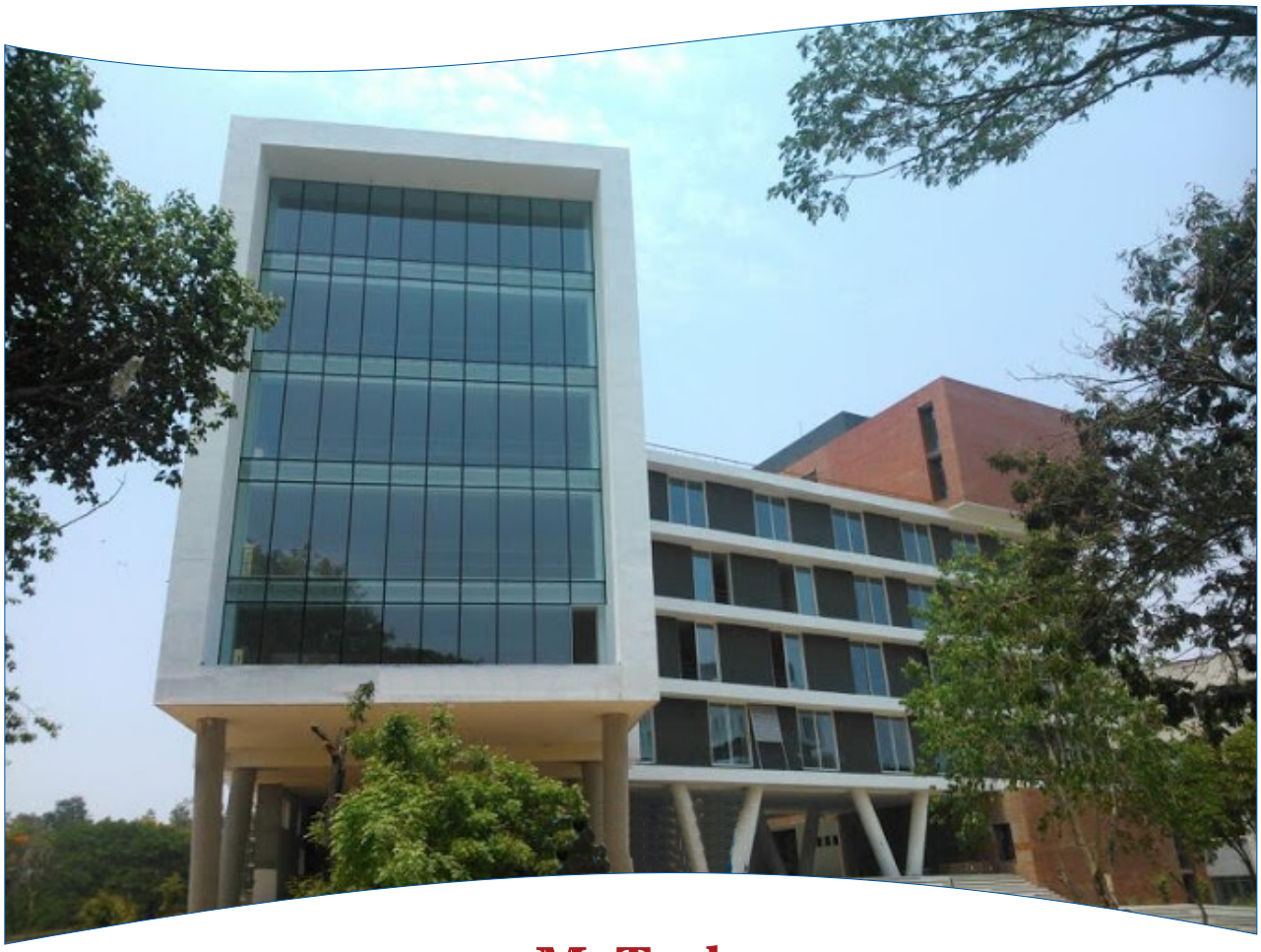
CURRICULUM AND SYLLABI

REGULATIONS - 2016

(As approved by the 9th Academic Council)



M. Tech.

CAD - CAM

B.S.ABDUR RAHMAN UNIVERSITY

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)
Rated with A Grade by National Assessment and Accreditation Council
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048
www.bsauniv.ac.in

REGULATIONS, CURRICULUM AND SYLLABI

M. Tech.

CAD – CAM

(As approved by the 9th Academic Council)

JULY 2016

B.S.ABDUR RAHMAN
UNIVERSITY
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UNIVERSITY VISION AND MISSION

VISION

B.S. Abdur Rahman Institute of Science and Technology aspires to be a leader in Education, Training and Research in Engineering, Science, Technology and Management and to play a vital role in the Socio-Economic progress of the Country.

MISSION

- To blossom into an internationally renowned University
- To empower the youth through quality education and to provide professional leadership
- To achieve excellence in all its endeavors to face global challenges
- To provide excellent teaching and research ambience
- To network with global institutions of Excellence, Business, Industry and Research Organizations
- To contribute to the knowledge base through Scientific enquiry, Applied research and Innovation

VISION AND MISSION OF THE DEPARTMENT OF MECHANICAL ENGINEERING

VISION

To excel in providing quality education and training through Undergraduate and Postgraduate programmes and carryout quality research in the field of Mechanical Engineering.

MISSION

- To provide a good learning experience through appropriate design of curriculum and syllabi that facilitates students to gain thorough understanding of the fundamental concepts and applications in Mechanical Engineering
- To equip students to solve challenging problems in Mechanical Engineering and related areas taking in to account their impact on the society
- To facilitate students to develop good communication, leadership and managerial skills through team approach in conducting experiments and projects
- To pursue academic and collaborative research activities with industry and other research institutions ensuring high quality in publications and other research outputs

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

M. Tech. (CAD – CAM)

PROGRAMME EDUCATIONAL OBJECTIVES

- To provide a holistic approach in learning through well designed courses involving fundamental concepts and state-of-the-art techniques in the field of CAD – CAM
- To equip the graduates, with knowledge and skill to undertake design, analysis, evaluation of systems, processes and components
- To supplement course work through seminars, workshops, case studies and through paper presentation
- To inculcate research culture by way of solving typical problems, Project works from real life situation and innovative assignments
- To develop team spirit, problem solving skill and appreciation for ethical and social relevance of the technologies used

PROGRAMME OUTCOMES

On completion of programme, the graduates will

- have sound conceptual knowledge and skill in the area of design and manufacturing
- be able to design, analyse and manufacture real life systems and components
- have capability to use latest software in the area of computer aided engineering for modelling, analysis and manufacture
- be able to undertake academic and applied research and address open ended problems
- have the ability to discharge professional, social & economic responsibilities ethically

REGULATIONS – 2016
FOR
M. Tech. / MCA / M.Sc. DEGREE PROGRAMMES

1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires

i. **"Programme"** means a 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, which is the apex body on all academic matters of this University

vi. **"Dean (Academic Affairs)"** means Dean (Academic Affairs) of B.S. Abdur Rahman University, who administers the academic matters.

vii. **"Dean (P.G. Studies)"** means Dean (P.G. Studies) of B.S. Abdur Rahman University who administers all P.G Programmes of the University in coordination with Dean (Academic Affairs)

viii. **"Dean (Student Affairs)"** means Dean (Student Affairs) of B.S. Abdur Rahman University, who looks after the welfare and discipline of the students.

ix. **"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. /M.C.A. / M.Sc.	Full Time & Part Time – Day / Evening / Weekends

2.2 Modes of Study

2.2.1 Full-time

Students 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 Dean (Academic Affairs) through the Head of the Department. 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

In this mode of study, the students are required to attend classes for the courses in the time slots selected by them, during the daytime (or) evenings (or) weekends.

2.3 Admission Requirements

2.3.1 Students for admission to the first semester of the Master's Degree Programme shall be required to have passed the appropriate degree examination of this University as specified in the Table shown for eligible entry qualifications for admission to P.G. programmes or any other degree examination of any University or authority accepted by this University as equivalent thereto.

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

2.3.3 All part-time students should satisfy other conditions regarding experience, sponsorship etc., which may be prescribed by this Institution from time to time.

2.3.4 Student eligible for admission to M.C.A under lateral entry scheme shall be required to have passed three year degree in B.Sc (Computer Science) / B.C.A / B.Sc (Information Technology)

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.C.A. (Part Time)	9	18
M.C.A. (Full Time) – (Lateral Entry)	4	8
M.C.A. (Part Time) – (Lateral Entry)	6	12
M.Sc. (Full Time)	4	8
M. Sc. (Part Time)	6	12

3.2 The PG. programmes consist of the following components as prescribed in the respective curriculum

i. Core courses
ii. General Elective courses
iii. Professional Elective courses
iv. Project work / thesis / dissertation
v. Laboratory Courses
vi. Case studies
vii. Seminars
viii. Mini Project
ix. Industrial Internship

3.3 The curriculum and syllabi of all PG. programmes shall be approved by the Academic Council of this University.

3.4 The minimum 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 80 working days. Semester-end examinations will follow immediately after the last working day.

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)	
02	Mechanical Engineering	M. Tech. (Manufacturing Engineering)	B.E. / B. Tech. (Mechanical / Auto / Manufacturing / Production / Industrial / Mechatronics / Metallurgy / Aerospace /Aeronautical / Material Science / Marine Engineering)
		M. Tech. (CAD/CAM)	
03	Polymer Engineering	M. Tech. (Polymer Technology)	B. E. / B. Tech. Mechanical / 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)	B.E / B.Tech (EEE/ ECE / E&I / I&C / Electronics / Instrumentation)
		M. Tech. (VLSI and Embedded Systems)	B.E. / B. Tech. (ECE / Electronics / E&I / I&C / EEE)
06	ECE Department jointly with Physics Dept.	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)

Sl. No.	Name of the Department	P.G. Programmes offered	Qualifications for admission
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
		M. Tech. (Network Security)	B.E. / B. Tech. (CSE / IT / ECE / EEE / EIE / ICE / Electronics / MCA)
		M. Tech. (Computer Science and Engineering with specialization in Big Data Analytics)	B.E. / B. Tech. (CSE / IT / ECE / EEE / EIE / ICE / Electronics / MCA)
09	Information Technology	M. Tech. (Information Technology)	B.E / B. Tech. (IT / CSE / ECE / EEE / EIE / ICE / Electronics) MCA
		M. Tech. (Information Security & Digital Forensics)	B.E / B. Tech. (IT / CSE / ECE / EEE / EIE / ICE / Electronics) MCA
10	Computer Applications	M.C.A.	Bachelor Degree in any discipline with Mathematics as one of the subjects (or) Mathematics at +2 level
		M.C.A. – (Lateral Entry)	B.Sc Computer Science / B.Sc Information Technology / B.C.A
		M. Tech. (Systems Engineering and Operations Research)	BE / B. Tech. (Any Branch) or M.Sc., (Maths / Physics / Statistics / CS / IT / SE) or M.C.A.
		M. Tech. (Data & Storage Management	BE / B. Tech. (Any Branch) or M.Sc., (Maths / Physics / Statistics / CS / IT / SE) or M.C.A.
11	Mathematics	M.Sc. (Actuarial Science)	Any Degree with Mathematics / Statistics as one of the subjects of study.
		M.Sc. Mathematics	B.Sc. (Mathematics)
12	Physics	M.Sc.(Physics)	B.Sc.(Physics / Applied Science / Electronics / Electronics Science / Electronics & Instrumentation)
		M.Sc. (Material Science)	B.Sc.(Physics / Applied Science / Electronics / Electronics

Sl. No.	Name of the Department	P.G. Programmes offered	Qualifications for admission
			Science / Electronics & Instrumentation)
13	Chemistry	M.Sc.(Chemistry)	B.Sc (Chemistry / Applied Science)
14	Life Sciences	M.Sc. Molecular Biology & Biochemistry	B.Sc. in any branch of Life Sciences
		M.Sc. Genetics	B.Sc. in any branch of Life Sciences
		M.Sc. Biotechnology	B.Sc. in any branch of Life Sciences
		M.Sc. Microbiology	B.Sc. in any branch of Life Sciences
		M.Sc. Bioscience	B.Sc. in any branch of Life Sciences
		M. Tech. Biotechnology	B. Tech. (Biotechnology / Chemical Engineering) / M.Sc. in any branch of Life Sciences

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

Programme	Minimum prescribed credits
M. Tech.	73
M.C.A.	120
M.Sc.	72

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 (or) 15 periods per semester
- One credit for one tutorial period per week
- One credit each for seminar/practical session/project of two or three periods per week
- One credit for two weeks of industrial internship
- One credit for 15 periods of lecture (can even be spread over a short span of time)

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

P.G. Programme	Full Time		Part Time	
	Non-project Semester	Project semester	Non-project Semester	Project semester
M. Tech.	9 to 28	12 to 28	6 to 12	12 to 28
M.C.A.	9 to 29	12 to 29	6 to 12	12 to 29
M.Sc.	9 to 25	12 to 20	6 to 12	12 to 20

3.9 The student may choose a course prescribed in the curriculum from any department depending on his / her convenient time slot. All attendance will be maintained course-wise only.

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

3.11 A student may be permitted by the Head of the Department to choose electives from other PG programmes either within the Department or from other Departments up to a maximum of nine credits during the period of his/her study, with the approval of the Head of the Departments offering such courses.

3.12 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 student 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 Chairman, Academic Council 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.

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

3.14 Industrial internship, if specified in the curriculum shall be of not less than two weeks duration and shall be organized by the Head of the Department.

3.15 Project Work / Thesis / Dissertation

3.15.1 Project work / Thesis / Dissertation shall be carried out under the supervision of a Faculty member in the concerned Department.

3.15.2 A student may however, in certain cases, be permitted to work for the project in an Industrial/Research Organization, on the recommendation of the Head of the Department. In such cases, the project work shall be jointly supervised by a faculty of the Department and an Engineer / Scientist from

the organization and the student shall be instructed to meet the faculty periodically and to attend the review committee meetings for evaluating the progress.

3.15.3 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.

3.15.4 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 concerned department.

3.15.5 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.

3.15.6 If a student 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.

4.0 CLASS ADVISOR AND FACULTY ADVISOR

4.1 Class Advisor

A faculty member will be nominated by the HOD as Class Advisor for the whole class.

He / she is responsible for maintaining the academic, curricular and co-curricular records of all students throughout their period of study.

4.2 Faculty Advisor

To help the students in planning their courses of study and for general counseling on the academic programme, the Head of the Department of the students will attach a certain number of students to a faculty member of the department who shall function as Faculty Advisor for the students throughout their period of study. Such Faculty Advisor shall offer advice to the students on academic and personal matters and guide the students in taking up courses for registration and enrolment every semester.

5.0 CLASS COMMITTEE

5.1 Every class of the PG 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. Minimum two students of the class, nominated by the Head of the Department.

iv. Class Advisor / Faculty Advisor of the class - Ex-Officio Member

v. Professor in-charge of the PG 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 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 Dean (Academic Affairs). The class committee, **without the student members,** will also be responsible for finalization of the semester results and award of grades.

5.4 The Class Committee is required to meet at least thrice in a semester, first within a week of the commencement of the semester, second, after the first assessment and the third, after the semester-end examination to finalize the grades.

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 / Dean (Academic Affairs) 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 for the courses within one week from the commencement of the semester

7.2 For the subsequent semesters registration for the courses will be done by the student one week before the last working day 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 Advisor for the choice of courses. The Registration form shall be filled in and signed by the student and the Faculty Advisor.

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

7.4 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 Advisor. 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 (Academic Affairs), on the recommendation of the HOD, is permitted.

