UNIVERSITY VISION AND MISSION

VISION

B.S. Abdur Rahman Institute of Science & 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 programs 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 Industries and Research Organizations.

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 program, the graduates will

- have the ability to provide solutions for Product Realization
- have ability to appreciate the relation between Design and Manufacturing
- have a broad understanding an 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

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)
Seethakathi Estate, G.S.T. Road, Vandalur, Chennai - 600 048.

REGULATIONS 2013
FOR
M.TECH. DEGREE PROGRAMMES
(WITH AMENDMENTS INCORPORATED TILL JUNE 2015)

B.S. ABDUR RAHMAN UNIVERSITY, CHENNAI 48.
REGULATIONS -2013 FOR M.TECH / MCA / M.Sc. DEGREE PROGRAMMES

(With amendments incorporated till June 2015)

1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires

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

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

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

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

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

vi) **"Dean (Academic Affairs)"** means Dean (Academic Affairs) of B.S.Abdur Rahman University.

vii) **"Dean (Student Affairs)"** means Dean(Student Affairs) of B.S.Abdur Rahman University.

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

2.0 PROGRAMMES OFFERED, MODE OF STUDY AND ADMISSION REQUIREMENTS

2.1 P.G. Programmes Offered

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

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

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 Projectwork in part-time mode for valid reasons, shall apply to the Dean (Academic Affairs) through the Head of the Department, if the student satisfies the clause 2.3.4 of this Regulation. Permission may be granted based on merits of the case. Such conversion is not permitted in the middle of a semester.

2.2.3 Part time - Day time

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

2.2.4 Part time - Evening

In this mode of study, the students are required to attend normally classes in the evening and on Saturdays, if necessary.

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

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 A student eligible for admission to M.Tech. Part Time / Day Time programme shall have his/her permanent place of work within a distance of 65km from the campus of this Institution.

2.3.5 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. (Full Time) – (Lateral Entry)	4	8
M.Sc. (Full Time)	4	8

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

i. Core courses
ii. Elective courses
iii. Project work / thesis / dissertation
iv. Laboratory Courses
v. Case studies
vi. Seminars
vii. 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)	B.E. / B.Tech. (Civil Engineering) / (Structural Engineering)
02.	Mechanical Engineering	M.Tech. (Manufacturing Engineering)	B.E. / B.Tech. (Mechanical / Auto / Manufacturing / Production / Industrial / Mechatronics / Metallurgy / Aerospace /Aeronautical / Material Science / Marine Engineering)
03.	Polymer Technology	M.Tech. (Polymer Technology)	B.E./ B.Tech. degree Mech./Production/ Polymer Science or Engg or Tech / Rubber Tech / M.Sc (Polymer Sc./ Chemistry Appl. Chemistry)
04.	Electrical and Electronics Engineering	M.Tech. (Power Systems Engg)	B.E / B.Tech (EEE / ECE / E&I / I&C / Electronics / Instrumentation)
		M.Tech. (Power Electronics & Drives)	B.E / B.Tech (EEE / ECE / E&I / I&C / Electronics / Instrumentation)
05.	Electronics and Communication Engineering	M.Tech. (Communication Systems)	B.E / B.Tech (EEE/ ECE / E&I / I&C / Electronics / Instrumentation)
		M.Tech.(VLSI and Embedded Systems)	B.E./ B.Tech. in ECE / Electronics / EIE
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)
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 and Predictive Analytics)	B.E. /B.Tech. (CSE/IT/ECE/EEE/EIE/ICE/ Electronics / MCA)
09	InformationTechnology	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.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.

ELIGIBLE ENTRY QUALIFICATIONS FOR ADMISSION TO P.G. PROGRAMMES

Sl. No.	Name of the Department	P.G. Programmes offered	Qualifications for admission
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. (Full Time) – (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)	
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)	
13	Chemistry	M.Sc.(Chemistry)	B.Sc (Chemistry) of B.Sc. (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 credit range
M.Tech.	75 to 85
M.C.A.	120 to 130
M.Sc.	75 to 85

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

* One credit for one lecture period per week
* One credit for one tutorial period per week
* One credit each for seminar/practical session/project of two or three periods per week
* One credit for two weeks of industrial internship.

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	Non-project Semester	Project semester
M.Tech. (Full Time)	15 to 29	12 to 20
M.Tech. (Part Time)	6 to 18	12 to 16
M.C.A. (Full Time)	15 to 29	12 to 20
M.Sc. (Full Time)	15 to 25	12 to 20

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

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

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

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

3.13 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.

3.14 PROJECT WORK/THESIS/DISSERTATION

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

3.14.2 A 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.

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

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

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

3.14.6 If a 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.

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

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 and enroll for all the courses.

