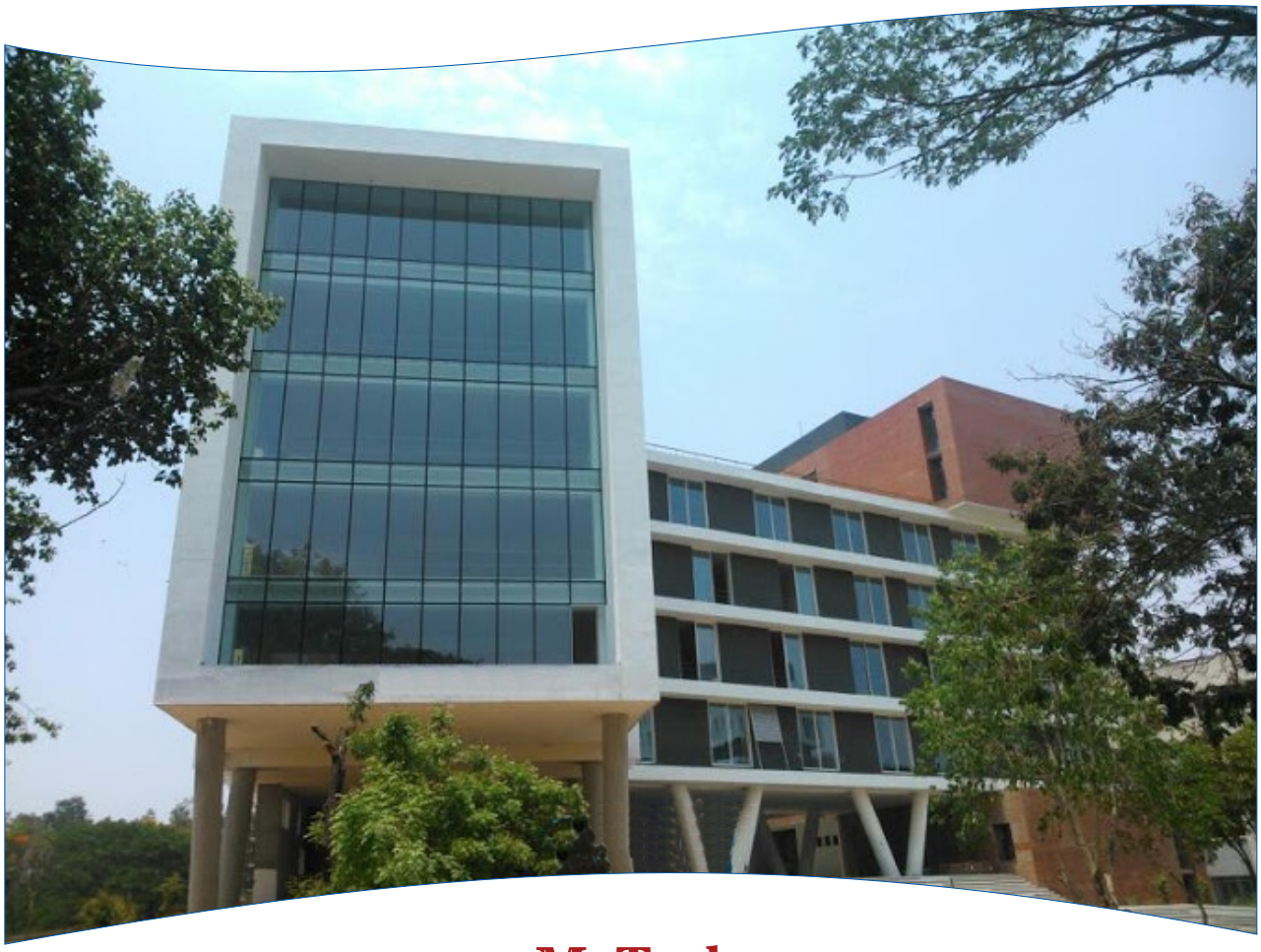
CURRICULUM AND SYLLABI

REGULATIONS - 2016

(As approved by the 9th Academic Council)



M. Tech.

MANUFACTURING ENGINEERING

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.
MANUFACTURING ENGINEERING

(As approved by the 9th Academic Council)

JULY 2016

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

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 facilitate 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. (Manufacturing Engineering)

PROGRAMME EDUCATIONAL OBJECTIVES:

- To provide intensive learning opportunities through well designed courses involving state-of-the-art concepts and techniques not only in the field of Manufacturing Engineering and in the related interdisciplinary aspects to ensure holistic approach
- To equip the post graduates, with knowledge and skill to undertake design, analysis, evaluation of manufacturing systems and processes
- 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, innovative assignments relating to the field of Manufacturing
- To employ multiple strategies to evaluate acquisition of knowledge and skill to enable the students to face real life situation in the globalised scenario
- To provide scope for self-study thereby preparing post graduates for lifelong learning to meet the varied needs in their future careers

PROGRAMME OUTCOMES:

On completion of programme, the graduates will

- have the ability to provide solutions for Product Realization
- have the ability to appreciate the relation between Design and Manufacturing
- have a broad understanding and knowledge about the various software in the area of Computer Aided Manufacturing and Inspection
- have ability to undertake research and address open ended problems
- have ability to articulate concepts and ideas with clarity
- have ability to acquire the knowledge in any specific area through study and research

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 Science / Electronics &

Sl. No.	Name of the Department	P.G. Programmes offered	Qualifications for admission
			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. (Manufacturing Engineering)
(FOUR SEMESTERS / FULL TIME)

CURRICULUM

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	MAC6183	Probability and Statistics	**3**	**1**	**0**	**4**
2	MEC6121	Non-Traditional Machining and Modern Fabrication	**3**	**0**	**0**	**3**
3	MEC6101	Applied Materials Engineering	**3**	**0**	**0**	**3**
4	MEC6122	Mechatronics in Manufacturing Systems (Integrated Lab)	**3**	**0**	**2**	**4**
5	MEC6103	Advanced Finite Element Analysis (Integrated Lab)	**2**	**1**	**2**	**4**
6		Professional Electives #				**3**
						21
		SEMESTER II				
1	GEC6201	Research Methodology for Engineers	**3**	**0**	**0**	**3**
2	MEC6221	Automated and Computer Integrated Manufacturing (Integrated Lab)	**3**	**0**	**2**	**4**
3	MEC6222	Metal Forming Techniques	**2**	**0**	**0**	**2**
4	MEC6202	Advanced Metrology and NDT (Integrated Lab)	**3**	**0**	**2**	**4**
5		Professional Electives ##				**6**
6	MEC6223	Manufacturing and Measurement Project	**0**	**0**	**2**	**1**
						20
		SEMESTER III				
1		General Electives*				**3**
2		Professional Electives###				**9**
3	MEC7122	Industry Internship				**1**
4	MEC7121	Project Phase I	**0**	**0**	**12**	**6****
						13

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER IV				
1	MEC7121	Project Phase II	**0**	**0**	**36**	**18****
		Total Credit (semester IV)				**18 + 06 = 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 MANUFACTURING				
1	MECY031	Advances in Casting and Welding	**3**	**0**	**0**	**3**
2	MECY032	Cellular Manufacturing System	**3**	**0**	**0**	**3**
3	MECY033	Lean Manufacturing System and Implementation	**3**	**0**	**0**	**3**
4	MECY034	Manufacturing System Simulation	**3**	**0**	**0**	**3**
5	MECY035	Mechatronics in CNC Machines	**3**	**0**	**0**	**3**
6	MECY036	Additive Manufacturing	**2**	**0**	**0**	**2**
7	MECY037	Advanced Joining Process	**2**	**0**	**0**	**2**
8	MECY038	Laser Material Processing	**2**	**0**	**0**	**2**
9	MECY039	Plant Layout and Material Handling	**2**	**0**	**0**	**2**
10	MECY020	Automotive Manufacturing	**1**	**0**	**0**	**1**
11	MECY040	Failure Mode and Effect Analysis	**1**	**0**	**0**	**1**
12	MECY041	Reliability Engineering	**1**	**0**	**0**	**1**
13	MECY021	Virtual Manufacturing	**1**	**0**	**0**	**1**
		PROFESSIONAL ELECTIVES ON DESIGN ENGINEERING				
14	MECY003	Advanced Tool Design	**3**	**0**	**0**	**3**
15	MECY042	Design for Manufacturing	**3**	**0**	**0**	**3**
16	MECY043	Industrial Robotics and Expert Systems	**3**	**0**	**0**	**3**
17	MECY044	Reverse Engineering	**3**	**0**	**0**	**3**
18	MECY045	Tribology of Machines	**3**	**0**	**0**	**3**
19	MECY046	Hydraulics and Pneumatics	**2**	**0**	**0**	**2**
20	MECY047	AI based Optimization Techniques	**1**	**0**	**0**	**1**
21	MECY048	Finite Element Analysis In Manufacturing	**1**	**0**	**0**	**1**
22	MECY013	Geometric Dimensioning and Tolerancing	**1**	**0**	**0**	**1**

Sl. No.	Course Code	Course Title	L	T	P	C
		PROFESSIONAL ELECTIVES ON MATERIAL SCIENCE ENGINEERING				
23	MECY049	Corrosion and Surface Engineering	**3**	**0**	**0**	**3**
24	MECY050	MEMS & Nano Technology	**3**	**0**	**0**	**3**
25	MECY051	Polymers and Composite Materials	**3**	**0**	**0**	**3**
		PROFESSIONAL ELECTIVES ON MANUFACTURING MANAGEMENT				
26	MECY052	Lean Six sigma	**3**	**0**	**0**	**3**
27	MECY053	Manufacturing Management	**3**	**0**	**0**	**3**
28	MECY054	Production and Inventory Management	**3**	**0**	**0**	**3**
29	MECY055	Productivity Management and Re-engineering	**3**	**0**	**0**	**3**
30	MECY056	Supply Chain Management	**3**	**0**	**0**	**3**
31	MECY057	Technology Management	**3**	**0**	**0**	**3**
32	MECY058	Total Quality System and Management	**3**	**0**	**0**	**3**
33	MECY059	Entrepreneurship	**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

MAC6183 PROBABILITY AND STATISTICS

L	T	P	C
3	1	0	4

COURSE EDUCATIONAL OBJECTIVES:

This course intends to provide

- a comprehensive introduction to the probability distributions,
- familiarize with testing of hypothesis and estimation theory.
- basic knowledge in simulations used in engineering.

MODULE I PROBABILITY DISTRIBUTIONS 10+03

Axioms of probability – addition and multiplication theorem – conditional probability – total Probability – random variables- moments – moments generating functions and their properties- Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions.

MODULE II TWO DIMENSIONAL RANDOM VARIABLES 09+03

Joint distributions - Marginal and conditional distributions – functions of random variables - Covariance - Correlation and regression - Central limit theorem.

MODULE III ESTIMATION THEORY 09+03

Partial, Multiple correlations and regressions – Estimation of parameters using maximum likelihood estimator and method of moments.

MODULE IV TESTING OF HYPOTHESIS 08+03

Hypothesis, test statistic, decisions and errors - classical testing, significance and p-values – Student's t- test , Fisher's test and Chi-square tests.

