B.S.ABDUR RAHMAN
U N I V E R S I T Y
B.S.ABDUR RAHMAN INSTITUTE OF SCIENCE & TECHNOLOGY
(Estd.u/s 3 of the UGC Act, 1956)
(FORMERLY B.S.ABDUR RAHMAN CRESCENT ENGINEERING COLLEGE)
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048.

REGULATIONS (2009), CURRICULUM AND SYLLABUS FOR M.Tech. CAD-CAM (Four Semesters / Full Time)

(Updated upto June 2012)

REGULATIONS (2009) FOR M.Tech CAD-CAM

1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires

i) **"Programme"** means Post Graduate Degree Programme (M.Tech./ MCA / M.Sc.)

ii) **"Course"** means a theory or practical subject that is normally studied in a semester, like Applied Mathematics, Structural Dynamics, Computer Aided Design, etc.

iii) **"University"** means B.S.Abdur Rahman University, Chennai, 600048.

iv) **"Institution"** unless otherwise specifically mentioned as an autonomous or off campus institution means B.S.Abdur Rahman University.

v) **"Academic Council"** means the Academic Council of the University.

vi) **'Dean (Academic Courses)'** means Dean (Academic Courses) of B.S.Abdur Rahman University.

vii) **'Dean (Students)'** means Dean(Students) of B.S.Abdur Rahman University.

viii) **"Controller of Examinations"** means the Controller of Examinations of B.S.Abdur Rahman University who is responsible for conduct of examinations and declaration of results.

2.0 PROGRAMMES OFFERED, MODE OF STUDY AND ADMISSION REQUIREMENTS

2.1 P.G. Programmes Offered

The various P.G. Programmes and their modes of study are as follows:

Degree	Mode of study
M.Tech.	Full Time
M.Tech.	Part Time – Day / Evening
M.C.A.	Full Time
M. Sc.	Full Time

2.2 MODES OF STUDY

2.2.1 Full-time

Candidates admitted under "Full-Time" shall be available in the institution during the complete working hours for curricular, co-curricular and extra-curricular activities assigned to them.

2.2.2 A full time student, who has completed all non-project courses desiring to do the Project work in part-time mode for valid reasons, shall apply to the Head of the Institution through the Head of the Department, if the student satisfies the clause 2.3.5 of this Regulations. Permission may be granted based on merits of the case. Such conversion is not permitted in the middle of a semester.

2.2.3 Part time - Day time

In this mode of study, the candidates are required to attend classes for the courses registered along with full time students.

2.2.4 Part time - Evening

In this mode of study, the candidates are required to attend only evening classes.

2.2.5 A part time student is not permitted to convert to the full time mode of study.

2.3. ADMISSION REQUIREMENTS

2.3.1 Candidates for admission to the first semester of the Master's Degree Programme shall be required to have passed an appropriate degree examination of this University as specified in Table 1 or any other examination of any University or authority accepted by the University as equivalent thereto.

2.3.2 Notwithstanding the qualifying examination the candidate might have passed, he/she shall have a minimum level of proficiency in the appropriate programme/courses as prescribed by the institution from time to time.

2.3.3 Eligibility conditions for admission such as class obtained, number of attempts in qualifying examination and physical fitness will be as prescribed by the Institution from time to time.

2.3.4 All part-time candidates should satisfy other conditions regarding experience, sponsorship etc., which may be prescribed by the institution from time to time.

2.3.5 A candidate eligible for admission to M.Tech. Part Time - Day Time programmeshall have his/her permanent place of work within a distance of 65km from the campus of the institution.

2.3.6 A candidate eligible for admission to M.B.A. Part Time - Evening programme shall have a working experience of 2 years at least at supervisory level. He/ she shall have his/her place of work within a distance of 65 km from the campus of the institution.

3.0 DURATION AND STRUCTURE OF THE P.G. PROGRAMME

3.1. The minimum and maximum period for completion of the P.G. Programmes are given below:

Programme	Min. No. of Semesters	Max. No. of Semesters
M.Tech. (Full Time)	4	8
M.Tech.(Part Time)	6	12
M.C.A. (Full Time)	6	12
M.Sc. (Full Time)	4	8

3.2 The P.G. programmes will consist of the following components as prescribed in the respective curriculum

i. Core courses

ii. Elective courses

iii. Project work / thesis / dissertation

iv. Laboratory Courses

v. Case studies

vi. Seminars

vii. Practical training

3.3 The curriculum and syllabi of all the P.G. programmes shall be approved by the Academic Council.

3.4 The number of credits to be earned for the successful completion of the programme shall be specified in the curriculum of the respective specialization of the P.G. programme.

3.5 Each academic semester shall normally comprise of 75 to 80 working days spread over sixteen weeks. End-semester examinations will follow immediately after these working days.

M.Tech. CAD-CAM

ELIGIBLE ENTRY QUALIFICATIONS FOR ADMISSION TO P.G. PROGRAMMES

Sl.No.	Name of the Department	P.G. Programmes offered	Qualifications for admission
01.	Civil Engineering	M.Tech. (Structural Engineering)	B.E / B.Tech. (Civil Engineering) / (Structural Engineering)
		M.Tech. (Construction Engineering and Project Management)	B.E. / B.Tech. (Civil Engineering) /(Structural Engineering)
02.	Mechanical Engineering	M.Tech. (CAD - CAM)	B.E. / B.Tech. (Mechanical / Auto /Manufacturing / Production / Industrial/Mechatronics / Metallurgy / Aerospace/Aeronautical / Material Science / Marine Engineering)
		M.Tech. (Manufacturing Engineering)	B.E. / B.Tech. (Mechanical / Auto / Manufacturing / Production / Industrial/Mechatronics / Metallurgy / Aerospace/Aeronautical / Material Science / Marine Engineering)
03.	Polymer Technology	M.Tech. (Polymer Technology)	B. E. / B. Tech. degree Mech./ Production / Polymer Science or Engg or Tech/Rubber Tech/ M.Sc(Polymer Sc./Chemistry Appl. Chemistry)
04.	Electrical and Electronics Engineering	M.Tech. (Power Systems Engg)	B.E/B.Tech (EEE/ECE/E&I/ I&C/ Electronics / Instrumentation)
		M.Tech. (Power Electronics & Drives)	B.E/B.Tech (EEE/ECE/E&I/ I&C/ Electronics/ Instrumentation)
05.	Electronics and Communication Engineering	M.Tech. (Communication Systems)	M.Tech (Power System Engg) B.E / B.Tech (EEE/ ECE / E&I / I&C / Electronics / Instrumentation) B.E./ B.Tech. in ECE / Electronics / EIE
		M.Tech. (VLSI and Embedded Systems)	
06.	ECE Department jointly with Physics Department	M.Tech. (Optoelectronics and Laser Technology)	B.E./B.Tech. (ECE / EEE / Electronics / EIE / ICE) M.Sc (Physics / Materials Science / Electronics / Photonics)
07.	Electronics and Instrumentation Engineering	M.Tech. (Electronics and Instrumentation Engineering)	B.E./B.Tech. (EIE/ICE/Electronics/ECE/EEE)
08.	Computer Science and Engineering	M.Tech. (Computer Science and Engineering)	B.E. /B.Tech. (CSE/IT/ECE/EEE/EIE/ICE/ Electronics / MCA)
		M.Tech. (Software Engineering)	B.E. / B.Tech. (CSE / IT) MCA
09	Information Technology	M.Tech. (Information Technology)	B.E /B.Tech. (IT/CSE/ECE/EEE/EIE/ICE/ Electronics) MCA
10	Computer Applications	M.C.A.	Any degree. Must have studied Mathematics / Statistics /Computer oriented subject.
		M.Tech. (Systems Engineering and Operations Research)	Any degree. Must have studied Mathematics / Statistics /Computer oriented subject.
11	Mathematics	M.Sc. (Actuarial Science)	B.Sc. (Mathematics) of B.Sc. (Applied Science)
12	Chemistry	M.Sc.(Chemistry)	B.Sc (Chemistry) of B.Sc. (Applied Science)

3.6 The curriculum of P.G. programmes shall be so designed that the minimum prescribed credits required for the award of the degree shall lie within the limits specified below:

Programme	Minimum prescribed credit range
M.Tech.	70 to 80
M.C.A	130 to 140
M.Sc	74 to 80

3.7 Credits will be assigned to the courses for all P.G. programmes as given below:

* One credit for one lecture period per week
* One credit for one tutorial period per week
* One credit each for seminar/practical session of two or three periods per week
* One credit for four weeks of practical training

3.8 The number of credits registered by a candidate in non-project semester and project semester should be within the range specified below:

P.G. Programme	**Non-project Semester**	**Project semester**
M.Tech. (Full Time)	15 to 23	12 to 20
M.Tech. (Part Time)	6 to 12	12 to 16
M.C.A. (Full Time)	12 to 25	12 to 20
M.Sc. (Full Time)	15 to 25	12 to 20

3.9 The electives from the curriculum are to be chosen with the approval of the Head of the Department.

3.10 A candidate may be permitted by the Head of the Department to choose electives offered from other P.G. Programmes either within a Department or from other Departments up to a maximum of three courses during the period of his/her study, provided the Heads of the Departments offering such courses also agree.

3.11 To help the students to take up special research areas in their project work and to enable the department to introduce courses in latest/emerging areas in the curriculum, "Special Electives" may be offered. A candidate may be

permitted to register for a "Special Elective" up to a maximum of three credits during the period of his/her study, provided the syllabus of this course is recommended by the Head of the Department and approved by the Dean (AC) before the commencement of the semester, in which the special elective course is offered. Subsequently, such course shall be ratified by the Board of Studies and Academic Council.

3.12 The medium of instruction, examination, seminar and project/thesis/ dissertation reports will be English.

3.13 Practical training or industrial attachment, if specified in the curriculum shall be of not less than four weeks duration and shall be organized by the Head of the Department.

3.14 PROJECT WORK/THESIS/DISSERTATION

3.14.1 Project work / Thesis / Dissertation shall be carried out under the supervision of a qualified teacher in the concerned Department.

3.14.2 A candidate may however, in certain cases, be permitted to work on the project in an Industrial/Research Organization, on the recommendation of Head of the Department, with the approval of the Head of the Institution. In such cases, the project work shall be jointly supervised by a supervisor of the Department and an Engineer / Scientist from the organization and the student shall be instructed to meet the supervisor periodically and to attend the review committee meetings for evaluating the progress.

3.14.3 Project work / Thesis / Dissertation (Phase - II in the case of M.Tech.) shall be pursued for a minimum of 16 weeks during the final semester, following the preliminary work carried out in Phase-1 during the previous semester.

3.14.4 The Project Report/Thesis / Dissertation report / Drawings prepared according to approved guidelines and duly signed by the supervisor(s) and the Head of the Department shall be submitted to the Head of the Institution.

3.14.5 The deadline for submission of final Project Report / Thesis / Dissertation is within 30 calendar days from the last working day of the semester in which Project / Thesis / Dissertation is done.

3.14.6 If a candidate fails to submit the Project Report / Thesis / Dissertation on or before the specified deadline he / she is deemed to have not completed the Project Work / Thesis / dissertation and shall re-register the same in a subsequent semester.

3.14.7 A student who has acquired the minimum number of total credits prescribed in the Curriculum for the award of the Masters Degree will not be permitted to enroll for more courses to improve his/her cumulative grade point average (CGPA).

4.0 FACULTY ADVISER

To help the students in planning their courses of study and for getting general advice on academic programme, the concerned department will assign a certain number of students to a faculty member who will be called the Faculty Adviser.

5.0 CLASS COMMITTEE

5.1 Every class of the P.G. Programme will have a Class Committee, constituted by the Head of the Department as follows:

i. Teachers of all courses of the programme

ii. One senior faculty preferably not offering courses for the class, as chairperson.

iii. One or two students of the class, nominated by the Head of the Department.

iv. Faculty Advisers of the class - Ex-Officio Members

v. Professor in-charge of the P.G. Programme - Ex-Officio Member.

5.2 The Class Committee shall be constituted by the respective head of the department of the students.

5.3 The basic responsibilities of the Class Committee are to review periodically the progress of the classes, to discuss problems concerning curriculum and syllabi and the conduct of the classes. The type of assessment for the course will be decided by the teacher in consultation with the Class Committee and will be announced to the students at the beginning of the semester. Each Class Committee will communicate its recommendations to the Head of the Department and the Head of the Institution. The class committee, **without the student members,** will also be responsible for finalization of the semester results.

5.4 The Class Committee is required to meet at least thrice in a semester, once at the beginning of the semester, another time after the end-semester examination to finalise the grades, and once in between.

