ACADEMIC REGULATIONS

COURSE STRUCTURE

AND

DETAILED SYLLABUS

CHOICE BASED CREDIT SYSTEM

MLR15

CAD/CAM

for

Master of Technology (M.Tech)

M. Tech. - Regular Two Year Degree Course
(For batches admitted from the academic year 2015 - 2016)

MARRI LAXMAN REDDY
GROUP OF INSTITUTIONS

MLR Institute of Technology

(Autonomous)

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FOREWORD

The autonomy is conferred on MLR Institute of Technology by UGC based on its performance as well as future commitment and competency to impart quality education. It is a mark of its ability to function independently in accordance with the set norms of the monitoring bodies like UGC and AICTE. It reflects the confidence of the UGC in the autonomous institution to uphold and maintain standards it expects to deliver on its own behalf and thus awards degrees on behalf of the college. Thus, an autonomous institution is given the freedom to have its own **curriculum, examination system and monitoring mechanism**, independent of the affiliating University but under its observance.

MLR Institute of Technology is proud to win the credence of all the above bodies monitoring the quality in education and has gladly accepted the responsibility of sustaining, if not improving upon the standards and ethics for which it has been striving for more than a decade in reaching its present standing in the arena of contemporary technical education. As a follow up, statutory bodies like Academic Council and Boards of Studies are constituted with the guidance of the Governing Body of the College and recommendations of the JNTU Hyderabad to frame the regulations, course structure and syllabi under autonomous status.

The autonomous regulations, course structure and syllabi have been prepared after prolonged and detailed interaction with several expertise solicited from academics, industry and research, in accordance with the vision and mission of the college to order to produce quality engineering graduates to the society.

All the faculty, parents and students are requested to go through all the rules and regulations carefully. Any clarifications, if needed, are to be sought, at appropriate time and with principal of the college, without presumptions, to avoid unwanted subsequent inconveniences and embarrassments. The Cooperation of all the stake holders is sought for the successful implementation of the autonomous system in the larger interests of the college and brighter prospects of engineering graduates.

PRINCIPAL

M. Tech. - Regular Two Year Degree Program
(For batches admitted from the academic year 2015 - 16)

For pursuing two year post graduate Masters Degree Programme of study in Engineering (M.Tech) offered by M L R Institute of Technology under Autonomous status and herein referred to as MLRIT (Autonomous):

All the rules specified herein approved by the Academic Council will be in force and applicable to students admitted from the Academic Year 2015-16 onwards. Any reference to "Institute" or "College" in these rules and regulations shall stand for M L R Institute of Technology (Autonomous).

All the rules and regulations, specified hereafter shall be read as a whole for the purpose of interpretation as and when a doubt arises, the interpretation of the Chairman, Academic Council is final. As per the requirements of statutory bodies, the Principal, M L R Institute of Technology shall be the Chairman, Academic Council.

1. **ADMISSION**

Admission into first year of two year M. Tech. degree Program of study in Engineering:

Eligibility:

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.

2.0 AWARD OF M. Tech. DEGREE

2.1 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 two academic years of course work, failing which he shall forfeit his seat in M. Tech. programme.

2.2 The student shall register for all 88 credits and secure all the 88 credits.

2.3 The minimum instruction days in each semester are 90.

3.0 COURSESOFSTUDY

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

1. Aerospace Engineering
2. CAD/CAM
3. Computer Science and Engineering
4. Digital Systems & Computer Electronics
5. Embedded Systems
6. Thermal Engineering
7. Software Engineering

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 class work 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.

5.1 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%.

5.2 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.

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

5.4 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.

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

5.6 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.

5.7 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.

- For the theory subjects 70 marks shall be awarded for the performance in the Semester End Examination and 30 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.

Sessional Examinations

- Subjective Paper shall contain three questions. Question 1 & 2 with internal choice from unit-I, question 3 & 4 with internal choice from unit-II and question 5 having a, b questions with internal choice from first half part of unit-III for I-MID examinations. For II-MID 1 & 2 questions from unit-4, questions 3 & 4 from unit-5 and question no 5 from remaining half part of unit-3.

The first mid-term examination shall be conducted for the first 50% of the syllabus, and the second mid-term examination shall be conducted for the remaining 50% of the syllabus.