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

7.8 A student undergoing a full time PG Programme should have enrolled for all preceding semesters before registering for a particular semester

7.9 A student undergoing the P.G. programme in Part Time mode can choose not to register for any course in a particular semester with written approval from the head of the department. However the total duration for the completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 3.1)

8.0 TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

A student may be permitted by the Dean (Academic Affairs) to avail temporary break of study from the programme up to a maximum of two semesters for reasons of ill health or other valid grounds. Such student has to rejoin only in the same semester from where he left. However the total duration for completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 3.1).

9.0 MINIMUM REQUIREMENTS TO REGISTER FOR PROJECT / THESIS / DISSERTATION

9.1 A student 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 enroll for project semester
M. Tech. (Full time / Part time)	18
M.C.A. (Full time / Part time)	45
M.C.A. (Full time / Part time) – (Lateral Entry)	22
M.Sc.(Full time / Part time)	18

9.2 If the student has not earned 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 semester.

10.0 DISCIPLINE

10.1 Every student is required to observe discipline and decorous behavior 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 student reported to the Head of the Institution will be referred to a Discipline and Welfare Committee for taking appropriate action.

11.0 ATTENDANCE

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

11.2 Ideally every student is expected to attend all classes and earn 100% attendance in the contact periods of every course, subject to 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 semester-end examination in that course, failing which the student shall be awarded "I" grade in that course. If the course is a core course, the student should register for and repeat the course when it is offered next. If the course is an elective, either he/she can register and repeat the same elective or can register for a new elective.

11.3 The students of Full Time mode of study, who have not attended a single hour in all courses in a semester and awarded ‘I’ grade are not permitted to

write the examination and also not permitted move to next higher semester. Such students should repeat all the courses of the semester in the next Academic year.

12.0 SUMMER TERM COURSES

12.1 Summer term courses may be offered by a department on the recommendation of the Departmental Consultative Committee and approved by the Dean (Academic Affairs). No student should register for more than three courses during a summer term.

12.2 Summer term courses will be announced by the Head of the department 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.

12.3 The number of contact hours and the assessment procedure for any course during summer term will be the same as those during regular semesters.

Students with U grades will have the option either to write semester end arrears exam or to redo the courses during summer / regular semesters, if they wish to improve their continuous assessment marks subject to the approval of the Head of the department.

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

12.5 The summer term courses are not applicable for the students of Part Time mode.

13.0 ASSESSMENTS AND EXAMINATIONS

13.1 The following rule shall apply to all the PG 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 in the Class Committee will be announced to the students right from the beginning of the semester by the course teacher.

13.2 There shall be one examination of three hours duration, at the end of the semester.

13.3 In one (or) two credit courses that are not spread over the entire semester, the evaluation will be conducted at the completion of the course itself. Anyhow approval for the same is to be obtained from the HoD and the Dean of Academic Affairs.

13.4 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.

13.5 At the end of industrial internship, the student shall submit a certificate from the organization 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.

14.0 WEIGHTAGES

14.1 The following shall be the weightages for different courses:

i) Lecture based course

Two continuous assessments	50%
Semester-end examination	50%

ii) Laboratory based courses

Laboratory work assessment	75%
Semester-end examination	25%

iii) Project work

Periodic reviews	50%
Evaluation of Project Report by	
External Examiner	20%
Viva-Voce Examination	30%

14.2 Appearing for semester end examination for each course (Theory and Practical) is mandatory and a student should secure a minimum of 40% marks in semester end examination for the successful completion of the course.

14.3 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 the weightages given in clause 13.1.

15.0 SUBSTITUTE EXAMINATION

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

15.2 A student who misses any assessment in a course shall apply in a prescribed form to the Dean (Academic Affairs) 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 semester-end examinations.

16.0 COURSEWISE GRADING OF STUDENTS AND LETTER GRADES

16.1 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
W	-
I	-
AB	-

- Flexible range grading system will be adopted
- **“W”** denotes withdrawal from the course.
- **"I"** denotes inadequate attendance and hence prevention from semester-end examination
- **"U"** denotes unsuccessful performance in a course.
- **“AB”** denotes absent for the semester end examination

16.2 A student is considered to have completed a course successfully if he / she secure five grade points or higher. A letter grade ‘U’ in any course implies unsuccessful performance in that course.

16.3 A course successfully completed cannot be repeated for any reason.

17.0 AWARD OF LETTER GRADE

17.1 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.

17.2 After finalization of the grades at the class committee meeting the Chairman will forward the results to the Controller of Examinations, with copies to Head of the Department and Dean (Academic Affairs).

18.0 DECLARATION OF RESULTS

18.1 After finalization 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.

18.2 In case any student feels aggrieved about the results, he/she can apply for revaluation after paying the prescribed fee for the purpose, within one week from the announcement of results.

A committee will be constituted by the concerned Head of the Department comprising of the Chairperson of the concerned Class Committee (Convener), the teacher concerned and a 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 marks to the Controller of Examinations with full justification for the revision, if any.

18.3 The “U” and “AB” 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.

19.0 COURSE REPETITION AND ARREARS EXAMINATION

19.1 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.

19.2 A student who is awarded “U” or “AB” grade in a course shall write the semester-end examination as arrear examination, at the end of the next semester, along with the regular examinations of next semester courses.

19.3 A student who is awarded “U” or “AB” grade in a course will have the option of either to write semester end arrear examination at the end of the subsequent semesters, or to redo the course whenever the course is offered. Marks earned during the redo period in the continuous assessment for the course, will be used for grading along with the marks earned in the end-semester (re-do) examination.

19.4 If any student obtained “U” or “AB” grade, the marks earned during the redo period for the continuous assessment for that course will be considered for

further appearance as arrears.

19.5 If a student with “U” or “AB” grade prefers to redo any particular course fails to earn the minimum 75% attendance while doing that course, then he/she will not be permitted to write the semester end examination and his / her earlier ‘U’ grade and continuous assessment marks shall continue.

20.0 GRADE SHEET

20.1 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.

20.2 The GPA will be calculated according to the formula

$$GPA = \frac{\sum_{i=1}^{n}(C_i)(GP_i)}{\sum_{i=1}^{n}(C_i)}$$

where n = number of courses

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 of time.

‘I’ and ‘W’ grades will be excluded for GPA calculations.

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

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

20.3.1 For students under full time mode of study

CGPA	Classification
8.50 and above, having completed all courses in first appearance	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 student should not have obtained U or I grade in any course during his/her study and should have completed the PG 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 student 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 students 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 two decimal places. For the purpose of comparison of performance of students and ranking, CGPA will be considered up to three decimal places.

20.3.2 For students under part time mode of study

CGPA	Classification
8.50 and above, having completed all courses in first appearance	First class with Distinction
6.50 and above	First Class
All others	Second Class

For the purpose of classification, the CGPA will be rounded to two decimal places.

21.0 ELIGIBILITY FOR THE AWARD OF THE MASTERS DEGREE

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

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

ii) no disciplinary action is pending against him/her.

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

22.0 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.

CURRICULUM & SYLLABI FOR
M. Tech. (CAD – CAM)
(FOUR SEMESTERS / FULL TIME)

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	MAC6182	Differential Equations and Numerical Methods	**3**	**1**	**0**	**4**
2	MEC6101	Applied Materials Engineering	**3**	**0**	**0**	**3**
3	MEC6102	Computer Graphics and Geometric Modeling (Integrated Lab)	**3**	**0**	**2**	**4**
4	MEC6103	Advanced Finite Element Analysis (Integrated Lab)	**2**	**1**	**2**	**4**
5	MEC6104	Rapid Prototyping	**2**	**0**	**0**	**2**
6		Professional Electives #				**3**
						20
		SEMESTER II				
1	GEC6201	Research Methodology For Engineers	3	0	0	3
2	MEC6201	Integrated Product Design	3	0	0	3
3	MEC6202	Advanced Metrology and NDT (Integrated Lab)	3	0	2	4
4	MEC6203	Flexible Manufacturing Systems	3	0	0	3
5		Professional Electives ##				6
6	MEC6204	Design Project	0	0	2	1
						20
		SEMESTER III				
1		General Elective*	3	0	0	3
2	MEC7102	Non Linear Finite Element Analysis	1	0	0	1
3		Professional Electives ###				9
4	MEC7103	Industry Internship	0	0	0	1
5	MEC7101	Project Work - Phase I	0	0	12	6**
						14

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER IV				
	MEC7101	Project Work - Phase II	0	0	36	18**
		Total credit (Semester IV)				**18 + 6 = 24**
		GRAND TOTAL CREDIT				**78**

\# Professional Electives can be chosen from the list, provided that the cumulative credits should not be less than 3.

\## Professional Electives can be chosen from the list, provided that the cumulative credits should not be less than 6.

\### Professional Electives can be chosen from the list, provided that the cumulative credits should not be less than 9.

* General Electives can be chosen from the list, provided that the cumulative credits should not be less than 3.

** Credits for project work phase I to be accounted along with project work phase II in IV semester

LIST OF PROFESSIONAL ELECTIVES

Sl. No.	Course Code	Course Title	L	T	P	C
		PROFESSIONAL ELECTIVES ON CAD				
1	MECY001	Advanced Mechanisms Design and Simulation	**3**	**0**	**0**	**3**
2	MECY002	Advanced Strength of Materials	**3**	**0**	**0**	**3**
3	MECY003	Advanced Tool Design	**3**	**0**	**0**	**3**
4	MECY004	Computational Fluid Dynamics	**3**	**0**	**0**	**3**
5	MECY005	Computer Aided Process Planning	**3**	**0**	**0**	**3**
6	MECY006	Design of Hydraulic and Pneumatic Systems	**3**	**0**	**0**	**3**
7	MECY007	Design of Material Handling Equipment	**3**	**0**	**0**	**3**
8	MECY008	Industrial Robotics and Flexible Automation	**3**	**0**	**0**	**3**
9	MECY009	Mechanical Vibrations	**3**	**0**	**0**	**3**
10	MECY010	Optimization Techniques in Design	**3**	**0**	**0**	**3**
11	MECY011	Tribology	**3**	**0**	**0**	**3**
12	MECY012	Mechanics of Composite Materials	**2**	**0**	**0**	**2**
13	MECY013	Geometric Dimensioning and Tolerancing	**1**	**0**	**0**	**1**
		PROFESSIONAL ELECTIVES ON CAM				
14	MECY014	Advances in Manufacturing Technology	**3**	**0**	**0**	**3**
15	MECY015	CNC Machines and Computer Aided Manufacturing	**3**	**0**	**0**	**3**
16	MECY016	Polymers and Composites	**3**	**0**	**0**	**3**
17	MECY017	Precision Engineering and Nano Technology	**3**	**0**	**0**	**3**
18	MECY018	Mechatronics for Manufacturing Systems	**2**	**0**	**0**	**2**
19	MECY019	Newer Materials	**2**	**0**	**0**	**2**
20	MECY020	Automotive Manufacturing	**1**	**0**	**0**	**1**
21	MECY021	Virtual Manufacturing	**1**	**0**	**0**	**1**
		PROFESSIONAL ELECTIVES ON CAD / CAM MANAGEMENT				
22	MECY022	Data Communication in CAD/CAM	**3**	**0**	**0**	**3**
23	MECY023	Industrial Safety Management	**3**	**0**	**0**	**3**
24	MECY024	Integrated Manufacturing Systems and Management	**3**	**0**	**0**	**3**

Sl. No.	Course Code	Course Title	L	T	P	C
25	MECY025	Manufacturing Information Systems	**3**	**0**	**0**	**3**
26	MECY026	Reliability and Total Productive Maintenance	**3**	**0**	**0**	**3**
27	MECY027	Product Life Cycle Management	**1**	**0**	**0**	**1**

GENERAL ELECTIVES FOR M.TECH PROGRAMMES

Sl. No.	Course Code	Course Title	L	T	P	C
1	GECY101	Project Management	**3**	**0**	**0**	**3**
2	GECY102	Society, Technology & Sustainability	**3**	**0**	**0**	**3**
3	GECY103	Artificial Intelligence	**3**	**0**	**0**	**3**
4	GECY104	Green Computing	**3**	**0**	**0**	**3**
5	GECY105	Gaming Design	**3**	**0**	**0**	**3**
6	GECY106	Social Computing	**3**	**0**	**0**	**3**
7	GECY107	Soft Computing	**3**	**0**	**0**	**3**
8	GECY108	Embedded System Programming	**3**	**0**	**0**	**3**
9	GECY109	Principles of Sustainable Development	**3**	**0**	**0**	**3**
10	GECY110	Quantitative Techniques in Management	**3**	**0**	**0**	**3**
11	GECY111	Programming using MATLAB & SIMULINK	**1**	**0**	**2**	**2**
12	GECY112	JAVA Programming	**1**	**0**	**2**	**2**
13	GECY113	PYTHON Programming	**1**	**0**	**2**	**2**
14	GECY114	Intellectual Property Rights	**1**	**0**	**0**	**1**

SEMESTER I

MAC6182	DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS	L	T	P	C
		3	1	0	4

COURSE EDUCATIONAL OBJECTIVES:

The aim of this course is to

- Familiarize the students with boundary value problems of partial differential equations in engineering.
- Expose the students to variational problems, numerical integration techniques and conformal mapping.

MODULE I ONE DIMENSIONAL WAVE AND HEAT EQUATIONS 10+03

Laplace transformation for one dimensional wave equation – displacements in a line string – longitudinal vibration of an elastic bar – Fourier transformation for one dimensional heat conduction problems in infinite and semi-infinite rods.

MODULE II CALCULUS OF VARIATIONS 10+03

Variation and its properties – Euler's equation – functional dependant on first and higher order derivatives – functional dependant on functions of several independent variables – variational problems with moving boundaries – Isoperimetric Problems – Ritz and Kantorovich methods.

ODULE III NUMERICAL INTEGRATION 07+03)

Newton - Cotes formula - Trapezoidal, Simpson's one third and three eighth rules - Gauss Quadrature formulae.

MODULE IV NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS 09+03

Solution of Laplace and Poisson equations on a 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.

MODULE V CONFORMAL MAPPING AND APPLICATIONS 09+03

The Schwarz – Christoffel transformation – transformation of boundaries in parametric form – physical applications – fluid flow and heat flow problems.

L – 45; T – 15; Total Hours: 60

TEXT BOOKS:

1. Curtis F. Gerald and Patrick O. Wheatley, Applied Numerical Analysis, 7th edition, Pearson Publications, USA, 2004.
2. S.K. Gupta, Numerical methods for Engineers, New Age Intl. Publishers (Earlier: Wiley Eastern, New Delhi), 1995,Second Edition, 2010 (from IITB).
3. Sankar Rao, Introduction to Partial Differential Equations, PHI Learning Pvt. Ltd., 2010.

REFERENCES:

1. Sneddon, I.N., “Elements of Partial Differential Equations”, Mc Graw-Hill, 1986.
2. Gupta, A.S., “Calculus of Variations with Applications”, Prentice Hall of India Pvt. Ltd, New Delhi, 1997.
3. Kreyszig, E., “Advanced Engineering Mathematics”, 8th Edition, John Wiley & Sons, Inc., Singapore, 2002.
4. L.E. Elsgolts, “Differential equations and calculus of variations”, University Press of the Pacific, 2003.

COURSE OUTCOMES:

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

- Problems using the concepts of Laplace transform
- Problems using the concepts of Fourier transform.
- Problems on calculus of variation.
- Problems on Conformal mapping.
- Heat flow problems of one and two dimensional conditions using numerical methods.

MEC6101 APPLIED MATERIALS ENGINERING

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To study the elastic and plastic behaviour of engineering materials
- To understand the fracture behaviour of engineering materials
- To gain the knowledge on selection of materials for specific applications
- To select the modern materials and identify their applications
- To suggest suitable non-metallic materials for various engineering applications

MODULE I ELASTIC AND PLASTIC BEHAVIOUR 12

Elasticity in metals and polymers - Anelastic and visco-elastic behaviour – Mechanism of plastic deformation and non metallic shear strength of perfect and real crystals – Strengthening mechanisms - work hardening, solid solutioning, grain boundary strengthening, poly phase mixture, precipitation, particle, fiber and dispersion strengthening - Effect of temperature, strain and strain rate on plastic behaviour – Super plasticity – Deformation of non crystalline materials.