6.0 COURSE COMMITTEE

Each common theory course offered to more than one group of students shall have a "Course Committee" comprising all the teachers teaching the common course with one of them nominated as Course coordinator. The nomination of the Course coordinator shall be made by the Head of the Department / Head of the Institution depending upon whether all the teachers teaching the common course belong to a single department or to several

departments. The Course Committee shall meet as often as possible and ensure uniform evaluation of the tests and arrive at a common scheme of evaluation for the tests. Wherever it is feasible, the Course Committee may also prepare a common question paper for the test(s).

7.0 REGISTRATION AND ENROLMENT

7.1 For the first semester every student has to register and enroll for the courses he/she intends to undergo on a specified day notified to the student. The concerned Faculty Adviser will be present and guide the students in the registration/enrolment process.

7.2 For the subsequent semesters registration for the courses will be done by the student during a specified week before the end-semester examination of the previous semester. The curriculum gives details of the core and elective courses, project and seminar to be taken in different semester with the number of credits. The student should consult his/her Faculty Adviser for the choice of courses. The Registration form is filled in and signed by the student and the Faculty Adviser.

7.3 Late registration will be permitted with a prescribed fine up to two weeks from the last date specified for registration.

7.4 From the second semester onwards all students shall pay the prescribed fees and enroll on a specified day at the beginning of a semester.

A student will become eligible for enrolment only if he/she satisfies clause 9 and in addition he/she is not debarred from enrolment by a disciplinary action of the Institution. At the time of enrolment a student can drop a course registered earlier and also substitute it by another course for valid reasons with the consent of the Faculty Adviser. Late enrolment will be permitted on payment of a prescribed fine up to two weeks from the date of commencement of the semester.

7.5 Withdrawal from a course registered is permitted up to one week from the date of the completion of the first assessment test.

7.6 Change of a course within a period of 15 days from the commencement of the course, with the approval of Dean (AC), on the recommendation of the HOD, is permitted.

7.6.1 Courses withdrawn will have to be taken when they are offered next if they belong to the list of core courses.

7.7 SUMMER TERM COURSES

7.7.1 Summer term courses may be offered by a department on the recommendation by the Departmental Consultative Committee and approved by the Head of the Institution. No student should register for more than three courses during a summer term.

7.7.2 Summer term courses will be announced by the Head of the Institution at the end of the even semester before the commencement of the end semester examinations. A student will have to register within the time stipulated in the announcement. A student has to pay the fees as stipulated in the announcement.

7.7.3 Fast-track summer courses of 30 periods for 3 credit courses and 40 periods for 4 credit courses will be offered for students with I grades. They may also opt to redo such courses during regular semesters with slotted time-tables. Students with U grades will have the option either to write semester end arrears exam or to redo the courses during summer / regular semesters with slotted time-table, if they wish to improve their continuous assessment marks also.

The assessment procedure in a summer term course will also be similar to the procedure for a regular semester course.

7.7.4 Withdrawal from a summer term course is not permitted. No substitute examination will be held for the summer term courses.

8.0 TEMPORARY WITHDRAWAL FROM THE PROGRAMME

A student may be permitted by the Head of the Institution to temporarily withdraw from the programme up to a maximum of two semesters for reasons of ill health or other valid grounds. However the total duration for completion of the programme shall not exceed the prescribed number of semesters (vide clause 3.1).

9.0 MINIMUM REQUIREMENTS TO REGISTER FOR PROJECT / THESIS / DISSERTATION

9.1 A candidate is permitted to register for project semester, if he/she has earned the minimum number of credits specified below:

Programme	Minimum No. of credits to be earned to enrol for project semester
M.Tech. (Full time)	18 (III semester)
M.Tech. (Part-time)	18 (V semester)
M.C.A. (Full time)	45 (VI semester)
M.Sc. (Full-time)	28 (IV semester)

9.2 **M.Tech.:** If the candidate has not earned minimum number of credits specified, he/she has to earn the required credits (at least to the extent of minimum credit specified in clause 9.1) and then register for the project semester.

9.3 **M.C.A.:** If the candidate has not earned the required minimum number of credits specified he/she has to earn the required credits (at least to the extent of minimum credits specified in clause 9.1) and then register for the project work in subsequent semesters.

10.0 DISCIPLINE

10.1 Every candidate is required to observe discipline and decorous behaviour both inside and outside the campus and not to indulge in any activity, which will tend to bring down the prestige of the institution.

10.2 Any act of indiscipline of a candidate reported to the Head of the Institution will be referred to a Discipline and Welfare Committee for taking appropriate action.

10.3 Every candidate should have been certified by the HOD that his / her conduct and discipline have been satisfactory.

11.0 ATTENDANCE

11.1 Attendance rules for all Full Time Programme and Part time - day Time Programmes are given in the following sub-clauses.

11.2 A student **shall earn 100% attendance** in the contact periods of every course, subject to a **a maximum relaxation of 25%** for genuine reasons like on medical grounds , representing the University in approved events etc., to become eligible to appear for the end-semester examination in that course, failing which the student shall be awarded "I" grade in that course. If the course is a core course, the candidate should register for and repeat the course when it is offered next.

12.0 ASSESSMENTS AND EXAMINATIONS

12.1 The following rule shall apply to the full-time and part-time P.G. programmes (M.Tech./ M.C.A. / M.Sc.)

For lecture-based courses, normally a minimum of two assessments will be made during the semester. The assessments may be combination of tests and assignments. The assessment procedure as decided at the Class Committee will be announced to the students right at the beginning of the semester by the teacher and informed to Dean(AC)

12.2 There shall be one **examination** of three hours duration, at the end of the semester, in each lecture based course.

12.3 The evaluation of the Project work will be based on the project report and a Viva-Voce Examination by a team consisting of the supervisor concerned, an Internal Examiner and External Examiner to be appointed by the Controller of Examinations.

12.4 At the end of practical training or industrial attachment, the candidate shall submit a certificate from the organization where he/she has undergone training and also a brief report. The evaluation will be made based on this report and a Viva-Voce Examination, conducted internally by a Departmental Committee constituted by the Head of the Department.

13.0 WEIGHTAGES

13.1 The following shall be the weightages for different courses:

i)	**Lecture based course**		
	Two sessional assessments	-	50%
	End-semester examination	-	50%
ii)	**Laboratory based courses**		
	Laboratory work assessment	-	75%
	End-semester examination	-	25%
iii)	**Project work**		
	Periodic reviews	-	50%
	Evaluation of Project Report by External Examiner	-	20%
	Viva-Voce Examination	-	30%

13.2 The markings for all tests, tutorial assignments (if any), laboratory work and examinations will be on absolute basis. The final percentage of marks is calculated in each course as per weightages given in clause 13.1.

14.0 SUBSTITUTE EXAMINATION

14.1 A student who has missed for genuine reasons any one of the three assessments including end-semester examination of a course may be permitted to write a substitute examination. However, permissions to take up a substitute examination will be given under exceptional circumstances, such as accident or admissions to a hospital due to illness, etc.,

14.2 A student who misses any assessment in a course shall apply in a prescribed form to the Dean(AC) through the Head of the department within a week from the date of missed assessment. However the substitute tests and examination for a course will be conducted within two weeks after the last day of the end-semester examinations.

15.0 COURSEWISE GRADING OF STUDENTS AND LETTER GRADES:

15.1 Based on the semester performance, each student is awarded a final letter grade at the end of the semester in each course. The letter grades and the corresponding grade points are as follows, but grading has to be relative grading

Letter grade	Grade points
S	10
A	9
B	8
C	7
D	6
E	5
U	0
I	-
W	-

Flexible range grading system will be adopted

"W" denotes withdrawal from the course.

"I" denotes inadequate attendance and hence prevention from End Semester examination.

"U" denotes unsuccessful performance in a course.

15.2 A student is considered to have completed a course successfully and earned the credits if he / she secure five grade points or higher. A letter grade U in any course implies unsuccessful performance in that course. A course successfully completed cannot be repeated for any reason.

16.0 METHOD OF AWARDING LETTER GRADE:

16.1 A final meeting of the Class Committee without the student member(s) will be convened within ten days after the last day of the semester end examination. The letter grades to be awarded to the students for different courses will be finalized at the meeting.

16.2 Three copies of the results sheets for each course, containing the final grade and three copies with the absolute marks and the final grade should be submitted by the teacher to the concerned Class Committee Chairman. After finalisation of the grades at the class committee meeting the Chairman will forward two copies of each to the Controller of Examinations and the other copies to the Head of the Department in which course is offered.

17.0 DECLARATION OF RESULTS:

17.1 After finalisation by the Class Committee as per clause 16.1 the Letter Grades awarded to the students in the each course shall be announced on the departmental notice board after duly approved by the Controller of Examinations. In case any student feels aggrieved, he/she can apply for revaluation after paying the prescribed fee for the purpose, within two weeks from the commencement of the semester immediately following the announcement of results. A committee will be constituted by the Controller of Examinations comprising the Chairperson of the concerned Class Committee (Convener), the teacher concerned and another teacher of the department who is knowledgeable in the concerned course. If the Committee finds that the case is genuine, it may jointly revalue the answer script and forward the revised mark to the Controller of Examinations with full justification for the revision if any.

17.2 The **"U"** grade once awarded stays in the grade sheet of the students and is not deleted when he/she completes the course successfully later. The grade acquired by the student later will be indicated in the grade sheet of the appropriate semester.

18.0 COURSE REPETITION AND ARREARS EXAMINATION

18.1 A student should register to re-do a core course wherein "I" or "W" grade is awarded. If the student is awarded "I", or "W" grade in an elective course either the same elective course may be repeated or a new elective course may be taken.

18.2 A student who is awarded "U" grade in a course shall write the end-semester examination as arrear examination , at the end of the next semester, along with the regular examinations of next semester courses. **The marks earned earlier in the continuous assessment tests for the course, will be used for grading along with the marks earned in the end-semester arrear examination for the course.**

19.0 GRADE SHEET

19.1 The grade sheet issued at the end of the semester to each student will contain the following:

(i) the credits for each course registered for that semester.

(ii) the performance in each course by the letter grade obtained.

(iii) the total credits earned in that semester.

(iv) the Grade Point Average (GPA) of all the courses registered for that semester and the Cumulative Grade Point Average (CGPA) of all the courses taken up to that semester.

19.2 The GPA will be calculated according to the formula

$$GPA = \frac{\sum_i (Ci)(GPi)}{\sum_i Ci}$$

where C_i is the number of credits assigned for i^{th} course
GP_i - Grade point obtained in the i^{th} course
For the cumulative grade point average (CGPA) a similar formula is used except that the sum is over all the courses taken in all the semesters completed up to the point in time.

I and W grades will be excluded for GPA calculations.

U, I and W grades will be excluded for CGPA calculations.

19.3 Classification of the award of degree will be as follows:

CGPA	Classification
8.50 and above, having completed in first appearance in all courses	First class with Distinction
6.50 and above, having completed within a period of 2 semesters beyond the programme period.	First Class
All others	Second Class

However, to be eligible for First Class with Distinction, a candidate should not have obtained U or I grade in any course during his/her study and should have completed the P.G. Programme within a minimum period covered by the minimum duration (clause 3.1) plus authorized break of study, if any (clause 8). To be eligible for First Class, a candidate should have passed the examination in all courses within the specified minimum number. of semesters reckoned from his/her commencement of study plus two semesters. For this purpose, the authorized break of study will not be counted. The candidates who do not satisfy the above two conditions will be classified as second class. For the purpose of classification, the CGPA will be rounded to first decimal place. For the purpose of comparison of performance of candidates and ranking, CGPA will be considered up to three decimal places.

20 ELIGIBILITY FOR THE AWARD OF THE MASTERS DEGREE

20.1 A student shall be declared to be eligible for the award of the Masters Degree, if he/she has:

i) registered for and undergone all the core courses and completed the Project Work,

ii) successfully acquired the required credits as specified in the Curriculum corresponding to his/her programme within the stipulated time,

iii) successfully completed the field visit/industrial training, if any, as prescribed in the curriculum.

iv) has no dues to the Institution, Hostels and Library.

v) no disciplinary action is pending against him/her

20.2 The award of the degree must be approved by the University.

21.0 POWER TO MODIFY:

Notwithstanding all that have been stated above, the Academic Council has the right to modify any of the above regulations from time to time.