- The Semester End Examination will be conducted for 70 marks examination shall be conducted for a total duration of 180 minutes. Question paper Consists of Part –A and Part-B with the following.
- Part-A is a compulsory question consisting of 5 questions, one from each unit and carries 4 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.

6.1 For practical subjects, 70 marks shall be awarded for performance in the Semester End Examinations and 30 marks shall be awarded for day-to-day performance as Internal Marks.

6.2 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 Chief Controller of Examination in two weeks before for commencement of the lab end examinations.

6.3 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 50 marks. 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.

6.4 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.

6.5 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.

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

6.7 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.

7 Examinations and Assessment - The Grading System

7.1 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.

7.2 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 (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

A student obtaining F Grade in any Subject shall be considered 'failed' and is be 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.

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.

7.3 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 sake of '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 A student earns Grade Point (GP) in each Subject/ Course, on the basis of the Letter Grade obtained by him in that Subject/Course (excluding Mandatory non-credit Courses). Then 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

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

SGPA $= \{\sum_{i=1}^{N} C_i G_i\} / \{\sum_{i=1}^{N} C_i\}$ **…. 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 that ix Subject, and G_i represents the Grade Points (GP) corresponding to the Letter Grade awarded for that ith Subject.

7.11 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

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

(ie., upto and inclusive of S Semesters, S ≥ 2),

where 'M' is the TOTAL no. of Subjects (as specifically required and listed under the Course Structure of the parent Department) the Student has 'REGISTERED' from the 1st Semester onwards upto and inclusive of the Semester S (obviously M > N), 'j' is the Subject indicator index (takes into account all Subjects from 1 to S Semesters), C_j is the no. of Credits allotted to the jth Subject, and G_j represents the Grade Points (GP) corresponding to the Letter Grade awarded for that jth 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.

7.12 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. EVALUATIONOFPROJECT/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

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 Structure, satisfies all the Course Requirements, and passes the examinations prescribed in the 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. WITHOLDING OF RESULTS

If the student has not paid the dues, if any, to the college 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 MLR15 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 University 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 University.

MALPRACTICES RULES

DISCIPLINARY ACTIONFOR /IMPROPER CONDUCT IN EXAMINATIONS

S.No	Nature of Malpractices/Improper conduct	Punishment
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.
(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 and sent to the Principal.
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 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 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 Addl. Controller of examinations / 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 addl. Controller of examinations or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the addl. Controller of examinations, 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	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 them.

	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.	
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 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 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 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. 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 principal for further action to award suitable punishment.	

COURSE STRUCTURE

I Year I Semester								
Code	Course Title	Hours per Week			Credits	Scheme of Examination Maximum Marks		
		L	T	P		Internal	External	Total
B10401	Advanced CAD	3	-	-	3	30	70	100
B10402	Advanced Finite Element Analysis	3	-	-	3	30	70	100
B10403	Precision Engineering	3	-	-	3	30	70	100
	Core Elective I	3	-	-	3	30	70	100
	Core Elective II	3	-	-	3	30	70	100
	Open Elective I	3	-	-	3	30	70	100
B10404	Computer Aided Design Lab	-	-	4	2	30	70	100
B10405	Seminar-I	-	-	4	2	50	-	50
TOTAL		**18**	**-**	**8**	**22**	**260**	**490**	**750**

I Year II Semester								
Code	Course Title	Hours per Week			Credits	Scheme of Examination Maximum Marks		
		L	T	P		Internal	External	Total
B10412	Design of Hydraulics and Pneumatics	3	-	-	3	30	70	100
B10413	Flexible Manufacturing Systems	3	-	-	3	30	70	100
B10414	Computer Aided Manufacturing	3	-	-	3	30	70	100
	Core Elective III	3	-	-	3	30	70	100
	Core Elective IV	3	-	-	3	30	70	100
	Open Elective II	3	-	-	3	30	70	100
B10415	Advanced Computer Aided Manufacturing Lab	-	-	4	2	30	70	100
B10416	Seminar-II	-	-	4	2	50	-	50
TOTAL		**18**	**-**	**8**	**22**	**260**	**490**	**750**