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

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 Adviser. Late enrolment will be permitted on payment of a prescribed fine up to two weeks from the date of commencement of the semester.

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

7.6 Change of a course within a period of 15 days from the commencement of the course, with the approval of Dean (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 should have registered for all preceding semesters before registering for a particular semester.

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)	18 (III semester)
M.Tech. (Part time)	18 (V semester)
M.C.A. (Full time)	45 (V semester)
M.C.A. (Full time) – (Lateral Entry)	22 (V semester)
M.Sc.(Full time)	30 (IV semester) if project is in IV semester 18 (III semester) if project is in III semester

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.

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

11.0 ATTENDANCE

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

13.0 ASSESSMENTS AND EXAMINATIONS

13.1 The following rule shall apply to the full-time and part-time 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, in each lecture based course.

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

13.4 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

$$GPA = \frac{\sum_{i=1}^{n}(C_i)(GPi)}{\sum_{i=1}^{n} C_i} \qquad Where\ \ n = number\ of\ courses$$

where Ci 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:

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.

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

SEMESTER I

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MAB6184	Probability and Statistical Methods	3	1	0	4
2.	MEB6101	Research Methodology	3	0	0	3
3.	MEB6102	Applied Materials Engineering	3	0	0	3
4.	MEB6121	Advances in Manufacturing Technology	3	0	0	3
5.	MEB6122	Mechatronics in Manufacturing Systems	3	0	0	3
6.		Elective	3	0	0	3
7.	MEB6123	CIM Lab	0	0	4	2
8.	MEB6124	Seminar	0	0	2	1
						22

SEMESTER II

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MEB6231	Automated and Computer Integrated Manufacturing	3	0	0	3
2.	MEB6232	Finite Element Applications in Manufacturing	3	1	0	4
3.	MEB6233	Lean Manufacturing System and Implementation	3	0	0	3
4.	MEB6234	Metal Forming Techniques	3	0	0	3
5.		Elective	3	0	0	3
6.		Elective	3	0	0	3
7.	MEB6235	Automation Lab	0	0	4	2
8.	MEB6236	Design / Fabrication Project	0	0	4	2
						23

SEMESTER III

Sl. No.	Course Code	Course Title	L	T	P	C
1.		Elective	3	0	0	3
2.		Elective	3	0	0	3
3.		Elective	3	0	0	3
4.	MEB7102	Project Management	3	0	0	3
5.	MEB7121	Project Work - Phase I	0	0	12	6*
						12

SEMESTER IV

Sl. No.	Course Code	Course Title	L	T	P	C
1.	MEB7121	Project Work - Phase II	0	0	36	18*
						18 + 6 = 24

* Credits for Project Work Phase I to be accounted along with Project Work Phase II in IV Semester

TOTAL CREDITS : 81

LIST OF ELECTIVES

Sl. No.	Course Code	Course Title
1.	MEBY26	Optimization Techniques in Engineering
2.	MEBY27	Manufacturing System Simulation
3.	MEBY28	Productivity Management and Re Engineering
4.	MEBY29	Reverse Engineering
5.	MEBY30	Advanced Tool Design
6.	MEBY31	Advances in Casting & Welding
7.	MEBY32	Cellular Manufacturing System
8.	MEBY33	Mechatronics in CNC Machines
9.	MEBY34	Plastics & Composite Materials
10.	MEBY35	Total quality system and management
11.	MEBY36	Manufacturing Management
12.	MEBY37	Tribology of Machines
13.	MEBY38	Technology Management
14.	MEBY39	Lean Sixsigma
15.	MEBY40	MEMS & Nano Technology
16.	MEBY41	Engine Management System
17.	MEBY42	Design and Analysis of Experiments
18.	MEBY43	Supply Chain Management
19.	MEBY44	Production and Inventory Management
20.	MEBY45	Design for Manufacture
21.	MEBY46	Industrial Robotics and Expert Systems
22.	MEBY47	Advanced Metrology and Computer Aided Inspection
23.	MEBY48	Corrosion and Surface Engineering
24.	MEBY49	Manufacturing of Automotive Components
25.	SSBY01	Society, Technology & Sustainability

SEMESTER I

MAB6184 PROBABILITY AND STATISTICAL METHODS

L	T	P	C
3	1	0	4

OBJECTIVE:

- This course intends to provide a comprehensive introduction to the probability distributions and statistical methods used in engineering.

MODULE I PROBABILITY AND DISTRIBUTIONS 8

Probability: concepts - probability laws - Baye's theorem, Frequency distribution -measures of central tendency and dispersion, Probability distributions: continuous - normal - log normal - Weibull - Gamma - Exponential, discrete distributions - Binomial - Poisson.

MODULE II SAMPLING AND DISTRIBUTION 8

Sampling - different methods - sample error - confidence intervals, sampling distributions - Test of hypothesis - level of significance - one tail / two tail tests, students t distributions, χ^2 distribution.