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B.S. ABDUR RAHMAN UNIVERSITY, CHENNAI - 48.
M.Tech. CAD-CAM
(Four Semesters / Full time)

CURRICULUM

Sl. No	Subject Code	Subject	L	T	P	C	TC
		Semester I					
Theory							
1	MA 613	Applied Mathematics	3	1	0	4	
2	ME 601	Applied Materials Engineering	3	0	0	3	
3	ME 641	Advances in Manufacturing Technology	3	0	0	3	
4	ME 603	Computer Graphics and Geometric Modeling	3	0	0	3	
5	ME 604	Finite Element Method	3	1	0	4	
6		Elective I	3	0	0	3	
Practical							
1	ME 642	CAD Lab	0	0	4	2	**22**

Semester II

Theory

1	ME 643	Advanced Metrology and NDT	3	0	0	3	
2	ME 644	Integrated Product Design	3	1	0	4	
3	ME 608	Mechanical Vibrations	3	0	0	3	
4	ME 645	Integrated Manufacturing Systems and Management	3	0	0	3	
5		Elective II	3	0	0	3	
6		Elective III	3	0	0	3	

Practical

1	ME 646	CAM & Metrology lab	0	0	4	2	**21**

Semester III

Theory

1		Elective IV	3	0	0	3	
2		Elective V	3	0	0	3	
3		Elective VI	3	0	0	3	

Practical

1	ME 741	Project Work (Phase I)	0	0	12	6*	**9**

Semester IV

Practical

1	ME 742	Project Work (Phase II)	0	0	35	18+6*	**24**

Note:6 * Credits for project work (Phase I) in the third semester will be accounted along with 18 credits for project work (Phase II) in the fourth semester.

Total Credits :76

LIST OF ELECTIVES

Code	Course Title	L	T	P	C
MEY001	Design of Hydraulic & Pneumatic Systems	3	0	0	3
MEY002	Mechatronics	3	0	0	3
MEY003	Advanced Tool Design	3	0	0	3
MEY004	Newer Materials	3	0	0	3
MEY005	Artificial Intelligence	3	0	0	3
MEY007	Manufacturing Information Systems	3	0	0	3
MEY009	Tribology	3	0	0	3
ME611	CNC machines and Computer Aided Manufacturing	3	0	0	3
MEY011	Industrial Robotics & Flexible Automation	3	0	0	3
MEY057	Computer Aided Process Planning	3	0	0	3
MEY101	Flexible Competitive Manufacturing Systems	3	0	0	3
MEY102	Data Communication in CAD/CAM	3	0	0	3
MEY103	Industrial Safety Management	3	0	0	3
MEY104	Performance Modeling and Analysis of Manufacturing system	3	0	0	3
MEY105	Rapid Prototyping and Tooling	3	0	0	3
MEY058	Total Quality System and Management	3	0	0	3
MEY106	Reliability and Total Productive Maintenance	3	0	0	3
MEY013	Computational Fluid Dynamics	3	0	0	3
MEY051	Precision Engineering & Nano Technology	3	0	0	3
MEY107	Optimization Techniques in Design	3	0	0	3
MEY108	Advanced Mechanisms Design and Simulation	3	0	0	3
ME602	Advanced Strength of Materials	3	0	0	3
MEY112	Design of Material Handling Equipments	3	0	0	3

SEMESTER - I

MA 613 APPLIED MATHEMATICS

L	T	P	C
3	1	0	4

Objectives:

- To gain knowledge in mathematical techniques such as transform methods, calculus of variations and numerical solution of partial differential equation
- To develop skills in mathematical analysis for solving engineering problems

1. TRANSFORM METHODS **9**

Laplace transform methods for one dimensional wave equation - Displacements in a string –Longitudinal vibration of an elastic bar - Fourier transform methods for one- dimentional heat conduction problems in infinite and semi-infinite rod.

2. ELLIPTIC EQUATIONS **8**

Laplace equation - Properties of harmonic functions - Fourier transform methods for Laplaceequation. Solution for Poison equation by Fourier transform method.

3. CALCULUS OF VARIATIONS **9**

Variation and its properties - Euler's equation - Functionals dependent on first and higher order derivatives - Functionals dependent on functions of several independent variables – Some applications - Direct methods – Ritz and Kantorovich methods.

4. NUMERICAL SOLUTION OF PDE & Numerical Integration **10**

Solution of Laplace's and Poisson equation on a rectangular region by Liebmann's method -Diffusion equation by the explicit and Crank Nicolson - Implicit methods - Stability and Convergence criterion - Solution of wave equation by explicit scheme.Numerical Integration – Trapizodal Rule, SImpson's Rule, Neuton – Cotes Formula, Gauss Quadrature in one dimension and two dimensions.

5. CONFORMAL MAPPING AND APPLICATIONS **9**

The Schwarz - Christoffel transformation - Transformation of boundaries in parametric form – Physical applications - Application to fluid flow - Application to heat flow.

Total No of periods: 45

REFERENCES:

1. Sneddon, I.N., Elements of partial differential equations, McGraw-Hill ,1986.
2. Spiegel , M.R., Theory and problems of complex variables with an introduction to confomal mapping and its applications, Schaum's outline series, McGraw-Hill Book Co., 1987.
3. Sankara Rao, K., Introduction to partial differential equations, Prentice - Hall of India, New Delhi, 1995.
4. Elsgolts, L., Differential equation and calculus of variations, Mir Publishers, Moscow, 1966.

ME 601 APPLIED MATERIALS ENGINEERING L T P C
3 0 0 3

Objectives:

- To study the elastic, plastic and fracture behavior of engineering materials.
- To study the various modern materials , properties and their applications
- To understand the selection of metallic and non-metallic materials for various engineering applications.

1. ELASTIC AND PLASTIC BEHAVIOUR 10

Elasticity in metals and polymers - Mechanism of plastic deformation, role of dislocations, yield stress, shear strength of perfect and real crystals - Strengthening mechanisms, work hardening, solid solutioning, grain boundary strengthening, poly phase mixture, precipitation, particle, fibre and dispersion strengthening. Effect of temperature, strain and strain rate on plastic behaviors - Super plasticity - Deformation of non crystalline material.

2. FRACTURE BEHAVIOUR 10

Griffith's theory, stress intensity factor and fracture toughness - Toughening mechanisms - Ductile, brittle transition in steel - High temperature fracture, creep - Larson-Miller parameter – Deformation and fracture mechanism maps - Fatigue, low and high cycle fatigue test, crack initiation and propagation mechanisms and Paris law - Effect of surface and metallurgical parameters on fatigue - Fracture of non metallic materials – Failure analysis, sources of failure, procedure of failure analysis.

3. SELECTION OF MATERIALS 10

Motivation for selection, cost basis and service requirements - Selection for mechanical properties, strength, toughness, fatigue and creep - Selection for surface durability corrosion and wear resistance – Relationship between materials selection and processing - Case studies in materials selection with relevance to aero, auto, marine, machinery and nuclear applications.

4. MODERN METALLIC MATERIALS 8

Dual phase steels, Micro alloyed, High strength low alloy (HSLA) steel, Transformation induced plasticity (TRIP) steel, Maraging steel - Intermetallics, Ni and Ti aluminides - Smart materials, shape memory alloys - Metallic glass - Quasi crystal and nano crystalline materials.

5. NON METALLIC MATERIALS **7**

Polymeric materials - Formation of polymer structure - Production techniques of fibres, foams, adhesives and coatings - Structure, properties and applications of engineering polymers -Advanced structural ceramics, WC, TiC, TaC, AI2O3, SiC, Si3N4, CBN and diamond - properties, processing and applications.

Total No of periods: 45

REFERENCES:

1. Thomas H.Courtney, " Mechanical Behaviour of Materials ", (2nd Edition), McGraw-Hill,2000.
2. Charles J.A., Crane, F.A.A and Furness, J.A.G., " Selection and use of EngineeringMaterials ", (3rd Edition), Butterworth-Heiremann, 1977.
3. Flinn, R.A. and Trojan, P.K., " Engineering Materials and their Applications ", (4th Edition),Jaico, 1999.
4. George E.Dieter, " Mechanical Metallurgy ", McGraw Hill, 1988.
5. Metals Hand Book, Vol.10, " Failure Analysis and Prevention ", (10th Edition), 1994.

ME 641 ADVANCES IN MANUFACTURING TECHNOLOGY L T P C
3 0 0 3

Objective:

- To study the various newer machining processes and their applications
- To understand the concepts of various micro fabrication devices and technology

1. METAL CUTTING AND TOOL MATERIALS 12

Orthogonal and oblique cutting - Types of tool wear, Abrasion, Diffusion, Oxidation, Fatigue and Adhesive wear - Prediction of tool life - Monitoring of tool wear, Cutting forces and vibration – Tool materials, Cemented carbide, Coated carbide, Cermets, Ceramic, CBN and PCD - Selection of machining parameters and Tools.

2. SPECIAL MACHINING 9

Deep hole drilling - Gun drills - Gun boring - Trepanning - Honing - Lapping - Super finishing - Burnishing - Broaching - High speed machining.

3. UNCONVENTIONAL MACHINING 9

Principles, processes, Various influencing parameters and Applications of Ultrasonic machining, Electro Discharge Machining, Electro Chemical Machining, Electron and Laser Beam Machining, Plasma Arc Machining and Water Jet Machining.

4. RAPID PROTOTYPING 6

Stereo lithography - Laminated object manufacturing - selective laser sintering - Vacuum process casting – Resin injection - Applications of RPT - Micro finishing process.

5. ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS 9

Introduction - Pattern recognition - Control strategies - Heuristic search, Forward and Backward reasoning - Search algorithms - Game playing - Knowledge representation - structural representation of knowledge – Expert systems in manufacturing.

Total No of periods: 45

REFERENCES:

1. Armarego E.J.A. and Brown R.H., " The machining of metals ", Prentice Hall , 1982.
2. Battacharya," Theory of metal cutting ", NCB Agency, 1984.
3. HMT Manual, " Non-traditional machining methods ", 1975.
4. Rich E. and Knight K., " Artificial Intelligence ", McGraw Hill Inc, 1991.
5. Pham D.T., " Expert Systems in Engineering ", IFS Publishers, Springer-Verlag, 1988.
6. Durvent W.R., " The Lithographic hand book ", Narosa Publishers, 1995.
7. Pandey P.S. and Shah N. " Modern Manufacturing Processes ", 1980.
8. Sadasivan T.A. and Sarathy D. " Cutting tools for Productive Machining ", Widia (India) Limited,1999.

ME 603 COMPUTER GRAPHICS AND GEOMETRIC MODELING L T P C
3 0 0 3

Objective:

- To acquire knowledge for generating high quality images of massive geometric models in a short time
- To learn about the concepts of surface modeling, physically based modeling and surface visualization.

1. IMAGE GENERATION AND MANIPULATION 9

Overview of display devices and systems – generation of primitives – 2D & 3D transformation –viewing transformation – projections.

2. IMAGE ENHANCEMENT AND GRAPHICS STANDARDS 9

Clipping – Hidden line/surface removal – shading and rendering; Graphic standards – Computing shades – Data exchange standards – Data Communication Standards.

3. MODELING OF CURVES AND SURFACES 9

Curves: Parametric representation – Analytic curves; synthetic curves – Bicubic, Bezier, B-spline, NURBS; Surfaces: surface patches – Bicubic – Bezier – B-spline – Coons patch, Sweep surfaces; continuity conditions; manipulation of curves & surfaces.

4. MODELING OF SOLIDS 9

Constructive Solid Geometry (CSG) – Boundary Models – Sweeping; Other methods of solid modeling; Constraint based modeling – parametric – variational; Feature based modeling; Data associativity; features of Solid modeling packages – current trends in modeling.

5. GRAPHICS IN DESIGN AND MANUFACTURE 9

Graphical techniques in FEA: preprocessing – mesh generation techniques – error detection; Post processing – display of results – animated shapes; Graphical techniques in manufacture –estimation of material removal quantity – cutter and gauge detection – tool path generation; Rapid prototype – slicing techniques.

Total : 45

REFERENCES :

1. Ibrahim Zeid, CAD / CAM- Theory and Practice, Mc Graw Hill International Edition, 1998.
2. Chris Mc Mahon and Jimmie Browne, CAD CAM – Principles, Practice and Manufacturing Management, 2nd edition, Pearson Education Asia LN, 2005.
3. Donald Hearn and Pauline Baker, Computer Graphics Printice Hall Inc.

ME 604 FINITE ELEMENT METHOD L T P C
3 1 0 4

Objectives:

- To study the fundamentals of finite element method
- To apply finite element method for solving one dimensional and two dimensional structural and thermal problems.

1. REVIEW OF ONE DIMENSIONAL FEM 9

FEM Methodology – Modeling and discretization Interpolation, elements, nodes and degrees-of-freedom-applications of FEA. One-Dimensional Elements: Bar element – beam element – assembly of elements – properties of stiffness matrices-boundary conditions-solution of equations-mechanical loads and stresses-thermal loads and stresses-example problems.

2. REVIEW OF TWO AND THREE DIMENSIONAL FEM 9

Interpolation and shape functions - element matrices-linear triangular elements (CST)-quadratic triangular elements – bilinear rectangular elements-solid elements-higher order elements – stress calculations .