MODULE II FRACTURE BEHAVIOUR 15

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.

MODULE III SELECTION OF MATERIALS 08

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 – Computer aided materials selection.

MODULE IV MODERN METALLIC MATERIALS 05

Dual phase steels, High strength low alloy (HSLA) steel, Transformation induced

plasticity (TRIP) Steel, Maraging steel, Nitrogen steel – Intermetallics, Ni and Ti aluminides – Smart materials, Shape memory alloys – Metallic glass and Nano crystalline materials.

MODULE V NON METALLIC MATERIALS 05

Polymeric materials – Formation of polymer structure – Production techniques of fibers, foams, adhesives and coating – structure, properties and applications of engineering polymers – Advanced structural ceramics, WC, TiC, TaC, Al_2O_3, SiC, Si_3N_4 CBN and Diamond – properties, processing and applications.

Total Hours: 45

REFERENCES:

1. George E. Dieter, Mechanical Metallurgy, McGraw Hill, 1988.
2. Thomas H. Courtney, Mechanical Behaviour of Materials, (2nd edition), McGraw Hill, 2000.
3. Charles, J.A., Crane, F.A.A. and Fumess, J.A.G., Selection and use of engineering materials, (3rd edition), Butterworth-Heiremann, 2001.
4. Flinn, R.A., and Trojan, P.K., Engineering Materials and their Applications, (4th Edition) Jaico, 1999.
5. ASM Hand book, Vol.11, Failure Analysis and Prevention, (10th Edition), ASM, 2002.
6. Ashby M.F., Material Selection in Mechanical Design, 3rd Edition, Butter Worth 2005.

COURSE OUTCOMES:

Students should be able to

- Describe the elastic and plastic behaviour of engineering materials
- Interpret the fracture behavior of engineering materials
- Use the suitable materials for specific applications
- Choose the modern materials for appropriate applications
- Employ the non- metallic materials for various engineering applications

MEC6102	COMPUTER GRAPHICS AND GEOMETRIC MODELLING	L	T	P	C
		3	0	2	4

COURSE EDUCATIONAL OBJECTIVES:

- To acquire knowledge for generating high quality images of massive geometric models in a short time.
- To learn about the concepts of complex curves and surface models
- To learn the concepts of solid modelling and current trends in modelling
- To understand the surface visualization, models presentation and communication techniques.
- To acquire knowledge on the applications of CAD

MODULE I IMAGE GENERATION AND MANIPULATION 09+06

Overview of display devices and systems – generation of primitives; line, circle, ellipse generation algorithms – 2D & 3D transformation –viewing transformation – projections.

Practice on Develop 3D models to realizing the transformation and projections.

MODULE I I MODELLING OF CURVES AND SURFACES 09+06

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.

Practice on Models with free form curves and surfaces (bike petrol tank, car body).

MODULE II MODELLING OF SOLIDS 09+06

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.

Practice on

1. Simple constrain based models to appreciate their advantages.
2. Realization of Data associativity principles (Edit part model and realize the change in drawing).
3. Parametric modeling of Bolt – Nut assembly, Flange, Gears.

MODULE IV IMAGE ENHANCEMENT AND GRAPHICS STANDARDS 09+06

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

Practice on

1. Shading and rendering of real life products.
2. Hidden line/Surface removal of machine components.
3. Data exchange between CAD and CAE software.

MODULE V COLLABORATIVE ENGINEERING AND APPLICATIONS 09+06

Collaborative design – Product Lifecycle Management; Mass property calculation - Assembly modeling – Mesh generation techniques - Animation Techniques – Tool path generation

Practice on

1. Mass property calculation for complex models.
2. Assembly modeling.

L: 45, P: 30, Total Hours: 75

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.

COURSE OUTCOMES:

Students would be able to

- Generate high quality images of massive geometric models in a short time.
- Realize the concepts of analytic and synthetic curve/surface generation, and develop physical models to represent them.
- Acquire knowledge on the development of solid models including the current techniques in the industry.
- Prepare the components for visual presentation and exchange the models between CAD/CAE software.
- Realize the applications of CAD

MEC6103 ADVANCED FINITE ELEMENT ANALYSIS

L	T	P	C
2	1	1	4

COURSE EDUCATIONAL OBJECTIVES:

- To introduce the mathematical and physical principles underlying the Finite Element Method (FEM).
- To uncover iso-parametric formulation and its importance
- Top describe the elementary concepts of plate bending behaviour and theory.
- To introduce time dependent finite element procedure
- To introduce error norms and convergence rates

MODULE I REVIEW OF 1D FEM 12

Historical background - Concept of finite element method - Finite element formulation based on weighted residual method and stationary of a functional - Review of static analysis using 1D element – Bar, truss, Beam element.

Practice on FEA analysis of Machine elements under static loads

MODULE II 2D & 3D FEM 12

Triangular, quadrilateral, tetrahedral element, Lower order and higher order element, Iso-parametric formulation, Static structural and thermal analysis applications.

Practice on FEA analysis of Heat transfer – steady state and transient

MODULE III BENDING OF PLATES & SHELLS 12

Bending of plate and shells - Thin (Kirchoff) and Thick (Mindlin) plate elements – Finite Element Formulation of Plate and Shell Elements – Applications and Examples.

Practice on FEA analysis of Modal analysis, Harmonic analysis

MODULE IV STRUCTURAL DYNAMICS 12

Dynamical equations of motion, Consistent and Lumped Mass Matrices, Damping matrices, Vibration Analysis, Eigenvalue problems and solution techniques, Transient dynamical and structural dynamical problems, Explicit and implicit schemes of integrations, Stability issues.

Practice on FEA analysis of Plate bending analysis

MODULE V ERROR ESTIMATES AND ADAPTIVE REFINEMENT 12

Classification of errors – Error tests - Convergence rates- Mesh revision and Gradient Recovery – Adaptive meshing - h refinement with adaptivity – adaptive refinement.

Practice on FEA analysis of Error estimation and convergence tests

Total Hours: 60

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. Nitin S. Gokhale , Sanjay S. Deshpande and Sanjeev V. Bedekar, “Practical Finite Element Analysis”, Amazon India, 2008.
4. Chandrupatla & Belagundu, “Finite Elements in Engineering”, Prentice Hall of India Private Ltd., 1997.
5. Zienkiewicz. O.C, Taylor. R.L “The Finite Element Method” McGraw Hill International Editions, Fourth Edition, 1991, Volume 2.
6. Bathe, K.J., “Finite Element Procedures in Engineering Analysis, 1990.
7. S.S. Rao, Finite Element Analysis, 2002 Edition.
8. David V Hutton “Fundamentals of Finite Element Analysis”. McGraw-Hill International Edition, 2004.

COURSE OUTCOMES:

Students will be able to

- Solve static structural problem by functional approximation and finite element method.
- Solve structural and thermal problems involving complex geometries.
- Model and analyse structures such as pressure vessel, automobile parts and chimney stacks.
- Perform Modal analysis, Harmonic analysis and transient analysis.
- Enhance the skills of interpreting results

MEC6104 RAPID PROTOTYPING

L	T	P	C
2	0	0	2

COURSE EDUCATIONAL OBJECTIVES:

- To learn the fundamentals of rapid prototyping and automated fabrication.
- To acquire knowledge on the generation of suitable CAD models.
- To study the current rapid prototyping fabrication technologies, the use of secondary processing and the impact of these technologies.
- To understand the various rapid prototyping fabrication technologies, their underlying material science and the application of this technology on society.

MODULE I INTRODUCTION 05

Introduction to RP –Technology- Description -Definition to RP -Overview of RP - Benefits and Application.

MODULE II RPT FILE GENERATION 08

RP Processes: Process overviews, STL file Generation, File Verification & Repair, Build File Creation, Part Construction, Part Cleaning and finishing, Process Strength & limitations.

MODULE III LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS 08

Classes of RP systems: 3D Printers, Enterprise Prototyping centers, Direct digital tooling, Direct digital manufacturing, system classification, Stereo lithography, SL with photo polymerization, Selective Laser Sintering, Fused deposition modeling, Laminated object manufacturing, Laser powder forming. Prototype properties: Material, color, dimensional accuracy, stability, surface finish, machine-ability, environmental resistance, operational properties

MODULE IV RAPID PROTOTYPING APPLICATIONS 09

RP Applications: Design, Concept Models, Form & fit checking, Ergonomic Studies, Functional testing, Requesting Price quotes, CAD data verification, Rapid Tooling, rapid manufacturing, Science & Medicine, Archeology, Paleontology & forensic Science, miniaturization

Total Hours: 30

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.

COURSE OUTCOMES:

The students will

- Identify the currently available rapid prototyping systems, their fundamental operating principles and their characteristics
- Demonstrate complementary, secondary fabrication processes commonly used with the above rapid prototyping systems
- Select the appropriate fabrication technology or technologies for a given prototyping task

SEMESTER II

GEC6201	RESEARCH METHODOLOGY FOR ENGINEERS	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To provide a perspective on research to the scholars
- To educate on the research conceptions for designing the research
- To impart knowledge on statistical techniques for hypothesis construction
- To gain knowledge on methods of data analysis and interpretation
- To learn about the effective communication of research finding

MODULE I RESEARCH PROBLEM FORMULATION 07

Research – objectives – types, Research process, Solving engineering problems, Identification of research topic, Formulation of research problem, Literature survey and review.

MODULE II HYPOTHESIS FORMULATION 08

Research design – meaning and need – basic concepts, Different research designs, Experimental design – principle – important experimental designs, Design of experimental setup, Mathematical modeling, Simulation – validation and experimentation, Dimensional analysis and similitude.

MODULE III STATISTICAL TECHNIQUES 12

Statistics in research – concept of probability – popular distributions –Hypothesis testing- sample design- Design of experiments – factorial designs -– orthogonal arrays- ANOM - ANOVA - Multivariate analysis - Use of optimization techniques – traditional methods – evolutionary optimization techniques –Transportation model.

MODULE IV STATISTICAL ANALYSIS OF DATA 10

Research Data analysis – interpretation of results – correlation with scientific facts- Accuracy and precision – error analysis, limitations - Curve fitting, Correlation and regression.

MODULE V RESEARCH REPORT 08

Purpose of written report – audience, synopsis writing, preparing papers for International journals, Thesis writing – organization of contents – style of writing – graphs and charts – referencing, Oral presentation and defense, Ethics in

research, Patenting, Intellectual Property Rights.

Total Hours: 45

REFERENCES:

1. Ganesan R., Research Methodology for Engineers, MJP Publishers, Chennai, 2011.
2. Ernest O., Doebelin, Engineering Experimentation: planning, execution, reporting, McGraw Hill International edition, 1995.
3. George E. Dieter., Engineering Design, McGraw Hill – International edition, 2000.
4. Madhav S. Phadke, Quality Engineering using Robust Design, Printice Hall, Englewood Cliffs, New Jersey, 1989.
5. Kothari C.R., Research Methodology – Methods and Techniques, New Age International (P) Ltd, New Delhi, 2003.
6. Kalyanmoy Deb., “Genetic Algorithms for optimization”, KanGAL report, No.2001002.
7. Holeman, J.P., Experimental methods for Engineers, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2007.
8. Govt. of India, Intellectual Property Laws; Acts, Rules & Regulations, Universal Law Publishing Co. Pvt. Ltd., New Delhi 2010.
9. University of New South Wales, “How to write a Ph.D. Thesis” Sydney, Australia, Science @ Unsw.
10. Shannon. R.E., System Simulation: the art and science, Printice Hall Inc, Englewood Cliffs, N.J.1995.
11. Scheffer. R.L. and James T. Mc Clave, Probability and Statistics for Engineers, PWS – Kent Publishers Co., Boston, USA, 1990.

COURSE OUTCOMES:

Students should be able to

- Formulate the research problem
- Design and Analyse the research methodology
- Construct and optimize the research hypothesis
- Analyse and interpret the data
- Report the research findings

MEC6201 INTEGRATED PRODUCT DESIGN

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To provide and learn the scientific approach to product design that integrates technical, human and business concerns
- To understand the tools and methods of concept development with focus on the front end processes of new product development
- To learn and enable the student to architecture the geometrical layout of product
- To create awareness and role of industrial design, integration of computerized tools and quality design
- To gain knowledge on multiple functional areas like design for manufacturing and assembly, product development economics, prototyping and intellectual property that makes confidence and capability to create an own new product

MODULE I INTRODUCTION 08

Strategic importance of integrated product design - product life cycle - characteristics and challenges of product development - a generic product development process - the front end processes - the variants of generic product development process - concept of concurrent engineering - integration of customer, designer, material supplier, process planner and competitor - plan for products - understanding the market opportunity - understanding and identifying customer needs - establishing product specifications - competitive benchmarking analysis - house of quality.

MODULE II CONCEPT GENERATION, SELECTION AND TESTING 10

Need for creative thinking and innovation - creativity and problem solving - activities of concept generation - clarify the problem - search externally and internally - explore systematically - reflect on the solutions and process - concept selection - concept screening - concept scoring - concept testing - protocol of concept testing.

MODULE III PRODUCT ARCHITECTURE 08

Concept embodiment design - product architecture - types of modular architecture - implications of the architecture - product change - variety - component standardization - product performance - manufacturability - product development management - establishing the product architecture - related system level design issues - portfolio architecture

MODULE IV INDUSTRIAL DESIGN 08

Integrated process design - integrating CAE, CAD and CAM tools - need for industrial design - impact - industrial design process - management of design process - technology driven and user driven products - assessing the quality of industrial design - robust design.

MODULE V ECONOMICS AND IMPLEMENTATION OF DESIGN 11

Design for 'X' (DFX) - environment - strength - manufacturing and assembly - estimation of manufacturing cost - reducing the cost of components, assembly and supporting production - prototyping - principles of prototyping - planning for prototypes - rapid prototyping - 3D printers - toy design - product development economics - introduction to patents and intellectual property

Total Hours: 45

REFERENCES:

1. Karl T.Ulrich, Steven D.Eppinger, Anita Goyal, "Product Design and Development ", 4th Edition, 2009, Tata McGraw-Hill Education, ISBN-10-007-14679-9
2. Kevin Otto, Kristin Wood, "Product Design", Indian Reprint 2013, Pearson Education, New Delhi, ISBN 9788177588217
3. George E.Dieter, Linda C.Schmidt, "Engineering Design", McGraw-Hill International Edition, 4th Edition, 2009, ISBN 978-007-127189-9
4. Yousef Haik, T. M. M. Shahin, "Engineering Design Process", (2nd Edition – 2010 reprint), Cengage Learning, ISBN 0495668141
5. G.Pahl, and W. Beitz, "Engineering Design – A Systematic Approach", Springer- Verlag, 1996

COURSE OUTCOMES:

Upon satisfactory completion of the course, the student will be able to:

- Identify the role and integration of customer, marketing, finance, design and production in creating a new product
- Apply structured approach to generate the concepts, selection and testing
- Construct the geometrical layout of product in architecture way
- Describe the industrial design and quality of product design
- Demonstrate the physical model preparation and analyze the cost reduction techniques
- Effectively communicate the solutions of engineering or societal context

MEC6202 ADVANCED METROLOGY AND NDT

L	T	P	C
3	0	2	4

COURSE EDUCATIONAL OBJECTIVES:

- To train the students in recent measurement systems
- To educate the students on laser based measuring instruments usage
- To gain knowledge in liquid penetrant and magnetic particle test
- To impart knowledge in radiography and its applications
- To perceive ultrasonic and acoustic emission techniques

MODULE I MEASURING MACHINES 15

Tool Maker's microscope - Coordinate measuring machine (CMM)- Universal measuring machine - Machine vision technology -Microprocessors in metrology- Nano-metrology -Measurement system analysis.