MODULE III ANALYSIS OF VARIANCE 7

ANOVA - one way - two way classification – Latin Square design – 2^2 factorial design.

MODULE IV DESIGN OF EXPERIMENTS 7

Experimental factors – interaction of factors, Types of experimental designs - blocking design - factorial – fractional factorial, Taguchi's orthogonal approach.

MODULE V REGRESSION, CORRELATION AND CURVE FITTING 7

Regression analysis - simple linear regression - regression coefficient, multiple regression -multiple & partial correlation coefficient, curve fitting - graphical - least square - method testing of goodness of fit.

MODULE VI SIMULATION 8

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

Total Hours: 60

REFERENCES:

1. Douglas C. Montgomery, George C. Runger, “Applied Statistics and Probability for Engineers”, 4th Edition, Wiley publication, 2006.
2. Richard A. Johnson, “Probability and Statistics for Engineers”’ Pearson Editions 6th ed. Indian Reprint 2002.
3. Jerry Banks, John S. Carson, Barry L. Nelson, “Discrete – Event systems Simulation”, Prentice Hall India, New Delhi, 1999.
4. Jay L. Devore, “Probability and Statistics for Engineering and the Sciences”, Duxbury publication, 2007.
5. R. Lyman Ott, Michael Longnecker, “An Introduction to Statistical Methods and Data Analysis”, 6th edition, Brooks/Cole Cengage Learning, USA, 2010.
6. Sheldon M. Ross, “Introduction to probability models”, 10th edition, Academic Press, 2009.

OUTCOMES:

At the end of the course students will be able to

- Identify and fit probability distribution for a given data.
- Analyze samples and make decisions.
- Solve problems in modeling using simulation techniques.

MEB6101 RESEARCH METHODOLOGY

L	T	P	C
3	0	0	3

OBJECTIVE:

- The aim of the course is to introduce a number of perspectives on research to the scholars so as to broaden their conceptions of what research involves. This course covers research design, problem formulation, literature survey an review, information retrieval, use of statistical techniques, writing of research reports and evaluation, ethics in research and Intellectual Property Rights.

MODULE I RESEARCH PROBLEM FORMULATION 7

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

MODULE II RESEARCH DESIGN 8

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 USE OF STATISTICAL TOOLS IN RESEARCH 12

Importance of statistics in research – concept of probability – popular distributions – sample design. Hypothesis testing, ANOVA, Design of experiments – factorial designs – orthogonal arrays, Multivariate analysis – Curve fitting, Correlation and regression.

MODULE IV ANALYSIS AND INTERPRETATION OF DATA 10

Research Data analysis – interpretation of results – correlation with scientific facts, Accuracy and precision – error analysis, limitations, Use of optimization techniques – traditional methods – evolutionary optimization techniques.

MODULE V THE RESEARCH REPORT 8

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 defence, 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.

OUTCOMES:

- Students will be able to acquire a perspective on research concepts.
- Students will be able to know the techniques related to research such as problem formulation, literature survey , information retrieval, use of statistical techniques, writing of research reports and evaluation
- Students will be exposed to the ethics in research and Intellectual Property rights

MEB6102 APPLIED MATERIALS ENGINERING L T P C
3 0 0 3

OBJECTIVES:

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

MODULE I ELASTIC AND PLASTIC BEHAVIOR 12

Elasticity in metals and polymers An elastic 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 8

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 5

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 5

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

Total Hours: 45

REFERENCES:

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

OUTCOME:

- Students gain knowledge of advanced materials and will be able to select the right material for various engineering applications.

MEB6121 ADVANCES IN MANUFACTURING TECHNOLOGY **L T P C**
3 0 0 3

OBJECTIVES:

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

MODULE I NEWER MACHINING PROCESSES - I **9**

(Non thermal energy) – 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 NEWER MACHINING PROCESS – II **9**

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

MODULE III NEWER MACHINING PROCESS – III **9**

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

MODULE IV FABRICATION OF MICRO DEVICES **9**

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

MODULE V MICROFABRICATION TECHNOLOGY **9**

Wafer preparation – monolithic processing – moulding – PCB board hybrid & mcm technology – programmable devices & ASIC – electronic material and processing.– steriolithography SAW devices, Surface Mount Technology.

Total Hours: 45

REFERENCES:

1. Serope kelpekijian & stevan r. schmid- manufacturing process engg material – 2003.
2. Micro senors Mems & smart devices- Julian W.Hardner – 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 HS Modern Machining Processes, Standard Publishing Co., 1980.
7. More Madon, Fundamentals of Microfabrication, CRC Press, 1997.

OUTCOME:

- Students will understand and appreciate the latest manufacturing process and apply while working in industry.