MODULE V SIMULATION 09+03

Simulation - definition - Monte Carlo simulation - random number generation, simulation model building - validation - run size determination - simulation applications - inventory control - facilities creation, simulation software.

L – 45; T – 15; Total Hours: 60

TEXT BOOKS:

1. Douglas C. Montgomery, George C. Runger, “Applied Statistics and Probability for Engineers”, 4th Edition, Wiley publication, 2006.
2. Richard A. Johnson, “Miller and Freund’s Probability and Statistics for Engineers”, 8th Edition, PHI, 2011.
3. Sheldon M. Ross, “Introduction to probability models”, 10th edition, Academic Press, 2009.

REFERENCES:

1. Jerry Banks, John S. Carson, Barry L. Nelson, “Discrete – Event systems Simulation”, Prentice Hall India, New Delhi, 1999.
2. Jay L. Devore, “Probability and Statistics for Engineering and the Sciences”, Duxbury publication, 2007.
3. R. Lyman Ott, Michael Longnecker, “An Introduction to Statistical Methods and Data Analysis”, 6th edition, Brooks/Cole Cengage Learning, USA, 2010.

COURSE OUTCOMES:

At the end of the course students will be able to

- identify and fit probability distribution for a given data.
- solve two dimensional random variable problem.
- solve estimation theory problem.
- testing the hypothesis.
- solve problems in modeling using simulation techniques.

MEC6121	NON-TRADITIONAL MACHINING AND MODERN FABRICATION	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To gain knowledge on mechanical and chemical energy based non - traditional manufacturing process
- To impart the working principles of electrical energy based non -traditional manufacturing process
- To inculcate the electro thermal energy based non-traditional manufacturing process
- To educate various methods of micro fabrication process
- To learn about micro fabrication technology

MODULE I NON-TRADITIONAL MANUFACTURING PROCESS I (MECHANICAL & CHEMICAL ENERGY BASED) 09

Non thermal energy process – Abrasive machining – Water jet machining - Ultrasonic machining – Chemical machining – Electro chemical machining – construction working principle – steps - types – process parameters – derivations – problems, merits, demerits and applications.

MODULE II NON-TRADITIONAL MANUFACTURING PROCESS II (ELECTRICAL ENERGY BASED) 09

Electro chemical machining – Electro chemical grinding - Electric discharge machining – Wire cut EDM - construction – principle – types – control - circuits – tool design – merits, demerits & applications.

MODULE III NON-TRADITIONAL MANUFACTURING PROCESS III (ELECTRO THERMAL ENERGY BASED) 09

Laser beam machining – Electron beam machining – Plasma arc machining – Ion beam machining – construction working principle types – process parameters – derivations – problems, merits, demerits and applications.

MODULE IV MICROFABRICATION PROCESS 09

Semiconductors – films and film depurification – Oxidation - diffusion – ion implantation – etching – metallization – bonding – surface and bulk machining – LIGA (lithography) Process – Solid free form fabrication.

MODULE V MICROFABRICATION TECHNOLOGY (WAFER LEVEL) 09

Wafer preparation – monolithic processing – moulding – Printed circuit board hybrid & multi chip module technology – programmable devices & application specific integrated circuits (ASIC) – electronic material and processing– steriolithography surface acoustic wave (SAW) devices, Surface Mount Technology.

Total Hours: 45

REFERENCES:

1. Serope kalpakjian & Stevan R. Schmid- Manufacturing Process for Engineering Material, Pearson education, 2008.
2. Julian W.Hardner, Vijay K. Varadan, Osama O. Awadelkarim, Micro sensors MEMS & Smart Devices, John Wiley& Sons Ltd., 2002.
3. Brahem T. Smith, Advanced Machining I.F.S. UK 1989.
4. Jaeger R.C., Introduction to Microelectronic Fabrication, Addison Wesley, 1988.
5. Nario Taniguchi – Nano technology – Oxford University Press 1996.
6. Pandey P.C. & Shan H.S., Modern Machining Processes, Standard Publishing Co., 1980.
7. More Madon, Fundamentals of Microfabrication, CRC Press, 1997.

COURSE OUTCOMES:

Students should be able to

- perform mechanical and chemical energy based non -traditional manufacturing process
- execute electrical energy based non -traditional manufacturing process
- use electro thermal energy based non-traditional manufacturing process
- identify various methods of micro fabrication process
- select suitable micro fabrication technology

MEC6101 APPLIED MATERIALS ENGINERING

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To study the elastic and plastic behavior of engineering materials
- To understand the fracture behavior 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, Al2O3, SiC, Si3N4 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

MEC6122	MECHATRONICS IN MANUFACTURING SYSTEMS	L	T	P	C
		3	0	2	4

COURSE EDUCATIONAL OBJECTIVES:

- To study the fundamentals of mechatronic systems
- To educate the working principles of various sensors and transducers
- To understand the role of actuators in manufacturing technology
- To learn the functions of programmable logic controllers
- To impart knowledge on Mechatronics design in factory automation through case studies

MODULE I INTRODUCTION 10

Mechatronics definition - Systems- Need for Mechatronics - Emerging area of Mechatronics - Classification of Mechatronics - Measurement Systems - Control Systems.

Practices on LabVIEW.

MODULE II SENSORS AND TRANSDUCERS 15

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

Practices on Sensors - Potentiometer, Strain gauge, Torque, LVDT, Hall-effect, speed, Vibration, Pressure - Practices on Transducer – Temperature, optical - operational amplifier circuits.

MODULE III ACTUATORS 15

Actuators – Mechanical - Electrical - Fluid Power - Piezoelectric – Magnetostrictive - Shape memory alloy - Applications - Selection of actuators.

Practices on various hydraulics and pneumatics circuits - Hydraulic circuits, Hydraulic and Pneumatic components, Electro Pneumatic Sequencing circuits, Hydraulic and Pneumatic Circuits using simulation software, Hydraulic and Pneumatic circuits using Programmable Logic Controllers (PLC), Electronic Power controls of DC and AC motors.

MODULE IV PROGRAMMABLE LOGIC CONTROLLERS 10

Introduction - Basic structure - Input and output processing - Programming - Mnemonics- Timers, counters and Internal relays - Data handling - Selection of PLC.

Practices on Simulation of bottling plant and punching operation using PLC.

MODULE V DESIGN AND MECHATRONICS CASE STUDIES 10

Designing - Possible design solutions-Traditional and Mechatronics design concepts - Case studies of Mechatronics systems - Pick and place Robot - Conveyor based material handling system - PC based CNC drilling machine – Mechatronics control in automated manufacturing - Data acquisition Case studies. **Practices on** heating and ventilation control using NI-6009.

Total Hours: 60

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 Applications, 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:

Students should be able to

- Summarize the fundamentals of mechatronic systems
- Select suitable sensor and transducer based on the requirement
- Choose appropriate actuators for an engineering application
- Use Programmable Logic Controller and write simple PLC programs
- Design simple mechatronics systems

MEC6103 ADVANCED FINITE ELEMENT ANALYSIS

L	T	P	C
2	1	2	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
- To 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

- Solving static structural problem by functional approximation and finite element method.
- Solving 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

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

MEC6221	AUTOMATED AND COMPUTER INTEGRATED MANUFACTURING	L	T	P	C
		3	0	2	4

COURSE EDUCATIONAL OBJECTIVES:

- To understand basic concepts of Computer Integrated Manufacturing System
- To learn the various mechanisms of automated manufacturing system
- To acquire the knowledge on group technology (GT) and Flexible Manufacturing Systems (FMS)
- To study the various process planning (PP) methods
- To gain the knowledge in computer aided process control and data capturing techniques

MODULE I INTRODUCTION 12

Introduction to CAD/CAM and CIM - Evolution of CIM – CIM wheel and cycle – Production concepts – CIM hardware and software – Major elements of CIM system –Implementation of CIM –– Computer networks for manufacturing – The future automated factory – Management of CIM – Impact of CIM on personnel.

MODULE II AUTOMATED MANUFACTURING SYSTEMS 12

Automated production line – System configurations, Work part transfer mechanisms – Fundamentals of automated assembly system – System configuration, Part delivery at workstations – Design for automated assembly– Overview of material handling equipments – Consideration in material handling system design - Automated Guided Vehicle (AGV) system – Automated storage/Retrieval system and Carousel storage system.

Practices on CNC Lathe: Plain Turning, Step turning, Taper turning, Threading, Grooving & canned cycle.

MODULE III GROUP TECHNOLOGY AND FMS 12

Part families – Visual – Parts classification and coding – Production flow analysis – Grouping of parts and Machines by rank order clustering method – Benefits of GT – Case studies – FMS – Components – Workstations – FMS layout configurations – FMS planning and implementation issues – Architecture of FMS – Flow chart showing various operations in FMS –FMS applications, Benefits.

MODULE IV PROCESS PLANNING 12

Typical process sheet – Case studies in manual process planning, Computer aided process planning – Process planning module and data base – Variant process

planning (VPP) – Two stages in VPP – Generative process planning – Flow chart showing various activities in generative PP – Semi generative process planning.

MODULE V TYPES OF PROCESS CONTROL AND AUTOMATIC DATA CAPTURE 12

Introduction to process model formulation – Linear feedback control systems – Optimal control – Adaptive control –Sequence control and Programmable Logic Controller (PLC), Computer process control – Computer process interface – Interface hardware – Computer process monitoring – Direct digital control and Supervisory computer control - Overview of Automatic identification methods – Bar code technology – Other automatic data capture technologies.

Practices on CNC Milling Machine: Profile Milling, Mirroring, Scaling & canned cycle.

Total Hours : 60

REFERENCES:

1. Mikell P.Groover, Automation, Production system and Computer integrated Manufacturing, Prentice Hall of India Pvt. Ltd., 2008.
2. Radhakrishnan,P., Subramanian,S., and Raju,V., CAD/CAM/CIM, New Age International Publishers, 2000.
3. James A. Retrg, Herry W. Kraebber, Computer Integrated Manufacturing, Pearson Education, Asia, 2001.
4. Gideon Halevi and Ronald D.Weill, Principles of Process Planning, Chapman Hall, 1995.
5. Viswanathan. N., and Narahari,Y.,Performance Modeling and Automated Manufacturing Systems, Prentice Hall of India Pvt. Ltd., 2000.
6. Kant Vajpayee S., Computer Integrated Manufacturing, Prentice Hall of India, New Delhi, 2007.
7. Alavudeen and Venkateshwaran, Computer Integrated Manufacturing, PHI Learning Pvt. Ltd., New Delhi, 2008.

COURSE OUTCOMES:

Students should be able to

- Describe the basic concepts of Computer Integrated Manufacturing System
- Apply the mechanisms of automated manufacturing system
- Execute the concepts of group technology and Flexible Manufacturing Systems
- Establish various process planning methods
- Perform computer aided process control and data capturing techniques

MEC6222 METAL FORMING TECHNIQUES

L	T	P	C
2	0	0	2

COURSE EDUCATIONAL OBJECTIVES:

- To understand the plasticity theories
- To learn the various bulk forming process and their applications
- To study the different sheet metal forming process

MODULE I THEORY OF PLASTICITY 10

Theory of plastic deformation – Yield criteria – Tresca and Von-mises – Distortion energy – Stress-strain relation – Mohr's circle representation of a state of stress – Cylindrical and spherical co-ordinate system – Upper and lower bound solution methods – Overview of FEM applications in metal forming analysis.

