)

UNIT-I:

Two dimensional elasticity theory in Cartesian coordinates, plane stress problem in polar coordinates Thick cylinders, Rotating discs - stress concentration.

UNIT- II:

Torsion of non circular prismatic sections, rectangular and axisymmetric, Circular plates, introduction to shell theory — contact stresses.

UNIT- III:

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

UNIT- IV:

Transient vibrations of single and two degree freedom systems, multi-degree of freedom systems - applications of matrix methods , continuous systems.

UNIT -V:

Free and forced vibrations of strings bars and beCAD/CAM. Principle of orthogonality - classical and energy methods.

TEXT BOOKS:

1. Theory of Elasticity/Timoshenko S.P. and Goodier J.N./Koakusha Publishers
2. Advanced strength of materials / Den Hortog J.P./Torrent
3. Mechanical Vibrations/ Den Ilartog J.P./ Dover Publications
4. Theory of Vibrations with Applications/ Thomson W.T./ CBS Publishing
5. Mechanical Vibrations/ Rao S.S./ Addison Wesley Longman

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UGC AUTONOMOUS

M.Tech.: CAD /CAM	**L**	**T-P-D**	**C**
I Year - I Semester	**4**	**0-0-0**	**4**

RAPID PROTOTYPING TECHNOLGIES
(Core Elective – I)

Unit – I

Introduction: Prototyping fundamentals, Historical development, Fundamentals of Rapid Prototyping, Advantages and Limitations of Rapid Prototyping, Commonly used Terms, Classification of RP process, Rapid Prototyping Process Chain: Fundamental Automated Processes, Process Chain.

Unit – II

Liquid-based Rapid Prototyping Systems: Stereo lithography Apparatus (SLA): Models and specifications, Process, working principle, photopo l ymers, photo po l ymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies. Solid ground curing (SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies

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.

Unit-III

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.

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 3DP.

Unit – IV

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. 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.

Unit –V

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. 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 Biomolecules.

TEXT BOOKS:

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

REFERANCE BOOKS:

6 Rapid Manufacturing – D.T. Pham and S.S. Dimov, Springer , 2001
7 Whalers Report 2000 – Terry Wohlers, Wohlers Associates, 2000 Rapid Prototyping & Manufacturing – Paul F.Jacobs, ASME Press, 1996.

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UGC AUTONOMOUS

M.Tech.: CAD /CAM	**L**	**T-P-D**	**C**
I Year - I Semester	**4**	**0-0-0**	**4**

AUTOMATION IN MANUFACTURING
(Core Elective – II)

UNIT – I

Over View of Manufacturing and Automation: Production systems, Automation in production systems, Automation principles and strategies, Manufacturing operations, production facilities. Basic elements of an automated system, levels of automation; Hardware components for automation and process control, programmable logic controllers and personal computers.

UNIT – II:

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.

UNIT – III:

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.

UNIT – IV:

Automated Assembly Systems: Fundamentals, Analysis of Assembly systems. Cellular manufacturing, part families, cooling, production flow analysis. Group Technology and flexible Manufacturing systems, Quantitative Analysis.

UNIT – V:

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.

REFERANCES

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

4. System Approach to Computer Integrated Design and Manufacturing/ Singh/John Wiley /96.
5. Computer Aided Manufacturing/Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang/ Pearson/ 2009.
6. Manufacturing and Automation Technology / R Thomas Wright and Michael Berkeihiser / Good Heart/Willcox Publishers.

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UGC AUTONOMOUS

M.Tech.: CAD /CAM	**L**	**T-P-D**	**C**
I Year - I Semester	**4**	**0-0-0**	**4**

COMPUTER AIDED PROCESS PLANNING
(Core Elective – II)

UNIT-I:

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

UNIT-II:

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.

UNIT-III;

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, AI.

UNIT-IV

Computer Aided Process Planning Systems: Logical Design of process planning-Implementation considerations-Manufacturing system components, Production Volume, No. of production families - CAM-I, CAPP, MIPLAN, APPAS, AUTOPLAN and PRO, CPPP.