3. APPLICATIONS TO FIELD PROBLEMS 9

Solution to problems in linear elasticity- plane problems in elasticity- plates and shells- solution of problems in heat-transfer and fluid mechanics- numerical examples- discussion on error estimates

4. NON-LINEAR ANALYSIS 9

Non-linear problems in elasticity- some solution methods- plasticity: introduction, general formulation for small strains- formulation for von Mises theory- computational procedure- geometric non-linearity- modeling considerations.

5. FINITE ELEMENTS IN STRUCTURAL DYNAMICS APPLICATIONS 9

Dynamic equations – mass and damping matrices – natural frequencies and modes – damping – reduction of number of degrees-of-freedom-response history – model methods – Ritz vectors – component mode synthesis – harmonic response – direct integration techniques – explicit and implicit methods – analysis by response spectra – example problems.

Total No of periods: 45
Tutorials : 15

REFERENCES:

1. Reddy J.N. An Introduction to the Finite Element Method, McGraw Hill, International Edition, 1993.
2. Cook, Robert Davis et al “Concepts and Applications of Finite Element Analysis”, Wiley, John & Sons, 1999.
3. Chandrupatla & Belagundu, “Finite Elements in Engineering”, Prentice Hall of India Private Ltd., 1997.
4. Zienkiewicz.O.C, Taylor.R.L “The Finite Element Method” McGraw Hill International Editions, Fourth Edition, 1991, Volume 2
5. Bathe, K.J., “Finite Element Procedures in Engineering Analysis”, 1990.
6. S.S.Rao, Finite Element Analysis, 2002 Edition.
7. David V Hutton “Fundamentals of Finite Element Analysis”. McGraw-Hill International Edition., 2004.

ME 642	CAD –Lab	L T P C 0 0 4 2

Objective :

- To review and train in CAD modeling
- To train on various areas of finite element analysis of mechanical components

1. Review of Computer Aided Drafting, Solid Modeling assembly and drawing generation using a CAD Package

   Analysis of Mechanical Components – Use of FEA packages, Exercises shall include FEA analysis of

   i) Machine elements under static loads

   ii) Heat transfer and Flow Analysis

   iii) Determination of natural frequency

   iv) Non-linear Analysis

   v) Contact Analysis

   vi) Fatigue Analysis

   Use of kinematics and dynamics simulation software - Analysis of velocity & acceleration for mechanical linkages of different mechanisms.

SEMESTER II

ME 643 ADVANCED METROLOGY AND NDT L T P C
3 0 0 3

Objective:

- To gain knowledge in the advanced measuring methods and the non destructive techniques

1. MEASURING MACHINES 9

Tool Maker's microscope - Co-ordinate measuring machines - Universal measuring machine - Laser metrology - Use of computers - Machine vision technology -Microprocessors in metrology.

2. STATISTICAL QUALITY CONTROL 9

Data presentation - Statistical measures and tools - Process capability – control charts for variables and for attributes - Theory of probability – Sampling plants - Reliability and life testing.

3. LIQUID PENETRANT AND MAGNETIC PARTICLE TESTS 9

Characteristics of liquid penetrants - different washable systems - Developers - applications - Methods of production of magnetic fields - Principles of operation of magnetic particle test - Applications - Advantages and limitations.

4. RADIOGRAPHY 9

Sources of ray-x-ray production - properties of Gamma and x rays - film characteristics - exposure charts - contrasts - operational characteristics of x ray equipment - applications.

5. ULTRASONIC AND ACOUSTIC EMISSION TECHNIQUES 9

Production of ultrasonic waves - different types of waves - general characteristics of waves - pulse echo method - A, B, C scans - Principles of acoustic emission techniques - Advantages and limitations - Instrumentation and applications.

Total No of periods: 45

REFERENCES:

1. JAIN, R.K. " Engineering Metrology ", Khanna Publishers, 1997.
2. Barry Hull and Vernon John, " Non Destructive Testing ", MacMillan, 1988.
3. American Society for Metals, " Metals Hand Book ", Vol.II, 1976.
4. Progress in Acoustic Emission, " Proceedings of 10th International Acoustic Emission Symposium ",Japanese Society for NDI, 1990.

ME 644 INTEGRATED PRODUCT DESIGN L T P C
3 1 0 4

Objective:

- To gain knowledge on multiple functional areas like marketing, finance, industrial design, engineering and production in creating a new product

I. INTRODUCTION 8

Need for IPPD-Strategic importance of Product development - integration of customer, designer, material supplier and process planner, Competitor and customer - behavior analysis. Understanding customer-promoting customer understanding-involve customer in development and managing requirements - Organization process management and improvement

2 CONCEPT GENERATION, SELECTION AND TESTING 10

Plan and establish product specifications. Task - Structured approaches - clarification - search-externally and internally-Explore systematically - reflect on the solutions and processes - concept selection - methodology - benefits. Implications - Product change - variety - component standardization - product performance - manufacturability – Concept Testing Methodologies.

3 PRODUCT ARCHITECTURE 8

Product development management - establishing the architecture - creation - clustering - geometric layout development - Fundamental and incidental interactions - related system level design issues - secondary systems - architecture of the chunks - creating detailed interface specifications-Portfolio Architecture.

4 INDUSTRIAL DESIGN 8

Integrate process design - Managing costs - Robust design - Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically - Need for industrial design-impact – design process - investigation of customer needs - conceptualization - refinement - management of the industrial design process - technology driven products - user - driven products - assessing the quality of industrial design.

5 DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT 11

Definition - Estimation of Manufacturing cost-reducing the component costs and assembly costs – Minimize system complexity - Prototype basics -

Principles of prototyping - Planning for prototypes - Economic Analysis - Understanding and representing tasks-baseline project planning - accelerating the project-project execution.

Total No of periods: 45L+15T

REFERENCES:

1. Karl T.Ulrich and Steven D.Eppinger, Product Design and Development, McGraw Hill International Edns.1999
2. Concurrent Engg./Integrated Product Development. Kemnneth Crow, DRM
3. Associates, 6/3, Via Olivera, Palos Verdes, CA 90274(310) 377-569, Workshop Book
4. Effective Product Design and Development, Stephen Rosenthal, Business One Orwin, Homewood, 1992,ISBN, 1-55623-603-4
5. Tool Design – Integrated Methods for successful Product Engineering, Stuart Pugh, Addison Wesley Publishing,Neyourk, NY, 1991, ISBN 0-202-41639-5

ME 608 MECHANICAL VIBRATIONS L T P C
3 0 0 3

Objectives:

- To understand the fundamentals of vibration phenomenon and its measurement
- To know the various constraints of vibration system and its analysis
- To study the vibrations of various generic components, its effect on balancing and the devices for its measurements

1. FUNDAMENTALS OF VIBRATION 8

Review of Single degree system - Response to arbitrary periodic exicitations - Duhamel's Integral – Impulse Response function - Virtual work - Lagrange's equation - Single degree freedom forced vibration with elastically coupled viscous dampers - System Identification from frequency response - Transient Vibration – Laplace transformation formulation.

2. TWO - DEGREE FREEDOM SYSTEMS 8

Free vibration of spring - coupled system - mass coupled system - Bending vibration of two degree of freedom system - forced vibration - Vibration Absorber - Vibration isolation.

3. MULTI-DEGREE FREEDOM SYSTEM 12

Normal mode of vibration - Flexibility Matrix and Stiffness matrix - Eigen values and Eigen vectors – orthogonal properties - Modal matrix-Modal Analysis - Forced Vibration by matrix inversion - Modal damping in forced vibration - Numerical methods for fundamental frequencies

4. VIBRATION OF CONTINUOUS SYSTEMS 8

Systems governed by wave equations - Vibration of strings - vibration of rods - Euler Equation for Beams -Effect of Rotary inertia and shear deformation - Vibration of plates.

5. MACHINE DYNAMICS 9

Vibration isolation – Role of foundation – Balancing of rotating and reciprocating masses in machines – Applications in machines like Turbines, Compressors, Grinding Machine and Presses.

Experimental Vibration Analysis - Vibration exciters, Sensors and Spectrum Analysers - Industrial case studies.

Total No of periods: 45

REFERENCES:

1. Thomson, W.T. - "Theory of Vibration with Applications", CBS Publishers and Distributors, NewDelhi,1990.
2. Rao, J.S., & Gupta, K. - "Introductory Course on Theory and Practice of Mechanical Vibrations" ,New Age International Ltd., 1984.
3. Den Hartog, J.P. "Mechanical Vibrations", Dover Publication 1990.
4. Rao, S.S., "Mechanical Vibrations", Addison Wesley Longman 1995.

ME 645	INTEGRATED MANUFACTURING SYSTEMS AND MANAGEMENT	L	T	P	C
		3	0	0	3

Objectives:

- To know about the Product life cycle and its management
- To learn the Manufacturing strategies and compositeness
- To understand the Designing of Products, facilities and jobs,
- To gain knowledge on Inventory systems, MRP and information control systems.

1. FIELD OF MANUFACTURING MANAGEMENT **9**

Introduction – Manufacturing Strategies and competitiveness-Meeting the competitive Project management-Product Life Cycle – Role of CIM in Modern Manufacturing Management

2. DESIGNING OF PRODUCTION PROCESSES **9**

Process selection-Process flow Design – Operations Technology -Waiting line management-Computer simulation of waiting lines – Quality management.

3. DESIGN OF FACILITIES AND JOBS **9**

Capacity and Requirement planning – Strategies – Planning service capacity-JIT –Facility location and layout-Job Design and Work measurement. – Lean Manufacturing

4. INVENTORY SYSTEMS AND MRP **9**

Definition-Purposes of Inventory-Inventory models-Fixed order Quantity models and Fixed-time period models - MRP Systems-MRP system structures-Improvements in the MRP system-Advanced MRP-type systems.

5. INFORMATION SYSTEM FOR MANUFACTURING **9**

Parts oriented production information system - concepts and structure - computerized production scheduling, online production control systems, Computer based production management system, computerized manufacturing information system - case study.

TOTAL : 45

REFERENCES:

1. Chase, Aquilano and Jacobs, Production and Operations Management, , Tata McGraw Hill, eighth Edition
2. Robert A. Olsen, Manufacturing management: a quantitative approach, International Textbook Co, 1968.
3. Chary S.N., Production and Operations Management, Tata McGraw-Hill, 3rd Edition 2006.
4. Jay Heizer, Barry Render Production and Operations Management: Strategic and Tactical Decisions, Business & Economics – 1996.
5. Jae K. Shim, Joel G. Siegel ,Operations Management,- Business & Economics – 1999.

ME 646	CAM & METROLOGY LAB	L T P C 0 0 4 2

Objective:

- To train on part programming and program generation from a CAD model
- To train on machining in various CNC machines
- To train on various modern measuring instruments

(A) Computer Aided Manufacturing

(i) Automatics Program Generation for CNC Machining using advanced CAM Packages

(ii) Machining of components in VMC and Turning Center using programs generated by CAM packages

(iii) Machining using special machining cycles in Fanuc and Siemens controllers

(B) Metrology

(i) Measurement of dimensional features in complex components like engine block or cylinder head using CMM

(ii) Cloud point data generation for Free form surfaces using CMM

(iii) Automated inspection using Vision system

(iv) Surface roughness measurement

(v) Comprehensive reverse engineering of industrial components

ELECTIVES

ME Y001 DESIGN OF HYDRAULIC & PNEUMATIC SYSTEMS

L	T	P	C
3	0	0	3

Objective:

- To study the various fluid power system and their application
- To understand the designing of various fluid power circuits for a particular application
- To learn the modern controls for fluid power system and their maintenance.

1. OIL HYDRAULIC SYSTEMS AND ACTUATORS 5

Hydraulic Power Generators - Selection and specification of pumps, pump characteristics. Hydraulic actuators - Linear and Rotary Actuators - selection, specification and characteristics.

2. CONTROL AND REGULATION ELEMENTS 10

Pressure, direction and flow control valves - relief valves, non return and safety valves – actuation systems.

3. HYDRAULIC CIRCUITS 8

Reciprocation, quick return, sequencing, synchronizing circuits - accumulator circuits – industrial circuits –Hydraulic press circuits - milling machine, grinding, planning, copying, forklift, and earth mover circuits - design and selection of components - safety and emergency manuals.

4. PNEUMATIC SYSTEMS AND CIRCUITS 15

Pneumatic fundamentals - control elements, position and pressure sensing - logic circuits - switching circuits - fringe conditions modules and their integration - sequential circuits – cascade methods - mapping methods – step counter method - compound circuit design – combination circuit design.

5. INSTALLATION, MAINTENANCE AND SPECIAL CIRCUITS 7

Pneumatic equipments - selection of components - design calculations - application - fault finding –hydro pneumatic circuits - use of microprocessors for sequencing - PLC, Low cost automation - Robotic circuits.