MODULE II THEORY AND PRACTICE OF BULK FORMING PROCESSES 10

Analysis of plastic deformation in forging, rolling, extrusion, rod/wire drawing and tube drawing – Effect of friction – Calculation of forces, Work done – Process parameters, Equipment used – Defects – Applications – Recent advances in forging, rolling, extrusion and drawing processes – Design consideration in forming.

MODULE III SHEET METAL FORMING 10

Formability studies – Conventional processes – High energy rate Forming (HERF) techniques – Super plastic forming techniques – Hydroforming – Stretch forming – Water hammer forming – Principles and process parameters – Advantage, limitations and application

Total Hours: 30

REFERENCES:

1. Dieter G.E., Mechanical Metallurgy (Revised Edition II), McGraw Hill Co., 2004.
2. Altan T., Metal forming – Fundamentals and Applications – American Society of Metals, Metals Park, 2003.
3. ASM Hand book, Forming and Forging, Ninth edition, Vol. – 14, 2003.
4. Shiro Kobayashi, Soo-Ik-Oh-Altan. T, Metal forming and Finite element method, Oxford University Press, 2001.

5. Altan.T, Soo-Ik-Oh, Gegel, HL – Metal forming, Fundamentals and Applications, American Society of Metals, Metals Park, Ohio, 1983.
6. Marciniak,Z., Duncan J.L., Hu S.J., Mechanics of Sheet Metal Forming, Butterworth-Heinemann, Elsevier, 2006

COURSE OUTCOMES:

Students should be able to

- Express the plasticity theories
- Apply various bulk forming process for different applications
- Use appropriate sheet metal forming techniques based on the needs

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

		L	T	P	C
MEC6223	**MANUFACTURING AND MEASUREMENT PROJECT**	**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 manufacturing and measurement. The students will work in groups.

SEMESTER III

		L	T	P	C
MEC7122	**INDUSTRY INTERNSHIP**	**0**	**0**	**0**	**1**

Students must undergo two weeks industrial training to gain practical experience.

MEC7121	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
MEC7121	**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

PROFESSIONAL ELECTIVES ON MANUFACTURING

		L	T	P	C
MECY031	**ADVANCES IN CASTING AND WELDING**	**3**	**0**	**0**	**3**

COURSE EDUCATIONAL OBJECTIVES:

- To impart knowledge on casting design
- To instruct about metallurgical aspects of castings
- To study various casting process and foundry layout
- To educate metallurgical aspects of welding and design
- To understand various welding process

MODULE I CASTING DESIGN 08

Heat transfer between metal and mould — Design considerations in casting – Designing for directional solidification and minimum stresses - Principles and design of gating and risering.

MODULE II CASTING METALLURGY 08

Solidification of pure metal and alloys – Shrinkage in cast metals – Progressive and directional solidification — Degasification of the melt - Casting defects – Castability of steel, cast iron, Al alloys, babbit alloy and Cu alloy.

MODULE III RECENT TRENDS IN CASTING AND FOUNDRY LAYOUT 08

Shell moulding, Precision investment casting, CO2 moulding, Centrifugal casting, Die casting, Continuous casting, Counter gravity low pressure casting, Squeeze casting and semisolid processes - Layout of mechanized foundry – Sand reclamation – Material handling in foundry - Pollution control in foundry — Computer aided design of casting.

MODULE IV WELDING METALLURGY AND DESIGN 10

Heat affected zone and its characteristics – Weldability of steels, cast iron, stainless steel, aluminum, Mg, Cu, Zr and Ti alloys – Carbon equivalent of plain and alloy steels - Hydrogen embrittlement – Lamellar tearing – Residual stress – Distortion and its control - Heat transfer and solidification - Analysis of stresses in welded structures – Pre and post welding heat treatments – Weld joint design – Welding defects – Testing of weldment.

MODULE V RECENT TRENDS IN WELDING 11

Friction welding, friction stir welding – Explosive welding – Diffusion bonding – High frequency induction welding – Ultrasonic welding – Electron beam welding– Laser beam welding –Plasma welding – Electroslag welding - Narrow gap, hybrid twin wire active TIG – Tandem MIG- Modern brazing and soldering techniques – Induction, dip resistance, diffusion processes – Hot gas, wave and vapour phase soldering - Overview of automation of welding in aerospace, nuclear, surface transport vehicles and under water welding.

Total Hours: 45

REFERENCES:

1. ASM Handbook, Vol. 15, Casting, 2004.
2. ASM Handbook Vol. 6, Welding, Brazing & Soldering, 2003.
3. Parmer R.S., Welding Engineering and Technology, Khanna Publishers, 2002.
4. Srinivasan N.K., Welding Technology, Khanna Tech Publishers, 2002.
5. Heineloper & Rosenthal, Principles of Metal Casting, Tata McGraw Hill, 2000.
6. Jain P.L., Principles of Foundry Technology, Tata McGraw Hill Publishers, 2003.
7. Carrry B., Modern Welding Technology, Prentice Hall Pvt Ltd., 2002.
8. Iotrowski, Robotic welding – A guide to selection and application – Society of Mechanical Engineers, 1987.
9. Schwariz M.M., Source book on innovative welding processes – American Society for Metals (OHIO), 1981.
10. Cornu. J. Advanced Welding Systems – Vol. I, II and III, Jaico Publishers, 1994.
11. Lancaster. J .F., Metallurgy of Welding – George Alien & Unwin Publishers, 1980.

COURSE OUTCOMES:

Students should be able to

- Demonstrate the casting design
- Interpret the metallurgical aspects of materials
- Distinguish various casting processes and layouts
- Exhibit metallurgical aspect of welding and design
- Perform various welding process

MECY032 CELLULAR MANUFACTURING SYSTEM

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the basic concepts of cellular manufacturing system
- To impart knowledge on cellular manufacturing system planning and design
- To educate implementation of cellular manufacturing system
- To study the performance measurement and control of cellular manufacturing system
- To gain knowledge on conventional and cellular manufacturing system framework

MODULE I INTRODUCTION 12

Introduction to Group Technology, Limitations of traditional manufacturing systems, characteristics and design of groups, benefits of GT and issues in GT.

MODULE II CMS PLANNING AND DESIGN 10

Problems in GT/CMS - Design of CMS - Models, traditional approaches and non-traditional approaches -Genetic Algorithms, Simulated Annealing, Neural networks.

MODULE III IMPLEMENTATION OF GT/CMS 10

Inter and Intra cell layout, cost and non-cost based models, establishing a team approach, Managerial structure and groups, batch sequencing and sizing, life cycle issues in GT/CMS.

MODULE IV PERFORMANCE MEASUREMENT AND CONTROL 08

Measuring CMS performance - Parametric analysis - PBC in GT/CMS, cell loading, GT and MRP - framework.

MODULE V ECONOMICS OF GT/CMS 05

Conventional Vs group use of computer models in GT/CMS, Human aspects of GT/CMS - cases.

Total Hours: 45

TEXT BOOKS:

1. Askin, R.G. and Vakharia, A.J., G.T "Planning and Operation, in the automated factory-Hand Book: Technology and Management", Cleland.D.I. and Bidananda, B (Eds), TAB Books , NY, 1991.
2. Kamrani, A.K, Parsaei, H.R and Liles, D.H. (Eds), "Planning, design and analysis of cellular manufacturing systems", Elsevier, 1995.

REFERENCES:

1. Burbidge, J.L. Group "Technology in Engineering Industry", Mechanical Engineering pub.London, 1979.
2. Irani, S.A. "Cellular Manufacturing Systems", Hand Book.

COURSE OUTCOMES:

- Illustrate the concepts of cellular manufacturing system
- Perform cellular manufacturing system planning and design
- Execute cellular manufacturing system
- Assess the performance and control of cellular manufacturing system
- Critique conventional and cellular manufacturing system

MECY033	LEAN MANUFACTURING SYSTEM AND IMPLEMENTATION	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To educate the concepts of lean manufacturing system
- To understand the concepts of modern manufacturing
- To instruct the principles of TQM
- To impart knowledge on six sigma
- To gain knowledge on implementation of lean manufacturing through case studies

MODULE I INTRODUCTION TO LEAN MANUFACTURING 07

Conventional Manufacturing versus Lean Manufacturing – Principles of Lean Manufacturing – Basic elements of lean manufacturing – Introduction to lean manufacturing Tools.

MODULE II CELLULAR MANUFACTURING, JIT, TPM 09

Cellular Manufacturing – Types of Layout, Principles of cell layout, Implementation, JIT – Principles of JIT and Implementation of Kanban. TPM – Pillars of TPM, Principles and implementation of TPM.

MODULE III SET UP TIME REDUCTION, TQM 10

Set up time reduction – Definition, philosophies and reduction approaches, TQM – Principles and implementation, 5S Principles and implementation - Value stream mapping - Procedure and principles.

MODULE IV SIX SIGMA 09

Six Sigma – Definition, statistical considerations, variability reduction, design of experiments – Six Sigma implementation.

MODULE V CASE STUDIES 10

Case studies - Implementation of lean manufacturing in industries.

Total Hours: 45

REFERENCES:

1. Ronald G. Askin & Jeffrey B. Goldberg, Design and Analysis of Lean Production Systems, John Wiley & Sons, 2003.

2. Rother M. and Shook J, 'Learning to See: Value Stream Mapping to Add Value and Eliminate Muda', Lean Enterprise Institute, Brookline, MA. 1999.
3. Mikell P. Groover, Automation, Production Systems and CIM, 2002.

COURSE OUTCOMES:

Students should be able to

- Explain the concepts of lean manufacturing system
- Utilize the modern manufacturing concepts
- Apply principles of TQM
- Execute the concepts of six sigma
- Implement lean manufacturing system for industries

MECY034 MANUFACTURING SYSTEM SIMULATION

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the basic concepts of manufacturing system and simulation
- To learn the random number generation methods
- To perform the design of simulation experiments
- To perceive the simulation languages used in manufacturing system simulation
- To represent the case studies of simulation models

MODULE I INTRODUCTION 08

Basic concepts of system – Elements of manufacturing system - Concept of simulation – Simulation as a decision making tool – Types of simulation – Monte-Carlo simulation - System modeling – Types of modeling – Limitations and application.

MODULE II RANDOM NUMBERS GENERATION 09

Probability and statistical concepts of simulation – Pseudo random numbers – Methods of generating random numbers – Discrete and continuous distribution– Testing of random numbers – Kolmogorov-Smirnov test, Chi-Square test - Sampling - Simple, random and simulated.

MODULE III DESIGN OF SIMULATION EXPERIMENTS 10

Problem formulation – Data collection and reduction – Time flow - Mechanical key variables - Logic flow chart starting condition – Run size – Experimental design consideration – Output analysis, interpretation and validation – Application of simulation in engineering industry.

MODULE IV SIMULATION LANGUAGE 09

Comparison and selection of simulation languages - Study of General Purpose Simulation System (GPSS) - Basic blocks - Generate, queue, depart, size, release, advance, terminate, transfer, enter and leave.