UNIT-V

An Intergarted Process Planning Systems: Totally integrated process planning systems-An Overview-Modulus structure-Data Structure-Operation-Report Generation, Expert process planning

REFERANCES

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", PrenticeHall1985
3. Chang,T.C., "An Expert Process Planning System", Prentice Hall,1985
4. Nanua Singh, "Systems Approach to Computer Intergrated Design and Manufacturing", John Wiley &Sons,1996
5. Rao P.N., "Computer Aided Manufacturing", Tata McGraw Hill Publishing Co., 2000.

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UGC AUTONOMOUS

M.Tech.: CAD /CAM	**L**	**T-P-D**	**C**
I Year - I Semester	**4**	**0-0-0**	**4**

PERFORMANCE MODELING AND ANALYSIS OF MANUFACTURING SYSTEMS
(Core Elective – II)

UNIT I:

Manufacturing Systems & Control: Automated Manufacturing Systems – Modeling – Role of performance modeling – simulation models-Analytical models. Product cycle – Manufacturing automation – Economics of scale and scope – input/output model – plant configurations. Performance measures – Manufacturing lead time – Work in process – Machine utilization – Throughput – Capacity
– Flexibility – Performability – Quality Control Systems – Control system architecture – Factory communications – Local area network interconnections – Manufacturing automation protocol – Database management system.

UNIT II:

Manufacturing Processes: Examples of stochastics processes – Poisson process - Discrete time Markov chain models – Definition and notation – Sojourn times in states – Examples of DTMCs in manufacturing – Chapman – Kolmogorov equation – Steady-state analysis. Continuous Time Markov Chain Models – Definitions and notation – Sojourn times in states – examples of CTMCs in manufacturing – Equations for CTMC evolution – Markov model of a transfer line. Birth and Death Processes in Manufacturing – Steady state analysis of BD Processes – Typical BD processes in manufacturing.

UNIT III:

Queuing Model: Notation for queues – Examples of queues in manufacturing systems – Performance measures – Little's result – Steady state analysis of M/M/m queue, queues with general distributions and queues with breakdowns – Analysis of a flexible machine center.

UNIT IV:

Queuing Networks: Examples of QN models in manufacturing – Little's law in queuing networks – Tandem queue – An open queuing network with feedback – An open central server model for FMS – Closed transfer line – Closed server model – Garden Newell networks.

UNIT V:

Petrinets: Classical Petri Nets – Definitions – Transition firing and reachability – Representational power – properties – Manufacturing models.

Stochastic Petri Nets – Exponential timed Petri Nets – Generalized Stochastic Petri Nets – modeling of KANBAN systems – Manufacturing models.

REFERANCES

1. Performance Modelling of Automated Manufacturing Systems/ Viswanadham, N and Narahari, Y/ Prentice Hall of India, New Delhi, 1994
2. Probability and Statistics with Reliability, Queuing and Computer Science Applications/ Trivedi, K.S./ Prentice Hall, New Jersey, 1982.
3. Fundamentals of Mathematical Statistics/ Gupta S.C. & Kapoor V.K./ 3rd Edition, Delhi, 1988

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UGC AUTONOMOUS

M.Tech.: CAD /CAM	**L**	**T-P-D**	**C**
I Year - I Semester	**4**	**0-0-0**	**4**

NUMERICAL METHODS FOR PARTIAL DIFFERENTIAL EQUATIONS
(Open Elective – I)

UNIT-I:

Introduction to finite difference formula- Parabolic Equation: Introduction – Explicit finite difference approximation to one dimensional equation Crank – Nicholson implicit method – derivation boundary conditions.

UNIT-I:

Alternate direction implicit (ADI) method finite difference in cylindrical and spherical polar co-ordinates.

Convergence stability and consistency: Definitions of local truncation error and consistency convergence analysis – stability analysis by matrix method eigen value von Newmann stability methods, global rounding error-local truncation error-lax's equation theorem.