II Year I Semester								
Code	Course Title	Hours per Week			Credits	Scheme of Examination Maximum Marks		
		L	T	P		Internal	External	Total
B10423	Comprehensive Viva-Voce	-	-	-	4	-	100	100
B10424	Project Work and Review-I	-	-	-	18	50	-	50
TOTAL		-	-	-	22	50	100	150
II Year II Semester								
Code	Course Title	Hours per Week			Credits	Scheme of Examination Maximum Marks		
		L	T	P		Internal	External	Total
B10425	Project Work and Review-II	-	-	-	6	50	-	50
B10426	Project Evaluation (Viva-voce)	-	-	-	16	-	150	150
TOTAL		-	-	-	22	50	150	200

OPEN ELECTIVES			
OE1		OE2	
B10430	Numerical Methods for Partial Differential Equations	B10432	Engineering Research and Methodology
B10431	Production and Operations Management	B10433	Quality Engineering in Manufacturing
CORE ELECTIVE			
CE1		CE2	
B10406	Design for Manufacturing and Assembly	B10409	Advanced Mechanics of Composite Materials
B10407	Advanced Mechanics of Solids	B10410	Total Quality Management
B10408	Advanced Mechatronics	B10411	Stress Analysis and Vibrations
CE3		CE4	
B10417	Industrial Robotics	B10420	Design Optimization
B10418	Computational Fluid Dynamics	B10421	Intelligent Manufacturing Systems
B10419	Automation in Manufacturing	B10422	Computer Aided Process Planning

SYLLABUS

M.Tech – I year I Sem. (CAD/CAM)

ADVANCED CAD

UNIT I:

PRINCIPLES OF COMPUTER GRAPHICS : Introduction, graphic primitives, point plotting, lines, Bresenham's circle algorithm, ellipse, transformation in graphics, coordinate systems, view port, 2D and 3D transformation, hidden surface removal, reflection, shading and generation of characters.

UNIT II:

CAD TOOLS: Definition of CAD Tools, Types of system, CAD/CAM system evaluation criteria, brief treatment of input and output devices. Graphics standard, functional areas of CAD, Modeling and viewing, software documentation, efficient use of CAD software. **GEOMETRICMODELLING:** Types of mathematical representation of curves, wire frame models wire frame entities parametric representation of synthetic curves her mite cubic splines Bezier curves B-splines rational curves.

UNIT III:

SURFACE MODELING :Mathematical representation surfaces, Surface model, Surface entities surface representation, Parametric representation of surfaces, plane surface, rule surface, surface of revolution, Tabulated Cylinder.

UNIT IV:

PARAMETRIC REPRESENTATION OF SYNTHETIC SURFACES:

Hermite Bicubic surface, **Bezier** surface, **B-** Spline surface, COONs surface, Blending surface Sculptured surface, Surface manipulation — Displaying, Segmentation, Trimming, Intersection, Transformations (both 2D and 3D).

UNIT V:

GEOMETRICMODELLING-3D : Solid modeling, Solid Representation, Boundary Representation (13-rep), Constructive So! id Geometry (CSG). CAD/CAM Exchange : Evaluation of data — exchange format, IGES data representations and structure, STEP Architecture, implementation, ACIS & DXF. Design Applications: Mechanical tolerances, Mass property calculations, Finite Element Modeling and Analysis and Mechanical Assembly.

Collaborative Engineering: Collaborative Design, Principles, Approaches, Tools, Design Systems.

REFERENCES :

1. Mastering CAD/CAM / Ibrhim Zeid / Mc Graw Hill International.
2. CAD/CAM Principles and Applications/ P.N.Rao/TMH/3rd Edition
3. CAD/CAM /Groover M.P./ Pearson education
4. CAD/CAM Concepts and Applications/ Alavala/ PHI

M.Tech – I year I Sem. (CAD/CAM)

ADVANCED FINITE ELEMENT ANALYSIS

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 BEAMS** : 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.

REFERENCES:

1. The Finite Element Methods in Engineering / SS Rao / Pergamon.
2. Finite Element Methods: Basic Concepts and applications, Alavala, PHI
3. Introduction to Finite Elements in Engineering, Chandrupatla, Ashok and Belegundu, Prentice – Hall
4. Finite Element Method – Zincowitz / Mc Graw Hill

M.Tech – I year I Sem. (CAD/CAM)

PRECISION ENGINEERING

UNIT I:

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.