MODULE V CASE STUDIES 09

Development of simulation models using GPSS for queuing, production, inventory, maintenance and replacement systems – Case studies.

Total Hours: 45

REFERENCES:

1. Jerry Banks and John S.Carson, Discrete event system simulation, Prentice Hall 1991.
2. John H.Mize and J.Grady Cox, Essentials of simulation, Prentice hall 1989.
3. Geoffrey Gordon, System simulation, Prentice Hall of India, 1992.
4. Jeffrey L. Written, Lonnie D, Bentley and V.M. Barice, System analysis and Design Methods, Galgotia publication, 1995.
5. Averill M.Law and W.David Kelton, Simulation Modeling and analysis, McGraw Hill International Editions, 1991.

COURSE OUTCOMES:

Students should be able to

- Describe the basic concepts of manufacturing system simulation
- Ascertain the random number generation methods
- Execute the design of simulation experiments
- Distinguish the simulation languages used in manufacturing system simulation
- Interpret the case studies of simulation models

MECY035 MECHATRONICS IN CNC MACHINES

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the fundamentals of adaptive controls
- To learn about mechatronic elements in CNC machine
- To educate mechatronic elements in CNC measuring system and tooling
- To impart knowledge on CNC programming
- To gain knowledge on installation and maintenance of CNC machines

MODULE I INTRODUCTION OF NC, CNC, DNC AND ADAPTIVE CONTROL 06

Classification of machine tools – types, functions and processes - fundamentals of NC and CNC technologies Adaptive control - types, application and benefits - general configuration of adaptive control and function – reasons for process change - practical problems with adaptive control - example for feedback and adaptive control.

MODULE II MECHATRONIC ELEMENTS IN CNC MACHINE 09

CNC systems - configuration of the CNC system – interfacing – monitoring – diagnostics - machine data - compensations for machine accuracies - PLC in CNC – PLC programming for CNC, steps in programming and case studies - machine structure -types of loads on CNC machine - guide ways and types - mechanical transmission elements - elements for rotary motion to linear motion - ball screw and types - roller screw and types - rack and pinion - various torque transmission elements - requirements of feed drives and spindle drive.

MODULE III MECHATRONIC ELEMENTS IN CNC MEASURING SYSTEM AND TOOLING 12

Measuring systems - feedback devices - velocity feedback - analog and digital - position feedback - rotary and linear. Tooling - requirement and planning - preset, qualified and semi qualified tools. Fixtures – requirement - unified and modular fixtures - tool identification - touch trigger probe- tool coding - EEPROM tools.

Tool condition monitoring - various indirect and direct methods. Identification and gauging of work piece. Tool locking system - ball lock mechanism and contact pressure monitoring. Automatic tool changing system - types and benefits - tool magazine –sensors in CNC.

MODULE IV CNC PROGRAMMING 13

Machine axes identification - primary, secondary and tertiary - manual CNC programming - Milling programming fundamentals - compensation and offset in milling -fixed cycles in milling - repetitive programming - loops, sub programs and macros. Turning programming fundamentals - compensation and offset in turning - fixed cycles in turning – Computer assisted programming in APT - basic geometry definition - cutter motion definition - postprocessor statements - generation and execution of APT programs.

MODULE V TESTING AND MAINTENANCE OF CNC MACHINES 05

Verification of technical specification and functional aspects, Verification during idle running & machine tool and the work piece accuracy - Installation of CNC machines - Maintenance of CNC machines - machine elements – hydraulic elements - electrical and electronic elements – maintenance schedules.

Total Hours: 45

REFERENCES:

1. Jonathan Lin,S.C., “Computer Numerical Control (From Programming to Networking)”, Delmar Publishers Inc., 2000.
2. HMT Limited, “Mechatronics”, Tata Mcgraw-Hill Publishing Co Ltd, 2002.
3. Groover,M.P., “Automation, Production System and CIM”, Prentice Hall of India Pvt. Ltd, 2003.
4. Grahamt.Smith, “Advanced Machining: The Handbook of Cutting Technology”, IFS Publications Ltd., 1989
5. Sehrawatt,M.S., and Narang,J.S., “CNC Machine”, Dhanpat Rai And Co, 2002.
6. Jayakumar,V., and Mahendran, B., “Computer Aided Manufacturing”, Lakshmi Publications 2005.
7. Radhakrishnan,P., “CNC Machine”, New Central Book Agency, 2000.
8. Stenerson and Curran, “Computer Numerical Control-Operation and Programming”, PHI Learning Pvt. Ltd., 2008

COURSE OUTCOMES

Students should be able to

- Describe the fundamentals of adaptive controls
- Express the mechatronic elements in CNC machine
- Use various mechatronic elements in CNC measuring system and tooling
- Write CNC programming for various parts
- Execute the installation and maintenance of CNC machines

MECY036 ADDITIVE MANUFACTURING

L	T	P	C
2	0	0	2

COURSE EDUCATIONAL OBJECTIVES:

- To gain knowledge on cad modeling and slicing techniques
- To learn various additive processes
- To understand various applications of additive manufacturing

MODULE I CAD MODELING AND SLICING 10

Basic concept- Digitization techniques – Model reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data requirements – Geometric modeling techniques: Wire frame, surface and solid modeling – data formats Data interfacing, Part orientation and support generation, Support structure design, Model Slicing, Tool path generation-Software for AM- Case studies.

MODULE II ADDITIVE PROCESS 15

Material extrusion - Fused deposition Modeling (FDM): Principle, Process details, process variables, types, suitable materials and products, Shape Deposition Manufacturing (SDM) – sheet lamination - Laminated Object Manufacturing (LOM): Working Principles, details of processes, products, materials, advantages, limitations - Photo polymerization – Stereolithography (SLA): Principle, pre-build process, part-building and post-build processes, photo polymerization of SL resins, recoating issues, materials, advantages, limitations Solid Ground Curing (SGC): working principle, process, strengths, weaknesses - Powder bed fusion - Selective Laser Sintering (SLS): Principle, process, Indirect and direct SLS- powder structures, materials, post processing, surface deviation and accuracy, Ballastic Particle Manufacturing (BPM), Selective Laser Melting (SLM), Electron Beam Melting (EBM)- Direct energy deposition - Laser Engineered Net Shaping (LENS): Processes, materials, products, advantages, limitations, case studies – Material Jetting and Binder jetting - Three dimensional Printing (3DP): Principle, basic process, Physics of 3DP, types of printing, process capabilities, materials

MODULE III ADDITIVE PROCESS APPLICATIONS 05

Functional models, Medical models, art models, Engineering analysis models, new materials development, Bi-metallic parts, Re-manufacturing - Application examples for Aerospace, defense, automobile, Bio-medical and general engineering industries - comparison of additive manufacturing methods - business opportunities and future directions

Total Hours: 30

REFERENCES

1. Gibson, I., Rosen, D.W. and Stucker, B., “Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2010.
2. Chua, C.K., Leong K.F. and Lim C.S., “Rapid prototyping: Principles and applications”, second edition, World Scientific Publishers, 2010.
3. Gebhardt, A., “Rapid prototyping”, Hanser Gardener Publications, 2003.
4. Liou, L.W. and Liou, F.W., “Rapid Prototyping and Engineering applications : A tool box for prototype development”, CRC Press, 2011.
5. Kamrani, A.K. and Nasr, E.A., “Rapid Prototyping: Theory and practice”, Springer, 2006.
6. Hilton, P.D. and Jacobs, P.F., Rapid Tooling: Technologies and Industrial Applications, CRC press, 2005.
7. D.T. Pham, S.S. Dimov, Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling, Springer 2001
8. Ian Gibson, David W Rosen, Brent Stucker., “Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2010.

COURSE OUTCOMES:

Students should be able to

- Describe different cad modeling and slicing techniques
- Use suitable additive manufacturing process for different materials
- Apply additive manufacturing techniques

MECY037 ADVANCED JOINING PROCESS

L	T	P	C
2	0	0	2

COURSE EDUCATIONAL OBJECTIVES:

- To gain knowledge on unique welding processes
- To educate different welding techniques of polymers
- To instruct the design of weld structures based on stress

MODULE I UNIQUE WELDING PROCESSES 10

Plasma welding-Laser Beam Welding-Electron Beam Welding-Friction Welding-Cold Pressure Welding-Ultrasonic Welding-Diffusion Welding-Accumulative Roll Bonding (ARB)

MODULE II WELDING OF POLYMERS 10

Hot plate, Butt fusion, Hot gas welding - extrusion welding - induction welding, resistance welding - implant welding, high frequency, friction, electro – fusion, ultrasonic and vibration welding - adhesive bonding.

MODULE III JOINT DESIGN BASED ON STRESSES IN WELD STRUCTURES 10

Joint design for structural elements such as bars, beams, plates, slabs, columns, trusses, plate girders, cylindrical shells and pressure vessels and pipe lines - Design for flanged connections

Total Hours: 30

REFERENCES

1. Md. Ibrahim Khan, Welding Science & Technology
2. Welding Technology and Design – V. M. Radhakrishnan, Revised Second Ed., New Age International Publishers.
3. A Guide to Designing Welds – J.G. Hicks, Woodhead Publising Ltd.,
4. Welding Engineering and Technology-R.S. Parmar, M/s.Khanna Publishers, 2B Nath Market, Nai Sarak, Delhi-10006.
5. A Textbook of Welding Technology - O. P. Khanna.
6. Welding Handbook, American Welding Society, Section-II : Gas, Arc Resistance.
7. The Science and Practice of Welding, Vol-1: Welding Science and Technology.

8. The Science and practice of Welding, Vol-2: The Practice of Welding: A.C. Davies, Cambridge University Press (Website: www.cambridge.org).
9. Messler R.W., Principles of Welding, John Wiley & Sons, 1999.
10. Welding Technology for Engineers, Eds. Baldev Raj, V. Shankar, A.K. Bhaduri, Narora Publishing House, 3rd Reprint, 2009.