Total No of periods: 45

REFERENCES:

1. Antony Espossito, " Fluid power with Applications ", Prentice Hall, 1980.
2. Dudleyt, A.Pease and John J.Pippenger, " Basic Fluid Power ", Prentice Hall, 1987.
3. Andrew Parr, " Hydraulic and Pneumatics ", (HB), Jaico Publishing House, 1999.
4. Bolton. W. " Pneumatic and Hydraulic Systems ", Butterworth - Heineman, 1997.
5. Majumdar, " Oil Hydraulics Systems: Principles and Maintenance " Tata McGrawHill,2004
6. Majumdar, " Pneumatic system : Principles and Maintenance" Tata McGrawHill,2004

ME Y002 **MECHATRONICS** **L T P C**
3 0 0 3

Objectives:

- To learn the Mechatronics systems such as controls and drives, real time interfacing, data acquisition system, sensors for condition monitoring, mechanical controlling, automated manufacturing.
- To understand the basic concepts, properties and interfacing of controls and drives in the Mechatronics System Design.

1. INTRODUCTION **3**

Introduction to Mechatronics - Systems - Mechatronics in Products - Measurement Systems -Control Systems - Traditional design and Mechatronics Design.

2. SENSORS AND TRANSDUCERS **12**

Introduction - Performance Terminology - Displacement, Position and Proximity - Velocity and Motion – Force and Torque - Fluid pressure – Vibration Sensors - Temperature sensors – Light sensors - Selection of sensors - Signal processing - Servo systems.

3. MICROPROCESSORS IN MECHATRONICS **15**

Introduction - Architecture - Pin configuration - Instruction set - Programming of Microprocessors using 8085 instructions - Interfacing input and output devices - Interfacing D/A converters and A/D converters –Applications - Temperature control - Stepper motor control - Traffic light controller.

4. PROGRAMMABLE LOGIC CONTROLLERS **8**

Introduction - Basic structure - Input / Output processing - Programming - Mnemonics Timers, Internal relays and counters - Data handling - Analog input / output - Selection of PLC. Introduction to Controllers.

5. DESIGN AND MECHATRONICS **7**

Designing - Possible design solutions - Case studies of Mechatronics systems.

Total No of periods: 45

REFERENCES:

1. Michael B.Histand and David G. Alciatore, " Introduction to Mechatronics and Measurement Systems", McGraw-Hill International Editions, 1999.
2. Bradley, D.A., Dawson, D, Buru, N.C. and Loader, AJ., " Mechatronics ", Chapman and Hall, 1993.
3. Ramesh.S, Gaonkar, " Microprocessor Architecture, Programming and Applications ", Wiley Eastern, 1998.
4. Lawrence J.Kamm, " Understanding Electro-Mechanical Engineering, An Introduction to Mechatronics ",Prentice-Hall, 2000.
5. Ghosh, P.K. and Sridhar, P.R., 0000 to 8085, " Introduction to Microprocessors for Engineers and Scientists ", Second Edition, Prentice Hall, 1995.

ME Y003 ADVANCED TOOL DESIGN L T P C
3 0 0 3

Objectives:

- To study the basic concepts of tool design
- To design various tooling such as cutting tools, Jigs and fixtures, press tools and CNC machine tools

1. TOOL-DESIGN METHODS 5

Introduction – The Design Procedure – Statement of the problem – The Needs Analysis –Research and Ideation – Tentative Design Solutions – The Finished Design – Drafting and Design Techniques in Tooling drawings – Screws and Dowels – Hole location – Jig-boring practice –Installation of Drill Bushings – Punch and Die Manufacture – Electro-discharge machining –Electro-discharge machining for cavity.

2. TOOLING MATERIALS AND HEAT TREATMENT 9

Introduction – Properties of Materials – Ferrous Tooling Materials – Tool steels – Cast Iron – Mild, or low-carbon Steel – Nonmetallic Tooling Materials – Nonferrous Tooling Materials – Metal cutting Tools – Single-point cutting tools – Milling cutters – Drills and Drilling – Reamer classification –Taps – Tap classification- the selection of carbide cutting tools – Determining the insert thickness for carbide tools.

3. DESIGN OF DRILL JIGS 9

Introduction – Fixed Gages – Gage Tolerances – The selection of material for Gages – Indicating Gages – Automatic gages – Principles of location – Locating methods and devices – Principles of clamping – Drill jigs – Chip formation in drilling – General considerations in the design of drill jigs – Drill bushings – Methods of construction – Drill jigs and modern manufacturing.

4. DESIGN OF FIXTURES AND DIES 14

Introduction – Fixtures and economics – Types of Fixtures – Vise Fixtures – Milling Fixtures –Boring Fixtures – Broaching Fixtures – Lathe Fixtures – Grinding Fixtures – Types of Die construction – Die-design fundamentals – Blanking and Piercing die construction – Pilots – Strippers and pressure pads-Presswork materials – Strip layout – Short-run tooling for Piercing – Bending dies – Forming dies – Drawing operations.

5. TOOL DESIGN FOR NUMERICALLY CONTROLLED MACHINE TOOLS **8**

Introduction – The need for numerical control – A basic explanation of numeric control – Numerical control systems in use today – Fixture design for numerically controlled machine tools – Cutting tools for numerical control – Tool holding methods for numerical control – Automatic tool changers and tool positioners – Tool presetting – Introduction – General explanation of the Brown and sharp machine – tooling for Automatic screw machines

Total No of periods: 45

REFERENCES

1. Cyrll Donaldson, George H.LeCain, V.C. Goold, “Tool Design”, Tata McGraw Hill Publishing Company Ltd., 2000.
2. Prakash Hiralal Joshi, “Tooling data”, Wheeler Publishing, 2000

ME Y004 **NEWER MATERIALS** **L T P C**
3 0 0 3

Objective:

- To know about the various new materials for modern applications and their manufacturing processes

1. INTRODUCTION **5**

Chemistry and Classification of Polymers - Properties of Thermo Plastics - Properties of Thermosetting Plastics - Applications - Merits and Demerits.

2. PROCESSING OF PLASTICS **12**

Extrusion - Injection Moulding - Blow Moulding - Compression and Transfer Moulding - Casting –Thermo Forming.

3. MACHINING AND JOINING OF PLASTICS **7**

General Machining properties of Plastics - Machining Parameters and Their effect - Joining of Plastics - Mechanical Fastners - Thermal bonding - Press Fitting.

4. COMPOSITE MATERIALS AND PROCESSING **12**

Fibres - Glass, Boron, Carbon, Organic, Ceramic and Metallic Fibers - Matrix Materials - Polymers,Metals and Ceramics – Composites Processing- Open Mould Processes, Bag Moulding,Compression Moulding with BMC and SMC - Filament winding - Pultrusion - Centrifugal Casting -Injection Moulding - Application of PMC's.

5. PROCESSING OF METAL MATRIX COMPOSITES **9**

Solid State Fabrication Techniques - Diffusion Bonding - Powder Metallurgy Techniques – Plasma Spray, Chemical and Physical Vapour Deposition of Matrix on Fibres - Liquid State Fabrication Methods - Infiltration - Squeeze Casting - Rheo Casting –Application of MMCS.

Total No of periods: 45

REFERENCES:

1. Harold Belofsky, Plastics : " Product Design and Process Engineering, Hanser Publishers,1995.

2. Bera, E and Moet, A, " High Performance Polymers ", Hanser Publishers, 1991.

3. Hensen, F, " Plastics Extrusion technology ", Hanser Publishers, 1988.

4. Johannaber F, " Injection Moulding Machines ", Hanser Publishers, 1983.

5. Rauwendaal, C, " Polymer extrusion ", Hanser Publishers, 1990.

6. Rosatao, D.V., " Blow Moulding Handbook, Hanser Publisher, 1989.

7. Seamour,E.B., " Modern Plastics Moulding ", John Wiley.

8. John Dalmonte, " Plastics Moulding ", John Wiley.

9. Akira Kobyashi, " Machining of Plastics ", Mc-Graw Hill.

10. Krishan K.Chawla, " Composite Materials science and Engineering ", springer-Verlag, 1987.

11. Agarwal. D. and Broutman L.J., " Analysis and Performance of Fiber Composites ", Wiley,1990.

12. Mallick, P.K. and Newman, S. " Composite Materials Technology ", Hanser Publishers, 1990.

ME Y005 ARTIFICIAL INTELLIGENCE L T P C
3 0 0 3

Objective:

- To learn about the fundamentals of artificial intelligence and application tools
- To know about the implementation of artificial intelligence in Industry and the suspected problems

1. INTRODUCTION TO ARTIFICIAL INTELLIGENCE 9

Definition, Three AI branches- Expert Systems, Natural language systems, Perception for vision, speech and touch-Eminent domains-misconception-human intelligence_ Development of an system: goal, fact obtaining data-rules, inferences- verification throt- the inference Mechanism.

2. KNOWLEDGE BASED SYSTEMS 9

Identification – knowledge bases- knowledge- representation – methods-reasoning stratagoes frames, rules- logic, scamentic network. Object oriented programming- acquiring knowledge from an expert.

3. AI APPLICATION DEVELOPMENT TOOLS 8

Building a knowledge system- choosing a tool for building expert system-inheritance- A knowledge base tool with data base feature application areas-problem features.

4. AI IN INDUSTRY 10

Planning and scheduling- Project management-factory simulation- Long term planning and integration of knowledge systems. Sales, design, Manufacturing, distribution, field services and Expert system integration- Diagnosis and Trouble shooting overview of robots applications- Welding, spray painting, grinding-Pa…. handling transfer, assembly operation, parts sorting and inspection.

5. PERCEPTION AND WARNING 9

Techniques used in solving, perceptual problems-constraint satisfaction, random learning and Neural nets, concept learning by analogy, Introduction to AI Programming language.

Total No of periods: 45

REFERENCES

1. Winston, P.H., “Artificial Intelligence”, Addision Wesley.
2. Nilsson, N.J., “Principles of Artificial Intelligence”,
3. Rich, E., “Artificial Intelligence”, Mc Graw Hill, 1983.
4. Rauch Hindin.B., “ A guide to commercial Artificial Intelligence – Fundamentals and real world applications”, Prentice Hall, Englewood Cliffs, New Jerscy.
5. Klafter, Richard D., and Chemieleswski,A., “ Robotic Engineering”, Prentice Hall international Editions.

ME Y007 MANUFACTURING INFORMATION SYSTEMS

L	T	P	C
3	0	0	3

Objectives:

- To understand the basics of production organization and database involved in the manufacturing information system
- To design the database and its utilization in information development for production management

1. INTRODUCTION **5**

The evolution of order policies, from MRP to MRP II, the role of Production organization, Operations control.

2. DATABASE **7**

Terminologies - Entities and attributes - Data models, schema and subschema - Data Independence – ER Diagram - Trends in database.

3. DESIGNING DATABASE **13**

Hierarchical model - Network approach - Relational Data model -concepts, principles, keys, relational operations - functional dependence -Normalisation, types - Query languages.

4. MANUFACTURING CONSIDERATION **10**

The product and its structure, Inventory and process flow - Shop floor control - Data structure and procedure -various model - the order scheduling module, input / output analysis module the stock status database – the complete IOM database.

5. INFORMATION SYSTEM FOR MANUFACTURING **10**

Parts oriented production information system - concepts and structure - computerised production scheduling, online production control systems, Computer based production management system, computerised manufacturing information system - case study.

Total No of periods: 45

REFERENCES:

1. Luca G. Sartori, "Manufacturing Information Systems", Addison-Wesley Publishing Company, 1988.

2. Date.C.J., " An Introduction to Database systems ", Narosa Publishing House, 1997.

3. Orlicky.G., " Material Requirements Planning ", McGraw-Hill Publishing Co., 1975.

4. Kerr.R, " Knowledge based Manufacturing Management ", Addison-wesley, 1991.

ME Y009 **TRIBOLOGY** **L T P C**
3 0 0 3

Objectives:

- To study the effect of friction on wear and its measurement
- To understand the various lubrication methods and their influence on wear

1. SURFACES, FRICTION AND WEAR **8**

Topography of Surfaces – Surface features – Surface interaction – Theory of Friction – Sliding and Rolling Friction, Friction properties of metallic and non-metallic materials – friction in extreme conditions – wear, types of wear – mechanism of wear – wear resistance materials – surface treatment – Surface modifications – surface coatings.

2. LUBRICATION THEORY **8**

Lubricants and their physical properties lubricants standards – Lubrication Regimes Hydrodynamic lubrication – Reynolds Equation, Thermal, inertia and turbulent effects – Elasto hydrodynamic and plasto hydrodynamic and magneto hydrodynamic lubrication – Hydro static lubrication – Gas lubrication.