Practices on Tool Makers Microscope- - Machine vision technology and surface roughness measurement- CMM

MODULE II LASER METROLOGY 12

Precision instruments based on laser-Principles- laser interferometer-application in linear, angular measurements and machine tool metrology- need, constructional features – types, applications – computer aided inspection.

Practices on measuring the quality using linear measuring Instruments

MODULE III LIQUID PENETRANT AND MAGNETIC PARTICLE TESTS 12

Characteristics of liquid penetrates - Different washable systems – Developers - Applications - Methods of production of magnetic fields - Principles of operation of magnetic particle test - Applications - Advantages and limitations.

Practices on Liquid Penetrant and Magnetic Particle Tests

MODULE IV RADIOGRAPHY 12

Sources of ray-x-ray production - Properties of gamma and x rays – Film characteristics - Exposure charts - Contrasts - Operational characteristics of x ray equipment - Applications.

MODULE V ULTRASONIC AND ACOUSTIC EMISSION TECHNIQUES 09

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 Hours: 60

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. I. G. Scott, Basic Acoustic Emission, CRC Press, 1991.

COURSE OUTCOMES:

Students should be able to

- Measure various engineering specifications using recent measurement system
- Use advanced measurement tools such as CMM
- Adopt liquid penetrant and magnetic particle test for engineering applications
- Execute radiography techniques
- Perform ultrasonic and acoustic emission techniques

MEC6203 FLEXIBLE MANUFACTURING SYSTEMS

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the swiftness and flexibility of changes in the manufacturing technology.
- To learn the FMS components and its layouts.
- To understand the tool magazines in FMS
- To acquire knowledge on suitable material handling systems used in FM cell.
- To acquire knowledge about the software used in FMS.

MODULE I INTRODUCTION TO FMS 09

Evolution of Manufacturing systems, Definition, Objective and Need, Components, Merits, Demerits and Applications Flexibility in Pull and Push type.

MODULE II LAYOUTS OF FMS 09

Layouts and their Salient features, Single line, dual line, loop, ladder, robot centre type etc. Group Technology.

MODULE III PROCESSING STATIONS 09

Salient features Machining Centers, Turning Centre, Coordinate measuring machine (CMM), Washing/Deburring station.

MODULE IV MATERIAL HANDLING SYSTEM 09

An introduction, Conveyor, Robots, Automated Guided Vehicle (AGV), Automated Storage Retrieval System (ASRS)s.

MODULE V COMPUTER SOFTWARE, SIMULATION AND DATABASE OF FMS 09

System issues, Types of software, specification and selection, Trends, Application of simulation, Software, Manufacturing data systems, data flow, CAD/CAM considerations, Planning FMS database; Typical case studies-future prospects.

.

Total Hours: 45

REFERENCES:

1. William W Luggen, “Flexible Manufacturing Cells and System” Prentice Hall of Inc New Jersey, 1991.
2. Reza A Maleki “Flexible Manufacturing System” Prentice Hall of Inc New Jersey, 1991.
3. John E Lenz “Flexible Manufacturing” marcel Dekker Inc Newyork, 1989.
4. Groover, M.P “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall of India Pvt Ltd. New Delhi 2009.

COURSE OUTCOMES:

The students will be able to

- Classify and differentiate FMS with other manufacturing systems including job-shop and mass production systems.
- Comprehend the FMS components and layouts and plan the FMS layouts.
- Illustrate the tool management in FMS.
- Explain processing stations and material handling systems used in FMS environments.
- Analyze FMS using simulation and analytical techniques

MEC6204 DESIGN PROJECT

L	T	P	C
0	0	2	1

The main objective is to inculcate problem based learning and to promote team spirit. Students will be asked to take a real world problem in CAD / CAM and solve it by designing a system or/ and simulate in the CAM software. Students will work in groups.

SEMESTER III

MEC7102	NON LINEAR FINITE ELEMENT ANALYSIS	L	T	P	C
		1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To introduce nonlinear FEA analysis procedures considering geometric, material nonlinearity.
- Designed to broaden the class of physical problems such as beam, plates, shells, contact and impact nonlinearity solved by FEA method.

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MODULE I NON LINEAR FININTE ELEMENT BASICS 07

Basic Nonlinear Continuum Mechanics of Solids, Total and Updated Lagrangian Approaches – Non linear bending of beams - Nonlinear Plates and Shells, Time-dependent Deformation of Shells.

MODULE II NON LINEAR FINITE ELEMENTS OF SOLIDS 08

Material Nonlinearities, Geometric Nonlinearities, Nonlinear Elasticity, Plasticity, Viscoplasticity, Viscoelasticity, Stability, bifurcation and nonlinear buckling, Contact and impact nonlinearity.

Total Hours: 15

REFERENCES:

1. Cook R. D., Finite Element Modelling for Stress Analysis, John Wiley and
2. Sons Inc, 1995
3. Reddy, J. N., An Introduction to Nonlinear Finite Element Analysis, Oxford
4. University Press, Oxford, UK, 2004.
5. E.A. de Souza Neto, D. Peric and D.R.J. Owen: Computational Methods for Plasticity: Theory and Applications, Wiley, 2008

COURSE OUTCOMES:

The students will be able to

- Decide whether or not a nonlinear analysis is necessary.
- Explain the different steps of a nonlinear finite element analysis.
- Perform nonlinear FEA of real engineering problems such that a drop test or sheet metal forming.
- Interpret the results of a nonlinear analysis.

MEC7103 INDUSTRY INTERNSHIP

L	T	P	C
0	0	0	1

Students must undergo two weeks industrial training preferably in the industries relevant to CAD/ CAM to gain practical experience.

MEC7101 PROJECT WORK - PHASE I

L	T	P	C
0	0	12	6

The main objective is to promote project based learning.

(Refer to clause 3.15 of B.S. Abdur Rahman University regulations)

SEMESTER IV

		L	T	P	C
MEC7101	**PROJECT WORK - PHASE II**	**0**	**0**	**36**	**18**

This is in continuation with Phase I. The main objective is to promote project based learning.

(Refer to clause 3.15 of B.S. Abdur Rahman University regulations)

PROFESSIONAL ELECTIVES ON CAD

MECY001	ADVANCED MECHANISMS DESIGN AND SIMULATION	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To familiarize basics concepts of mechanism design.
- To provide knowledge in the kinematic analysis of simpler mechanisms.
- To introduce concepts and theories for complex mechanism design.
- To learn the art of synthesis of mechanism.
- To realize the importance of special purpose mechanism.

MODULE I INTRODUCTION 09

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.

MODULE II KINEMATIC ANALYSIS 09

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-Hardenberg Parameters – Forward and inverse kinematics of robot manipulators.

MODULE III PATH CURVATURE THEORY, COUPLER CURVE 09

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.

MODULE IV SYNTHESIS OF FOUR BAR MECHANISMS 09

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.

MODULE V SYNTHESIS OF COUPLER CURVE BASED MECHANISMS & CAM MECHANISMS 09

Cognate Linkages-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 Hours: 45

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.

COURSE OUTCOMES:

Students will be able to

- Understand the fundamentals of kinematics and network formula.
- Perform displacement analysis, velocity and acceleration for planar mechanisms
- Apply path curvature theory to design complex mechanism.
- Synthesize a mechanism for a motion and function generation
- Design and fabricate simple mechanisms for single dwell , double dwell period

MECY002 ADVANCED STRENGTH OF MATERIALS

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the stress strain relations and location of shear centers.
- To study and analyze stress and deflections in curved beams.
- To understand the stresses in flat plates.
- To study and analyze torsional stresses in thin walled tubes and non-circular sections.
- To understand the stresses in rotary sections and contacts.

MODULE I ELASTICITY 09

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 Hooke's law - St. Venant's principle - plane stress - Airy's stress function. Energy methods.

MODULE II 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.

MODULE III 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.

MODULE IV TORSION OF NON-CIRCULAR SECTIONS 07

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

MODULE V STRESSES IN ROTARY SECTIONS AND CONTACT STRESSES 09

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 Hours: 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

COURSE OUTCOMES:

Students will be able to

- Analyze two and three dimensional complex stress problems.
- Compute stresses and deflections in beams subjected to unsymmetrical loading.
- Critique stresses in curved beams and flat plates.
- Analyze and solve torsion of non-circular sections.
- Evaluate problems arising from stresses in rotary sections and contact applications

MECY003 ADVANCED TOOL DESIGN

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To learn tool design methods and techniques of manufacturing dies and its accessories.
- To acquire knowledge on different materials available for cutting tools and necessary heat treatment procedures to get the required properties.
- To acquire knowledge in selecting suitable materials for calibrating and inspecting gauges.
- To learn to design fixtures for various machining and metal forming operations.
- To acquire knowledge on designing fixtures and cutting tools for NC machine tools.

MODULE I TOOL DESIGN METHODS 05

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.

MODULE II TOOLING MATERIALS AND HEAT TREATMENT 09

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.

MODULE III DESIGN OF DRILL JIGS 09

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.

MODULE IV 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.

MODULE V TOOL DESIGN FOR NUMERICALLY CONTROLLED MACHINE TOOLS 08

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 Hours: 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.

COURSE OUTCOMES:

Students will be able to

- Summarize tool design methods and punch and die manufacturing techniques
- Judge in selecting materials for cutting tools and identify their nomenclature.
- Identify the materials for gauges and to make them with the available technology
- Design fixtures for milling, boring, lathe, grinding and welding
- Design and analyse fixtures and cutting tools for NC machine tools

MECY004 COMPUTATIONAL FLUID DYNAMICS

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the equations describing fluid flow and numerical solutions to these equation.
- To teach the concepts of conduction of heat through solids in steady and transient state.
- To learn the methods to solve the governing equations of an incompressible fluid flow.
- To apply computational method to solve convection heat transfer.
- To introduce different turbulence models for accurate prediction of fluid flow.

MODULE I 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.

MODULE II CONDUCTION HEAT TRANSFER 10

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

MODULE III 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.

MODULE IV 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.

MODULE V TURBULENCE MODELS 05

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

standard codes.

Total Hours: 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.

COURSE OUTCOMES:

Students will be able to

- solve heat conduction problems numerically.
- describe the methods of discretize a partial differential equation
- understand standard algorithms applied for solving incompressible fluid flow
- apply FEM to solve a convection heat transfer problem
- choose the best turbulence model for the flow analysis encounters turbulence.

MECY005 COMPUTER AIDED PROCESS PLANNING

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To provide basic knowledge on process planning in a manufacturing cycle
- To impart knowledge on geometrical representation of part design
- To provide knowledge on process planning methodology
- To inculcate systematic process planning using computers
- To provide knowledge on integration of various process planning systems

MODULE I INTRODUCTION 09

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

MODULE II PART DESIGN REPRESENTATION 09

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.

MODULE III PROCESS ENGINEERING AND PROCESS PLANNING 09

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

MODULE IV COMPUTER AIDED PROCESS PLANNING SYSTEMS 09

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.

MODULE V AN INTERGRADED PROCESS PLANNING SYSTEMS 09

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

Total Hours: 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.

COURSE OUTCOMES:

At the end of the course students will be able to

- Analyse process planning in a manufacturing cycle
- Analyse and model the geometrical representation of parts
- Analyse the methodology on processes and their planning
- Designing the process planning systems
- Analyse and design the advanced process planning systems

MECY006	DESIGN OF HYDRAULIC & PNEUMATIC SYSTEMS	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To learn the various hydraulic power system and their components.
- To understand the various components of fluid power system.
- To understand the designing of various hydraulic power circuits for a particular application.
- To acquire knowledge on the similarities between hydraulic and pneumatic power and to design various pneumatic circuits for industrial application.
- To understand the electro-hydraulic and electro-pneumatic circuits and their maintenance.

MODULE I OIL HYDRAULIC SYSTEMS AND ACTUATORS 05

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

MODULE II CONTROL AND REGULATION ELEMENTS 10

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

MODULE III HYDRAULIC CIRCUITS 08

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.

MODULE IV 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.

MODULE V INSTALLATION, MAINTENANCE AND SPECIAL CIRCUITS 07

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 Hours: 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 McGraw Hill, 2004
6. Majumdar, “Pneumatic system : Principles and Maintenance” Tata McGrawHill, 2004.

COURSE OUTCOMES:

- Students will be able to classify the various fluid power system and their applications.
- Students will be able to illustrate important components of fluid power used in power packs.
- Students will be able to design and analyze fluid power circuits for a specific application.
- Students will be able to summarize the modern controls for fluid power system and their maintenance.

MECY007 DESIGN OF MATERIAL HANDLING EQUIPMENT

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To acquire knowledge of different material handling equipment and its selection.
- To learn the different types of hoist and its accessories.
- To understand the various drives of hoisting gear.
- To gain knowledge on variety of conveyors for specific applications.
- To obtain a basic understanding of vertical transportation.

MODULE I MATERIALS HANDLING EQUIPMENT 05

Types, selection and applications

MODULE II 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.

MODULE III 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.

MODULE IV CONVEYORS 10

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

MODULE V 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 Hours: 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

COURSE OUTCOMES:

At the end of the course students will be able to

- Analyse various material handling equipment
- Designing of hoists for material handling
- Analyse and design typical drives and gears for hoists
- Analyse and select various conveyor systems for material transfer
- Analyse the components and accessories of elevators for material handling

MECY008	INDUSTRIAL ROBOTICS AND FLEXIBLE AUTOMATION	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To provide basic knowledge on kinematics of robots
- To impart knowledge on various drives and controls for robotics
- To provide in knowledge on typical sensors and their applications in robotics
- To impart detailed knowledge on various automation systems in robotics
- To provide knowledge on robot programming

MODULE I 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.

MODULE II ROBOT DRIVES AND CONTROL 09

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.

MODULE III ROBOT SENSORS 09

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.

MODULE IV ROBOT FOR FLEXIBLE AUTOMATION 09

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.

MODULE V ROBOT PROGRAMMING, AI & EXPERT SYSTEMS 08

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 Hours: 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.

COURSE OUTCOMES:

At the end of the course students will be able to

- Analyse kinematically the operation of robots
- Analyse and design various drives and controls for robotics
- Analyse and identify typical sensors in robotics as per their applications
- Analyse and identify suitable automation systems in robotics
- Analyse and Programming for intelligent robots

MECY009 MECHANICAL VIBRATIONS

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand how to apply theory of vibration to engineering problems and appreciate the importance of vibrations in mechanical design of machine parts that operates in vibratory conditions.
- To obtain linear vibratory models of dynamic systems with changing complexities (SDOF, MDOF)
- To familiarize the methods of controlling vibrations.
- To understand the methods of obtaining solution for a vibratory continuous systems.
- To learn the techniques for vibration isolation and balancing of masses.

MODULE I FUNDAMENTALS OF VIBRATION 08

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.

MODULE II TWO - DEGREE FREEDOM SYSTEMS 08

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

MODULE III 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

MODULE IV VIBRATION OF CONTINUOUS SYSTEMS 08

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.

MODULE V VIBRATION MEASURMENT AND CONTROL 09

Measurement of vibration, free and forced tests, FFT analyzer, Modal analysis, methods of vibration control, excitation reduction at source, balancing of rigid rotors, field balancing, detuning and decoupling,

Total Hours: 45

REFERENCES:

1. Thomson W T, "Theory of Vibration with Applications", Prentice Hall of India, 1997.
2. Singiresu S Rao "Mechanical Vibrations", Prentice Hall, 2010
3. Ashok Kumar Mallik, "Principles of Vibration Control", Affiliated East-West Press Pvt. Ltd, 1990.