UNIT-III:

Hyperbolic Equations: Analytical solution of 1^{st} order quasi linear equation – numerical integration along a characteristic lax wenderoff explicit method.

CFI condition wenderoff implicit approximation – propagation of discontinues – Numerical solution by the method of characteristics.

UNIT-IV:

Elliptic Equations: Introduction – Finite differences in polar co-ordinates – formulas for derivative near a curved boundary analysis of the discretization error of the five point approximation to polman's equation over a rectangle.

UNIT-V:

Systemactic iterative methods for large linerar systems – necessary and sufficient condition for convergence of iterative methods – stones implicit methods.

Finite Element Method: weighted residual method – variations methods – division of the region into elements linear element – Galerkin formuation.

REFERANCES

1. Numerical Solution of partial differential equations, Finite Differences methods/ G.D. Smith/ Brunel University, Clarandon Press Oxford.
2. The Finite Differences Methods in Partial Differential equation/ A.R. Mitchel and D.F. Grnra/ John Wiley.
3. Numerical Methods for Engineers and scientists/Joe D. Hoffman/ Mc Graw Hill
4. Applied Finite Element Analysis/ Larry J. Segerlind/ John Wiley.

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UGC AUTONOMOUS

M.Tech.: CAD /CAM	**L**	**T-P-D**	**C**
I Year - I Semester	**4**	**0-0-0**	**4**

PRODUCTION AND OPERATIONS MANAGEMENT
(Open Elective – I)

UNIT -I

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

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

UNIT – II

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

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.

UNIT - III

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 –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.

UNIT - IV

Scheduling: Policies – Types of scheduling – Forward and Backward Scheduling – Gantt Charts – Flow shop Scheduling – n jobs and 2 machines, n jobs and 3 machines – job shop Scheduling – 2 jobs and n machines – Line of Balance.

UNIT – V

Project Management: Programming Evaluation Review Techniques (PERT) – three times estimation

– critical path – probability of completion of project – critical path method – crashing of simple nature.

REFERANCES

2. Operations Management/ E.S. Buffs/ John Wiley & Sons / 2007
3. Operations Management Theory and Problems/ Joseph G. Monks / Macmillan / McGraw Hill / 3rd Edition.
4. Production Systems Management/ James I. Riggs / John Wiley & Sons.
5. Production and Operations Management/ Chary/ Mc Graw Hill/2004
6. Operations Management/ Richard Chase/ Mc Graw Hill/2006
7. Production and Operation Management / Panner Selvam / PHI.
8. Production and Operation Analysis/ Nahima/ Mc Graw Hill/2004

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M.Tech.: CAD /CAM	**L**	**T-P-D**	**C**
I Year - I Semester	**0**	**0-4-0**	**2**

ADVANCED CAD/CAM LAB

Features and selection of CNC turning and milling centers. Practice in part programming and operation of CNC turning machines, subroutine techniques and use of cycles. Practice in part programming and operating a machining center, tool panning and selection of sequences of operations, tool setting on machine, practice in APT based NC programming. Practice in Robot programming and its languages. Robotic simulation using software. Robo path control, preparation of various reports and route sheets, Simulation of manufacturing system using CAM software, controller operating system commands.

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UGC AUTONOMOUS

M.Tech.: CAD /CAM	**L**	**T-P-D**	**C**
I Year - II Semester	**4**	**0-0-0**	**4**

DESIGN FOR MANUFACTURING AND ASSEMBLY
(Core Course –IV)

UNIT - I

introduction: Design philosophy steps in Design process - General Design rules for manufacturability - basic principles of design Ling for economical production - creativity in design. Materials: Selection of Materials for design Developments in Material technology - criteria for material selection - Material selection interrelationship with process selection process selection charts.