3. DESIGN OF FLUID FILM BEARINGS **12**

Design and performance analysis of thrust and journal bearings – Full, partial, fixed and pivoted journal bearings design – lubricant flow and delivery – power loss, Heat and temperature rotating loads and dynamic loads in journal bearings – special bearings – Hydrostatic Bearing design.

4. ROLLING ELEMENT BEARINGS **10**

Geometry and kinematics – Materials and manufacturing processes – contact stresses – Hertzian stress equation – Load divisions – Stresses and deflection – Axial loads and rotational effects, Bearing life capacity and variable loads – ISO standards – Oil films and their effects – Rolling Bearings Failures.

5. TRIBO MEASUREMENT IN INSTRUMENTATION **7**

Surface Topography measurements – Electron microscope and friction and wear measurements – Laser method – instrumentation - International standards – bearings performance measurements – bearing vibration measurement.

Total No of periods: 45

REFERENCES:

1. Cameron, A. “Basic Lubrication Theory”, Ellis Herward Ltd., OK, 1981
2. Hulling, J. (Editor) – “Principles of Tribology “, Macmillian – 1984.
3. Williams J.A. “Engineering Tribology”, Oxford Univ. Press, 1994.
4. Neale, M.J. “Tribology Hand Book”, Butterworth Heinemann, 1995.

ME 611 CNC MACHINES AND COMPUTER AIDED MANUFACTURING **L T P C 3 0 0 3**

Objectives:

- To gain knowledge on Computer Numerical Machines and this components
- To learn the various programming modules involved in Computer Aided Manufacturing system.

1. INTRODUCTION TO CNC MACHINE TOOLS 7

Development of CNC Technology, principles, features, advantages, economic benefits, applications, CNC, DNC concept, classification of CNC Machine, types of control, CNC controllers, characteristics, interpolators.

2. STRUCTURE OF CNC MACHINE TOOL 9

CNC Machine building, structural details, configuration and design, guideways - friction and anti friction and other types of guide ways, elements used to convert the rotary motion to a linear motion - Screw and nut, recirculating ball screw, planetary roller screw, recirculating roller screw, rack and pinion, torque transmission elements - gears, timing belts, flexible couplings, Bearings.

3. DRIVES AND CONTROLS 9

Spindle drives - DC shunt motor, 3 phase AC induction motor, feed drives - stepper motor, servo principle, DC & AC servomotors. Open loop and closed loop control, Axis measuring system - synchro, synchro-resolver, gratings, moire fringe gratings, encoders, inductosyn, laser interferometer.

4. CNC PROGRAMMING 10

Coordinate system, structure of a part program, G & M Codes, Manual part programming for Fanuc, Heidenhain, Sinumeric control system, CAPP, APT part programming using CAD/CAM, Parametric Programming.

5. TOOLING AND MAINTENANCE OF CNC 10

Cutting tool materials, carbide insets classification, qualified, semi qualified and preset tooling, tooling system for Machining centre and Turning centre, work holding devices, maintenance of CNC Machines.

Total No of periods: 45

REFERENCES:

1. HMT, Mechatronics, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1998.

1. James Madison, " CNC Machining Hand Book ", Industrial Press Inc., 1996.

2. Steve Krar, Arthur Gill, " CNC Technology and Programming ", McGraw-Hill International Editions, 1990.

3. Berry Leathan - Jones, " Introduction to Computer Numerical Control ", Pitman, London, 1987.

4. Hans B.Kief, T.Fredericx Waters, " Computer Numerical Control ", MacMillan / McGraw-Hill, 1992.

5. Bernard Hodgers, “CNC Part Programming Work Book ", city and Guids / Macmillan, 1994.

6. David Gribbs, " An Introduction to CNC Machining ", Cassell, 1987.

7. Sadasivan, T.A. and Sarathy, D, " Cutting Tools for Productive Machining ", Widia (India) Ltd., August 1999.

8. Radhakrishnan, P. " Computer Numerical Control Machines ", New Central Book Agency, 1992.

9. Peter Smid, " CNC Programming Hand Book ", Industrial Press Inc., 2000.

ME Y011 INDUSTRIAL ROBOTICS & FLEXIBLE AUTOMATION

L	T	P	C
3	0	0	3

Objectives:

- To study the basic concepts of robotics and various components of Industrial robots
- To learn about robot programming, artificial intelligence and their applications in industrial automation

1. INTRODUCTION AND ROBOT KINEMATICS **10**

Definition need and scope of Industrial robots – Robot anatomy – Work volume – Precision movement – End effectors – Sensors. Robot Kinematics – Direct and inverse kinematics – Robot trajectories – Control of robot manipulators – Robot dynamics – Methods for orientation and location of objects.

2. ROBOT DRIVES AND CONTROL **9**

Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.

3. ROBOT SENSORS **9**

Transducers and Sensors – Sensors in Robot – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Grabbing – Image processing and analysis – Image segmentation – Pattern recognition – Training of vision system.

4. ROBOT FOR FLEXIBLE AUTOMATION **9**

Robot work cell design and control – Safety in Robotics – Robot cell layouts – Multiple Robots and machine interference – Robot cycle time analysis. Industrial application of robots.

5. ROBOT PROGRAMMING, AI & EXPERT SYSTEMS **8**

Methods of Robot Programming – Characteristics of task level languages lead through programming methods – Motion interpolation. Artificial intelligence – Basics – Goals of artificial intelligence – AI techniques – problem representation in AI – Problem reduction and solution techniques - Application of AI and KBES in Robots.

Total No of periods: 45

REFERENCES:

1. Fu .K.S., R.C. Gonzalez and C.S.G. Lee, “Robotics Control, Sensing, Vision and Intelligence”, Mc Graw Hill, 1987.
2. Yoram Koren,” Robotics for Engineers’ Mc Graw-Hill, 1987.
3. Kozyrey, Yu. “Industrial Robots”, MIR Publishers Moscow, 1985.
4. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, “Robotics Engineering – An Integrated Approach”, Prentice-Hall of India Pvt. Ltd., 1984.
5. Deb, S.R.” Robotics Technology and Flexible Automation”, Tata Mc Graw-Hill, 1994.
6. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey,” Industrial Robotics Technology, Programming and Applications”, Mc Graw-Hill, Int. 1986.
7. Timothy Jordanides et al ,”Expert Systems and Robotics “, Springer –Verlag, New York, May 1991.

ME Y057 COMPUTER AIDED PROCESS PLANNING

L	T	P	C
3	0	0	3

Objective:

- To understand the need for computer aided process planning and its various applications
- To study various process planning approach and comput3er aided process planning system

1 INTRODUCTION **9**

The Place of Process Planning in the Manufacturing cycle - Process Planning and Production Planning – Process Planning and Concurrent Engineering, CAPP, Group Technology.

2 PART DESIGN REPRESENTATION **9**

Design Drafting - Dimensioning - Conventional tolerance - Geometric tolerance - CAD - input / output devices - topology - Geometric transformation - Perspective transformation - Data structure - Geometric modelling for process planning - GT coding - The optiz system - The MICLASS system.

3 PROCESS ENGINEERING AND PROCESS PLANNING **9**

Experienced, based planning - Decision table and decision trees - Process capability analysis - Process Planning - Variant process planning - Generative approach - Forward and Backward planning, Input format, AI.

4 COMPUTER AIDED PROCESS PLANNING SYSTEMS **9**

Logical Design of a Process Planning - Implementation considerations - manufacturing system components, production Volume, No. of production families - CAM-I, CAPP, MIPLAN, APPAS, AUTOPLAN and PRO, CPPP.

5 AN INTEGRATED PROCESS PLANNING SYSTEMS **9**

Totally integrated process planning systems - An Overview - Modulus structure - Data Structure, operation - Report Generation, Expert process planning.

Total: .45

REFERENCES:

1. Gideon Halevi and Roland D. Weill, "Principles of Process Planning", A logical approach, Chapman & Hall, 1995.

2. Tien-Chien Chang, Richard A.Wysk, "An Introduction to automated process planning systems ", Prentice Hall, 1985.

3. Chang, T.C., " An Expert Process Planning System ", Prentice Hall, 1985.

4. Nanua Singh, " Systems Approach to Computer Integrated Design and Manufacturing ", John Wiley & Sons, 1996.

5. Rao, “Computer Aided Manufacturing ", Tata McGraw Hill Publishing Co., 2000.

MEY101 FLEXIBLE COMPETITIVE MANUFACTURING SYSTEMS

L	T	P	C
3	0	0	3

Objective:

- To understand the influence of automation on competitive manufacturing systems
- To study the various technologies of automation and flexible manufacturing.

1 MANUFACTURING IN A COMPETITIVE ENVIRONMENT 10

Automation of manufacturing process - Numerical control - Adaptive control - material handling and movement - Industrial robots - Sensor technology - flexible, fixturing - Design for assembly, disassembly and service.

2 GROUP TECHNOLOGY 9

Part families - classification and coding - Production flow analysis - Machine cell design - Benefits.

3 FLEXIBLE MANUFACTURING SYSTEMS 9

Introduction - Components of FMS - Application workstations - Computer control and functions - Planning, scheduling and control of FMS - Scheduling - Knowledge based scheduling - Hierarchy of computer control - Supervisory computer.

4 COMPUTER SOFTWARE, SIMULATION AND DATABASE OF FMS 8

System issues - Types of software - specification and selection - Trends - Application of simulation - software - Manufacturing data systems - data flow - CAD/CAM considerations - Planning FMS database.

5 JUST IN TIME 9

Characteristics of JIT - Pull method - quality -small lot sizes - work station loads - close supplier ties - flexible work force - line flow strategy - preventive maintenance - Kanban system - strategic implications - implementation issues - MRD JIT - Lean manufacture

Total: 45

REFERENCES

1. Groover M.P., “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice-Hall of India Pvt. Ltd., New Delhi, 1996.

2. Jha, N.K., “Handbook of Flexible Manufacturing Systems”, Academic Press Inc., 1991.

3. Kalpakjian, “Manufacturing Engineering and Technology”, Addison-Wesley Publishing Co., 1995.

4. Taiichi Ohno, Toyota, “Production System Beyond Large-Scale production”, Productivity Press (India) Pvt.Ltd., 1992.

ME Y102 DATA COMMUNICATION IN CAD/CAM

L	T	P	C
3	0	0	3

Objective:

- To provide knowledge on the various data communication tools used to transfer data in the CAD / CAM environment.

1 DIGITAL COMPUTERS & MICRO PROCESSORS 9

Block diagram - register transfer language - arithmetic, logic and shift micro operations - instruction code - training and control instruction cycle - I/O and interrupt design of basic computer. Machine language - assembly language - assembler.

Registers ALU and Bus Systems - timing and control signals - machine cycle and timing diagram - functional block diagrams of 80 x 86 and modes of operation. Features of Pentium Processors

2 OPERATING SYSTEM & ENVIRONMENTS 9

Types - functions - UNIX & WINDOWS NT - Architecture - Graphical User Interfaces.

Compilers - Analysis of the Source program - the phases of a compiler - cousins of the compiler, the grouping of phases - compiler construction tools.

3 COMMUNICATION MODEL 9

Data communication and networking - protocols and architecture - data transmission concepts and terminology - guided transmission media - wireless transmission - data encoding - asynchronous and synchronous communication - base band interface standards RS232C, RS449 interface.

4 COMPUTER NETWORKS 9

Network structure - network architecture - the OSI reference model services - network standardization – example - Managing remote systems in network - network file systems - net working in manufacturing.

5 INTERNET 9

Internet services - Protocols - intranet information services - mail based service - system and network requirements - Internet tools - usenet - e-mail - IRC - www - FTP - Telnet.

Total: 45

REFERENCES:

1. Morris Mano. M., "Computer System Architecture", Prentice Hall of India, 1996.
2. Gaonkar R.S., "Microprocessor Architecture, Programming and Applications of 8085", Penram International, 1997
3. Peterson J.L., Galvin P. and Silberschaz, A., "Operating Systems Concepts", Addison Wesley, 1997.
4. Alfred V. Aho, Ravi Setjhi, Jeffrey D Ullman, "Compilers Principles Techniques and Tools", Addison Wesley, 1986.
5. William Stallings, "Data of Computer Communications" Prentice Hall of India, 1997.
6. Andrew S. Tanenbanum "Computer Networks", Prentice Hall of India 3rd Edition, 1996.
7. Christian Crumlish, "The ABC's of the Internet", BPB Publication, 1996.

ME Y103 INDUSTRIAL SAFETY MANAGEMENT L T P C
3 0 0 3

Objective:

- To gain exposure to various aspects of industrial safety
- To study the various safety measures to prevent accident in the industry
- To know about the safety regulations and laws followed in the industry

1 SAFETY MANAGEMENT 9

Evaluation of modern safety concepts - Safety management functions - safety organization, safety department - safety committee, safety audit - performance measurements and motivation - employee participation in safety - safety and productivity.