COURSE OUTCOMES:

At the end of the course students will be able to

- To write the basic equations of motion of vibratory systems.
- To predict Eigen values and Eigen vectors of two -degrees of freedom systems.
- To apply numerical methods to solve a multi degree freedom subjected to different types of excitation.
- To obtain solution for a continuous system.
- To measure and process vibration signals and employ methods of vibration control.

MECY010 OPTIMIZATION TECHNIQUES IN DESIGN

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To provide basic knowledge on optimization requirements
- To impart knowledge on various types optimization techniques
- To provide in knowledge on multi objective optimization
- To impart detailed knowledge on various static applications of optimization
- To provide knowledge on dynamic applications of optimization

MODULE I INTRODUCTION 05

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

MODULE II 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.

MODULE III 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.

MODULE IV 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 torsionall loaded members – Design of springs.

MODULE V 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 Hours: 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.

COURSE OUTCOMES:

At the end of the course students will be able to

- Analyse the need of optimization
- Analyse and identify suitable optimization technique
- Analyse multi objective optimization
- Analyse the various static applications of optimization
- Analyse the various dynamic applications of optimization

MECY011 TRIBOLOGY

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the basic theories of tribology in industrial systems that experience friction and wear.
- To acquire knowledge on the methods to reduce the friction for engineering surface by the use of lubricants.
- To learn the basics of hydrodynamic theory of lubrication.
- To understand Hertz contact and rough surface contact and design methods of rolling bearings.
- To familiarize with the methods of testing friction and wear.

MODULE I SURFACES, FRICTION AND WEAR 08

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.

MODULE II LUBRICATION THEORY 08

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.

MODULE III 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.

MODULE IV 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

MODULE V TRIBO MEASUREMENT IN INSTRUMENTATION 07

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

Total Hours: 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.

COURSE OUTCOMES:

At the end of the course students will be able to

- Have a comprehensive, systematic and integrated knowledge of the principles of friction and wear.
- Have a clear picture about lubrication mechanism and how to apply them to the practical engineering problem.
- Design an efficient and robust tribological system such as hydrodynamic bearing and dry sliding bearings for the needs of a specific application.
- Explain Hertz contact and rough surface contact and design methods of rolling bearing.
- Asses and select suitable methods to measure friction and wear under different sliding conditions.

MECY012 MECHANICS OF COMPOSITE MATERIALS

L	T	P	C
2	0	0	2

COURSE EDUCATIONAL OBJECTIVES:

- To understand the constitutive equations of composite materials and learn mechanical behavior at micro and macro level.
- To learn the mechanical behavior of layered composites compared to isotropic materials.
- To calculate stresses and strains in composites.
- To understand mechanical behavior of composites due to variation in temperature and moisture.

MODULE I INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS 10

Lamina Constitutive Equations: Lamina Assumptions–Macroscopic Viewpoint. Generalized Hooke's Law. Reduction to Homogeneous Orthotropic Lamina–Isotropic limit case, Orthotropic Stiffness matrix (Qij), Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations–Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli. Evaluation of Lamina Properties from Laminate Tests. Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

MODULE II LAMINA STRENGTH ANALYSIS AND ANALYSIS OF LAMINATED FLAT PLATES 10

Introduction- Maximum Stress and Strain Criteria. Von- Misses Yield criterion for Isotropic Materials. Generalized Hill's Criterion for Anisotropic materials. Tsai-Hill's Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations– Natural Frequencies

MODULE III THERMAL ANALYSIS 10

Assumption of Constant Co-efficient of Thermal Expansion (C.T.E.)-Modification of Hooke's Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E's. C.T.E's for special Laminate Configurations – Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi - Isotropic Laminates

Total Hours: 30

REFERENCES:

1. Gibson, R.F., Principles of Composite Material Mechanics, McGraw-Hill, 1994,
2. Second Edition-CRC press in progress.
3. Hyer, M.W., “Stress Analysis of Fiber–Reinforced Composite Materials”, McGraw-Hill, 1998
4. Issac M. Daniel and Ori Ishai, “Engineering Mechanics of Composite Materials”, Oxford University Press-2006, First Indian Edition-2007
5. Mallick, P.K., Fiber–”Reinforced Composites: Materials, Manufacturing and Design”, Maneel Dekker Inc, 1993.5.Halpin, J.C., “Primer on Composite Materials, Analysis”, Techomic Publishing Co., 1984.
6. Agarwal, B.D., and Broutman L.J., “Analysis and Performance of Fiber composites”, John Wiley and Sons, New York, 1990.
7. Mallick, P.K. and Newman, S., (edition), “Composite Materials Technology: Processes and Properties”, Hansen Publisher, Munish, 1990.
8. Madhujit Mukhopadhyay, “Mechanics of Composite Materials and Structures”, University Press (India) Pvt. Ltd., Hyderabad, 2004 (Reprinted 2008)
9. Chung, Deborah D.L., “Composite Materials: Science and Applications”, Ane Books Pvt. Ltd./Springer, New Delhi, 1st Indian Reprint, 2009

COURSE OUTCOMES:

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

- Apply constitutive equations of composite materials and understand mechanical behavior at micro and macro level.
- Explain the specifics of mechanical behavior of layered composites compared to isotropic materials.
- Determine stresses and strains in composites.
- Analyze mechanical behavior of composites due to variation in temperature and moisture.

MECY013	GEOMETRIC DIMENSIONING AND TOLERANCING	L	T	P	C
		1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To teach the principles of geometric product definition
- To educate the students on types of tolerances.

MODULE I INTRODUCTION 05

Introduction to limits fits and tolerances – GDNT definitions and importance -Datum reference frame – Feature control frame - MMC & LMC – General Rules – Datum System.

MODULE II PRINCIPLES OF MEASUREMENT FOR GEOMETRIC CHARACTERISTICS 10

Geometric characteristic symbols and meanings – Form tolerances – Profile tolerances – Location tolerances – Runout tolerances – Orientation tolerances – True position theory – Dimensional and tolerance schemes

Total Hours: 15

REFERENCES

1. ASME Y – 14.5
2. Rao Ming, Harry Peck, “Designing for Manufacture” , Pitman Publications, London, 1983.
3. Krulikowski. A, “Fundamentals of Geomtric Dimensioning and Tolerancing”, Delmar Publishers – New York, 1997
4. Spotts. M.F, “Dimensioning and Tolerance for Quality Production”, Prentice Hall Inc., New Jersey, 1983.
5. Oliver R Wade, “Tolerance Control in Design and Manufacturing”, Industrial Press Inc., New York, 2008.

COURSE OUTCOMES:

Students should be able to

- Analyze situations and proceed to the logical end to solve product’s geometric definitions in order to function and be cost effective.
- Totally consider function, manufacturing process and inspection methods in order to guarantee function with reduction in manufacturing and inspection cost.

PROFESSIONAL ELECTIVES ON CAM

		L	T	P	C
MECY014	**ADVANCES IN MANUFACTURING TECHNOLOGY**	**3**	**0**	**0**	**3**

COURSE EDUCATIONAL OBJECTIVES:

- To understand the wear mechanism in cutting tools and to predict its life.
- To learn the special machining process in creating holes and finishing it.
- To assess the principle and mechanism of metal removal of various unconventional machining processes.
- To understand the concept of various micro fabrication technology
- To explore the current scope, potential, limitations and implications of intelligent systems.

MODULE I 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.

MODULE II SPECIAL MACHINING 09

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

MODULE III UNCONVENTIONAL MACHINING 09

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.

MODULE IV MICROFABRICATION 06

Wafer preparation – monolithic processing – moulding – Printed circuit board hybrid and multi-chip module technology –electronic material and processing– stereolithographic surface acoustic wave (SAW) devices, Surface Mount Technology.

MODULE V ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS 09

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 Hours: 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. More Madon, Fundamentals of Microfabrication, CRC Press, 1997.
5. Rich E. and Knight K., “Artificial Intelligence ", McGraw Hill Inc, 1991.
6. Pham D.T., “Expert Systems in Engineering ", IFS Publishers, Springer-Verlag, 1988.
7. Durvent W.R., “The Lithographic hand book ", Narosa Publishers, 1995.
8. Pandey P.S. and Shah N. “Modern Manufacturing Processes ", 1980.
9. Sadasivan T.A. and Sarathy D. “Cutting tools for Productive Machining ", Widia (India) Limited, 1999.

COURSE OUTCOMES:

Students will be able

- To distinguish different materials used for cutting tools and to select the machining parameters for improving the tool life.
- To demonstrate various types of machining that can be carried out in special purpose machines.
- To identify the process parameters, their effect and applications of different processes.
- To realize the applications of Micro fabrication technology.
- To apply basic principles of AI in solutions that require problem solving, knowledge representation and learning

MECY015	CNC MACHINES AND COMPUTER AIDED MANUFACTURING	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To provide knowledge on basic concepts of computer aided manufacturing
- To impart knowledge on various components and structures of CNC machine tool
- To provide knowledge on various accessories of CNC machines
- To impart knowledge on programming involved in Computer Aided Manufacturing system
- To expose on various tools needed for CNC machines and maintenance of CNC machines

MODULE I INTRODUCTION TO CNC MACHINE TOOLS 07

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

MODULE II STRUCTURE OF CNC MACHINE TOOL 09

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.

MODULE III DRIVES AND CONTROLS 09

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.

MODULE IV 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.

MODULE V 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 Hours: 45

REFERENCES:

1. HMT, Mechatronics, Tata McGraw-Hill Publishing Company Limited, New Delhi, 1998.
2. James Madison, “CNC Machining Hand Book ", Industrial Press Inc., 1996.
3. Steve Krar, Arthur Gill, “CNC Technology and Programming ", McGraw-Hill International Editions, 1990.
4. Berry Leathan - Jones, “Introduction to Computer Numerical Control ", Pitman, London, 1987.
5. Hans B.Kief, T.Fredericx Waters, “Computer Numerical Control ", MacMillan / McGraw-Hill, 1992.
6. Bernard Hodgers, “CNC Part Programming Work Book ", city and Guids / Macmillan, 1994.
7. David Gribbs, “An Introduction to CNC Machining ", Cassell, 1987.
8. Sadasivan, T.A. and Sarathy, D, “Cutting Tools for Productive Machining ", Widia (India) Ltd., August 1999.
9. Radhakrishnan, P. “Computer Numerical Control Machines ", New Central Book Agency, 1992.
10. Peter Smid, “CNC Programming Hand Book ", Industrial Press Inc., 2000.

COURSE OUTCOMES:

At the end of the course students will be able to

- Analyse CNC machines
- Design and analyse the structure of CNC machine tools
- Identify appropriate accessories for CNC machines based on requirements
- Part Programming for CNC machining
- Identify tools and maintenance methods of CNC machines

MECY016 POLYMERS AND COMPOSITES

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To learn various polymers and their applications
- To know about the various processing techniques of plastics used in industries.
- To understand the machining and joining of plastics.
- To learn the important fibers used in the composite materials and various commercial procedures used for manufacturing PMCs.
- To acquire knowledge on the manufacturing methods of MMCs.

MODULE I INTRODUCTION 05

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

MODULE II PROCESSING OF PLASTICS 12

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

MODULE III MACHINING AND JOINING OF PLASTICS 07

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

MODULE IV 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.

MODULE V PROCESSING OF METAL MATRIX COMPOSITES 09

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 Hours: 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.

COURSE OUTCOMES:

At the end of the course students will be able to

- Explain different polymers and select a polymer for specific applications.
- Demonstrate different processing techniques of plastics.
- Evaluate the various techniques for shaping and joining of plastics.
- Compare variety of fibers used in PMCs and their fabrication techniques.
- Outline the techniques for manufacturing MMCs and identify their applications.

MECY017	PRECISION ENGINEERING AND NANO TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To provide basic knowledge on Precision engineering materials
- To impart knowledge on various types of Precision machining techniques
- To provide in knowledge on precision machining tools
- To impart detailed knowledge on characterization of nano materials
- To provide knowledge on various applications of Nano materials

MODULE I MATERIALS FOR PRECISION ENGINEERING 08

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.

MODULE II 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 iso-static dimensional wear of elements – instruments; Machining tools their influence an accuracy- error due to clamping and setting location.

MODULE III 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 bearings- applications-limitations - advantages.

MODULE IV NANOMATERIALS SYNTHESIS AND CHARACTERIZATION 10

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. Scanning Probe Microscopy (SPM), Transmission electron microscope, Scanning transmission electron microscope, Atomic force microscope, Scanning thermal microscopy Nano indentation.

MODULE V APPLICATIONS OF NANOMATERIALS 09

Applications in Mechanical, Electronics engineering industries – Use of nanomaterials in automobiles, aerospace, defense and medical applications – Metallic, polymeric, organic and ceramic nanomaterials. LIGA, Ion beam etching, Molecular manufacturing techniques – Nano machining techniques, Top/Bottom up Nano fabrication techniques - Sub micron lithographic technique, conventional film growth technique, Chemical etching, Quantum materials.

Total Hours: 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.

COURSE OUTCOMES:

At the end of the course students will be able to

- Analyse and identify precision engineering materials
- Analyse various types of Precision machining techniques
- Analyse and identify precision machining tools for requirement
- Analyse the characterization of nano materials
- Analyse various applications of Nano materials

MECY018	MECHATRONICS FOR MANUFACTURING SYSTEMS	L	T	P	C
		2	0	0	2

COURSE EDUCATIONAL OBJECTIVES:

- To study the definition and application of mechatronics systems
- To choose appropriate sensors to be used in manufacturing technology
- To select the required actuator for an application

MODULE I MECHATRONICS AND ITS APPLICATION 08

Mechatronics definition - Systems- Measurement Systems - Control Systems - Traditional and Mechatronics design concepts - Case studies of Mechatronics systems - Pick and place Robot -Conveyor based material handling system - PC based CNC drilling machine – Mechatronic control in automated manufacturing

MODULE II SENSORS AND TRANSDUCERS 12

Introduction - Performance Terminology – Potentiometers - LVDT-Capacitance sensors – Strain gauges – Eddy current sensor – Hall effect sensor - Temperature sensors – Light sensors - Selection of sensors - Signal processing .

MODULE III ACTUATORS 10

Actuators – Mechanicsl – Electrical – Fluid Power – Piezoelectric –magnetostrictive – Shape memory alloy – applications – selection of actuators

Total Hours: 30

REFERENCES:

1. Bolton.W, “Mechatronics” , Pearson education, second edition, fifth Indian Reprint, 2003.
2. Smaili.A and Mrad.F , "Mechatronics integrated technologies for intelligent machines", Oxford university press, 2008.
3. Devadas Shetty and Richard A.Kolk, “Mechatronics systems design”, PWS Publishing Company, 2007.
4. Godfrey C. Onwubolu, "Mechatronics Principles and Applications", Elsevier, 2006.
5. Nitaigour Premchand Mahalik, “Mechatronics Principles, Concepts and Applicatlions” Tata McGraw-Hill Publishing company Limited, 2003.
6. Michael B.Histand and Davis G.Alciatore,” Introduction to Mechatronics and Measurement systems”. McGraw Hill International edition, 1999.
7. Bradley D.A, Dawson.D, Buru N.C and Loader A.J, “Mechatronics” Nelson

Thornes ltd, Eswar press, Indian print, 2004.

COURSE OUTCOMES:

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

- Explain the importance of mechatronics and its application in manufacturing systems
- Select suitable sensor and corresponding signal conditioning that is required
- Choose appropriate actuators for given manufacturing system

MECY019 NEWER MATERIALS

L	T	P	C
2	0	0	2

COURSE EDUCATIONAL OBJECTIVES:

- To learn the Physical Properties of various Smart Materials
- To acquire knowledge on synthesis of newer materials.
- To learn the techniques of characterization of newer materials.
- To acquire knowledge on applications of smart sensor, actuator and transducer technologies.