UNIT- II

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

UNIT- III

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 die5 drop forging die design - general design recommendations. Extrusion & Sheet Metal Work: Design guidelines for extruded sections - design principles for Punching, Blanking, Bending, Deep Drawing - Keeler Goodman Forming Line Diagram - Component Design for Blanking.

UNIT-IV

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

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

UNIT-V

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, classification system for manual handling,

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.

REFERANCES

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.
3. Hand Book of Product Design/ Geoffrey Boothroyd/ Marcel and Dekken, N.Y. 1990.
4. Computer Aided Assembly London/ A Delbainbre/.
5. Product Design for Manufacturing and Assembly/ Geoffrey Boothroyd, Peter Dewhurst & Winston Ansthony Knight/CRC Press/2010

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UGC AUTONOMOUS

M.Tech.: CAD /CAM	**L**	**T-P-D**	**C**
I Year - II Semester	**4**	**0-0-0**	**4**

FLEXIBLE MANUFACTURING SYSTEMS
(Core Course –V)

UNIT- I:

Introduction to flexible manufacturing systems. Planning and scheduling and control of FMS. Knowledge based scheduling.

UNIT - II:

Hierarchy of computer control. Supervisory computer.

UNIT - III:

Software for simulation and database of FMS. Specification and selection, trends, application of simulation software.

UNIT - IV:

Manufacturing data systems data flow, CAD/CAM considerations. Planning FMS database, just in time characteristics, Pull method, quality small lot sizes, work station loads, close supplier ties, flexible workforce — line flow strategy.

UNIT - V:

Preventive maintenance. Karban system, implementation issues.

REFERANCES

1. Hand Book of Flexible Manufacturing Systems/ Jha N K/ Academic Press.
2. Production System l3eyond Large Scale Production/ Talichi Ohno/ Toyota Productivity Press
India Pvt. Lid.
3. Flexible Manufacturing Systems/ H K Shivanand/New Age International/2006

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UGC AUTONOMOUS

M.Tech.: CAD /CAM	**L**	**T-P-D**	**C**
I Year - II Semester	**4**	**0-0-0**	**4**

INDUSTRIAL ROBOTICS
(Core Course –VI)

UNIT - I

introduction: Automation and Robotics, Robot anatomy, robot configuration, motions joint notation work volume, robot drive system, control system and dynamic performance, precision of movement. **Control System and Components:** basic concept and modais controllers control system analysis, robot activation and feedback components. Positions sensors, velocity sensors, actuators sensors, power transmission system.

UNIT - II

Motion Analysis and Control: Manipulator kinematics, position representation forward transformation, homogeneous transformation, manipulator path control, robot dynamics, configuration of robot controller.

UNIT - III

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.

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.

UNIT - IV

Robot Programming: Lead through programming, Robot programming as a path in space, Motion interpolation, WAIT, SINONAL AND DELAY commands, Branching capabilities and Limitations. **ROBOT LANGUAGES**: Textual robot Languages, Generation, Robot language structures, Elements in function.

UNIT - V

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. **Robot Application**: Material transfer

REFERANCES

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

3. Robotics / Fu K S/ McGraw Hill.
4. Robotic Engineering / Richard D. Klafter, Prentice Hall
5. Robot Analysis and Intelligence / Asada and Slotine / Wiley Inter-Science.
6. Robot Dynamics & Control – Mark W. Spong and M. Vidyasagar / John Wiley & Sons (ASIA) Pte
Ltd.
7. Robotics and Control / Mittal R K & Nagrath I J / TMH

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M.Tech.: CAD /CAM	**L**	**T-P-D**	**C**
I Year - II Semester	**4**	**0-0-0**	**4**

INTELLIGENT MANUFACTURING SYSTEMS
(Core Elective – III)

UNIT I:

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

UNIT II:

Components of Knowledge Based Systems - Basic Components of Knowledge Based Systems, Knowledge Representation, Comparison of Knowledge Representation Schemes, Interference Engine, Knowledge Acquisition.