MEB6122 MECHATRONICS IN MANUFACTURING SYSTEMS **L T P C**
3 0 0 3

OBJECTIVES:

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

MODULE I INTRODUCTION **5**

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

MODULE II SENSORS AND TRANSDUCERS **12**

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

MODULE III ACTUATORS **12**

Actuators – Mechanical - Electrical - Fluid Power - Piezoelectric – Magnetostrictive - Shape memory alloy - applications - selection of actuators.

MODULE IV PROGRAMMABLE LOGIC CONTROLLERS **8**

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

MODULE V DESIGN AND MECHATRONICS CASE STUDIES **8**

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 – Mechatronic control in automated manufacturing - Data acquisition Case studies.

Total Hours: 45

REFERENCES:

1. Bolton.W, “Mechatronics” , Pearson education, second edition, fifth Indian Reprint, 2003.
2. Smaili.A and Mrad.F , "Mechatronics integrated technologies for intelligent machines", Oxford university press, 2008.
3. Devadas Shetty and Richard A.Kolk, “Mechatronics systems design”, PWS Publishing Company, 2007.
4. Godfrey C. Onwubolu, "Mechatronics Principles and Applications", Elsevier, 2006.
5. Nitaigour Premchand Mahalik, “Mechatronics Principles, Concepts and Applicatlions” Tata McGraw-Hill Publishing company Limited, 2003.
6. Michael B.Histand and Davis G.Alciatore,” Introduction to Mechatronics and Measurement systems”. McGraw Hill International edition, 1999.
7. Bradley D.A, Dawson.D, Buru N.C and Loader A.J, “Mechatronics” Nelson Thornes ltd, Eswar press, Indian print, 2004.

OUTCOME:

- Students will be able to design a Mechatronics system such as pick and place robot, car park barriers, car engine management and bar code reader.

MEB6123	CIM LAB	L T P C 0 0 4 2

OBJECTIVES:

- To learn about modeling of 2D and 3D components using advanced CAD software.
- To learn the programming and machining of various components using CAM software and CNC machines.

CAM LABORATORY

1. Exercise on CNC Lathe: Plain Turning, Step turning, Taper turning, Threading, Grooving & canned cycle
2. Exercise on CNC Milling Machine: Profile Milling, Mirroring, Scaling & canned cycle.

CAD LABORATORY

2D modeling and 3D modeling of components such as

1. Bearing
2. Couplings
3. Gears
4. Sheet metal components
5. Jigs, Fixtures and Die assemblies.

Total Hours: 30

OUTCOME:

- Students get practical exposure on the latest CAD/CAM softwares used in industries.

SEMESTER II

		L	T	P	C
MEB6231	AUTOMATED AND COMPUTER INTEGRATED MANUFACTURING	3	0	0	3

OBJECTIVES:

- To understand basic concepts of CIM system.
- To learn the various concepts of automated manufacturing system.
- To study the computer aided process planning and control and data capturing techniques.

MODULE I INTRODUCTION **9**

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 **9**

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 system – Automated storage/Retrieval system and Carousel storage system.

MODULE III GROUP TECHNOLOGY AND FMS **9**

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 **9**

Typical process sheet – case studies in Manual process planning. Computer Aided Process Planning – Process planning module and data base – Variant process planning – 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 **9**

Introduction to process model formulation – linear feed back control systems – Optimal control – Adaptive control –Sequence control and 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.

Total Hours : 45

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.

OUTCOME :

- Students will be able to appreciate the role of computers in manufacturing process and apply it in operation.

MEB6232 FINITE ELEMENT APPLICATIONS IN MANUFACTURING **L T P C 3 1 0 4**

OBJECTIVES:

- To impart knowledge in the area of finite element methods and its application in manufacturing.
- To study the fundamentals of one dimensional and two dimensional problems using FEA in manufacturing.

MODULE I INTRODUCTION **9**

Fundamentals – Initial, boundary and eigen value problems – weighted residual, Galerkin and Raleigh Ritz methods - Integration by parts – Basics of variational formulation – Polynomial and Nodal approximation.

MODULE II ONE DIMENSIONAL ANALYSIS **9**

Steps in FEM – Discretization. Interpolation, derivation of elements characteristic matrix, shape function, assembly and imposition of boundary conditions-solution and post processing – One dimensional analysis in solid mechanics and heat transfer.

MODULE III SHAPE FUNCTIONS AND HIGHER ORDER FORMULATIONS **9**

Shape functions for one and two dimensional elements- Three noded triangular and four nodded quadrilateral element Global and natural co-ordinates—Non linear analysis – Isoparametric elements – Jacobian matrices and transformations – Basics of two dimensional, plane stress, plane strain and axisymmetric analysis.