MODULE I SMART BEHAVIOURS AND MATERIALS 12

Piezoelectric, electrostrictive, magnetostrictive, pyroelectric, electrooptic, Piezomagnetism, Pyromagnetism, Piezoresitivity, Thermoelectricity, photon striction, Thermally and Magnetically activated Shape memory alloy, Superelastic, Viscoelastic, Thermochromic materials. Magneto rheological fluid: constitutive behaviour and its applications as damper, Behaviour of Electro active polymer and its use as artificial muscles.

MODULE II MATERIAL SYNTHESIS 06

Solid state reaction, sol-gel process.

MODULE III APPLICCATIONS 12

Impact Design and fabrication of devices and structures and their integration with system, Biomorphs / Moonies, Chip capacitor, Memory devices (FRAM), Sensor, actuator and transducers, Accelerometer, Gyroscopes, Ultrasonic Motor, Liquid Crystal display, Photonics, Structural Health Monitoring

Total Hours: 30

REFERENCES:

1. Volti Rudi, “Society and Technology Change”, 6th Edition, Worth publishers Inc, USA, 2009.
2. Ferroelectric devices- Kenji Uchino, Marcell Decker Inc., 2000.
3. Smart Materials and Structures- M.V. Gandhi, B.S. Thompson, Chapman and Hall, London1992.
4. Electromechanical Sensors and Actuators, Ilene J. Busch-Vishniac, Springer-Verlag NY,1999.
5. Fundamentals of Piezoelectricity- Takuro Ikeda, Oxford University Press, 1990.

6. Actuators: Basics and Applications H.armut Janocha (Ed), Springer-Verlag Berlin Heidelberg, 2004.
7. Smart Material Systems: Model Developments, Ralph C. Smith, Cambridge University Press, Series: Frontiers in Applied Mathematics (No. 32), 2005.
8. T. Yoneyama & S. Mayazaki, Shape memory alloys for biomedical applications, CRC Press, 2009
9. Kwang J. Kim & S. Tadokoro, Electroactive polymers for robotics applications, artificial muscles and sensors, Springer, 2007.

COURSE OUTCOMES:

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

- Summarize the properties of newer materials, their synthesis and characterization.
- Explain the development of actuators and sensors and their integration into a smart structure
- Demonstrate about application areas of smart materials

MECY020 AUTOMOTIVE MANUFACTURING

L	T	P	C
1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To impart knowledge on various machining processes of automotive components
- To gain knowledge on different forming processes

MODULE I MACHINING PROCESS 08

Machining of connecting rods - crank shafts - cam shafts - pistons - piston pins – piston rings – valves - front and rear axle housings - fly wheel - Honing of cylinder bores - Copy turning and profile grinding machines

MODULE II FORMING PROCESS 07

Powder injection molding - Production of aluminum MMC liners for engine blocks - Plasma spray coated engine blocks and valves - Recent developments in auto body panel forming –Squeeze Casting of pistons - aluminum composite brake rotors - Sinter diffusion bonded idler sprocket – gas injection molding of window channel – cast con process for auto parts

Total Hours: 15

TEXT BOOK

1. Heldt. P.M., “High Speed Combustion Engines”, Oxford Publishing Co., New York, 1990

REFERENCES

1. Haslehurst.S.E., “Manufacturing Technology”, ELBS, London, 1990
2. Rusinoff, “Forging and Forming of metals”, D.B. Taraporevala Son & Co. Pvt Ltd., Mumbai, 1995.
3. Sabroff.A.M. & Others, “Forging Materials & Processes”, Reinhold Book Corporation, New York, 1988.
4. Upton, “Pressure Die Casting”, Pergamon Press, 1985.
5. High Velocity “Forming of Metals”, ASTME, prentice Hall of India (P) Ltd., New Delhi, 1990

COURSE OUTCOMES:

Students should be able to

- Execute various machining processes
- Apply suitable forming process for various automotive components

MECY021 VIRTUAL MANUFACTURING

L	T	P	C
1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To understand the fundamentals of virtual manufacturing
- To introduce different facets of virtual manufacturing

MODULE I FUNDAMENTALS OF VIRTUAL MANUFACTURING 08

Paradigms of VM: Design-centered VM, Production-centered VM and Control-centered VM. Generic VM Issues - relationships between VM, Virtual Prototyping, the Virtual Enterprise. Role of object oriented technology in VM - Integrated Simulation Method to Support Virtual Factory Engineering Application of Virtual Reality

MODULE II FACETS OF VIRTUAL MANUFCATURING 07

Dispersed Network Manufacturing - Virtual factory, enterprise collaborative modeling system - virtual manufacturing (VM) system - Web-based work flow management, collaborative product commerce - applications of multi-agent technology - e-supply chain management and tele-manufacturing

Total Hours: 15

TEXT BOOKS

1. Warim Ahmed Khan Abdul Raouz, Kari Chens, Virutal Manufacturing, Springer Series in Advanced Manufacturing.

REFERENCES

1. Crabb, C. H., The Virtual Engineer-21st Century Product Development, Society of Manufacturing Engineers, 1998.
2. Rao Ming, Qun Wang, Jianzhong Cha, Integrated Distributed Intelligent Systems in Manufacturing (Intelligent Manufacturing), Chapman & Hall 1993.
3. Prasant Banerjee, Virtual manufacturing a willey, I addition 2001.

COURSE OUTCOMES:

Students should be able to

- Describe the fundamentals of virtual manufacturing
- Explain different facets of virtual manufacturing

PROFESSIONAL ELECTIVES ON CAD / CAM MANAGEMENT

MECY022 DATA COMMUNICATION IN CAD/CAM

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To provide basic knowledge on various digital computers and microprocessors
- To impart knowledge on typical components of operating systems and environments
- To provide in depth knowledge on data communication systems
- To impart detailed knowledge on networking systems
- To provide knowledge on internet services and tools for communication

MODULE I DIGITAL COMPUTERS & MICRO PROCESSORS 09

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.

MODULE II OPERATING SYSTEM & ENVIRONMENTS 09

Types - functions - UNIX & WINDOWS - 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.

MODULE III COMMUNICATION MODEL 09

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.

MODULE IV COMPUTER NETWORKS 09

Network structure - network architecture - the OSI reference model services network standardization – example - Managing remote systems in network – cloud computing- on demand computing- high performance computing- network file systems.

MODULE V INTERNET 09

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

Total Hours: 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.

COURSE OUTCOMES:

At the end of the course students will be able to

- Analyse various digital computers and microprocessors
- Describe and identify typical components of operating systems and environments
- Analyse and design necessary data communication system
- Incorporate various networking systems and remote computing
- Identify and select suitable internet services and tools for communication

MECY023 INDUSTRIAL SAFETY MANAGEMENT

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the fundamentals of safety management.
- To acquire knowledge on the occupational hazards in extreme cases.
- To learn the safety measures followed in the Industry.
- To acquire knowledge on the safety standards that must be maintained with regulatory requirements.
- To learn the various safety laws in the work place.

MODULE I SAFETY MANAGEMENT 09

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.

MODULE II OPERATIONAL SAFETY 09

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.

MODULE III SAFETY MEASURES 09

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.

MODULE IV ACCIDENT PREVENTION 09

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.

MODULE V SAFETY, HEALTH, WELFARE & LAWS 09

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 Hours: 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.

COURSE OUTCOMES:

Students will be able to

- Demonstrate safety concepts practiced in Industry.
- Analyze the required safety precautions under worst operating conditions.
- Evaluate the possible safety prevention measures while handling hazardous substances.
- Demonstrate an understanding of work place injury prevention and incident investigations.
- Students are expected to have knowledge in the safety laws to be followed at various places of the workplace.

MECY024	INTEGRATED MANUFACTURING SYSTEMS AND MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the various manufacturing strategies and the role of CIM in management.
- To acquire knowledge to select a suitable process in order to minimize waiting time in a system.
- To understand the importance of location of plant and facilities.
- To gain knowledge on Inventory systems, MRP and information control systems.
- To learn to use computers to increase the productivity.

MODULE I FIELD OF MANUFACTURING MANAGEMENT 09

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

MODULE II DESIGNING OF PRODUCTION PROCESSES 09

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

MODULE III DESIGN OF FACILITIES AND JOBS 09

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

MODULE IV INVENTORY SYSTEMS AND MRP 09

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.

MODULE V INFORMATION SYSTEM FOR MANUFACTURING 09

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 Hours: 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.

COURSE OUTCOMES:

Students will be able to

- Analyze the various strategies adopted in a Management.
- Simulate various queuing techniques to select a suitable process.
- Evaluate the importance of location of plant layout.
- Predict the importance of Inventory systems.
- Apply the use of computers in creating data base for production scheduling.

MECY025 MANUFACTURING INFORMATION SYSTEMS

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To provide basic knowledge on MRP and production organization
- To impart knowledge on various types and components of data
- To provide in knowledge on various approach of database design
- To impart detailed knowledge on various components of manufacturing organization
- To provide knowledge on Information management for manufacturing

MODULE I INTRODUCTION 05

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

MODULE II DATABASE 07

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

MODULE III DESIGNING DATABASE 13

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

MODULE IV 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.

MODULE V 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 Hours: 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.

COURSE OUTCOMES:

At the end of the course students will be able to

- Analyse on MRP and production organization
- Analyse various types and components of database
- Analyse various approaches and Design the database
- Analyse various components of manufacturing database organization
- Analyse the Information management for manufacturing

MECY026	RELIABILITY AND TOTAL PRODUCTIVE MAINTENANCE	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To provide knowledge on basic concepts of reliability and failure analysis
- To impart knowledge on various reliability assessment and monitoring techniques
- To provide in knowledge on approach to reliability improvement
- To impart detailed knowledge on basics and types of maintainability
- To provide knowledge on various maintainability issues and remedies

MODULE I 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.

MODULE II RELIABILITY ASSESSMENT AND MONITORING 09

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.

MODULE III RELIABILITY IMPROVEMENT 06

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

MODULE IV 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.

MODULE V MAINTENANCE LOGISTICS, QUALITY AND TPM 09

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 Hours: 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.

COURSE OUTCOMES:

At the end of the course students will be able to

- Analyse reliability and failure in mechanical systems
- Assess reliability
- Analyse various monitoring and reliability improvement techniques
- Analyse the maintainability of equipment
- Analyse various maintainability issues and remedies

MECY027 PRODUCT LIFE CYCLE MANAGEMENT

L	T	P	C
1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To provide basic knowledge Product Life Cycle Management
- To provide in knowledge on PLM concepts
- To understand PLM strategy and assessment

MODULE I INTRODUCTION TO PRODUCT LIFE CYCLE MANAGEMENT (PLM) 05

Definition- PLM Lifecycle model-Threads of PLM-Need for PLM- Opportunities and benefits of PLM- Views, Components and Phases of PLM- PLM feasibility study-PLM visioning.

MODULE II PLM CONCEPTS AND PROCESSES 05

Characteristics of PLM- Environment driving PLM- PLM Elements- Drivers of PLM-Conceptualization- Design- Development-Validation- Production-, Support of PLM

MODULE III PLM STRATEGY AND ASSESSMENT 05

Strategy, Impact of strategy, implementing a PLM strategy, PLM initiatives to support corporate objectives. Infrastructure assessment, assessment of current systems and applications.

Total Hours: 15

REFERENCES:

1. Grieves, Michael. Product Lifecycle Management, McGraw-Hill, 2006.
2. Product Life Cycle Management - by Antti Saaksvuori, Anselmi Immonen, Springer, 1st Edition, 2003
3. Stark, John. Product Lifecycle Management: Paradigm for 21st Century Product Realisation, Springer-Verlag, 2004.
4. Team Center Engineering and Product Lifecycle Management Basics, by Stephen M. Samuel; Eric D. Weeks and Mark A. Kelley

COURSE OUTCOMES:

At the end of the course students will be able to

- Realize the importance of PLM in CAD/CAM
- Analyse and identify PLM processes
- Design and assess PLM strategy

GENERAL ELECTIVES

GECY101	PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

The objectives of the course would be to make the students

- Learn to e valuate and choose an optimal project and build a project profile.
- Attain knowledge on risk identification and risk analysis
- Gain insight into a project plan and components
- Familiar with various gamut of technical analysis for effective project implementation
- Learn to apply project management techniques to manage resources.

MODULE I INTRODUCTION & PROJECT INITIATION 09

Introduction to project and project management - projects in contemporary organization – The project life cycle - project initiation - project evaluation methods & techniques - project selection criteria - project profile.

MODULE II RISK ANALYSIS 09

Sources of risk: project specific - competitive - industry specific - market and international risk – perspectives of risk – risk analysis: sensitivity analysis - scenario analysis - breakeven analysis - simulation analysis - decision tree analysis – managing/mitigating risk – project selection under risk.

MODULE III PROJECT PLANNING & IMPLEMENTATION 09

Project planning – importance – functions - areas of planning - project objectives and policies - steps in planning process - WBS – capital requirements - budgeting and cost estimation - feasibility analysis - creation of project plan – project implementation: pre-requisites - forms of project organization

MODULE IV TECHNICAL ANALYSIS 09

Technical analysis for manufacturing/construction/infrastructure projects – process/technology - materials and inputs - product mix - plant capacity – plant location and site selection – plant layout - machinery and equipment – structures and civil works – schedule of project implementation – technical analysis for software projects.

MODULE V PROJECT MANAGEMENT TECHNIQUES 09

Project scheduling - network construction – estimation of project completion time – identification of critical path - PERT & CPM – crashing of project network - complexity of project scheduling with limited resources - resource allocation - resource leveling – resource smoothing – overview of project management software.

Total Hours: 45

REFERENCES:

1. Projects: Planning, Analysis, Financing, Implementation and Review, Prasanna Chandra, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2004.
2. Project Management and Control, Narendra Singh, Himalaya Publishing, New Delhi, 2015.
3. A Management Guide to PERT/CPM, Jerome, D. Weist and Ferdinand K. Levy, Prentice Hall of India, New Delhi, 1994.

OUTCOMES:

On successfully completing this course, the student will be able to:

- Evaluate & select a project as well as develop a project profile.
- Identify various risks associated with the project and manage it effectively.
- Prepare a detailed project plan addressing its components.
- Perform technical analysis for effective project implementation
- Apply project management techniques for maximizing resource utilization.

GECY102 SOCIETY, TECHNOLGY & SUSTAINABILITY

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To aware of new technologies through advances in Science and Engineering.
- To make them realise the profound impact on society.
- To understand the ethical issues raised by technological changes and its effect on society.
- To introduce students a broad range of perspectives on the adoption and use of technologies.
- To make them realize the need of sustainability in the context of emerging technologies.

MODULE I TECHNOLOGY AND ITS IMPACTS 09

Origin and evolution of technologies – Nature of technology- Innovation – Historical Perspective of technology – Sources of technological change - Co-evolution of technology and economy – Scientific knowledge and technological advance – Science and Engineering aspects of Technology – Impact on the Society – Social and Ethical Issues associated with technological change – Social and environmental consequences - Impact of technological change on human life – Technology and responsibility – Technology and social justice.

MODULE II TECHNOLOGY AND ITS ADVANCEMENT 09

Sociological aspects of technology – Ethics and technology – Technology and responsibility – International Economics, Globalisation and Human Rights – Sustainability and Technology – Population and environment - Technology, Energy and Environment – Organisations and technological change.

MODULE III SOCIETY AND TECHNOLOGY 09

Impact of technologies on contemporary society – Role of society in fostering the development of technology – Response to the adaption and use of technology – Impact of technology on developer and consumers – Technological change and globalisation.

MODULE IV IMPACT OF A SPECIFIC TECHNOLOGY ON HUMAN WELFARE 09

Impact of the following technologies on Human life – Medical and Biomedical – Genetics Technology – Electronics and Communications – Electronic media

Technology – Information Systems Technology – Nanotechnology – Space Technology and Energy Technology.