GEOMETIC DEIMENSIONING 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.

UNIT II:

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

UNIT III:

TOLERANCE ANALYSIS: Process Capability, Mean, Variance, Skewness, Kurtosis, Process Capability Metrics, Cp, Cpk, Cost aspects, Feature Tolerances, Geometric Tolerances. 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.

UNIT IV:

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.

UNIT V:

FOUNDAMENTALS OF NANOTECHNOLGY: Systems of nanometer accuracies – Mechanism of metal Processing – Nano physical processing of atomic bit units. Nanotechnology and Electrochemical atomic bit processing.

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.

REFERENCES:

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.
3. Nano Technology / Norio Taniguchi / Oxford University Press, 1996.
4. Engineering Design – A systematic Approach / Matousek / Blackie & Son Ltd., London
5. Precision Engineering/VC Venkatesh & S Izman/TMH

M.Tech – I year I Sem. (CAD/CAM)

DESIGN FOR MANUFACTURING AND ASSEMBLY

(CORE ELECTIVE - I)

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.

REFERENCES:

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.

M.Tech – I year I Sem. (CAD/CAM)

ADVANCED MECHANICS OF SOLIDS
(CORE ELECTIVE - I)

UNIT - I

SHEAR CENTRE: Bending axis and shear center-shear center for axi-symmetric and unsymmetrical sections.

Unsymmetrical bending: Bending stresses in Beams subjected to Nonsymmetrical bending; Deflection of straight beams due to nonsymmetrical bending.

UNIT - II

CURVED BEAM THEORY: Winkler Bach formula for circumferential stress – Limitations – Correction factors – Radial stress in curved beams – closed ring subjected to concentrated and uniform lads- stresses in chain links.

UNIT - III

TORSION: Torsion of a cylindrical bar of Circular cross Section; Saint-Venant's semi-inverse methods; Linear elastic solution; Prandtl elastic membrane (Soap-Film) Analogy; Narrow rectangular cross Section; Hallow thin wall torsion members, Multiply connected Cross section, Thin wall torsion members with restrained ends

Axi-Symmetric Problems: Rotating Discs – Flat discs, Discs of uniform thickness, Discs of Uniform Strength, Rotating Cylinders.

UNIT - IV

THEORY OF PLATES: Introduction; Stress resultants in a flat plate; Kinematics: Strain-Displacement relations for plates; Equilibrium equations for small displacement theory of flat plates; Stress – Strain – Temperature relation for Isotropic plates: Strain energy of a plate; Boundary conditions for plate; Solution of rectangular plate problem; Solution of circular plate problem.

Beams on Elastic Foundation: General theory; Infinite Beam subjected to Concentrated load; boundary conditions; Infinite beam subjected to a distributed lad segment; Semi-infinite beam with concentrated load near its end; Short Beams.

UNIT - V

CONTACT STRESSES: Introduction, problem of determining contact stresses; Assumptions on which a solution for contact stresses is based; Expressions for principal stresses; Methods of computing contact stresses; Deflection of bodies in point contact; Stresses for two bodies in contact over narrow rectangular area (Line contact), Loads normal to area; Stresses for two bodies in line contact. Normal and Tangent to contact area.

REFERENCES:

1. Advanced Mechanics of materials/Seely and Smith/ John Willey
2. Advanced Mechanics of materials / Boresi & Sidebottom/wiely international
3. Advanced strength of materials / Den Hortog J.P./Torrent

M.Tech – I year I Sem. (CAD/CAM)

ADVANCED MECHATRONICS

(CORE ELECTIVE - I)

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.

M.Tech – I year I Sem. (CAD/CAM)

ADVANCED MECHANICS OF COMPOSITE MATERIALS
(CORE ELECTIVE - II)

UNIT – I

BASIC CONCEPTS AND CHARACTERISTICS: Geometric and Physical definitions, natural and man-made composites, Aerospace and structural applications, types and classification of composites.

Reinforcements: Fibres – Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide fibres. Particulate composites, Polymer composites, Thermoplastics, Thermosetts, Metal matrix and ceramic composites.

UNIT – II

MICROMECHANICS: Unidirectional composites, constituent materials and properties, elastic properties of a lamina, properties of typical composite materials, laminate characteristics and configurations. Characterization of composite properties.