COURSE OUTCOMES:

Students should be able to

- Use unique welding processes
- Apply different welding techniques of polymers
- Execute design of weld structures based on stress

MECY038 LASER MATERIAL PROCESSING

L	T	P	C
2	0	0	2

COURSE EDUCATIONAL OBJECTIVES:

- To understand the fundamentals of laser processing
- To gain knowledge of laser in processing of materials
- To impart knowledge of laser in manufacturing

MODULE I FUNDAMENTALS OF LASER PROCESSING 10

Laser processing fundamentals: Laser beam interaction with metal, semiconductor and insulator, Ultra short laser pulse interaction, heat flow theory and metallurgical considerations

MODULE II LASER IN PROCESSING 10

Laser Material Processing Applications: Laser cutting and drilling: Process characteristics, material removal modes, practical performances - Laser welding: Process mechanisms like keyhole and plasma effect, operating characteristics and process variation Laser surface modifications: Heat treatment, surface remelting, surface alloying and cladding, surface texturing, LCVD and LPVD

MODULE III LASER IN MANUFACTURING 10

Laser rapid manufacturing - Laser metal forming: Mechanisms involved including thermal temperature gradient, buckling, upsetting Laser peening - Fundamentals of Laser Shock Processing, Effects of various laser and process parameters, Mechanical effects and microstructure modification during laser shock processing

Total Hours: 30

TEXT BOOKS

1. Steen, William M., Mazumder, Jyotirmoy, Laser Material Processing by William M.Steen, Springer-Verlag 3rd Ed., 2010

REFERENCES

1. Elijah Kannatey-Asibu, Jr, Principles of Laser Materials Processing, John Wiley & Sons, USA,2009
2. John IonLaser Processing of Engineering Materials: Principles, Procedure and Industrial Application, Butterworth Heinemann,2005

COURSE OUTCOMES:

Students should be able to

- Explain the fundamentals of laser processing
- Use laser in processing of materials
- Apply knowledge of laser in manufacturing

MECY039 PLANT LAYOUT AND MATERIAL HANDLING

L	T	P	C
2	0	0	2

COURSE EDUCATIONAL OBJECTIVES:

- To study the fundamentals of plant layout
- To impart knowledge on space determination and area allocation
- To learn various materials handling equipment and approaches

MODULE I PLANT LAYOUT 10

Importance of plant layout in plant design - Types of layout - Factors affecting design of plant layout - Principles of plant layout design – methods of constructing the layout – Present the layout to the management – Implement the layout

MODULE II SPACE DETERMINATION AND AREA ALLOCATION 10

Factors for consideration in space planning- receiving, storage, production, shipping, tool room and tool crib, other auxiliary service actions - Establishing total space requirement - area allocation factors to be considered, expansion, flexibility, aisles column- area allocation procedure - Design of layout using Travel chart, plot plan, block plan, Sequence demand straight line method and non-directional method

MODULE III MATERIAL HANDLING 10

Definition – Principles - system design and selection of equipment – characteristic features of various MH systems- unit load concepts - basic layout types – Immer, Nadler, Muther, Apple James and Ree's approaches to plant layout - automated guided vehicle systems and automated storage & retrieval systems.

Total Hours: 30

REFERENCES

1. Facilities Planning -Thompkins. J A and White, J. A.
2. Facility layout and Location -Francies, R.L. and White, J.A..
3. Plant Layout and Material handling -James M Apple, 2nd Edition, John, Wiely and Sail.
4. Practical plant layout -Muther Richard, - McGraw Hill-1955.
5. Facilities Design -Sunderesh Heragu, PWS Publishing Company, ISBN- 0-534-95183.
6. Plant Layout Design -James M Moore., Mac Millon Co. 1962 LCCCN: 61-5204.

7. Richard Muther, Practical Plant layout, McGraw Hill Book Company, New York
8. Vijay Sheth, Facilities Planning and Materials Handling, Marcle Decker, New York.
9. Tompkins, While Facilities Planning, John Wiley & Sons, New York.
10. J.M Apple, Plant Layout & Material Handing, John Woley & Sons, N. York.
11. Francis White, Facility Location & Layout, PHI, New Delhi
12. G.K Aggarwal, Plant layout & material handling, Jain Publishers, New Delhi
13. Krajewski, Operations Management, Pearson Education, New Delhi

COURSE OUTCOMES:

Students should be able to

- Explain the fundamentals of plant layout
- Analyze space determination and area allocation
- Use various material handling equipment and approaches

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

MECY040 FAILURE MODE AND EFFECT ANALYSIS

L	T	P	C
1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To study about FMEA and its need
- To understand different types of FMEA in space and automotive industries

MODULE I INTRODUCTION 05

Definition - General overview of FMEA – History of FMEA – Origin and development – objectives of FMEA – need of FMEA – FMEA team synergy.

MODULE II TYPES AND APPLICATIONS OF FMEA 10

Types of FMEA – System FMEA, Design FMEA, Process FMEA, Service FMEA, Machine FMEA - FMEA software – Applications of FMEA in space and automotive industries

Total Hours: 15

REFERENCES

1. D. H. Stamatis, Failure Mode and Effect Analysis, FMEA From Theory to Execution, 2nd Edition, American Society for Quality Press, 2003.
2. Robin E. McDermott, Raymond J. Mikulak, Michael R. Beauregard, The Basics of FMEA, Productivity Press, 1st edition, 1996.
3. Kenneth Dailey, The FMEA pocket handbook, DW Publishing Co, 1st edition, 2004.
4. Dyadem Press, Guidelines for Failure Mode and Effects Analysis (FMEA), for Automotive, Aerospace, and General Manufacturing Industries 1st Edition, CRC Press, 1st edition, 2003.

COURSE OUTCOMES:

Students should be able to

- Describe FMEA and its need
- Apply various FMEA techniques in industry

MECY041 RELIABILITY ENGINEERING

L	T	P	C
1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To understand various reliability concepts and their analysis
- To gain knowledge on risk assessment and reduction techniques

MODULE I RELIABILITY CONCEPT AND ANALYSIS 10

Reliability function - failure rate - Mean Time between Failures (MTBF) - Mean Time to Failure (MTTF) - a priori and a posteriori concept - mortality curve - useful life availability - maintainability – system effectiveness - Time-to-failure distributions - Exponential, normal, Gamma, Weibull, ranking of data – probability plotting techniques - Hazard plotting

MODULE II RISK ASSESSMENT 05

Definition and measurement of risk - risk analysis techniques - risk reduction resources - industrial safety and risk assessment

Total Hours: 15

REFERENCES

1. Modarres, “Reliability and Risk analysis ", Mara Dekker Inc., 1993.
2. John Davidson, “The Reliability of Mechanical system ", Institution of Mechanical Engineers,London, 1988.
3. C.O. Smith" Introduction to Reliability in Design ", McGraw Hill, London, 1976

COURSE OUTCOMES:

Students should be able to

- Interpret various reliability concepts and their analysis
- Analyse risk assessment and apply suitable reduction techniques

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, ISBN:-10: 047135443

COURSE OUTCOMES:

Students should be able to

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

PROFESSIONAL ELECTIVES ON DESIGN ENGINEERING

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- 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

MECY042 DESIGN FOR MANUFACTURING

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To obtain knowledge on design principles for manufacturing
- To instruct casting design and weldment design
- To recognize the design considerations for metal forming techniques
- To train the design for machined parts
- To educate the students on case studies of assembly design

MODULE I INTRODUCTION 06

Economics of Process selection – General design principles of manufacturability – Proper material selection – Strength and Mechanical factors - application of form design.

MODULE II CASTING DESIGN AND WELDMENT DESIGN 10

Factors affecting casting design- Strength aspects – Sand casting and die casting design-Factors affecting weldment design-Gas and arc welding design.

MODULE III DESIGN OF METAL FORMING PROCESS 10

Design considerations for the manufacture of extruded, cold headed metal parts – Tube and section bends – Powder metal parts-Thermo setting plastic parts-Reinforced – Plastic/Composite parts.

MODULE IV DESIGN FOR MACHINED PARTS 10

Design considerations for the manufacture of Turned parts-drilled parts-milled parts, planned, shaped and slotted parts-Ground parts-parts produced by EDM.

MODULE V DESIGN FOR ASSEMBLY (DFA) 09

Types of assembly – DFA –Index – evaluation of assembly – assembly cost reduction – case of assembly – impact on quality – related software usage – case studies.

Total Hours: 45

TEXT BOOKS:

1. James G. Bralla – “Handbook of product design for manufacture”, McGraw Hill Book Co., 1986.

REFERENCE BOOKS:

1. Henry Peck – “Designing for manufacture”, Sir Isaac Pitman & Sons Ltd., 1973.
2. Matousek – “Engineering Design”, Blackie & sons, 1956.

COURSE OUTCOMES:

Students should be able to

- Express the design principles for manufacturing
- Execute casting design and weldment design
- Prepare the design needs of metal forming techniques
- Apply the design for machined parts
- Propose the assembly design for industry needs

MECY043	INDUSTRIAL ROBOTICS AND EXPERT SYSTEMS	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To impart the fundamentals of robots and its kinematics
- To study various drives and controls of robot
- To gain knowledge on working principles of different sensors
- To inculcate robot cell design
- To learn robot programming, artificial intelligence and their applications.

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 – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing –Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.

MODULE IV ROBOT CELL DESIGN AND APPLICATION 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, ARTIFICIAL INTELLIGENCE AND 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

TEXT BOOK:

1. K.S.Fu, R.C. Gonzalez and C.S.G. Lee, “Robotics Control, Sensing, Vision and Intelligence”, Mc Graw Hill, 1987.

REFERENCE:

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

COURSE OUTCOMES:

Students should be able to

- Demonstrate the fundamentals of robots and its kinematics
- Apply suitable drives and controls for robot design
- Choose appropriate sensors
- Execute the design for robot cell
- Use robot programming and artificial intelligence

MECY044 REVERSE ENGINEERING

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To explain reverse engineering and its scope
- To learn the tools for reverse engineering
- To study the concepts of reverse engineering
- To enlighten the students on data management
- To study different integration methods of reverse engineering

MODULE I INTRODUCTION 05

Scope and tasks of reverse engineering - Domain analysis- Process of duplicating.

MODULE II TOOLS FOR REVERSE ENGINEERING 08

Functionality- Dimensional- Developing technical data - Digitizing techniques - Construction of surface model - Solid-part material- Characteristics evaluation - Software and application- Prototyping - Verification.

MODULE III CONCEPTS 12

History of reverse engineering – Preserving and preparation for the four stage process – Evaluation and verification- Technical data generation, Data verification, Project implementation.

MODULE IV DATA MANAGEMENT 10

Data reverse engineering – Three data reverse engineering strategies – Definition – Organization data issues - Software application – Finding reusable software components – Recycling real-time embedded software – Design of experiments to evaluate a reverse engineering tool – Rule based detection for reverse engineering user interfaces – Reverse engineering of assembly programs: A model based approach and its logical basics.

MODULE V INTEGRATION 10

Cognitive approach to program understated – Integrating formal and structured methods in reverse engineering – Integrating reverse engineering, reuse and specification tool environments to reverse engineering - Coordinate measurement – Feature capturing – Surface and solid members.

Total Hours: 45

REFERENCES:

1. Bigger staff T J, Design Recovery for Maintenance and Reuse, IEEE Corpn. July 1991.
2. Rugaban S, White paper on RE, Technical Report, Georgia Instt. of Technology, 1994.
3. Katheryn A. Ingle, Reverse Engineering, McGraw-Hill, 1994
4. Aiken Peter, Data Reverse Engineering, McGraw-Hill, 1996
5. Linda Wills, Reverse Engineering, Kluiver Academic Publishers, 1996
6. Donald R. Honsa, Co-ordinate Measurement and reverse engineering, American Gear Manufacturers Association.

COURSE OUTCOMES:

Students should be able to

- Describe about reverse engineering and its scope
- Use relevant tools for reverse engineering
- Apply the concepts of reverse engineering
- Practice data management
- Synthesize various integration methods of reverse engineering

MECY045 TRIBOLOGY OF MACHINES

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand theories of friction its surface interaction
- To study various types of wear and surface treatment
- To gain knowledge on lubricants and lubrication system
- To impart knowledge on hydrostatics and hydrodynamic applications
- To educate high pressure contacts and elasto hydrodynamic lubrication

MODULE I SURFACE INTERACTION AND FRICTION 07

Topography of Surfaces – Surface features-Properties and measurement – Surface interaction – Adhesive Theory of Sliding Friction –Rolling Friction-Friction properties of metallic and non-metallic materials – friction in extreme conditions – Thermal considerations in sliding contact.