MODULE V THE IMPORTANCE OF SUSTAINABILITY 09

Sustainability – A brief history – Concepts and contexts for sustainability – Ecological imbalance and biodiversity loss – Climate change – Population explosion. Industrial ecology – systems approach to sustainability – Green engineering and technology- sustainable design- sustainable manufacturing- Green consumer movements – Environmental ethics – Sustainability of the planet Earth – Future planning for sustainability.

Total Hours: 45

REFERENCES:

1. Volti Rudi, “Society and Technology Change”, 6th Edition, Worth publishers Inc, USA, 2009.
2. Arthur W.A, “The nature of Technology: What it is and how it evolves”, Free Press, NY, USA, 2009.
3. Winston M and Edelbach R, “Society, Ethics and Technology”, 3rd Edition, San Francisco, USA, 2005.
4. Martin A.A Abraham, “Sustainability Science and Engineering: Defining Principles”, Elsevier Inc, USA, 2006.
5. R.V.G.Menon, “Technology and Society”, Pearson Education, India, 2011.

COURSE OUTCOMES:

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

- Understand the benefits of modern technology for the well-being of human life.
- Connect sustainability concepts and technology to the real world challenges.
- Find pathway for sustainable society.

GECY103 ARTIFICIAL INTELLIGENCE

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- Expose the history and foundations of artificial intelligence.
- Showcase the complexity of working on real time problems underlying the need for intelligent approaches.
- Illustrate how heuristic approaches provide a good solution mechanism.
- Provide the mechanisms for simple knowledge representation and reasoning.
- Highlight the complexity in working with uncertain knowledge.
- Discuss the current and future applications of artificial intelligence.

MODULE I HISTORY AND FOUNDATIONS 08

History – Scope – Influence from life – Impact of computing domains - Agents in environments - Knowledge representation – Dimensions of Complexity – Sample application domains – Agent structure.

MODULE II SEARCH 10

Problem solving as search – State spaces – Uninformed Search – Heuristic search – Advanced search – Constraint satisfaction - Applications.

MODULE III KNOWLEDGE REPRESENTATION AND REASONING 10

Foundations of knowledge representation and reasoning, representing and reasoning about objects, relations, events, actions, time, and space predicate logic, situation calculus, description logics, reasoning with defaults, reasoning about knowledge, sample applications.

MODULE IV REPRESENTING AND REASONING WITH UNCERTAIN KNOWLEDGE 08

Probability, connection to logic, independence, Bayes rule, Bayesian networks, probabilistic inference, sample applications.

MODULE V CASE STUDY AND FUTURE APPLICATIONS 09

Design of a game / Solution for problem in student's domain. Natural Language processing, Robotics, Vehicular automation – Scale, Complexity, Behaviour – Controversies.

Total Hours: 45

TEXT BOOK:

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice Hall, Third Edition, 2010.
2. David Poole, Alan Mackworth, Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press, 2010.
3. Nils J. Nilsson, The Quest for Artificial Intelligence, Cambridge University Press, Online edition, 2013.
4. Keith Frankish, William M. Ramsey (eds) The Cambridge Handbook of Artificial Intelligence, Cambridge University Press, 2014.

COURSE OUTCOMES:

Students who complete this course will be able to

- Discuss the history, current applications, future challenges and the controversies in artificial intelligence.
- Apply principle of AI in the design of an agent and model its actions.
- Design a heuristic algorithm for search problems.
- Analyze and represent the fact using logic for a given scenario
- Represent uncertainty using probabilistic models
- Develop a simple game or solution using artificial intelligence techniques.

GECY104 GREEN COMPUTING

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To focus on the necessity of green computing technology.
- To expose to various issues with information technology and sustainability.
- To attain knowledge on the technologies for enabling green cloud computing.
- To elaborate on the energy consumption issues
- To illustrate a Green and Virtual Data Center
- To develop into a Green IT Technologist.

MODULE I INTRODUCTION 08

Trends and Reasons to Go Green - IT Data Center Economic and Ecological Sustainment - The Growing Green Gap: Misdirected Messaging, Opportunities for Action - IT Data Center “Green” Myths and Realities - PCFE Trends, Issues, Drivers, and Related Factors - Green Computing and Your Reputation- Green Computing and Saving Money- Green Computing and the Environment

MODULE II CONSUMPTION ISSUES 10

Minimizing power usage – Cooling - Electric Power and Cooling Challenges - Electrical – Power -Supply and Demand Distribution - Determining Energy Usage - From Energy Avoidance to Efficiency - Energy Efficiency Incentives, Rebates, and Alternative Energy Sources - PCFE and Environmental Health and Safety Standards- Energy-exposed instruction sets- Power management in power-aware real-time systems.

MODULE III NEXT-GENERATION VIRTUAL DATA CENTERS 09

Data Center Virtualization - Virtualization beyond Consolidation - Enabling Transparency - Components of a Virtual Data Center - Datacenter Design and Redesign - Greening the Information Systems - Staying Green- Building a Green Device Portfolio- Green Servers and Data Centers- Saving Energy

MODULE IV TECHNOLOGIES FOR ENABLING GREEN AND VIRTUAL DATA CENTERS 08

Highly Effective Data Center Facilities and Habitats for Technology - Data Center Electrical Power and Energy Management - HVAC, Smoke and Fire Suppression

- Data Center Location - Virtual Data Centers Today and Tomorrow - Cloud Computing, Out-Sourced, and Managed Services.

MODULE V SERVERS AND FUTURE TRENDS OF GREEN COMPUTING 10

Server Issues and Challenges - Fundamentals of Physical Servers - Types, Categories, and Tiers of Servers - Clusters and Grids - Implementing a Green and Virtual Data Center - PCFE and Green Areas of Opportunity- 12 Green Computer Companies- What's in Green computer science-Green off the Grid aimed for data center energy evolution-Green Grid Consortium- Green Applications- Green Computing Making Great Impact On Research

Total Hours: 45

REFERENCES:

1. Bud E. Smith,"Green Computing Tools and Techniques for Saving Energy, Money, and Resources", Taylor & Francis Group, CRC Press, ISBN-13: 978-1-4665-0340-3, 2014.
2. Jason Harris, "Green Computing and Green IT Best Practices, On Regulations and Industry Initiatives, Virtualization and power management, materials recycling and Tele commuting, Emereo Publishing .ISBN-13: 978-1-9215-2344-1,2014.
3. Ishfaq Ahmed & Sanjay Ranka, "Handbook of Energy Aware and Green Computing", CRC Press, ISBN: 978-1-4665-0116-4, 2013.
4. Kawahara, Takayuki, Mizuno, "Green Computing with Emerging Memory", Springer Publications, ISBN:978-1-4614-0811-6, 2012
5. Greg Schulz, "The Green and Virtual Data Center", CRC Press, ISBN-13:978-1-4200-8666-9, 2009.
6. Marty Poniatowski, "Foundation of Green IT: Consolidation, Virtualization, Efficiency, and ROI in the Data Center", Printice Hall, ISBN: 9780-1-3704-375-0, 2009.

COURSE OUTCOMES:

Students who complete this course will be able to

- Demonstrate issues relating to a range of available technologies, systems and practices to support green computing.
- Select appropriate technologies that are aimed to reduce energy consumption.
- Address design issues needed to achieve an organizations' green

computing objectives.

- Analyze the functionality of Data Centers.
- Critically evaluate technologies and the environmental impact of computing resources for a given scenario.
- Compare the impact of Green Computing with other computing techniques.

GECY105 GAMING DESIGN

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To master event-based programming
- To learn resource management as it relates to rendering time, including level-of-detail and culling.
- To become familiar with the various components in a game or game engine.
- To explore leading open source game engine components.
- To become familiar of game physics.
- To be compatible with game animation.

MODULE I INTRODUCTION 09

Magic Words – What Skills Does a Game Designer Need? – The Most Important Skill -The Five Kinds of Listening-The Secret of the Gifted.

MODULE II THE DESIGNER CREATES AN EXPERIENCE 09

The Game Is Not the Experience -Is This Unique to Games? -Three Practical Approaches to Chasing Rainbows -Introspection: Powers, Perils, and Practice -Dissect Your Feelings -Defeating Heisenberg -Essential Experience.

MODULE III THE EXPERIENCE IN THE PLAYER MIND AND GAME MECHANICS 08

Modeling – Focus -Empathy – Imagination – Motivation – Space – Objects, Attributes, and States – Actions – Rules.

MODULE IV GAMES THROUGH AN INTERFACE 09

Breaking it Down – The Loop of Interaction – Channels of Information – Other Interface.

MODULE V BALANCED GAME MECHANICS 10

Balance – The Twelve Most Common Types of Game Balance – Game Balancing Methodologies - Balancing Game Economies.

Total Hours: 45

REFERENCES:

1. Jesse Schell, "The Art of Game Design: A Book of Lenses", 2nd Edition

ISBN-10: 1466598646, 2014.

2. Ashok Kumar, Jim Etheredge, Aaron Boudreaux, “Algorithmic and Architectural Gaming Design: Implementation and Development", 1st edition, Idea Group, U.S ISBN-10: 1466616342, 2012.
3. Katie Salen Tekinba, Melissa Gresalfi, Kylie Peppler, Rafi Santo, "Gaming the System - Designing with Gamestar Mechanic" MIT Press , ISBN-10: 026202781X, 2014.
4. James M. Van Verth, Lars M. Bishop "Essential Mathematics for Games and Interactive Applications", Third Edition, A K Peters / CRC Press, ISBN-10: 1482250926, 2015.

COURSE OUTCOMES:

Students who complete this course will be able to

- Realize the basic history and genres of games
- Demonstrate an understanding of the overall game design process
- Explain the design tradeoffs inherent in game design
- Design and implement basic levels, models, and scripts for games
- Describe the mathematics and algorithms needed for game programming
- Design and implement a complete three-dimensional video game

GECY106 SOCIAL COMPUTING

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To create original social applications, critically applying appropriate theories and effective practices in a reflective and creative manner.
- To critically analyze social software in terms of its technical, social, legal, ethical, and functional features or affordances.
- To encourage the development of effective communities through the design, use, and management of social software.
- To give students with a base of knowledge and advances for them to critically examine existing social computing services.
- To plan and execute a small-scale research project in social computing in a systematic fashion.
- To become familiar with the concept of computational thinking.

MODULE I BASIC CONCEPTS 09

Networks and Relations: Relations and Attributes, Analysis of Network Data, Interpretation of network data -New Social Learning – Four Changes that Shift Work - Development of Social Network Analysis: Sociometric analysis and graph theory, Interpersonal Configurations and Cliques – Analysing Relational Data.

MODULE II SOCIAL LINK 09

Individual Actors, Social Exchange Theory, Social Forces, Graph Structure, Agent Optimization Strategies in Networks – Hierarchy of Social Link Motivation- Social Context.

MODULE III SOCIAL MEDIA 08

Trends in Computing – Motivations for Social Computing – Social Media: Social relationships, Mobility and Social context – Human Computation – Computational Models- Business use of social Media.

MODULE IV SOCIAL INFORMATION FILTERING 09

Mobile Location Sharing – Location based social media analysis – Social Sharing and Social Filtering – Automated recommender Systems – Traditional and Social Recommender Systems.

MODULE V SOCIAL NETWORK STRATEGY 10

Application of Topic Models – Opinions and Sentiments – Recommendation Systems – Language Dynamics and influence in online communities – Psychometric analysis – Case Study: Social Network Strategies for surviving the zombie apocalypse.

Total Hours: 45

REFERENCES:

1. Tony Bingham, Marcia Conner, “The New Social Learning, Connect. Collaborate. Work”, 2nd Edition, ATD Press, ISBN-10:1-56286-996-5, 2015.
2. Nick Crossley, Elisa Bellotti, Gemma Edwards, Martin G Everett, Johan Koskinen, Mark Tranmer, “Social Network Analysis for Ego-Nets”, SAGE Publication, 2015.
3. Zafarani, Abbasi and Liu, Social Media Mining: An Introduction, Cambridge University Press, 2014.
4. Christina Prell, “Social Network Analysis: History, Theory and Methodology”, 1st Edition, SAGE Publications Ltd, 2012.
5. John Scott, “Social Network Analysis”, Third Edition, SAGE Publication, 2013.
6. Jennifer Golbeck, “Analyzing the Social Web”, Elsevier Publication, 2013.
7. Huan Liu, John Salerno, Michael J. Young, “Social computing and Behavioral Modeling”, Springer Publication, 2009.

COURSE OUTCOMES:

Students who complete this course will be able to

- Realize the range of social computing applications and concepts.
- Analyze data left after in social media.
- Recognize and apply the concepts of computational models underlying social computing.
- Take out simple forms of social diagnostics, involving network and language models, applying existing analytic tools on social information.
- Evaluate emerging social computing applications, concepts, and techniques in terms of key principles.
- Design and prototype new social computing systems.

GECY107 SOFT COMPUTING

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

The aim of the course is to

- Enumerate the strengths and weakness of soft computing
- Illustrate soft computing methods with other logic driven and statistical method driven approaches
- Focus on the basics of neural networks, fuzzy systems, and evolutionary computing
- Emphasize the role of euro-fuzzy and hybrid modeling methods
- Trace the basis and need for evolutionary computing and relate it with other soft computing approaches

MODULE I SOFT COMPUTING - BASICS 06

Soft computing – Hard Computing – Artificial Intelligence as the basis of soft computing – Relation with logic driven and statistical method driven approaches- Expert systems – Types of problems: Classification, Functional approximation, Optimizations – Modeling the problem – Machine Learning – Hazards of Soft Computing – Current and future areas of research

MODULE II ARTIFICIAL NEURAL NETWORK 12

Artificial Neuron – Multilayer perceptron – Supervised learning – Back propagation network –Types of Artificial Neural Network: Supervised Vs Un Supervised Network – Radial basis function Network – Self Organizing Maps – Recurrent Network – Hopfield Neural Network – Adaptive Resonance Theory – Issues in Artificial Neural Network – Applications

MODULE III FUZZY SYSTEMS 09

Fuzzy Logic – Membership functions – Operators – Fuzzy Inference systems – Other sets: Rough sets, Vague Sets – Fuzzy controllers - Applications

MODULE IV NEURO FUZZY SYSTEMS 09

Cooperative Neuro fuzzy systems – Neural network driven fuzzy reasoning – Hybrid Neuro fuzzy systems – Construction of Neuro Fuzzy systems: Structure Identification phase, Parameter learning phase – Applications

MODULE V EVOLUTIONARY COMPUTING 09

Overview of evolutionary computing – Genetic Algorithms and optimization –

Genetic Algorithm operators – Genetic algorithms with Neural/Fuzzy systems – Variants of Genetic Algorithms– Population based incremental learning – Evolutionary strategies and applications

Total Hours: 45

TEXTBOOKS:

1. Samir Roy, “Introduction to Soft Computing: Neuro-Fuzzy and Genetic Algorithms”, Pearson, 2013
2. Anupam Shukla, Ritu Tiwari and Rahul Kala, “Real life applications of Soft Computing”, CRC press, 2010.
3. Fakhreddine O. Karray, “Soft Computing and Intelligent Systems Design: Theory, Tools and Applications”, Pearson, 2009

COURSE OUTCOMES:

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

- Enumerate the theoretical basis of soft computing
- Explain the fuzzy set theory
- Discuss the neural networks and supervised and unsupervised learning networks
- Demonstrate some applications of computational intelligence
- Apply the most appropriate soft computing algorithm for a given situation

GECY108 EMBEDDED SYSTEM PROGRAMMING

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To introduce the design of embedded computing systems with its hardware and software architectures.
- To describe entire software development lifecycle and examine the various issues involved in developing software for embedded systems.
- To analyze the I/O programming and Embedded C coding techniques
- To equip students with the software development skills necessary for practitioners in the field of embedded systems.