Manufacturing methods: Autoclave, tape production, moulding methods, filament winding, man layup, pultrusion, RTM.

Unit – III

COORDINATE TRANSFORMATION: Hooke's law for different types of materials, Hooke's law for two dimensional unidirectional lamina, Transformation of stress and strain, Numerical examples of stress strain transformation, Graphic interpretation of stress – strain relations. Off – axis, stiffness modulus, off – axis compliance.

Elastic behavior of unidirectional composites: Elastic constants of lamina, relation ship between engineering constants and reduced stiffness and compliances, analysis of laminated composites, constitutive relations.

Unit – IV

STRENGTH OF UNIDIRECTIONAL LAMINA: Micro mechanics of failure, Failure mechanisms, strength of an orthotropic lamina, strength of a lamina under tension and shear maximum stress and strain criteria, application to design. The failure envelope, first ply failure, free-edge effects. Micros mechanical predictions of elastic constants.

Unit – V

ANALYSIS OF LAMINATED COMPOSITE PLATES:

Introduction thin plate theory, specially orthotropic plate, cross and angle ply laminated plates, problems using thin plate theory.

REFERENCES:

1. Mechanics of Composite Materials/ R. M. Jones/ Mc Graw Hill Company, New York, 1975.
2. Engineering Mechanics of Composite Materials by Isaac and M Daniel, Oxford University Press, 1994.
3. Analysis and performance of fibre Composites/ B. D. Agarwal and L. J. Broutman/ Wiley-Interscience, New York, 1980.

M.Tech – I year I Sem. (CAD/CAM)

TOTAL QUALITY MANAGEMENT

(CORE ELECTIVE - II)

UNIT – I:

INTRODUCTION: The concept of TQM, Quality and Business performance, attitude and involvement of top management, communication, culture and management systems. Management of Process Quality: Definition of quality, Quality Control, a brief history, Product Inspection vs, Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

UNIT – II:

CUSTOMER FOCUS AND SATISFACTION: The importance of customer satisfaction and loyalty- Crating satisfied customers, Understanding the customer needs, Process Vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer – Supplier relationships. Bench Marketing: Evolution of Bench Marketing, meaning of Bench marketing, benefits of bench marketing, the bench marketing process, pitfalls of bench marketing.

UNIT – III:

ORGANIZING FOR TQM: The systems approach, Organizing for quality implementation, making the transition from a traditional to a TQM organizing, Quality Circles. Productivity, Quality and Reengineering: The leverage of Productivity and Quality, Management systems Vs. Technology, Measuring Productivity, Improving Productivity Re-engineering.

UNIT – IV:

THE COST OF QUALITY: Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost Information, Accounting Systems and Quality Management.

UNIT – V:

ISO9000: Universal Standards of Quality: ISO around the world, The ISO9000 ANSI/ASQCQ-90. Series Standards, benefits of ISO9000 certification, the third party audit, Documentation ISO9000 and services, the cost of certification implementing the system.

REFERENCES:

1. Total Quality Management / Joel E.Ross/Taylor and Franscis Limited
2. Total Quality Management/P.N.Mukherjee/PHI
3. Beyond TQM / Robert L.Flood

M.Tech – I year I Sem. (CAD/CAM)

STRESS ANALYSIS AND VIBRATION
(CORE ELECTIVE - II)

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 beams. Principle of orthogonality - classical and energy methods.

REFERENCES:

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

M.Tech – I year I Sem. (CAD/CAM)

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-II:

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 1st 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.

REFERENCES:

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

M.Tech – I year I Sem. (CAD/CAM)

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 – Grant 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.

REFERENCES:

1. Operations Management by E.S. Buffs
2. Operations Management Theory and Problems: by Joseph G. Monks.
3. Production Systems Management by James I. Riggs.

M.Tech – I year I Sem. (CAD/CAM)

COMPUTER AIDED DESIGN LAB

Creation of working drawing, creating geometry, constraining the profile, extracting a part using tools, creating pattern of holes, translating rotating, mirroring, managing the specification tree. Creating sheets and views, creating text and dimensions, creating an assembly, moving components, assembling existing components, creating bill of materials, creating wire frame and surface geometry using generative shape design and sweep tools. Generation of Ferguson's cubic surface patches, Bezier surface patches. Coons patches. Import and export of drawing from other software.