MODULE IV COMPUTER IMPLEMENTATION **9**

Pre Processing, mesh generation, elements connecting, boundary conditions, input of material and processing characteristics – Solution and post processing – Overview of application packages – Development of code for one dimensional analysis and validation.

MODULE V ANALYSIS OF PRODUCTION PROCESSES **9**

FE analysis of metal casting – special considerations, latent heat incorporation, gap element – Time stepping procedures – Crank – Nicholson algorithm –

Prediction of grain structure – Basic concepts of plasticity and fracture – Solid and flow formulation – small incremental deformation formulation – Fracture criteria – FE analysis of metal cutting, chip separation criteria, incorporation of strain rate dependency – FE analysis of welding.

Total Hours: 45

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.

OUTCOME:

- Students will be able to use the FEA in manufacturing applications.

MEB6233	LEAN MANUFACTURING SYSTEM AND IMPLEMENTATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the concepts of lean manufacturing system.
- To study the various tools for lean manufacturing and case studies.

MODULE I INTRODUCTION TO LEAN MANUFACTURING 7

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

MODULE II CELLULAR MANUFACTURING, JIT, TPM 9

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, 5S, VSM 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 9

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

MODULE V CASE STUDIES 10

Various case studies of implementation of lean manufacturing at 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.

OUTCOME:

- Students will be able to apply the tools to implement LM system in an organization.

MEB6234 METAL FORMING TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:

- To understand the behavior of materials during forming.
- To learn the various metal forming process and their applications.
- To study about powder metallurgy and modern forming process.
- To learn various surface treatment processes.

MODULE I THEORY OF PLASTICITY 9

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 9

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 9

Formability studies – Conventional processes – H E R F techniques – Superplastic forming techniques – Hydro forming – Stretch forming – Water hammer forming – Principles and process parameters – Advantage, Limitations and application

MODULE IV POWDER METALLURGY AND SPECIAL FORMING PROCESSES 9

Overview of P/M technique – Advantages – applications – Powder preform forging – powder rolling – Tooling, process parameters and applications. - Orbital forging – Isothermal forging – Hot and cold isostatic pressing – High speed extrusion – Rubber pad forming – Fine blanking – LASER beam forming

MODULE V SURFACE TREATMENT AND METAL FORMING APPLICATIONS **9**

Experiment techniques of evaluation of friction in metal forming selection – influence of temperature and gliding velocity – Friction heat generation – Friction between metallic layers – Lubrication carrier layer – Surface treatment for drawing, sheet metal forming, Extrusion and hot and cold forging.

Processing of thin Al tapes – Cladding of Al alloys – Duplex and triplex steel rolling – Thermo mechanical regimes of Ti and Al alloys during deformation – Formability of welded blank sheet – Laser structured steel sheet - Formability of laminated sheet.

Total Hours: 45

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 An Imprint of Elesevier, 2006
7. Proc. Of National Seminar on "Advances in Metal Forming" MIT, March 2000
8. SAE Transactions, Journal of Materials and Manufacturing Section 5, 1993-2007.

OUTCOME:

- Students will be able to apply the concepts while working in forming operations.

MEB6235	AUTOMATION LAB	L	T	P	C
		0	0	4	2

OBJECTIVE:

- To teach the students about the functioning of different components of a automation system.

LIST OF EXPERIMENTS:

1. To simulate the various hydraulics and pneumatics circuits
2. Study of Sensors and Transducers. Potentiometer, Strain gauge, Torque, LVDT, Hall-effect, speed, Vibration, Pressure.
3. Study of Temperature Transducer.
4. Study of optical Transducer.
5. Exercises on Operational amplifier circuits.
6. Study of Fiber optic sensors.
7. Electronic Power controls of DC and AC motors.
8. Study of Hydraulic and Pneumatic components.
9. Exercise on Hydraulic circuits.
10. Exercise on Electro hydraulic circuits.
11. Study of Electro Pneumatic Sequencing circuits.
12. Study of Hydraulic and Pneumatic Circuits using simulation software.
13. Exercise on Hydraulic and Pneumatic circuits using PLC.

OUTCOME:

- Students will get a practical exposure on the working of basic components of a system.

SEMESTER III

MEB7102	PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquire knowledge on project planning, implementation and analysis.
- To give an exposure on network analysis and Project scheduling.

MODULE I INTRODUCTION & PROJECT INITIATION 9

Introduction to PM: Projects in Contemporary Organization, Project Life Cycle

Project Initiation: Strategic Management, Project Selection & Evaluation, Selection Criteria & Models.

MODULE II RISK ANALYSIS 9

Risk Management, Portfolio Process, Project Proposals, Project manager: Demands on Project manager, Selecting the Project Manager, Multicultural Communication, Project Organization: Organizational Concepts in PM, Selecting an Organizational Form.