MODULE I INTRODUCTION OF EMBEDDED SYSTEM 09

Embedded computing – characteristics and challenges – embedded system design process – Overview of Processors and hardware units in an embedded system – Compiling, Linking and locating – downloading and debugging – Emulators and simulators processor – External peripherals – Memory testing – Flash Memory.

MODULE II SOFTWARE TECHNOLOGY 09

Software Architectures, Software development Tools, Software Development Process Life Cycle and its Model, Software Analysis, Design and Maintenance.

MODULE III INPUT/OUTPUT PROGRAMMING 09

I/O Instructions, Synchronization, Transfer Rate & Latency, Polled Waiting Loops, Interrupt – Driven I/O, Writing ISR in Assembly and C, Non Maskable and Software Interrupts

MODULE IV DATA REPRESENTATION IN EMBEDDED SYSTEMS 09

Data representation, Twos complement, Fixed point and Floating Point Number Formats, Manipulating Bits in -Memory, I/O Ports, Low level programming in C, Primitive data types, Arrays, Functions, Recursive Functions, Pointers, Structures & Unions, Dynamic Memory Allocation, File handling, Linked lists, Queues, Stacks.

MODULE V EMBEDDED C 09

Embedded Systems programming in C – Binding & Running Embedded C program in Keil IDE – Dissecting the program - Building the hardware. Basic techniques for

reading & writing from I/O port pins – switch bounce - LED Interfacing using Embedded C.

Total Hours: 45

REFERENCES:

1. Marilyn Wolf, "Computers as components ", Elsevier, 2012.
2. Qing Li and Carolyn Yao, "Real-Time Concepts for Embedded Systems", CMP Books, 2003.
3. Daniel W. Lewis, "Fundamentals of embedded software where C and assembly meet", Pearson Education
4. Michael Bass, "Programming Embedded Systems in C and C++", Oreilly, 2003.

COURSE OUTCOMES:

On completion of this course the student will be able to

- Design the software and hardware components in embedded system
- Describe the software technology
- Use interrupt in effective manner
- Use keil IDE for programming
- Program using embedded C for specific microcontroller
- Design the embedded projects

GECY109 PRINCIPLES OF SUSTAINABLE DEVELOPMENT

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To impart knowledge in the concepts and dimensions of sustainable development.
- To gain knowledge on the framework for achieving sustainability.

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 09

Environment and Development - Population poverty and Pollution – Global and Local environmental issues – Resource Degradation- Greenhouse gases – Desertification-industrialization – Social insecurity, Globalization and environment. History and emergence of the concept of sustainable development-Objectives of Sustainable Development.

MODULE II COMPONENTS AND DIMENSIONS OF SUSTAINABLE DEVELOPMENT 09

Components of Sustainability – Complexity of growth and equity – Social economic and environmental dimensions of sustainable development – Environment – Biodiversity – Natural – Resources – Ecosystem integrity – Clean air and water – Carrying capacity – Equity, Quality of Life, Prevention, Precaution – Preservation and Public Participation Structural and functional linking of developmental dimensions.

MODULE III FRAMEWORK FOR ACHIEVING SUSTAINABILITY 09

Operational guidelines – interconnected prerequisites for sustainable development Empowerment of Women, children, Youth, Indigenous People, Non-Governmental Organizations Local Authorities, Business and industry – Science and Technology for sustainable development – performance indicators of sustainability and assessment mechanism – Constraints and barriers for sustainable development.

MODULE IV SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 09

Demographic dynamics of sustainability – Policies for socio-economic development – Strategies for implementing eco-development programmes Sustainable development through trade – Economic growth – Action plan for implementing sustainable development – Urbanization and sustainable Cities – Sustainable Energy and Agriculture – sustainable livelihoods.

MODULE V SUSTAINABLE DEVELOPMENT AND INTERNATIONAL RESPONSE 09

Role of developed countries in the development of developing countries – international summits – Stockholm to Johannesburg – Rio principles – Agenda-Conventions – Agreements – Tokyo Declaration – Doubling statement – Tran boundary issues integrated approach for resources protection and management

Total Hours: 45

REFERENCES:

1. Sayer J. and Campbell, B., The Science of Sustainable Development: Local Livelihoods and the Global environment - Biological conservation restoration & Sustainability, Cambridge university Press, London, 2003.
2. M.K. Ghosh Roy. and Timberlake, Sustainable Development, Ane Books Pvt. Ltd, 2011.
3. Mackenthun K.M., Concepts in Environmental Management, Lewis Publications London, 1999.
4. APJ Abdul Kalam and Srijan Pal Singh, Target 3 Billion: Innovative Solutions Towards Sustainable Development, Penguin India, 2011

COURSE OUTCOMES:

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

- Describe the concepts of sustainable development
- Define the components and dimensions of sustainable development
- Outline the Frame work for achieving sustainability.
- State the policies and strategies for implementing sustainable development for Socio economic programmes.
- Examine the role of developed countries in sustainable development.

GECY110	QUANTITATIVE TECHNIQUES IN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart knowledge on

- Concepts of operations research
- Inventory control in production management
- Financial management of projects
- Decision theory and managerial economics

MODULE I OPERATIONS RESEARCH 09

Introduction to Operations research – Linear programming – Graphical and Simplex Methods, Duality and Post-Optimality Analysis – Transportation and Assignment Problems

MODULE II PRODUCTION MANAGEMENT 09

Inventory control, EOQ, Quantity Discounts, Safety Stock – Replacement Theory – PERT and CPM – Simulation Models – Quality Control.

MODULE III FINANCIAL MANAGEMENT 09

Working Capital Management – Compound Interest and Present Value methods – Discounted Cash Flow Techniques – Capital Budgeting.

MODULE IV DECISION THEORY 09

Decision Theory – Decision Rules – Decision making under conditions of certainty, risk and uncertainty – Decision trees – Utility Theory.

MODULE V MANAGERIAL ECONOMICS 09

Cost concepts – Break even Analysis – Pricing techniques – Game Theory applications.

Total Hours: 45

REFERENCES:

1. Vohra, N.D. , Quantitative Techniques in Management, Tata McGraw Hill Co., Ltd, New Delhi, 2009.
2. Seehroeder, R.G., Operations Management, McGraw Hill, USA, 2002.
3. Levin, R.I, Rubin, D.S., and Stinsonm J., Quantitative Approaches to Management, McGraw Hill Book Co., 2008.

4. Frank Harrison, E., The Managerial Decision Making Process, Houghton Miffin Co. Boston, 2005.
5. Hamdy A. Taha, Operations Research- An Introduction, Prentice Hall, 2002.

OUTCOME:

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

- Apply the concepts of operations research for various applications
- Create models for inventory control in production management
- Compute the cash flow for a project
- Choose a project using decision theory based on the risk criterion.
- Apply the concepts of managerial economics in construction management

GECY111 PROGRAMMING USING MATLAB & SIMULINK

L	T	P	C
1	0	2	2

COURSE EDUCATIONAL OBJECTIVES:

The aim of this course is to:

- Teach students how to mathematically model engineering systems
- Teach students how to use computer tools to solve the resulting mathematical models. The computer tool used is MATLAB and the focus will be on developing and solving models of problems encountered in engineering fields

MODULE I INTRODUCTION TO MATLAB AND DATA PRESENTATION 10

Introduction to MATLAB-Vectors, Matrices -Vector/Matrix Operations & Manipulation- Functions vs scripts- Making clear and compelling plots-Solving systems of linear equations numerically and symbolically.

Lab Experiments

1. Study of basic matrix operations and manipulations.
2. Numerical and symbolical solution of linear equations.

MODULE II ROOT FINDING AND MATLAB PLOT FUNCTION 10

Linearization and solving non-linear systems of equations- The Newton-Raphson method- Integers and rational numbers in different bases- Least squares regression -Curve fitting-Polynomial fitting and exponential fitting.

Lab Experiments

1. Solution of non linear equations using Newton-Raphson method.
2. Determination of polynomial fit and exponential fit for the given data.

MODULE III LINEAR AND NON-LINEAR DIFFERENTIAL EQUATIONS 13

Numerical integration and solving first order, ordinary differential equations (Euler's method and Runge-Kutta) - Use of ODE function in MATLAB- Converting second order and higher ODEs to systems of first order ODEs- Solving systems of higher order ODEs via Euler's method and Runge-Kutta) - Solving single and systems of non-linear differential equations by linearization-Use of the function ODE in MATLAB to solve differential equations - Plot Function –Saving & Painting Plots.

Lab Experiments

1. Solution of fourth order linear differential equations using
    a. Trapezoidal Rule

b. Euler method

2. Solution of fourth order non-linear differential equations using
   a. Modified Euler method
   b. Runge – Kutta method

MODULE IV INTRODUCTION OF SIMULINK 12

Simulink & its relations to MATLAB – Modeling a Electrical Circuit- Modeling a fourth order differential equations- - Representing a model as a subsystem- Programme specific Simulink demos.

Lab Experiments

1. Solution of fourth order non-linear differential equations using simulink.
2. Programme specific experiment based on simulink.

Total Hours (Including Practicals): 45

REFERENCE:

1. Griffiths D V and Smith I M, “Numerical Methods for Engineers”, Blackwell, 1991.
2. Laurene Fausett, “Applied Numerical Analysis Using MATLAB”, Pearson 2008.
3. Moin P, “Fundamentals of Engineering Numerical Analysis”, Cambridge University Press, 2001.
4. Wilson HB, Turcotte LH, Advanced mathematics and mechanics applications using MATLAB”, CRC Press, 1997
5. Ke Chen, Peter Giblin and Alan Irving, “Mathematical Exploration with MATLAB”, Cambridge University Press, 1999.

COURSE OUTCOMES:

At the end of this unit students will be able to:

- Use Matlab as a convenient tool for solving a broad range of practical problems in engineering from simple models to real examples.
- Write programs using first principles without automatic use of built-in ones.
- Write programs for solving linear and nonlinear systems, including those arising from boundary value problems and integral equations, and for root-finding and interpolation, including piecewise approximations.
- Be fluent in exploring Matlab’s capabilities, such as using matrices as the fundamental data-storage unit, array manipulation, control flow, script and function m-files, function handles, graphical output.
- Make use of Maltab visual capabilities for all engineering applications.

- An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GECY112 JAVA PROGRAMMING

L	T	P	C
1	0	2	2

COURSE EDUCATIONAL OBJECTIVES:

- To learn the fundamentals of Java programming such as data types, variables and arrays.
- To study the syntax and necessity of decision making and iterative statements.
- To create a class and invoke the methods.
- To instigate programming in overloading of methods.
- To emphasize the concept of packages.
- To learn the exception handling routines.

MODULE I INTRODUCTION TO JAVA PROGRAMMING 08

History and Evolution of Java – Overview of Java – Data types, variables and arrays – Operators – Control statements.

MODULE II METHODS AND CLASSES 07

Class fundamentals – Declaring objects – Methods – Constructors – Garbage collection – Overloading methods – Constructor overloading – Access control – Inheritance – Packages - Exception handling.

L: 15, P: 30, Total Hours: 15

REFERENCES:

1. Herbert Schildt, “Java The Complete Reference”, 9th Edition, Oracle Press, 2014, ISBN: 978007180855-2.
2. Nicholas S. Williams, **“**Professional Java for Web Applications: Featuring WebSockets, Spring Framework, JPA Hibernate and Spring Security (WROX)”, John Wiley & Sons, 2014, ISBN: 978111865651-8.
3. E Balagurusamy, “Programming with Java”, 5th Edition, Tata Mcgraw Hill, 2014.
4. Yashavant Kanetka**, “**Let Us Java”, 2nd Edition, BPB Publications, 2012**.**

COURSE OUTCOMES:

Students who complete this course will be able to

- Implement basic Java programming.
- Create a class and invoke methods for real world problems.

- Construct simple overloading of methods programs.
- Implement various types of inheritance concepts.
- Describe the access control mechanism.
- Handle exception thrown while implementing programming.

GECY113 PYTHON PROGRAMMING

L	T	P	C
1	0	2	2

COURSE EDUCATIONAL OBJECTIVES:

- To learn the list and records of python programming.
- To study the control statements and string functions of python.
- To instigate the fundamental python programming.
- To emphasize GUI in python.
- To integrate python with embedded systems.
- To implement programs in python.

MODULE I INTRODUCTION TO PYTHON PROGRAMMING 08

Installation and environment set up – syntax used in python – variable types – operators – Loops – decision making – string functions - formatted files - GUI basics.

MODULE II EMBEDDED PROGRAMMING USING PYTHON 07

Web interface – system tools – script execution context - Motion-triggered LEDs – Python - Arduino prototyping-storing and plotting Arduino data-Remote home monitoring system.

L: 15, P: 30, Total Hours: 15

REFERENCES:

1. Nick Goddard, “Python Programming”, 2nd edition, ISBN: 1533337772, 2016.
2. Pratik Desai, “Python Programming for Arduino”, 1st edition, Packt publishing, 2015, ISBN: 9781783285938.
3. Mark Lutz, Learning Python: Powerful Object-Oriented Programming, 5th Edition, O'Reilly Media, 2013.
4. Richard H. Barnett, Sarah Cox, Larry O'Cull, “Embedded C Programming and the Atmel AVR”, 2nd edition, 2006.
5. Michael Barr, Anthony Massa, “Programming Embedded Systems”, 2nd Edition, O'Reilly Media, 2006.

COURSE OUTCOMES:

Students who complete this course will be able to

- Implement date and time function programming using python.

- Write formatted file programming.
- Construct simple python programs.
- Create web interface using python programming
- Develop embedded system with python programming.
- Build Arduino prototype using python programming.

GECY114 INTELLECTUAL PROPERTY RIGHTS (IPR)

L	T	P	C
1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To study about Intellectual property rights and its need
- To explore the patent procedure and related issues

MODULE I INTRODUCTION 07

Introduction and the need for intellectual property right (IPR) – IPR in India – Genesis and Development – IPR in abroad – Important examples of IPR – Copyrights, Trademarks, Patents, Designs, Utility Models, Trade Secrets and Geographical Indications – Industrial Designs

MODULE II PATENT 08

Concept of Patent – Product / Process Patents & Terminology – Duration of Patents – Law and Policy Consideration Elements of Patentability –- Patentable Subject Matter – Procedure for Filing of Patent Application and types of Applications – Procedure for Opposition – Revocation of Patents – Working of Patents- Patent Agent – Qualification and Registration Procedure – Patent databases and information system – Preparation of patent documents – Process for examination of patent application- Patent infringement – Recent developments in patent system

Total Hours: 15

REFERENCES

1. B.L.Wadehra; Law Relating to Patents, Trade Marks, Copyright, Designs & Geographical Indications; Universal law Publishing Pvt. Ltd., India 2000
2. Ajit Parulekar and Sarita D' Souza, Indian Patents Law – Legal & Business Implications; Macmillan India ltd , 2006
3. P. Narayanan; Law of Copyright and Industrial Designs; Eastern law House, Delhi, 2010.
4. E. T. Lokganathan, Intellectual Property Rights (IPRs): TRIPS Agreement & Indian Laws Hardcover, 2012
5. Alka Chawla, P N Bhagwati , Law of Copyright Comparative Perspectives 1st Edition, LexisNexis, 2013
6. V. K. Ahuja, Law Relating to Intellectual Property Rights 2nd Edition, LexisNexis, 2nd Edition, 2013

7. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, 2015
8. Jatindra Kumar Das, Law of Copyright, PHI Learning, 2015

COURSE OUTCOMES:

Students should be able to

- Identify the various types of intellectual property and their value
- Apply the procedure to file a patent and to deal the related issues
- Search and extract relevant information from various intellectual database