UNIT III:

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

UNIT IV:

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. Equipment Selection Problem, Modeling the Manufacturing Equipment Selection Problem, Problem Solving approach in KBSES, Structure of the KRSES.

UNIT V:

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

REFERENCES

1. Intelligent Manufacturing Systems/ Andrew Kusiak/Prentice Hall.
2. Artificial Neural Networks/ Yagna Narayana/PHI/2006

3. Automation, Production Systems and CIM / Groover M.P./PHI/2007
4. Neural networks: A comprehensive foundation/ Simon Hhaykin/ PHI.
5. Artificial neural networks/ B.Vegnanarayana/PHI
6. Neural networks in Computer intelligence/ Li Min Fu/ TMH/2003
7. Neural networks/ James A Freeman David M S kapura/ Pearson education/2004
8. Introduction to Artificial Neural Systems/Jacek M. Zurada/JAICO Publishing House Ed. 2006.

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M.Tech.: CAD /CAM	**L**	**T-P-D**	**C**
I Year - II Semester	**4**	**0-0-0**	**4**

SPECIAL MANUFACTURING PROCESS
(Core Elective – III)

UNIT- I

Surface Treatment: Scope, Cleaners, Methods of cleaning, Surface coating types, and ceramic and organic methods of coating, economics of coating. Electro forming, Chemical vapor deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding.

UNIT- II

Processing of Ceramics: Applications, characteristics, classification .Processing of particulate ceramics, Powder preparations, consolidation, Drying, sintering, Hot compaction, Area of application, finishing of ceramics. Processing of Composites: Composite Layers, Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites.

UNIT- III

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.

UNIT - IV

E-Manufacturing: Nano manufacturing techniques and micromachining, High Speed Machining and hot machining

UNIT -V

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

REFERENCES

1. Manufacturing Engineering and Technology *I* Kalpakijian / Adisson Wesley, 1995.
2. Process and Materials of Manufacturing / R. A. Lindburg / 1th edition, PHI 1990.
3. Microelectronic packaging handbook / Rao. R. Thummala and Eugene, J. Rymaszewski /
   Van Nostrand Renihold,
4. MEMS & Micro Systems Design and manufacture / Tai — Run Hsu / TMGH
5. Advanced Machining Processes / V.K.Jain / Allied Publications.
6. Introduction to Manufacturing Processes / John A Schey *I* Mc Graw Hill.

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UGC AUTONOMOUS

M.Tech.: CAD /CAM	**L**	**T-P-D**	**C**
I Year - II Semester	**4**	**0-0-0**	**4**

DESIGN OPTIMIZATION
(Core Elective – III)

UNIT- I:

General Characteristics of mechanical elements, adequate and optimum design, principles of optimization, formulation of objective function, design constraints, classification of optimization problems. Single and multivariable optimization techniques

UNIT- II:

Technique of unconstrained minimization. Golden section, Random, Pattern and Gradient search methods, interpolation methods, equality and inequality constraints.

UNIT-III:

Direct methods and indirect methods using penalty function, Lagrange multipliers, Geometric programming, stochastic programming, Genetic algorithms

UNIT-IV:

Engineering applications, structural-design application axial and transverse loaded members for minimum cost, maximum weight. Design of shafts and torsion members, design optimization of springs.

UNIT-V:

Dynamics applications for two degree freedom system. vibration absorbers.
Application in mechanisms.

REFERENCES

1. Engineering Optimization -Theory and Practice/ Singerusu S. Rao/ New Age.
2. Optimum Design of Mechanical elements/ Johnson Ray C/ Wiley, John & Sons
3. Genetic Algorithms in search, Optimization and Machine/ Goldberg D. E. Addison/Wesley / NewYork..
4. Optimization for Engineering Design Algorithms and Examples/ Kalyanamoy Deb/Prentice Flail of India.
5. Introduction to Optimum Design/Jasbir S. Arora/ Academic Press/ Everest/ 3rd Edition

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M.Tech.: CAD /CAM	**L**	**T-P-D**	**C**
I Year - II Semester	**4**	**0-0-0**	**4**

ADVANCED MECHATRONICS
(Core Elective – IV)

UNIT-I

Mechatronics systems, elements, levels of mechatronics system, Mechatronics design process, system, measurement systems, control systems, microprocessor-based 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.