2 OPERATIONAL SAFETY 9

Hot metal Operation - Boiler, pressure vessels - heat treatment shop - gas furnace operation - electroplating-hot bending pipes - Safety in welding and cutting. Cold-metal Operation - Safety in Machine shop - Cold bending and chamfering of pipes - metal cutting - shot blasting, grinding, painting - power press and other machines.

3 SAFETY MEASURES 9

Layout design and material handling - Use of electricity - Management of toxic gases and chemicals - Industrial fires and prevention - Road safety - highway and urban safety - Safety of sewage disposal and cleaning - Control of environmental pollution - Managing emergencies in Industries - planning, security and risk assessments, on- site and off site. Control of major industrial hazards.

4 ACCIDENT PREVENTION 9

Human side of safety - personal protective equipment - Causes and cost of accidents. Accident prevention programmes - Specific hazard control strategies - HAZOP - Training and development of employees - First Aid- Fire fighting devices - Accident reporting, investigation.

5 SAFETY, HEALTH, WELFARE & LAWS 9

Safety and health standards - Industrial hygiene - occupational diseases prevention - Welfare facilities - History of legislations related to Safety-pressure

vessel act-Indian boiler act - The environmental protection act - Electricity act - Explosive act.

Total: 45

REFERENCES:

1. John V. Grimaldi and Rollin H. Simonds, "Safety Management", All India Travelers bookseller, New Delhi-1989.
2. Krishnan N.V., "Safety in Industry", Jaico Publisher House, 1996.
3. Occupational Safety Manual BHEL.
4. Industrial safety and the law by P.M.C. Nair Publisher's, Trivandrum.
5. Managing emergencies in industries, Loss Prevention of India Ltd., Proceedings,1999.
6. Singh, U.K. and Dewan, J.M., "Safety, Security and risk management", APH Publishing Company, New Delhi, 1996.

MEY104 PERFORMANCE MODELING AND ANALYSIS OF MANUFACTURING SYSTEM

L	T	P	C
3	0	0	3

Objective:

- To understand the various manufacturing system and control and different stochastic process for manufacturing
- To study apply optimization techniques for manufacturing systems

1 MANUFACTURING SYSTEMS & CONTROL **9**

Automated Manufacturing Systems - Modelling - Role of performance modelling - 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 networks - Factory net works - Open systems interconnection model - Net work to network interconnections - Manufacturing automation protocol - Database management system.

2 MANUFACTURING PROCESSES **9**

Examples of stochastic 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.

3 QUEUING MODELS **9**

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.

4 QUEUING NETWORKS **9**

Examples of QN models in manufacturing - Little's law in queuing networks - Tandem queue - An open queuing network with feed back - An open central server model for FMS - Closed transfer line - Closed server model - Garden Newell networks.

5 PETRI NETS **9**

Classical Petri Nets - Definitions - Transition firing and reachability - Representational power - properties - Manufacturing models. Stochastic Petri Nets - Exponential timed Petri Nets - Generalized Stochastic Petri Nets - modelling of KANBAN systems - Manufacturing models.

Total: 45

REFERENCES:

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

ME Y105 RAPID PROTOTYPING AND TOOLING L T P C
3 0 0 3

Objective:

- To understand the need and development of Rapid Prototyping
- To learn about the various Rapid Prototyping systems
- To learn the different technologies involved in the rapid prototyping

1 INTRODUCTION 8

Need - Development of RP systems – RP process chain - Impact of Rapid Prototyping on Product Development –Digital prototyping - Virtual prototyping- Rapid Tooling - Benefits- Applications.

2 REVERSE ENGINEERING AND CAD MODELING 10

Basic concept- Digitization techniques – Model Reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data Requirements – geometric modeling techniques: Wire frame, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing and contour data organization, direct and adaptive slicing, Tool path generation.

3 LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS 10

Stereolithography (SLA): Apparatus: Principle, per-build process, part-building, post-build processes, photo polymerization of SL resins, part quality and process planning, recoating issues, materials, advantages, limitations and applications.

Solid Ground Curing (SGC): working principle, process, strengths, weaknesses and applications.Fused deposition Modeling (FDM): Principle, details of processes, process variables, types, products, materials and applications. laminated object manufacturing(LOM): Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies.

4 POWDER BASED RAPID PROTOTYPING SYSTEMS 10

Selective Laser Sintering(SLS): Principle, process, Indirect and direct SLS-powder structures, modeling of SLS, materials, post processing, post curing, surface deviation and accuracy, Applications. Laser Engineered Net

Shaping(LENS): Processes, materials, products, advantages, limitations and applications– Case Studies.

5 OTHER RAPID PROTOTYPING TECHNOLOGIES 7

Three dimensional Printing (3DP):Principle, basic process, Physics of 3DP, types of printing, process capabilities, material system. Solid based, Liquid based and powder based 3DP systems, strength and weakness, Applications and case studies. Shape Deposition Manufacturing (SDM): Introduction, basic process, shape decomposition, mold SDM and applications. Selective Laser Melting, Electron Beam Melting – Rapid manufacturing.

TOTAL:45

REFERENCES:

1. Chua C.K., Leong K.F., and Lim C.S., Rapid prototyping: Principles and applications, second edition, World Scientific Publishers, 2003.
2. Andreas Gebhardt, Hanser Gardener, Rapid prototyping, Publications, 2003.
3. Liou W.Liou, Frank W.Liou, Rapid Prototyping and Engineering applications : A tool box for prototype development, CRC Press, 2007.
4. Ali K. Kamrani, Emad Abouel Nasr, Rapid Prototyping: Theory and practice, Springer, 2006.
5. Peter D.Hilton, Hilton/Jacobs, Paul F.Jacobs,Rapid Tooling: Technologies and Industrial Applications, CRC press, 2000.

ME Y058 TOTAL QUALITY SYSTEM AND MANAGEMENT

L	T	P	C
3	0	0	3

Objective:

- To study the concepts and techniques of TQM
- To understand the concepts of statistical quality control and sampling

1 INTRODUCTION **9**

Need for TQM, evolution of quality, Definition of quality, TQM philosophy – CONTRIBUTIONS OF Deming Juran, Crosby and Ishikawa, TQM models.

2 PLANNING **9**

Vision, Mission, Quality policy and objective Planning and Organization for quality, Quality policy Deployment, Quality function deployment, introduction to BPR and analysis of Quality Costs.

3 TQM PRINCIPLES **9**

Customer focus, Leadership and Top management commitment, Employee involvement – Empowerment and Team work, Supplier Quality Management, Continuous process improvement, Training, performance Measurement and customer satisfaction.

4 TQM TOOLS AND TECHNIQUES **9**

PDSA, The Seven Tools of Quality, New Seven management tools, Concept of six sigma, FMEA, Bench Marking, JIT, POKA YOKE, 5S, KAIZEN, Quality circles.

5 QUALITY SYSTEMS **9**

Need for ISO 9000 Systems, clauses Documentation, Implementation, Introduction to ISO14000 and OSHAS18000, Implementation of TQM, Case Studies.

TOTAL: 45

REFERENCES:

1. Dale H.Besterfiled, “Total Quality Management”, Pearson Education Asia, (Indian reprint 2002)
2. Oakland.J.S. “Total Quality Management”, Butterworth–Hcinemann Ltd., Oxford, 1989.

3. Narayana V. and Sreenivasan, N.S., “Quality Management – Concepts and Tasks”, New Age International 1996.

4. Zeiri. “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

5. Juran J.M and Frank M.Gryna Jr., “Quality Planning and Analysis”, TMH, India, 1982.

6. Brain Rethery, ISO 9000, Productivity and Quality Publishing Pvt.Ltd., 1993.

7. Mills. D, Quality Auditing, Chapman and Hall, 1993.

ME Y106	RELIABILITY AND TOTAL PRODUCTIVE MAINTENANCE	L	T	P	C
		3	0	0	3

Objective:

- To understand the concept of reliability, its assessment and improvement
- To study about the maintenance models, logistics and its influence on Quality

1 RELIABILITY CONCEPT AND FAILURE DATA ANALYSIS 11

Reliability definition – Quality and Reliability– Reliability mathematics – Reliability functions – Hazard rate – Measures of Reliability – Design life –A priori and posteriori probabilities – Mortality of a component –Bath tub curve – Useful life. Failure Data Analysis-Data collection –Empirical methods: Ungrouped/Grouped, Complete/Censored data – Time to failure distributions: Exponential, Weibull – Hazard plotting – Goodness of fit tests.

2 RELIABILITY ASSESSMENT AND MONITORING 9

Different configurations – Redundancy – m/n system – Complex systems: RBD – Baye's method – Cut and tie sets – Fault Tree Analysis – Standby system. Reliability Monitoring-Life testing methods: Failure terminated – Time terminated – Sequential Testing –Reliability growth monitoring – Reliability allocation – Software reliability.

3 RELIABILITY IMPROVEMENT 6

Analysis of downtime – Repair time distribution – System MTTR – Maintainability prediction – Measures of maintainability – System Availability – Replacement theory.

4 MAINTENANCE MODELS 10

Maintenance definition – Maintenance objectives – Maintenance management –Functions of maintenance department – Tero technology – Maintenance costs. Maintenance policies – Imperfect maintenance – PM versus b/d maintenance – Optimal PM schedule and product characteristics – Inspection decisions: Maximizing profit – Minimizing downtime – Replacement models.

5 MAINTENANCE LOGISTICS, QUALITY AND TPM 11

Maintenance staffing – Human factors –Resource requirements: Optimal size of service facility – Optimal repair effort – Maintenance planning and scheduling – Spares planning – Capital spare. Five Zero concept –FMECA – Maintainability prediction– Design for maintainability – Maintainability allocation – Reliability

Centered Maintenance. TPM fundamentals – Chronic and sporadic losses – Six big losses – OEE as a measure – TPM pillars– Autonomous maintenance –TPM implementation.

TOTAL: 45

REFERENCES:

1. Charles E. Ebeling, “An introduction to Reliability and Maintainability engineering”, TMH, 2000.
2. Roy Billington and Ronald N. Allan, “Reliability Evaluation of Engineering Systems”, Springer, 2007.
3. Andrew K.S.Jardine & Albert H.C.Tsang, “Maintenance, Replacement and Reliability”, Taylor and Francis, 2006.
4. Bikas Badhury & S.K.Basu, “Tero Technology: Reliability Engineering and Maintenance Management”, Asian Books, 2003.
5. Seichi Nakajima, “Total Productive Maintenance”, Productivity Press, 1993.

ME Y013 COMPUTATIONAL FLUID DYNAMICS L T P C
3 0 0 3

Objective:

- To gain an overview of CFD and the use of commercial CFD codes to analyze flow and heat transfer in problems of practical engineering interest.

1 GOVERNING DIFFERENTIAL EQUATION AND FINITE DIFFERENCE METHOD 10

Classification, Initial and Boundary conditions – Initial and Boundary Value problems – Finite difference method, Central, Forward, Backward difference, Uniform and non-uniform Grids, Numerical Errors, Grid Independence Test.

2 CONDUCTION HEAT TRANSFER 10

Steady one-dimensional conduction, Two and three dimensional steady state problems, Transient one-dimensional problem, Two-dimensional Transient Problems.

3 INCOMPRESSIBLE FLUID FLOW 10

Governing Equations, Stream Function – Verticity method, Determination of pressure for viscous flow, SIMPLE Procedure of Patankar and Spalding, Computation of Boundary layer flow, finite difference approach.

4 CONVECTION HEAT TRANSFER AND FEM 10

Steady One-Dimensional and Two-Dimensional Convection – diffusion, Unsteady one-dimensional convection – diffusion, Unsteady two-dimensional convection – Diffusion – Introduction to finite element method – solution of steady heat conduction by FEM – Incompressible flow – simulation by FEM.

5 TURBULENCE MODELS 5

Algebraic Models – One equation model, K – ? Models, Standard and High and Low Reynolds number models, Prediction of fluid flow and heat transfer using standard codes.

Total: 45

REFERENCES:

1. Muralidhar, K., and Sundararajan, T., “Computational Fluid Flow and Heat Transfer”, Narosa Publishing House, New Delhi, 1995.

2. Ghoshdasdidar, P.S., "Computer Simulation of flow and heat transfer" Tata McGraw-Hill Publishing Company Ltd., 1998.

3. Subas, V.Patankar "Numerical heat transfer fluid flow", Hemisphere Publishing Corporation, 1980.

4. Taylor, C and Hughes, J.B. "Finite Element Programming of the Navier-Stokes Equation", Pineridge Press Limited, U.K., 1981.

5. Anderson, D.A., Tannehill, J.I., and Pletcher, R.H., "Computational fluid Mechanics and Heat Transfer " Hemisphere Publishing Corporation, New York, USA,1984.