Linear static analysis, Automatic calculation of rigid body modes, uses specified eigen value shift, lumped and consistent mass matrices. Buckling analysis, Jacobi inverse iteration techniques. Steady state harmonic response, mode superposition method, overall structural and damping, linear dynamic analysis, non linear static analysis, non-linear dynamic analysis. Steady state heat transfer analysis problems. Transient heat transfer analysis. Familiarity with element library. Defining Boundary conditions, multipoint constraint familiarity with different types of loads. Solution techniques, direct and iterative solver. Results and analysis. Design optimization.

M.Tech I year II Sem. (CAD/CAM)

DESIGN OF HYDRAULICS & PNEUMATIC SYSTEMS

UNIT – I:

Oil hydraulic systems Hydraulic pumps, types and construction details, sizing and selection.
Direction control valves, flow and pressure control valves.

UNIT – II:

Linear actuators types Piston rod design sizing and selection, Rotary actuators, hydraulic reservoir accumulators.

UNIT – III:

Design of hydraulic circuits, seals and packings, hydraulic servo techniques, cylinders and air motors.

UNIT – IV:

Sequencing and synchronizing circuits, accumulator, low cost automation Hydro circuits, accumulators, Hydro pneumatic circuits principles of pneumatic circuit design.

UNIT – V:

Maintenance and trouble shooting of hydraulic and pneumatic circuits, components, PLC Automation and uses of Microprocessors.

REFERENCES:

1 Oil Hydraulic Systems/ S.R. Majumdar/ Tata Mc. Graw Hill
2 Pneumatic systems, principles and maintenance/ S.R. Majumdar/Tata Mc.GrawHill
3 Hydraulic and pneumatics/ Andrew Darr/ Jaico Publishing Hoise.
4 Fluid power with applications/ Antony Esponssito/ Prentice Hall

M.Tech I year II Sem. (CAD/CAM)

FLEXIBLE MANUFACTURING SYSTEMS

UNIT- I:

Introduction to flexible manufacturing systems. Planning and scheduling and control o 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.

REFERENCES:

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

M.Tech I year II Sem. (CAD/CAM)

COMPUTER AIDED MANUFACTURING

UNIT - I

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

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.

REFERENCES:

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 Principles and Applications, P.N.Rao, TMH
4. CAD / CAM Theory and Practice,/ Ibrahim Zeid,TMH
5. CAD / CAM / CIM, Radhakrishnan and Subramanian, New Age
6. Principles of Computer Aided Design and Manufacturing, Farid Amirouche, Pearson

M.Tech I year II Sem. (CAD/CAM)

INDUSTRIAL ROBOTICS
(CORE ELECTIVE - III)

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, Machine loading/unloading. Processing operation, Assembly and Inspection, Feature Application.

REFERENCES:

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.

M.Tech I year II Sem. (CAD/CAM)

COMPUTATIONAL FLUID DYNAMICS
(CORE ELECTIVE - III)

UNIT - I

INTRODUCTION: Finite difference method, finite volume method, finite element method, governing equations and boundary conditions, Derivation of finite difference equations.

Solution methods: Solution methods of elliptical equations — finite difference formulations, interactive solution methods, direct method with Gaussian elimination. Parabolic equations-explicit schemes and Von Neumann stability analysis, implicit schemes, alternating direction implicit schemes, approximate factorization, fractional step methods, direct method with tridiagonal matrix algorithm.

UNIT – II

Hyperbolic equations: explicit schemes and Von Neumann stability analysis, implicit schemes, multi step methods, nonlinear problems, second order one-dimensional wave equations. Burgers equations: Explicit and implicit schemes, Runge-Kutta method.

UNIT - III

FORMULATIONS OF INCOMPRESSIBLE VISCOUS FLOWS: Formulations of incompressible viscous flows by finite difference methods, pressure correction methods, vortex methods. **Treatment of compressible flows:** potential equation, Euler equations, Navier-stokes system of equations, flow field-dependent variation methods, boundary conditions, example problems.

UNIT - IV

FINITE VOLUME METHOD: Finite volume method via finite difference method, formulations for two and three-dimensional problems.

UNIT - V

STANDARD VARIATIONAL METHODS: Linear fluid flow problems, steady state problems, Transient problems.