UNIT-II

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

UNIT-III

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.

UNIT-IV

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.

UNIT-V

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

REFERENCES

1. MECHATRONICS Integrated Mechanical Electronics Systems/KP Ramachandran & GK Vijaya Raghavan/WILEY India Edition/2008
2. Mechatronics Electronics Control Systems in Mechanical and Electrical

Engineering by W Bolton,
Pearson Education Press, 3rd edition, 2005.
3. Mechatronics Source Book by Newton C Braga, Thomson Publications, Chennai.
4. Mechatronics – N. Shanmugam / Anuradha Agencies Publishers.
5. Mechatronics System Design / Devdas shetty/Richard/Thomson.
6. Mechatronics/M.D.Singh/J.G.Joshi/PHI.
7. Mechatronics – Electronic Control Systems in Mechanical and Electrical Engg. 4th Edition,
Pearson, 2012 W. Bolton
8. Mechatronics – Principles and Application Godfrey C. Onwubolu, Wlsevier, 2006 Indian print

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M.Tech.: CAD /CAM	**L**	**T-P-D**	**C**
I Year - II Semester	**4**	**0-0-0**	**4**

DESIGN AND MANUFACTURING OF MEMS AND MICRO SYSTEMS
(Core Elective – IV)

UNIT I:

Overview and Working Principles of MEMS and Microsystems

MEMS & Microsystems, Evolution of Micro fabrication, Microsystems & Microelectronics, Microsystems & Miniaturization, Applications of MEMS in Industries, Micro sensors, Micro actuation, MEMS with Micro actuators Micro accelerometers, Micro fluidies.

UNIT II:

Engineering Science for Microsystems Design and Fabrication:

Atomic structure of Matter, Ions and Ionization, Molecular Theory of Mater and Intermolecular Force, Doping of Semiconductors, The diffusion Process, Plasma Physics, Electrochemistry, Quantum Physics

UNIT III:

Engineering Mechanics for Microsystems Design:

Static Bending of thin Plates, Mechanical Vibration, Thermo mechanics Fracture Mechanics, Thin-Film Mechanics, Overview of Finite Element Stress Analysis

UNIT IV:

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, 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.

UNIT V:

Materials for MEMS & Microsystems and Their Fabrication:

Substrates and Wafers, Active substrate materials, Silicon as a substrate material, Silicon Compounds, Silicon Piezoresistors, Gallium Arsenide, Quartz, Piezoelectric Crystals and Polymers, Photolithography, Ion implantation, Diffusion and oxidation,

chemical and physical vapor deposition, Etching, Bulk micro manufacturing, Surface Micromachining, The LIGA Process

REFERENCES

1. MEMs & Microsystems: Design & Manufacture/ Tai-Ran Hsu/Tata Mc-Graw Hill., ed./2002
2. An Introduction to Microelectromechanical Systems Engineering/ Maluf, M./ Artech House, Boston, 2000
3. Micro robots and Micromechanical Systems/ Trimmer, W.S.N/ Sensors & Actuators, vol19, no.1989.
4. Applied Partial Differential Equations/ Trim, D.W/ PWS-Kent Publishing/ Boston 1990.
5. Fundamentals of Microfabrication. Madou, M/ CRC Press, Boca Raton, 1997.
6. The Finite Element Method in Thermomechanics/ Hsu, T.R / Alien & Unwin, London.

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M.Tech.: CAD /CAM	**L**	**T-P-D**	**C**
I Year - II Semester	**4**	**0-0-0**	**4**

FUZZY LOGIC AND NEURAL NETWORKS
(Core Elective – IV)

UNIT-I

Knowledge and Processing – Knowledge and Intelligence- logic frames- production systems. Fundamentals of Fuzzy logic-characteristics of fuzzy logic and systems-Fuzzy sets-Fuzzy number-Equality of fuzzy sets- Empty Fuzzy set –Fuzzy point-universal Fuzzy set. Operations on Fuzzy sets-Intersection-union –complement.