6. Fletcher, C.A.J. "Computational Techniques for Fluid Dynamics 1" Fundamental and General Techniques, Springer – Verlag, 1987.

7. Fletcher, C.A.J. "Computational Techniques for fluid Dynamics 2" Specific Techniques for Different Flow Categories, Springer – Verlag, 1987.Bose, T.X., "Numerical Fluid Dynamics" Narosa Publishing House, 1997.

ME Y051 PRECISION ENGINEERING & NANO TECHNOLOGY

L	T	P	C
3	0	0	3

Objective:

- To study about the materials, machining elements and processes of Precision Engineering
- To study about nano materials their synthesis, characterization and applications

1 MATERIALS FOR PRECISION ENGINEERING 8

Introduction – Accuracy and Precision– Need for high precision – concept of accuracy – tolerance an fits: system – Hole and shaft system – expects accuracy of a Manufacturing process – types of fits – Selective assembly. Materials-Diamond – types-single crystal- PCD – Natural-synthetic CBN - Ceramics – coated metals and non-metals–High– performance polymer – alloys – refractory metals: cutting tools – performance – components of instruments – Jewels – self Lubrication – smart materials – properties – testing – applications.

2 PRECISION MACHINING AND ERRORS 12

Precision grinding: IC chip manufacturing- ELID process – aspherical surface generation Grinding wheel- Designer and selection of grinding wheel-High-speed grinding-High-speed milling-Micro machining – Diamond turning-MEMS – micro finishing process – surface roughness measures – concept and non-concept method – comparison of features with machining process. Static stiffness - influence on machining accuracy. Introduction – over all stiffness in a machine/instrument – errors due to variation of cutting forces – clamping forces – errors due to compliance while machining. Inaccuracy due to thermal effects: Heat sources –war dissipation – Geometry of thermal deformation-influence of forced isstratics dimensional wear of elements – instruments; Machining tools their influence an accuracyerror due to clamping and setting location.

3 PRECISION MACHINE ELEMENTS: 06

Introduction- guide ways- Drive systems; rolling element bearings-Principles, construction, classification, application etc., -Lubricated sliding bearings-construction – Principles etc.,- Hydrostatics bearings-types – aerostatic bearings – linear drive motors – magnetic bearingsapplications- limitations - advantages.

4 NANOMATERIALS AND SYNTHESIS 12

Amorphous, crystalline, microcrystalline, quasi-crystalline and nano-crystalline materials. Historical development of nanomaterials – Issues in fabrication and characterization of nanomaterials Methods of production of Nanoparticles, Sol-gel synthesis, Inert gas condensation, High energy Ball milling, Plasma synthesis, Electro deposition and other techniques. Synthesis of Carbon Nanotubes – Solid carbon source based production techniques, Gaseous carbon source based production techniques - Growth mechanisms Nano wires.

5 CHARACTERISATION AND APPLICATIONS OF NANOMATERIALS 07

Scanning Probe Microscopy (SPM) – Scanning tunneling microscope, Transmission electron microscope, Scanning transmission electron microscope, Atomic force microscope, , Dynamic force microscopy, , Scanning thermal microscopy, Peizo force microscopy, scanning capacitance microscopy, Nano indentation. Applications in Mechanical, Electronics engineering industries – Use of nanomaterials in automobiles, aerospace, defense and medical applications – Metallic, polymeric, organic and ceramic nanomaterials. Molecular manufacturing techniques – Nano machining techniques –, Top/Bottom up Nano fabrication techniques.

Total periods: 45

REFERENCES:

1. Murthy R.L., Precision Engineering in Manufacturing, New age Instruction Publishes 2005. New Delhi.
2. Venkatesh V.C. and Sudin, Izwan, Precision engineering:- Tata McGraw Hill Co., New Delhi, 2007.
3. Bandyopadhyay A.K., " Nano Materials", New Age International Publishers, New Delhi, 2007
4. Bharat Bhushan, "Handbook of Nanotechnology", Springer, Germany, 2004.
5. JAMESD, MEADOWS, - "Geometric Dimensioning and tolerancing", Marcel Dekker Inc.1995.
6. Mark Ratner and Daniel Ratner, "Nano Technology", Pearson Education, New Delhi, 2003.
7. Gregory Timp, "Nanotechnology", Springer, India, 2005
8. Ahmed Busnaina, "Nanomanufacturing Handbook", CRC Press, London, 2006

ME Y107 OPTIMIZATION TECHNIQUES IN DESIGN

L	T	P	C
3	0	0	3

Objective:

- To study about the basic concept of optimization and various optimization techniques and their applications in design engineering.

1 INTRODUCTION **5**

General Characteristics of mechanical elements, adequate and optimum design, principles of optimization, formulation of objective function, design constraints – Classification of optimization problem.

2 OPTIMIZATION TECHNIQUES **10**

Single variable and multivariable optimization, Techniques of unconstrained minimization – Golden section, Random, pattern and gradient search methods – Interpolation methods; Optimization with equality and inequality constraints.

3 MULTI OBJECTIVE OPTIMIZATION **10**

Direct methods – Indirect methods using penalty functions, Lagrange multipliers; Geometric programming and stochastic programming; Multi objective optimization, Genetic algorithms and Simulated Annealing techniques.

4 STATIC APPLICATIONS **10**

Structural applications – Design of simple truss members. Design applications – Design of simple axial, transverse loaded members for minimum cost, maximum weight – Design of shafts and torsionally loaded members – Design of springs.

5 DYNAMIC APPLICATIONS **10**

Dynamic Applications – Optimum design of single, two degree of freedom systems, vibration absorbers. Application in Mechanisms – Optimum design of simple linkage mechanisms.

Total : 45

REFERENCES:

1. Johnson Ray, C., “Optimum design of mechanical elements”, Wiley, John & Sons, 1990.
2. Goldberg, D.E., “Genetic algorithms in search, optimization and machine”, Barnen, Addison-Wesley, New York, 1989.
3. Kalyanamoy Deb, “Optimization for Engineering design algorithms and Examples”, Prentice Hall of India Pvt. 1995.

ME Y108 ADVANCED MECHANISMS DESIGN AND SIMULATION **L T P C**
3 0 0 3

Objective:

- To understand the kinematic analysis of mechanisms and theories involved
- To understand the synthesis of various mechanisms

1 INTRODUCTION **9**

Review of fundamentals of kinematics-classifications of mechanisms-components of mechanisms – mobility analysis – formation of one D.O.F. multi loop kinematic chains, Network formula – Gross motion concepts-Basic kinematic structures of serial and parallel robot manipulators-Compliant mechanisms-Equivalent mechanisms.

2 KINEMATIC ANALYSIS **9**

Position Analysis – Vector loop equations for four bar, slider crank, inverted slider crank, geared five bar and six bar linkages. Analytical methods for velocity and acceleration Analysis– four bar linkage jerk analysis. Plane complex mechanisms-auxiliary point method. Spatial RSSR mechanism-Denavit-Hartenberg Parameters – Forward and inverse kinematics of robot manipulators.

3 PATH CURVATURE THEORY, COUPLER CURVE **9**

Fixed and moving centrodes, inflection points and inflection circle. Euler Savary equation, graphical constructions – cubic of stationary curvature. Four bar coupler curve-cusp-crunode-coupler driven six-bar mechanisms-straight line mechanisms

4 SYNTHESIS OF FOUR BAR MECHANISMS **9**

Type synthesis – Number synthesis – Associated Linkage Concept. Dimensional synthesis – function generation, path generation, motion generation. Graphical methods-Pole technique-inversion technique-point position reduction-two, three and four position synthesis of four- bar mechanisms. Analytical methods- Freudenstein's Equation-Bloch's Synthesis.

5 SYNTHESIS OF COUPLER CURVE BASED MECHANISMS & CAM MECHANISMS **9**

Cognate Lingages-parallel motion Linkages. Design of six bar mechanisms-single dwell-double dwell-double stroke. Geared five bar mechanism-multi-

dwell. Cam Mechanisms- determination of optimum size of cams. Mechanism defects. Study and use of Mechanism using Simulation Soft-ware packages. Students should design and fabricate a mechanism model as term project.

Total 45 Hrs

REFERENCES:

1. Robert L.Norton., “Design of Machinery”, Tata McGraw Hill, 2005.
2. Sandor G.N., and Erdman A.G., “Advanced Mechanism Design Analysis and Synthesis”, Prentice Hall, 1984.
3. Uicker, J.J., Pennock, G. R. and Shigley, J.E., “Theory of Machines and Mechanisms”, Oxford University Press, 2005.
4. Amitabha Ghosh and Asok Kumar Mallik, “Theory of Mechanism and Machines”, EWLP, Delhi, 1999.
5. Kenneth J, Waldron, Gary L. Kinzel, “Kinematics, Dynamics and Design of Machinery”, John Wiley-sons, 1999.
6. Ramamurti, V., “Mechanics of Machines”, Narosa, 2005.

ME 602 ADVANCED STRENGTH OF MATERIALS L T P C
3 0 0 3

Objective:

- To gain knowledge in the advanced theories of elasticity
- To apply the principles in the advanced complicated loading conditions and intricate components

1 ELASTICITY 9

Stress-Strain relations and general equations of elasticity in Cartesian, Polar and curvilinear coordinates, differential equations of equilibrium-compatibility-boundary conditions-representation of three-dimensional stress of a tension generalized hook's law - St. Venant's principle - plane stress - Airy's stress function. Energy methods.

2 SHEAR CENTER AND UNSYMMETRICAL BENDING 10

Location of shear center for various thin sections - shear flows. Stresses And deflections in beams subjected to unsymmetrical loading-kern of a section.

3 CURVED FLEXIBLE MEMBERS AND STRESSES IN FLAT PLATES 10

Circumference and radial stresses – deflections - curved beam with restrained ends - closed ring subjected to concentrated load and uniform load - chain links and crane hooks. Solution of rectangular plates – pure bending of plates – deflection – uniformly distributed load – various end conditions

4 TORSION OF NON-CIRCULAR SECTIONS 7

Torsion of rectangular cross section - St.Venants theory - elastic membrane analogy - Prandtl's stress function - torsional stress in hollow thin walled Stress

5 STRESSES IN ROTARY SECTIONS AND CONTACT STRESSES 9

Radial and tangential stresses in solid disc and ring of uniform thickness and varying thickness allowable speeds. Methods of computing contact stress-deflection of bodies in point and line contact applications.

Total: 45

REFERENCES:

1. Arthur P Boresi, Richard J. Schmidt, “Advanced mechanics of materials”,John Wiley, 2002.

2. Timoshenko and Goodier, “Theory of Elasticity”, McGraw Hill.

3. Robert D. Cook, Warren C. Young, “Advanced Mechanics of Materials”, Mc millan pub. Co., 1985.

4. Srinath. L.S., “Advanced Mechanics of solids”, Tata McGraw Hill, 1992.

5. Ryder G.H, “Strength of Materials Macmillan”, India Ltd, 2007

ME Y112 DESIGN OF MATERIAL HANDLING EQUIPMENTS

L	T	P	C
3	0	0	3

Objective:

To gain knowledge on various material handling equipments and their design

1 MATERIALS HANDLING EQUIPMENT 5

Types, selection and applications

2 DESIGN OF HOISTS 10

Design of hoisting elements: Welded and roller chains - Hemp and wire ropes - Design of ropes, pulleys, pulley systems, sprockets and drums, Load handling attachments. Design of forged hooks and eye hooks – crane grabs - lifting magnets - Grabbing attachments - Design of arresting gear - Brakes: shoe, band and cone types.

3 DRIVES OF HOISTING GEAR 10

Hand and power drives - Traveling gear - Rail traveling mechanism - cantilever and monorail cranes - slewing, jib and luffing gear - cogwheel drive - selecting the motor ratings.

4 CONVEYORS 10

Types - description - design and applications of Belt conveyors, apron conveyors and escalators Pneumatic conveyors, Screw conveyors and vibratory conveyors.

5 ELEVATORS 10

Bucket elevators: design - loading and bucket arrangements - Cage elevators - shaft way, guides, counter weights, hoisting machine, safety devices - Design of fork lift trucks.

Total: 45

REFERENCES:

1. Rudenko, N., Materials handling equipment, ELnvee Publishers, 1970.
2. Spivakovsy, A.O. and Dyachkov, V.K., Conveying Machines, Volumes I and II, MIR Publishers, 1985.

3. Alexandrov, M., Materials Handling Equipments, MIR Publishers, 1981.

4. Boltzharol, A., Materials Handling Handbook, The Ronald Press Company, 1958.

5. P.S.G. Tech., "Design Data Book", Kalaikathir Achchagam, Coimbatore, 2003.

6. Lingaiah. K. and Narayana Iyengar, "Machine Design Data Hand Book", Vol.1 & 2, Suma Publishers, Bangalore, 1983