MODULE III PROJECT PLANNING & IMPLEMENTATION 9

Project Planning: Systems integration, WBS, Responsibility Charts, Interface Coordination, Conflict and Negotiation in PM: Nature of Negotiation, Conflict and Project Life Cycle.

Project Implementation: Budgeting and Cost Estimation: Estimating Project Budgets, Improving Cost.

MODULE IV NETWORK ANALYSIS & PROBLEMS 9

Algorithms for shortest route problems-Dijkstra's, Flyod's, and Dantzig's algorithms; Algorithms for minimal spanning tree- Kruskal's algorithm and Prim's algorithm; Algorithms for maximal flow problems. Maximum flow minimum cut explanation.

Estimation Process, Scheduling: Background, Network Techniques: PERT & CPM, Risk Analysis.

MODULE V PROJECT SCHEDULING WITH LIMITED RESOURCES 9

Complexity of project scheduling with limited resources, leveling the demands on key resources, A simple heuristic program for resource allocation.

Total Hours: 45

REFERENCES:

1. A Management Guide to PERT/CPM, Jerome, D. Weist and Ferdinand K. Levy, Prentice Hall of India, New Delhi, 1994.
2. Projects Planning, Implementation and Control, Prasanna Chandra, Tata McGraw-Hill.
1. Publishing Company Ltd., New Delhi, 1995.
2. Operations Research: Principles and Practice, Ravindran, A. Phillips, Don T. and Solberg, James J. Second edition, John Wiley & Sons, 1987.
3. Project Management with CPM and PERT, Moder J.V. and Phillips, C.R.E. Van Nostrand Reinhold Company, 1964.
4. Project Management and Control, Narendra Singh, Himalaya Publishing

OUTCOME:

- On completion of the course the student will be able to plan, schedule, analyze and execute the project effectively.

MEB7121	PROJECT WORK - PHASE I	L	T	P	C
		0	0	12	6

The main objective is to promote project based learning.

(Refer to clause 3.14 of B.S. Abdur Rahman University regulations)

ELECTIVES

MEBY26 OPTIMISATION TECHNIQUES IN ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the various optimization techniques and their applications.
- To study the concepts of networking and various simulation techniques.

MODULE I INTRODUCTION **9**

Optimization – Historical Development – Engineering applications of optimization – Statement of an Optimization problem – classification of optimization problems.

MODULE II CLASSIC OPTIMIZATION TECHNIQUES **9**

Linear programming - Graphical method – simplex method – dual simplex method – revised simplex method – duality in LP – Parametric Linear programming – Goal Programming.

MODULE III NON-LINEAR PROGRAMMING **9**

Introduction – Lagrangeon Method – Kuhn-Tucker conditions – Quadratic programming – Separable programming – Stochastic programming – Geometric programming

MODULE IV INTEGER PROGRAMMING AND DYNAMIC PROGRAMMING AND NETWORK TECHNIQUES **9**

Integer programming - Cutting plane algorithm, Branch and bound technique, Zero-one implicit enumeration – Dynamic Programming – Formulation, Various applications using Dynamic Programming. Network Techniques – Shortest Path Model – Minimum Spanning Tree Problem – Maximal flow problem.

MODULE V ADVANCES IN SIMULATION **9**

Genetic algorithms – simulated annealing – Neural Network and Fuzzy systems.

Total Hours: 45

REFERENCES:

1. R. Panneerselvam, “Operations Research”, Prentice Hall of India Private Limited, New Delhi 2005
2. P.K. Guptha and Man-Mohan, Problems in Operations Research – Sultan chand & Sons, 1994
3. Ravindran, Philips and Solberg, Operations Research Principles and Practice, John Wiley & Sons, Singapore, 1992
4. J.K.Sharma, Operations Research – Theory and Applications – Macmillan India Ltd., 1997
5. Hamdy A. Taha, Operations Research – An Introduction, Prentice Hall of India, 1997

OUTCOME:

- Students will be able to make use of the techniques while modeling and solving the engineering problems of different fields.

MEBY27 MANUFACTURING SYSTEM SIMULATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the various concepts of manufacturing system simulation.
- To model manufacturing systems of different kinds.
- To make use of simulation languages for manufacturing systems.

MODULE I INTRODUCTION **8**

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 Areas of application of simulation.

MODULE II RANDOM NUMBERS **9**

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, the 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 **9**

Comparison and selection of simulation languages - Study of GPSS (Basic blocks only) Generate, Queue, Depart, Size, Release, Advance, Terminate, Transfer, Enter and Leave.

MODULE V CASE STUDIES **9**

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. 1 .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.

OUTCOME:

- Students will be able to use the simulation techniques in manufacturing process.

MEBY28	PRODUCTIVITY MANAGEMENT AND RE-ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the concept of productivity, its measurement and organizational transformation.
- To study the principles of re-engineering.