MODULE II WEAR AND SURFACE TREATMENT 08

Types of wear – Mechanism of various types of wear – Laws of wear – Theoretical wear models-Wear of Metals and Non metals – Surface treatments – Surface modifications – surface coatings methods- Surface Topography measurements – Laser methods – instrumentation - International standards in friction and wear measurements

MODULE III LUBRICANTS AND LUBRICATION REGIMES 08

Lubricants and their physical properties- Viscosity and other properties of oils – Additives - selection of Lubricants - Lubricants standards ISO, SAE, AGMA, BIS standards – Lubrication Regimes – Solid Lubrication - Dry and marginally lubricated contacts - Boundary Lubrication.

MODULE IV THEORY OF HYDRODYNAMIC AND HYDROSTATIC LUBRICATION 12

Reynolds Equation,-Assumptions and limitations-One and two dimensional Reynolds Equation-Reynolds and Sommerfeld boundary conditions- Pressure wave, flow, load capacity and friction calculations in Hydrodynamic bearings-Long and short bearings-Pad bearings and Journal bearings-Squeeze film effects-Thermal considerations-Hydrostatic lubrication of Pad bearing-Pressure, flow , load and friction calculations-Stiffness considerations- Various types of flow restrictors in hydrostatic bearings

MODULE V HIGH PRESSURE CONTACTS AND ELASTO HYDRODYNAMIC LUBRICATION 10

Rolling contacts of Elastic solids- contact stresses – Hertzian stress equation- Spherical and cylindrical contacts-Contact Fatigue life- Oil film effects- Elasto Hydrodynamic lubrication Theory-Soft and hard EHL-Reynolds equation for elasto hydrodynamic lubrication- Film shape within and outside contact zones-Film thickness and friction calculation- Rolling bearings- Stresses and deflections- Traction drives

Total Hours: 45

REFERENCES:

1. Rabinowicz.E, “Friction and Wear of materials”, John Willey & Sons, UK, 1995
2. Cameron, A. “Basic Lubrication Theory”, Ellis Herward Ltd., UK, 1981
3. Halling, J. (Editor) – “Principles of Tribology”, Macmillian – 1984.
4. Williams J.A. “Engineering Tribology”, Oxford Univ. Press, 1994.
5. S.K.Basu, S.N.Sengupta & B.B.Ahuja, “Fundamentals of Tribology”, Prentice –Hall of India Pvt Ltd, New Delhi, 2005
6. G.W.Stachowiak & A.W.Batchelor, Engineering Tribology, Butterworth-Heinemann, UK, 2005

COURSE OUTCOMES:

Students should be able to

- Express theories of friction its surface interaction
- Describe various types of wear and surface treatment
- Use suitable lubrication systems
- Apply hydrostatics and hydrodynamic lubrication systems
- Illustrate high pressure contacts and elasto hydrodynamic lubrication

MECY046 HYDRAULICS AND PNEUMATICS

L	T	P	C
2	0	0	2

COURSE EDUCATIONAL OBJECTIVES:

- To study the basics of hydraulic systems and pumps
- To gain knowledge on various hydraulic actuators and valves
- To impart knowledge on pneumatic systems

MODULE I HYDRAULIC BASICS AND PUMPS 10

Basic hydraulic systems and components- Reservoir, Strainers/filters, Accumulators, gauges, meters, circuitry systems, fittings/connections, leakage, seals – Pumps- Positive and non-positive displacement types-hydraulic symbols.

MODULE II HYDRAULIC ACTUATORS AND VALVES 10

Hydraulic actuators- (Linear- single acting, double acting, differential, non-differential, cushioned) and rotary – maintenance of actuators – Hydraulic valves – Pressure control valves, directional control valves, flow control valves-valve installation (Meter-in, Meter-out, Bleed-off circuits) – Troubleshooting valves

MODULE III PNEUMATICS 10

Pneumatics basics- Air filter and lubricators and regulators – Pneumatic actuators and valves – pneumatic circuits – pneumatic logic control

Total Hours: 30

REFERENCES

1. Hydraulic Control Systems by H.E. Merritt, Wiley New York.
2. Fluid Power by Esposito, Peaerson Education
3. Hydraulics and Pneumatics by Andrew Parr, Jaico Publishers.
4. Hydraulics and Pneumatics, A Technician's and Engineer's Guide, Third edition, Andrew Parr, Elsevier publications
5. “Oil Hydraulic Systems – Principles and Maintenance” by S.R. Majumdar
6. “Fundamentals of Pneumatic Control Engineering” by J.P. Hasebrink and R. Kobble

COURSE OUTCOMES:

Students should be able to

- Express the basics of hydraulic systems and pumps
- Use various hydraulic actuators and valves
- Implement pneumatic systems

MECY047 AI BASED OPTIMIZATION TECHNIQUES

L	T	P	C
1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To gain knowledge on novel methods for optimization
- To impart knowledge on neural networks and its application

MODULE I NOVEL METHODS FOR OPTIMIZATION 07

Introduction to simulated annealing - selection of simulated annealing parameters - simulated annealing algorithm - Genetic Algorithm (GA), Design of GA, Key concepts of GA.

MODULE II NEURAL NETWORKS 08

Basics - A framework for Neural Network models - Construction of Neural Network algorithm - Examples of simulated algorithm - genetic annealing and Neural Network method

Total Hours: 15

REFERNCES

1. Engineering Optimization S. S. Rao New Age International
2. Applied Optimal Design E. J. Haug and J.S. Arora Wiley, New York
3. Optimization for Engineering Design Kalyanmoy Deb Prentice Hall of India
4. Optimization G.V. Reklaites, A. Ravindran and K.M. Rogsdeth

COURSE OUTCOMES:

Students should be able to

- Practice on novel methods for optimization
- Apply neural networks for various applications

MECY048	FINITE ELEMENT ANALYSIS IN MANUFACTURING	L	T	P	C
		1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To study the application FEA in casting and welding
- To understand the application of FEA in plastic deformation process

MODULE I FEA IN CASTING AND WELDING 07

Steady state and Transient Thermal analysis of different casting processes – Thermo- mechanical analysis of welding processes

MODULE II FEA IN PLASTIC DEFORMATION PROCESS 08

Basic concepts of plasticity and fracture – Solid and flow formulation – small incremental deformation formulation – Fracture criteria – FE analysis of metal cutting and metal forming

Total Hours: 15

REFERENCES

1. Reddy, J.N. An Introduction to the Finite Element Method, McGraw Hill, 1985.
2. Rao, S.S., Finite Element method in engineering, Pergammon press, 1989.
3. Bathe, K.J., Finite Element procedures in Engineering Analysis, 1990
4. Kobayashi,S, Soo-ik-Oh and Altan,T, Metal Forming and the Finite Element Methods, Oxford University Press, 1989.
5. Lewis R.W.Morgan, K, Thomas, H.R. and Seetharaman, K.N. The Finite Element Method in Heat Transfer Analysis, John Wiley, 1994.

COURSE OUTCOMES:

Students should be able to

- Apply the concepts FEA in casting and welding
- Use FEA in plastic deformation process

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 MATERIAL SCIENCE ENGINEERING

MECY049	CORROSION AND SURFACE ENGINEERING	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand various types of corrosion and its mechanism
- To impart knowledge on testing and prevention of corrosion
- To gain knowledge on corrosion behavior of materials
- To learn surface protection techniques
- To study various surface modification processes

MODULE I MECHANISMS AND TYPES OF CORROSION 09

Principles of direct and Electro chemical Corrosion, Hydrogen evolution and Oxygen absorption mechanisms – Galvanic corrosion, Galvanic series-specific types of corrosion such as uniform, Pitting, Intergranular, Cavitations, Crevice Fretting, Erosion and Stress Corrosion –Factors influencing corrosion.

MODULE II TESTING AND PREVENTION OF CORROSION 09

Corrosion testing techniques and procedures- Prevention of Corrosion-Design against corrosion – Modifications of corrosive environment –Inhibitors – Cathodic Protection –Protective surface coatings

MODULE III CORROSION BEHAVIOR OF MATERIALS 09

Corrosion of steels, stainless steel, Aluminum alloys, copper alloys, Nickel and Titanium alloys corrosion of Polymers, Ceramics and Composite materials.

MODULE IV SURFACE PROTECTION 09

Diffusion coatings –Electro and Electroless Plating –Hot dip coating –Hard facing-Metal spraying, Flame and Arc processes- Conversion coating – Selection of coating for wear and Corrosion resistance.

MODULE V SURFACE MODIFICATION PROCESSES 09

Laser and Electron Beam hardening – Effect of process variables such as power and scan speed - Physical vapor deposition, Thermal evaporation, Arc vaporization, Sputtering, Ion plating – Chemical vapor deposition – Coating of

tools, TiC, TiN, Al2O3 and Diamond coating – Properties and applications of thin coatings.

Total Hours: 45

REFERENCES:

1. Fontana. G., “Corrosion Engineering”, McGraw Hill, 1985.
2. Serope Kalpakjian – “Manufacturing Engineering & Technology- Addison Wesley Publishing Co; New York 1995.
3. Schweitzer.P.A., “Corrosion Engineering Hand Book”, 3rd Edition, Marcel Decker, 1996.
4. Winston Revie. R. Uhlig, Corrosion, Hand Book 2nd edition. John Wiley, 2000.
5. Kenneth G.Budinski, “Surface Engineering for Wear Resistance”, Prentice hall, 1988.
6. ASM Metals Hand Book –Vol. 5, Surface Engineering, 1996.

COURSE OUTCOMES:

Students should be able to

- Describe various types of corrosion and its mechanism
- Utilize different testing to prevent corrosion
- Interpret corrosion behaviour of materials
- Use various surface protection techniques
- Implement a variety of surface modification processes

MECY050 MEMS & NANO TECHNOLOGY

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To learn the fundamentals of MEMS and microsystems
- To understand the materials and fabrication process for MEMS
- To impart knowledge on materials for micro devices
- To instruct the behaviour of nano materials
- To gain knowledge on characterization of nano materials

MODULE I OVER VIEW OF MEMS AND MICROSYSTEMS 06

Definition – Historical development – fundamentals – properties, micro fluidics, design and fabrication micro-system, microelectronics, working principle and applications of micro system.

MODULE II MATERIALS, FABRICATION PROCESSES AND MICRO SYSTEM PACKAGING 10

Substrates and wafers, silicon as substrate material, mechanical properties of Si, Silicon Compounds silicon piezo resistors, Galium arsenide, quartz, polymers for MEMS, conductive polymers. Photolithography, photo resist applications, light sources, in implantation, diffusion process exudation – thermal oxidation, silicon diode, chemical vapour deposition, sputtering - deposition by epitoxy – etching – bulk and surface machining – LIGA process Micro system packaging – considerations packaging – levels of micro system packaging die level, device level and system level.

MODULE III MICRO DEVICES AND MATERIALS 08

Sensors – classification – signal conversion ideal characterization of sensors micro actuators, mechanical sensors – measurands displacement sensors, pressure and flow sensors, micro actuators – smart materials – applications.