REFERENCES:

1. Computational fluid dynamics/ T. J.C'hung/ Cambridge University press,2002.
2. Text book of fluid dynamics/ Frank Choriton/ CBS Publishers & distributors, 1985
3. Numerical heat transfer and fluid flow / Suhas V. Patankar/ Hema shava Publishers corporation & Mc Graw Hill.
4. Computational Fluid Flow and Heat Transfer/ Muralidaran/ Narosa Publications
5. Computational Fluid Dynamics: Basics with applications/John D. Anderson/ Mc Graw Hill.
6. Fundamentals of Computational Fluid Dynamics/Tapan K. Sengupta / Universities Press.
7. Introduction to Theoretical and Computational Fluid Dynamics/C. Pozrikidis /Oxford University Press/2nd Edition

M.Tech I year II Sem. (CAD/CAM)

AUTOMATION IN MANUFACTURING
(CORE ELECTIVE - III)

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.

REFERENCES:

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

M.Tech I year II Sem. (CAD/CAM)

DESIGN OPTIMIZATION
(CORE ELECTIVE - IV)

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

M.Tech I year II Sem. (CAD/CAM)

INTELLIGENT MANUFACTURING SYSTEMS
(CORE ELECTIVE - IV)

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,comparision 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 Base, Clustering Algorithm.

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

M.Tech I year II Sem. (CAD/CAM)

COMPUTER AIDED PROCESS PLANNING
(CORE ELECTIVE - I)

UNIT-I

Introduction to CAPP: Information requirement for process planning system, Role of process planning, advantages of conventional process planning over CAPP, Structure of Automated process planning system, feature recognition, methods. **Generative CAPP system:** Importance. principle of Generative CAPP system, automation of logical decisions, Knowledge based systems, Inference Engine, implementation, benefits.

UNIT-II

Retrieval CAPP system: Significance, group technology, structure, relative advantages, implementation, and applications.
Selection of manufacturing sequence: Significance, alternative-manufacturing processes, reduction of total set-up cost for a particular sequence. quantitative methods for optimal selection, examples.

UNIT-III

Determination of machining parameters: reasons for optimal selection of machining parameters, effect of parameters on production i-ate, cost and surface quality, different approaches, advantages of mathematical approach over conventional approach, solving optimization models of machining processes.

UNIT -IV

Determination of manufacturing tolerances: design tolerances, manufacturing tolerances, methods of tolerance allocation, sequential approach, integration of design and manufacturing tolerances, advantages of integrated approach over sequential approach.

UNIT -V

Generation of tool path: Simulation of machining processes, NC tool path generation, graphical implementation, determination of optimal index positions for executing fixed sequence, quantitative methods.
Implementation techniques for CAPP: MIPLAN system, Computer programming languages tbr CAPP, criteria for selecting a CAPP system and benefits of CAPP. Computer integrated planning systems, and Capacity planning system.

REFERENCES:

1. Automation, Production systems and Computer Integrated Manufacturing System/ Mikell P Groover
2. Computer Design and Manufacturing/Sadhu Singh.
3. Computer Engineering /David Bedworth

M.Tech I year II Sem. (CAD/CAM)

ENGINEERING RESEARCH & METHODOLOGY
(OPEN ELECTIVE - II)

Unit - I

Introduction: Definition, Research Characteristics, Research Need, Objectives and types of research: Motivation and objectives – Research methods vs Methodology, Types of research – Descriptive vs. Analytical, Applied vs.Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical.

Unit - II

Research Formulation – Defining and formulating the research problem -Selecting the problem, Necessity of defining the problem, Importance of literature review in defining a problem, Literature review, Primary and secondary sources, reviews, treatise, monographs, patents, web as a source, searching the web, Critical literature review, Identifying gap areas from literature review, Development of working hypothesis. Summarizing a Technical Paper - summary template

Online tools - Google, CiteSeer, ACM Digital Library, IEEE, The on-line Computer Science bibliography, Searching patents

Unit - III

Research design and methods – Research design, Basic Principles, Need of research design, Features of good design, Important concepts relating to research design, Observation and Facts, Laws and Theories, Prediction and explanation, Induction, Deduction, Development of Models, Developing a research plan - Exploration, Description, Diagnosis, and Experimentation, Determining experimental and sample designs.