MODULE I PRODUCTIVITY **9**

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 **9**

Conceptual frame work, Management by COURSE OBJECTIVEs (MBO), Performance Objectivated Productivity (POP) – Methodology and application to manufacturing and service sector.

MODULE III ORGANISATIONAL TRANSFORMATION **9**

Elements of Organisational Transformation and Reengineering-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 **9**

PMI models, PASIM Model, Moen and Nolan Strategy for process improvement, LMICIP Model, NPRDC Model.

MODULE V RE-ENGINEERING TOOLS AND IMPLEMENTATION **9**

Analytical and process tools and techniques – Information and Communication Technology – Implementation of Reengineering 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

OUTCOMES:

- At the end of this course the students are expected to understand the general issues
- Relating to Productivity management and re-engineering.

MEBY29 REVERSE ENGINEERING L T P C
3 0 0 3

OBJECTIVE:

- To study the basic concepts and tools of reverse engineering.

MODULE I INTRODUCTION 5

Scope and tasks of RE - Domain analysis- process of duplicating.

MODULE II TOOLS FOR REVERSE ENGINEERING 8

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 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. T J Biggerstaff, Design Recovery for Maintenance and Reuse, IEEE Corpn. July 1991

2. S. Rugaban, 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, ISBN 1555897, American Gear Manufacturers Association

OUTCOME:

- Students will be able to appreciate the physical world through reverse engineering approach.

MEBY30 ADVANCED TOOL DESIGN L T P C
3 0 0 3

OBJECTIVES:

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

MODULE I INTRODUCTION TO TOOL DESIGN 8

Introduction –Tool Engineering – Tool Classifications– Tool Design COURSE COURSE OBJECTIVEs – Tool Design in manufacturing- Challenges and requirements- Standards in tool design-Tool drawings -Surface finish – Fits and Tolerances - Tooling Materials- Ferrous and Non ferrous Tooling Materials- Carbides, Ceramics and Diamond -Non metallic tool materials-Designing with relation to heat treatment.

MODULE II DESIGN OF CUTTING TOOLS 9

Mechanics of Metal cutting –Oblique and orthogonal cutting- Chip formation and shear angle - Single-point cutting tools – Milling cutters – Hole making cutting tools- Broaching Tools - Design of Form relieved and profile relieved cutters-Design of gear and thread milling cutters.

MODULE III DESIGN OF JIGS AND FIXTURES 10

Introduction – Fixed Gages – Gage Tolerances –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 –Thrust and Turning Moments in drilling - Drill jigs and modern manufacturing- Types of Fixtures – Vise Fixtures – Milling Fixtures – Boring Fixtures – Broaching Fixtures – Lathe Fixtures – Grinding Fixtures – Modular Fixtures – Cutting Force Calculations.

MODULE IV DESIGN OF PRESS TOOL DIES 10

Types of Dies –Method of Die operation–Clearance and cutting force calculations- Blanking and Piercing die design – Pilots – Strippers and pressure pads- Presswork materials – Strip layout – Short-run tooling for Piercing – Bending dies – Forming dies – Drawing dies-Design and drafting.

MODULE V TOOL DESIGN FOR CNC MACHINE TOOLS 8

Introduction –Tooling requirements for Numerical control systems – Fixture design for CNC machine tools- Sub plate and tombstone fixtures-Universal fixtures– Cutting tools– Tool holding methods– Automatic tool changers and tool positioners – Tool presetting– General explanation of the Brown and Sharp machine.

Total Hours: 45

REFERENCES:

1. Cyrll Donaldson, George H.LeCain, V.C. Goold, “Tool Design”, Tata McGraw Hill Publishing Company Ltd., 2000.
2. E.G.Hoffman, “Jig and Fixture Design”, Thomson Asia Pvt Ltd, Singapore, 2004
3. Prakash Hiralal Joshi, “Tooling data”, Wheeler Publishing, 2000
4. Venkataraman K., “Design of Jigs, Fixtures and Presstools”, TMH, 2005
5. Haslehurst M., “Manufacturing Technology”, The ELBS, 1978

OUTCOME:

- Students will be able to appreciate the importance of using tools for their designed purposes and develop skills in the care and maintenance of machine tools.

MEBY31 ADVANCES IN CASTING AND WELDING **L T P C**
3 0 0 3

OBJECTIVES:

- To know the basic concepts and advances in casting and welding processes.
- To study the metallurgical concepts and applications of casting and welding process, Computer assistance in casting and automation of welding process.

MODULE I CASTING DESIGN **8**

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 **8**

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 **8**

Shell moulding, precision investment casting, CO^2 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, Zirconium and titanium 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 McGrawHill 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 – Volumes I, II and III, Jaico Publishers, 1994.
11. Lancaster.J .F. – Metallurgy of welding – George Alien & Unwin Publishers, 1980.