MODULE IV SCIENCE OF NANO MATERIALS 10

Classification of nano structures – effect of the nanometer length scale - effects of nano scale dimensions on various properties – structural, thermal, chemical, mechanical, magnetic, optical and electronic properties – effect of nanoscale dimensions on biological systems - Fabrication methods – Top down processes – bottom up process.

MODULE V CHARACTERIZATION OF NANO MATERIALS 11

Nano-processing systems – Nano measuring systems – characterization – analytical imaging techniques – microscopy techniques, electron microscopy scanning electron microscopy, transmission electron microscopy, scanning tunneling microscopy, atomic force microscopy, diffraction techniques – spectroscopy techniques – Raman spectroscopy, 3D surface analysis – Mechanical, Magnetic and thermal properties – Nano positioning systems.

Total Hours: 45

REFERENCES:

1. Tai – Ran Hsu, MEMS and Microsystems Design and Manufacture, Tata-McGraw Hill, New Delhi, 2002.
2. Mark Madou Fundamentals of Microfabrication, CRC Press, New York, 1997.
3. Norio Taniguchi, Nano Technology, Oxford University Press, New York, 2003
4. The MEMS Hand book, Mohamed Gad-el-Hak, CRC Press, New York, London.
5. Charles P Poole, Frank J Owens, Introduction to Nano technology, John Wiley and Sons, 2003
6. Julian W. Hardner Micro Sensors, Principles and Applications, CRC Press 1993.

COURSE OUTCOMES:

Students should be able to

- Exhibit the fundamentals of MEMS and Microsystems
- Suggest the materials and fabrication process for MEMS
- Select materials for micro devices
- Express the behaviour of nano materials
- Perform the characterization of nano materials

MECY051 POLYMERS AND COMPOSITE MATERIALS

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To study the various properties of polymers
- To impart knowledge on processing of polymers
- To learn various fibres and matrix materials
- To educate various processing methods of polymer matrix composites
- To inculcate processing of metal matrix composites and ceramic matrix composites

MODULE I PROPERTIES OF POLYMERS 08

Chemistry and Classification of Polymers – Properties of Thermo plastics – Properties of Thermosetting plastics – Applications – Merits and Disadvantages.

MODULE II PROCESSING OF POLYMERS 09

Extrusion – Injection Moulding – Blow Moulding – Compression and Transfer Moulding – Casting – Thermo Forming – General Machining properties of Plastics – Machining parameters and their effect – Joining of plastics – Mechanical fasteners – Thermal bonding – Press fitting.

MODULE III INTRODUCTION TO FIBRES AND COMPOSITE MATERIALS 09

Fibres – Fabrication, Structure, properties and applications - Glass, boron, carbon, organic, ceramic and metallic fibers whiskers – Matrix materials structure – polymers, – metals and ceramics – Physical and chemical properties

MODULE IV PROCESSING OF POLYMER MATRIX COMPOSITES 09

Open mould process, bag moulding, compression moulding with BMC and SMC filament winding – pultrusion – centrifugal casting – injection moulding – structure, properties and application of PMC’s – Carbon Matrix Composites - Interfaces – Properties – recycling of PMC.

MODULE V PROCESSING OF METAL MATRIX COMPOSITES AND CERAMIC MATRIX COMPOSITES 10

Solid state fabrication techniques – diffusion bonding – powder metallurgy techniques – plasma spray, chemical and physical vapour deposition of matrix on fibres – Chemical vapour infiltration – Sol gel – liquid state fabrication methods –

infiltration – squeeze, casting – rheo casting – compocasting - Interfaces properties– application of MMC and ceramic matrix composites.

Total Hours: 45

REFERENCES:

1. Krishnan K Chawla, “Composite Materials Science and Engineering, International Edition”, Springer, 2006
2. Harold Belofsky, Plastics, Product Design and Process Engineering, Hanser Publishers, 2002.
3. Bera.E and Moet. A, High performance polymers, Hanser Publishers, 2001.
4. Rauwendaal,C., Polymer extrusium, Hanser publishers, 2000.
5. Rosatao, D.V. Blow moulding HandBook, Hanser Publishers, 1989.
6. Seamour, E.B. Modern Plastics Technology, Prentice Hall, 2002
7. Mallick, P.K. and Newman.S., Composite Materials Technology, Hanser Publishers, 2003

COURSE OUTCOMES

Students should be able to

- Describe the properties of polymers
- Report various processing of polymers
- Use various fibres and matrix materials for production of composite
- Prepare polymer matrix composites using various processing methods
- Produce metal matrix composites and ceramic matrix composites

PROFESSIONAL ELECTIVES ON MANUFACTURING MANAGEMENT

MECY052 LEAN SIX SIGMA

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the concepts and principles of lean Six Sigma
- To impart knowledge on lean six sigma methodologies
- To learn various tools and techniques of six sigma
- To instruct various lean tools
- To educate implementation of lean six sigma

MODULE I EVOLUTION OF LEAN SIX SIGMA 05

Introduction to Lean Principles and Six Sigma Concepts-Similarities and differences – Synergy-Evolution of Lean Six Sigma.

MODULE II LEAN SIX SIGMA APPROACH 08

Lean Six Sigma Methodology - Phases of Lean Six Sigma Method, Managing Lean Six sigma Project, Six sigma Methodologies (DMAIC, DMADV, DFSS)

MODULE III SIX SIGMA TOOLS AND TECHNIQUES 12

Advanced Statistical Tools - Statistical Process Control – Process Capability Analysis – Sigma computation - Hypothesis Testing – ANOVA-Design of Experiments- Chi – square test, Regression analysis – Case studies.

MODULE IV LEAN TOOLS 10

Value Stream Mapping – Poka Yoke-5S-Cycle Time Analysis-Push-Pull Systems-Waste Elimination – Total Productive Maintenance- Failure Mode Effect Analysis-Standard Work Practices-Control Plans, SMED, Kanban, Visual control, Kaizen – Case studies.

MODULE V LEAN SIX SIGMA IMPLEMENTATION 10

Identifying Lean Six Sigma Projects, Define Scope, Planning for Implementation, Selection of tools and techniques for each phase, Measuring the Benefits

Total Hours: 45

REFERENCES:

1. Michael L. George, David Rowlands, Bill Kastle ,What is Lean Six Sigma, McGraw-Hill, 2003
2. Thomas Pyzdek,The Six Sigma Handbook ,McGraw-Hill, 2000
3. James P. Womack, Daniel T. Jones, Lean Thinking, Free press business, 2003.
4. Forrest W. Breyfogle III, Implementing Six Sigma: Smarter Solutions Using Statistical Methods, 1999.
5. Liker, Jeffrey; Meier, David,Toyota Talent, Tata Mcgraw Hills

COURSE OUTCOMES:

Students should be able to

- Describe the concepts and principles of lean six sigma
- Use lean six sigma methodologies
- Apply various tools and techniques of six sigma
- Implement various lean tools
- Adopt lean six sigma for relevant industries

MECY053 MANUFACTURING MANAGEMENT

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the basic concepts of various layouts and material handling systems
- To learn work study techniques
- To gain knowledge on process planning and forecasting methods
- To inculcate knowledge on scheduling and project management
- To impart knowledge on functions of personnel and marketing management

MODULE I PLANT ENGINEERING 07

Plant location – Factors affecting plant location – Techniques – Plant layout - principles - Types –Comparison of layouts – Materials handling – Principles – Factors affecting selection of Materials handling system – Types of materials handling systems – Techniques.

MODULE II WORK STUDY 08

Method study – Principles of motion economy – steps in method study – Tools and Techniques – Work measurement – Purpose – stop watch time study – Production studies – work sampling – Ergonomics – Value analysis.

MODULE III PROCESS PLANNING AND FORECASTING 09

Process planning – Aims of process planning – steps to prepare the detailed work sheets for manufacturing a given component – Break even analysis – Forecasting – Purpose of forecasting – Methods of forecasting – Time series – Regression and Correlation – Exponential smoothing – Forecast errors.

MODULE IV SCHEDULING AND PROJECT MANAGEMENT 12

Scheduling – Priority rules scheduling – sequencing – Johnson's algorithm for job sequencing – n job M machine problems – Project Network analysis – PERT/CPM – Critical path –Floats – Resource leveling – Queuing analysis.

MODULE V PERSONNEL AND MARKETING MANAGEMENT 09

Principles of Management – Functions of personnel management – Recruitment – Training – Motivation – Communication – conflicts – Industrial relations – Trade Union – Functions of marketing – Sales promotion methods – Advertising – Product packaging – Distribution channels – Market research and techniques.

Total Hours: 45

REFERENCES

1. Dr. R. Kesavan, C.Elanchezian and B.Vijayaramnath, Production Planning and Control, Anuratha Publications, Chennai – 2008
2. Dr. R. Kesavan,C. Elanchezian and T.Sundar Selwyn, Engineering Management – Eswar Press, Chennai – 2005
3. Dr. R. Kesavan, C. Elanchezian, and B.Vijayaramnath, Principles of Management – Eswar Press – Chennai – 2004
4. R. Panneerselvam, Production and Operations Management, Prentice Hall of India, 2002
5. Martand T. Telsang, Production Management, S.Chand & Co., 2005
6. Thomas E Mortan, Production and Operations Management, Vikas Publications, 2003.

COURSE OUTCOMES:

Students should be able to

- Describe the basic concepts of various layouts and material handling systems
- Apply the work study techniques in industries
- Perform process planning and forecasting for a manufacturing industry
- Implement the scheduling and project management techniques
- Execute the functions of personnel and marketing management

MECY054 PRODUCTION AND INVENTORY MANAGEMENT

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the fundamentals of production management
- To instruct various forecasting methods
- To inculcate planning methodologies and strategies
- To acquire knowledge on various control activities
- To gain knowledge on types of inventory systems

MODULE I INTRODUCTION 05

Production Management – Input-output model, Trends and challenges, value chains, operations strategy – Technological Innovations in Manufacturing – Corporate strategic choices – Process planning and selection.

MODULE II FORECASTING 10

Forecasting process – Time series forecasting models – moving averages, exponential smoothing – multi-item forecasting – regression models, qualitative methods, forecasting system controls.

MODULE III PLANNING ACTIVITIES 10

Capacity planning – Aggregate production planning strategies and methods – Master Production Schedule, MRP, MRP II, CRP, ERP.

MODULE IV CONTROL ACTIVITIES 10

Production Activity Control – Just-in-time systems – Scheduling in Manufacturing – Theory of constraints and synchronous manufacturing.

MODULE V INVENTORY MANAGEMENT 10

Classification of Inventory - Inventory costs - Deterministic and probabilistic models – Inventory control systems.

Total Hours: 45

REFERENCES:

1. Seetharama L.Narasimhan, Dennis W.McLeavey, Peter J.Billington, “Production Planning and Inventory Control”, PHI, 2002.
2. Panneerselvam, R. Production and operations management, PHI, 2005

3. Lee J.Krajewski, Larry P.Ritzman, “Operations Management”, Pearson Education, 2000
4. Mahadevan,B. Operations- Theory & Practice, Pearson Education, 2007.