UNIT-II

Fuzzy Relations-classical N-Array Relation-Reflexivity-Anti reflexivity-symmetricity – Transitivity-Equivalence-Binary fuzzy relations, operation on Fuzzy relations-Intersection-union-projection-Cartesian product.

UNIT-III

Fuzzy Implications, Translation rules, Triangular norms, Triangular conorm, Fuzzy Rule base system, Fuzzy logic controller, Defuzzification Methods, Fuzzy logic applications-prevention of Road accidents-control room temperature-Robot control system-domestic applications-Industrial applications.

UNIT-IV

Basic concepts of Neural Network-Processing units-connection between units-output rules- Network topologies-paradigms of learning –perception, Back-propagation, classification Models-Association Models, optimization models.

UNIT-V

Rule Based Neural Networks-Network Training –Application of Neural Network in Mathematical Modeling-Knowledge based approaches-applications in Mechanical Engineering –Fuzzy –Neural, example, Neuro –Fuzzy examples-Intelligence in Automation.

REFERENCES

1. Intelligent Control Fuzzy Logic Applications/ Clarence W.de Silva/ CRS Press,1995.
2. Fuzzy logic &Neural Networks/ Chennakesava R. Alavala/ New Age International,2008
3. Fuzzy Logic with engineering Applications/ Timothy J. Ross/ Mc Graw Hill Inc., 1995.
4. Neural Networks in Computer Intelligence/ Limin Fu / Tata McGraw

5. Hill Publishing
Company Ltd.,2003
6. Stamations and Understanding Neural Networks and Fuzzy Logic/ V. Karthalopoulos Basic
concepts Applications, IEE Neural Networks Council PHI 2001.
7. Neural Networks Algorithms, Applications/ James A. Freeman and David M. Skapura
&Programming Techniques/ Pearson Education Asia,2001
8. Artificial Neural Networks/ Yegnarayane.B/ Prentice Hall- 2001.

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UGC AUTONOMOUS

M.Tech.: CAD /CAM	**L**	**T-P-D**	**C**
I Year - II Semester	**4**	**0-0-0**	**4**

ENGINEERING RESEARCH AND METHODOLOGY
(Open Elective – II)

UNIT-I

Research Methodology: Objectives and Motivation of Research, Types of Research, Research Approaches, Significance of Research, Research Methods verses Methodology, Research and Scientific Method, Important of Research Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. **Defining the Research Problem:** Definition of Research Problem, Problem Formulation, Necessity of Defining the Problem, Technique involved in Defining a Problem.

UNIT-II :

Literature Survey: Importance of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. **Literature Review:** Need of Review, Guidelines for Review, Record of Research Review.

UNIT-III:

Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design, Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Design of Experimental Set-up, Use of Standards and Codes.

UNIT-IV:

Data Collection: Exploring the data, Description and Analysis of Data, Sample Design and Sampling, Role of Statistics for Data Analysis, Functions of Statistics, Estimates of Population, Parameters, Parametric V/s Non Parametric methods, Descriptive Statistics, Points of Central tendency, Measures of Variability, Measures of relationship, Inferential Statistics-Estimation, Hypothesis Testing, Use of Statistical software. **Data Analysis:** Deterministic and random data, Uncertainty analysis, Tests for significance: Chi-square, student‘s_t‘ test, Regression modeling, Direct and Interaction effects, ANOVA,
F-test, Time Series analysis, Autocorrelation and Autoregressive modeling.

UNIT-V:

Research Report Writing: Format of the Research report, Style of writing report, References/Bibliography/Webliography, Technical paper writing/Journal report writing. **Research Proposal Preparation:** Writing a Research Proposal and Research Report, Writing Research Grant Proposal.