Data Collection and analysis: Execution of the research - Observation and Collection of data, Methods of data collection, Sampling Methods, Data Processing and Analysis strategies, Data Analysis with Statistical Packages, Hypothesis-testing -Generalization and Interpretation.

Unit - IV

Reporting and thesis writing – Structure and components of scientific reports, Types of report, Technical reports and thesis, Significance, Different steps in the preparation – Layout, structure and Language of typical reports – Illustrations and tables - Bibliography, referencing and footnotes, Oral presentation – Planning – Preparation – Practice – Making presentation – Use of visual aids - Importance of effective communication - Documentation and presentation tools: LATEX, Microsoft Office, PowerPoint and SLITHY, Adobe Flash, Slide Rocket, Zoho Show

Unit - V

Types of technical papers - Journal papers, Conference papers, Survey papers, Poster papers, Review papers Comparison, Structure of a survey, conference and journal paper, when to go for what type of technical paper in the research process

How to read a scientific paper - The three pass approach, comparing the approaches to find the holes

How to write scientific paper - Paper Design Process, Readers, Concept Sheet, Embodiment, General advice about writing technical papers in English – Grammar, Punctuation, Tips for writing correct English, How to organize thesis/ Project report. Present scientific paper and proposal writing – how to write a research proposal, how research is funded, budgeting etc.

Application of results and ethics - Environmental impacts - Ethical issues - ethical committees -Commercialization – Copy right – royalty - Intellectual property rights and patent law – Trade Related aspects of Intellectual Property Rights – Reproduction of published material – Plagiarism - Citation and acknowledgement - Reproducibility and accountability.

References

1. Kothari, C.R., Research Methodology: Methods and Techniques. New Age International
2. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., An introduction to Research Methodology, RBSA
3. Suresh Sinha, Anil K. Dhiman, “Research Methodology”, ESS Publications,Volumes 2

M.Tech I year II Sem. (CAD/CAM)

QUALITY ENGINEERING IN MANUFACTURING
(OPEN ELECTIVE - II)

UNIT – I

LASER METROLOGY

Introduction – types of lasers – laser in engineering metrology – metrological laser methods for applications in machine systems – Inter ferometry applications – speckle interferometry – laser interferometers in manufacturing and machine tool alignment testing – calibration systems for industrial robots laser Doppler technique – laser Doppler anemometry.

UNIT – II

PRECISION INSTRUMENTS BASED ON LASER

Laser telemetric systems – detection of microscopic imperfections on high quality surface Pitter NPL gauge interferometer – classification of optical scanning systems – high inertia laser scan technique – rotating mirror technique – laser gauging – bar coding – laser dimensional measurement system.

UNIT – III

CO-ORDINATE MEASURING MACHINE

Co-ordinate metrology – CMM configurations – hardware components – software – Probe sensors – isplacement devices – Performance Evaluations – Software –Hardware – Dynamic errors – Thermal effects diagram– temperature variations environment control – applications.

UNIT – IV

OPTO ELECTRONICS AND VISION SYSTEM

Opto electronic devices – CCD – On-line and in-process monitoring in production – applications image analysis and computer vision – Image analysis techniques – spatical feature – Image extraction – segmentation – digital image processing – Vision system for measurement – Comparison laser scanning with vision system.

UNIT – V

QUALITY IN MANUFACTURING ENGINEERING

Importance of manufacturing planning for quality – concepts of controllability – need for quality management system and models – quality engineering tools and techniques – statistical process control – six sigma concepts – Poka Yoke – Computer controlled systems used in inspection.

REFERENCES:

1. John A. Bosch, Giddings and Lewis Dayton, Co-ordinate Measuring Machines and Systems, Marcel Dekker, Inc, 1999.
2. Juran J.M. and Gyna F.M., Quality Planning and Analysis, Tata-McGraw Hill, New Delhi
3. Zuech, Nello Understanding and Applying Machine Vision, Marcel Dekker, Inc, 2000

M.Tech I year II Sem. (CAD/CAM)

ADVANCED COMPUTER AIDED MANUFACTURING 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 Joining 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. Robot path control, preparation of various reports and route sheets, Simulation of manufacturing system using CAM software, controller operating system commands.