COURSE OUTCOMES:

Students should be able to

- Explain the fundamentals of production management
- Apply various forecasting methods in production management
- Execute planning methodologies and strategies
- Implement different types of control activities
- Choose relevant inventory systems

MECY055	PRODUCTIVITY MANAGEMENT AND RE - ENGINEERING	L	T	P	C
		3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To learn productivity concepts and its measurement
- To impart knowledge on systems approach for productivity measurement
- To gain knowledge in organizational transformation concepts and models
- To study the Re-engineering process improvement models
- To educate Re-engineering tools and its implementation

MODULE I PRODUCTIVITY AND MEASUREMENT 09

Productivity concepts – Macro and micro factors of productivity – Dynamics of productivity - Productivity cycle - Productivity measurement at International, national and organisation level - Productivity measurement models.

MODULE II SYSTEMS APPROACH TO PRODUCTIVITY MEASUREMENT 09

Conceptual frame work – Management by objectives (MBO) - Performance objective productivity (POP) – Methodology and application to manufacturing and service sector.

MODULE III ORGANISATIONAL TRANSFORMATION 09

Elements of organisational transformation and re-engineering - Principles of organizational transformation and re-engineering – Fundamentals of process re-engineering – Preparing the workforce for transformation and re-engineering - Methodology, guidelines, LMI CIP Model – DSMC Q & PMP model.

MODULE IV RE-ENGINEERING PROCESS IMPROVEMENT MODELS 09

PMI models – PASIM model – Moen and Nolan strategy for process improvement – LMICIP model – NPRDC model.

MODULE V RE-ENGINEERING TOOLS AND IMPLEMENTATION 09

Analytical and process tools and techniques – Information and communication technology – Implementation of re-engineering projects – Success factors and common implementation problem – Cases.

Total Hours: 45

REFERENCES

1. Sumanth, D.J., Productivity Engineering and Management, TMH, New Delhi, 1990.
2. Edosomwan, J.A., Organisational Transformation and Process Re-engineering, Library Cataloging in Pub. Data, 1996.
3. Rastogi, P.N., Re-engineering and Re-inventing the Enterprise, Wheeler Pub. New Delhi, 1995.
4. Premvrat, Sardana, G.D. and Sahay, B.S., Productivity Management – A Systems Approach, Narosa Publishing House, New Delhi, 1998.

COURSE OUTCOMES:

Students should be able to

- Reproduce productivity concepts and its measurement
- Communicate systems approach for productivity measurement
- Apply organizational transformation concepts and models
- Implement the Re-engineering process improvement models
- Execute the Re-engineering tools

MECY056 SUPPLY CHAIN MANAGEMENT

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To study the basic concepts of supply chain management
- To acquire knowledge on logistics management
- To instruct the design of supply chain network
- To communicate the sourcing and pricing of supply chain
- To impart knowledge on technology involved in supply chain

MODULE I INTRODUCTION 06

Definition of Logistics and SCM: Evolution, Scope, Importance & Decision Phases – Drivers of SC Performance and Obstacles.

MODULE II LOGISTICS MANAGEMENT 10

Factors – Modes of Transportation - Design options for Transportation Networks- Routing and Scheduling – Inbound and outbound logistics- Reverse Logistics – 3PL- Integrated Logistics Concepts- Integrated Logistics Model – Activities - Measuring logistics cost and performance – Warehouse Management - Case Analysis.

MODULE III SUPPLY CHAIN NETWORK DESIGN 10

Distribution in Supply Chain – Factors in Distribution network design –Design options-Network Design in Supply Chain – Framework for network Decisions - Managing cycle inventory and safety.

MODULE IV SOURCING AND PRICING IN SUPPLY CHAIN 09

Supplier selection and Contracts - Design collaboration - Procurement process. Revenue management in supply chain

MODULE V COORDINATION AND TECHNOLOGY IN SUPPLY CHAIN 10

Supply chain coordination - Bullwhip effect – Effect of lack of co-ordination and obstacles – IT and SCM - supply chain IT frame work. E Business & SCM. Metrics for SC performance – Case Analysis.

Total Hours: 45

REFERENCES:

1. Sunil Chopra and Peter Meindl,Supply Chain Management, Strategy, Planning, and operation –- PHI, Second edition, 2007
2. David J.Bloomberg, Stephen Lemay and Joe B.Hanna,Logistics, , PHI 2002
3. Martin Christopher, Logistics and Supply Chain Management –Strategies for Reducing Cost and Improving Service. Pearson Education Asia, Second Edition
4. Jeremy F.Shapiro, Thomson Duxbury Modeling the supply chain, 2002
5. James B.Ayers, Handbook of Supply chain management, St.Lucle Press, 2000

COURSE OUTCOMES:

Students should be able to

- Confer the basic concepts of supply chain management
- Express the concepts of logistics management
- Execute the design of supply chain network
- Apply the thoughts of sourcing and pricing of supply chain
- Use relevant technology involved in supply chain

MECY057 TECHNOLOGY MANAGEMENT

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To understand the basic methods of technology management in the global context
- To gain exposure in technology forecasting methods
- To communicate choice and evaluation of decision making studies
- To impart knowledge on technology transfer and acquisition
- To study technology absorption and innovation

MODULE I INTRODUCTION 09

Technology management - Scope, components, and overview – Technology and environment – Technology and society – Technology Impact analysis, environmental, social, legal, political aspects, techniques for analysis - steps involved. Technology policy strategy: Science and technology Policy of India, implications to industry – The dynamics of technology change.

MODULE II TECHNOLOGY FORECASTING 09

Need, methodology and methods - trend Analysis, Analogy, Delphi, Soft System Methodology, Mathematical Models, Simulation, and System Dynamics.

MODULE III TECHNOLOGY CHOICE AND EVALUATION 09

Issues in the development of new high tech products – Methods of analyzing alternate technologies – Techno-economic feasibility studies – Need for multi-criteria considerations such as, social, environmental, and political – Analytic hierarchy method – Fuzzy multi-criteria decision making, and other methods.

MODULE IV TECHNOLOGY TRANSFER AND ACQUISITION 09

Import regulations – Implications of agreements like Uruguay Round and WTO – Bargaining process – Transfer option, MOU- Technology Adoption and Productivity - Adopting technology-human interactions – Organisational redesign and re-engineering – Technology productivity.

MODULE V TECHNOLOGY ABSORPTION AND INNOVATION 09

Present status in India – Need for new outlook – Absorption strategies for acquired technology – creating new/improved technologies – Innovations – Technology Measurement – Technology Audit, Risk and exposure, R&D portfolio management.

Total Hours: 45

REFERENCES:

1. Joseph M. Putti, Management – A Functional Approach, McGraw Hill, 1997
2. Kenneth C. Lauden , MIS: Organisation and Technology, Prentice Hall, 1995
3. James A.Senn, Information technology in Business, Prentice Hall, 1995
4. Ronald J. Jordan, Security analysis and Portfolio Management, Prentice Hall, 1995
5. Irvin M. Rubin, Organisational behavior an experimental approach, Prentice Hall, 1995
6. Gerard H. Gaynor, Handbook of Technology Management, McGraw-Hill Professional, 1996
7. Richard C. Dorf, Technology Management Handbook, CRC, 1999

COURSE OUTCOMES:

Students should be able to

- Describe the methods of technology management in the global context
- Illustrate technology forecasting methods
- Apply decision making studies for the choice and evaluation of technology
- Present knowledge on technology transfer and acquisition
- Critique technology absorption and innovation

MECY058 TOTAL QUALITY SYSTEM AND MANAGEMENT

L	T	P	C
3	0	0	3

COURSE EDUCATIONAL OBJECTIVES:

- To study the basic concepts of TQM
- To communicate the knowledge on practice of TQM
- To learn the techniques of TQM
- To understand the concepts of statistical quality control
- To educate various sampling techniques

MODULE I INTRODUCTION 09

Principles of Quality Management – Pioneers of TQM –Quality Cost-Quality System- Customer Orientation –Bench marking – Re-engineering - Concurrent Engineering.

MODULE II PRACTICE OF TQM 09

Leadership – Organizational Structure - Team Building- Information Systems and Documentation –Quality Auditing-ISO 9000-QS 9000.

MODULE III TECHNIQUES OF TQM 09

Single vendor Concept –J.I.T –Quality Function Deployment- Quality Circles – KAIZEN- POKA YOKE - Taguchi Methods.

MODULE IV STATISTICAL QUALITY CONTROL 09

Methods and Philosophy of statistical process control –Control Charts for Variables and Attributes – Cumulative sum and Exponential - weighted moving average control charts- other SPC techniques –Process Capability Analysis – Six Sigma accuracy.

MODULE V SAMPLING TECHNIQUES 09

Acceptance sampling Problem –Single Sampling Plans for Attributes –Double, Multiple and Sequential sampling, Military standards – Dodge – Romig Sampling plans.

Total Hours: 45

REFERENCES:

1. Mohamed Zairi, “Total Quality Management for Engineers”, Woodhead Publishing limited 1991.

2. Harvind Noori and Russel, “Production and operations Management-Total quality and Responsiveness”, McGraw-Hill Inc.1995.
3. Suresh Dalela and saurabh. “ISO 9000 A manual for Total Quality Management”, S.Chand and Company Ltd., 1997.
4. John Bank, “The Essence of Total Quality Management”, Prentice Hall of India Pvt., Ltd., 1995.
5. Monttgomery. D.C. “Introduction to Statistical Quality Control”, 2nd Edition, John Wiley and Sons, 1991.
6. Leavensworth. G.E.L., “Statistical Quality Control”, McGraw-Hill,1984.

COURSE OUTCOMES:

Students should be able to

- Express the basic concepts of TQM
- Implement the practice of TQM
- Apply the techniques of TQM
- Anayze the defects using control charts
- Use various sampling techniques for industrial products

MECY059 ENTREPRENEURSHIP

L	T	P	C
1	0	0	1

COURSE EDUCATIONAL OBJECTIVES:

- To introduce the fundamentals of entrepreneurship
- To impart knowledge on managerial skills and leadership qualities

MODULE I ENTREPRENEURSHIP 08

Entrepreneurship – Functions – Types – Expectations – Sources of finance – Concept of small scale and ancillary units – Sickness and Remedies in SMEs

MODULE II MANAGERIAL SKILLS AND LEADERSHIP QUALITIES 07

Characteristics of Management – Managerial Skills – Contribution of F.W.Taylor and Henry Fayol – Industrial Ownership - Leadership Styles – Qualities of Leadership – Morale – Motivation Theories (Maslow, Herzberg and ERG theory).

Total Hours: 15

TEXT BOOKS

1. “Text book of production management”, Shridhara Bhat.K, 1st Edition, Himalaya Publishing House.
2. “Industrial Engineering and Management”, Khanna.O.P, 2nd Edition, Dhanpat Rai Publications.

REFERENCES

1. “Entrepreneurial Development”, Jayshree Suresh, 5th Edition, Margham Publications.
2. “Entrepreneurship”, Robert D. Hisrich, 6th Edition, Tata McGraw Hill Publications.
3. “Entrepreneurship: Theory”, Process and Practice, Donald F. Kuratko, 9th Edition, Cengage Learning.

COURSE OUTCOMES:

Students should be able to

- Discuss the fundamentals of entrepreneurship
- Execute managerial skills and leadership qualities

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