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REFERENCES

1. C.R Kothari, Research Methodology, Methods & Technique; New Age International Publishers, 2004
2. R. Ganesan, Research Methodology for Engineers, MJP Publishers, 2011
3. Y.P. Agarwal, Statistical Methods: Concepts, Application and Computation, Sterling Publs., Pvt., Ltd., New Delhi, 2004
4. Vijay Upagade and Aravind Shende, Research Methodology, S. Chand & Company Ltd., New Delhi, 2009
5. P. Ramdass and A. Wilson Aruni, Research and Writing across the Disciplines, MJP Publishers, Chennai, 2009

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UGC AUTONOMOUS

M.Tech.: CAD /CAM	**L**	**T-P-D**	**C**
I Year - II Semester	**4**	**0-0-0**	**4**

QUALITY ENGINEERING IN MANUFACTURING
(Open Elective – II)

UNIT - I

Quality Value and Engineering: An overall quality system, quality engineering in production design, quality engineering in design of production processes. Loss Function and Quality Level: Derivation and use of quadratile loss function, economic consequences of tightening tolerances as a means to improve quality, evaluations and types tolerances.(N-type,S-type and L-type)

UNIT II:

Tolerance Design and Tolerancing: Functional limits, tolerance design for N-type. L-type and S-type characteristics, tolerance allocation fbr multiple components. Parameter and Tolerance Design: Introduction to parameter design, signal to noise ratios, Parameter design strategy, some of the case studies on parameter and tolerance designs.

UNIT – III

Analysis of Variance (ANOVA): Introduction to ANOVA, Need for ANOVA, NO-way ANOVA, One-way ANOVA, Two-way ANOVA, Critique of F-test, ANOVA for four level factors, multiple level factors.

UNIT - IV

Orthogonal Arrays: Typical test strategies, better test strategies, efficient test strategies, steps in designing, conducting and analyzing an experiment. Interpolation of Experimental Results: Interpretation methods, percent contributor, estimating the mean.

UNIT - V

Six Sigma and the Technical System: Six sigma DMAIC methodology, tools fpr process improvement, six sigma in services and small organizations, statistical foundations, statistical methodology.

REFERENCES

1. Taguchi Techniques for Quality Engineering / Phillip J. Ross / McGraw Hill/ Intl. II Edition, 1995.
2. Quality Engineering in Production systems *I* G. Taguchi, A. Elsayed et al / Mc.Graw Hill Intl.Edition, 1989.
3. Taguchi Methods explained: Practical steps to Robust Design / Papan P. Bagchi *I* Prentice Hall Pvt. Ltd., New Delhi.

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UGC AUTONOMOUS

M.Tech.: CAD /CAM	**L**	**T-P-D**	**C**
I Year - II Semester	**0**	**0-2-0**	**2**

MANUFACTURING SIMULATION & PRECISION ENGINEERING LABORATORY

A. MANUFACTURING SIMULATION

The students will be given training on the use and application of the following software to manufacturing problems:

1. Auto MOD Software.
2. PROMOD
3. SLAM-II
4. CAFIMS
5. Flexsim

They also learn how to write sub routines in C-language and interlinking with the above packages. Problems for modelling and simulation experiments:

1. AGV planning
2. ASRS simulation and performance evaluation
3. Machines, AGVs and AS/RS integrated problems
4. JIT system
5. Kanban flow
6. Material handling systems
7. M.R.P. Problems
8. Shop floor scheduling etc.

B. PRECISION ENGINEERING

1. Hydraulic and Pneumatic circuits
2. Closed loop control systems
3. Study of the chip formation in turning process
4. Study of operation of tool and cutter grinder, Centreless grinder
5. Determination of cutting forces in turning
6. Inspection of parts using tool makers microscope, roughness using Talysurf
7. Study of micro-controllers, programming on various CNC machine tools and also controllers
8. Studies on PLC programming
9. Study and programming of robots