OUTCOME:

- Students will acquire knowledge in advanced casting and welding process used in industries and to solve the problems faced.

MEBY32 CELLULAR MANUFACTURING SYSTEM **L T P C**
3 0 0 3

OBJECTIVES:

- To understand the planning, design and implementation of CMS.
- To understand the performance measurement, control and economical aspects of CMS.

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 **8**

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

MODULE V ECONOMICS OF GT/CMS **5**

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.

OUTCOME:

- At the end of this course the student should be able to understand the concepts and applications of Cellular manufacturing systems

MEBY33 MECHATRONICS IN CNC MACHINES

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the fundamentals and applications of adaptive controls.
- To know the various elements of mechatronics in the CNC machine tools and measuring systems.
- To know about the programming, testing and maintenance of CNC machines.

MODULE I INTRODUCTION OF NC, CNC, DNC AND ADAPTIVE CONTROL 6

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 TOOLS 9

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 5

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.

OUTCOME:

- Students will be able to control various CNC machine operations

MEBY34 PLASTICS AND COMPOSITE MATERIALS **L T P C**
3 0 0 3

OBJECTIVES:

- To study the various types properties and processing of polymers.
- To study the various processing and applications polymer matrix composites, metal matrix composites and ceramics matrix composites.

MODULE I PROPERTIES OF POLYMERS **8**

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

MODULE II PROCESSING OF POLYMERS **9**

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 **9**

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 **9**

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

OUTCOME:

- Students will develop knowledge on processing, interfacial properties and application of composites.

MEBY35 TOTAL QUALITY SYSTEM AND MANAGEMENT **L T P C**
3 0 0 3

OBJECTIVES:

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

MODULE I INTRODUCTION **9**

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

MODULE I PRACTICE OF TQM **9**

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

MODULE III TECHNIQUES OF TQM **9**

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

MODULE IV STATISTICAL QUALITY CONTROL **9**

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 ACCEPTANCE SAMPLING **9**

Acceptance sampling Problem –Single Sampling Plans for Attributes –Double, Multiple and sequential sampling, Military standards – The 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.

OUTCOME:

- Students will be familiarized with the concepts of quality gurus. The tools and used to follow quality concepts in industries. Problem solving techniques. With the statistical techniques and sampling procedures

MEBY36 MANUFACTURING MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:

- To understand the concepts of manufacturing management and its various functions.

MODULE I PLANT ENGINEERING 7

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 8

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

MODULE III PROCESS PLANNING AND FORECASTING 9

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 9

Principles of Management – Functions of personnel management – Recruitment – Traiing – 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.

OUTCOME:

- The students will be able to take up the functions as they get in to senior managerial positions.

MEBY37 TRIBOLOGY OF MACHINES

L	T	P	C
3	0	0	3

OBJECTIVES:

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

MODULE I SURFACE INTERACTION AND FRICTION 7

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 8

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 8

Lubricants and their physical properties- Viscosity and other properties of oils – Additives-and 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

OUTCOME:

- Students will have a comprehensive, systematic and integrated knowledge of the principles of friction, wear and lubrication and Understand the differences between proactive & predictive maintenance and their applications in industry.

MEBY38 TECHNOLOGY MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To understand methods of technology management boosted with information technology in the global context
- To gain exposure in the functional areas of technology management stream

MODULE I INTRODUCTION 9

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 9

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

MODULE III TECHNOLOGY CHOICE AND EVALUATION 9

Issues in the development 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 9

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 9

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

OUTCOME:

- At the completion of the course, you should be able to appreciate the breadth and depth of technology in business so that you can consider pursuing the Technical Management stream of studies.

MEBY39 LEAN SIXSIGMA L T P C
3 0 0 3

OBJECTIVES:

- To Understand the concepts of Lean Six Sigma.
- To understand the various tools of lean and six sigma techniques and implementation.

MODULE I EVOLUTION OF LEAN SIX SIGMA 5

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

MODULE II LEAN SIX SIGMA APPROACH 8

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

OUTCOME:

- Students learn how to improve quality and productivity by aligning the voices of the process with the voice of the customer. Students are familiarized with Six Sigma to create better business solutions and improve productivity.

MEBY40 MEMS & NANO TECHNOLOGY L T P C
3 0 0 3

OBJECTIVES:

- To learn about the emerging trends of MEMS and Nanotechnology and their applications.
- To understand the various fabrication processes involved in developing Micro- and nano- devices.

MODULE I OVER VIEW OF MEMS AND MICROSYSTEMS 6

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 8

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, 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.

OUTCOME:

- Students are expected to learn physical principles involved in micro- and nano-sensors and design a suitable sensor for a given application.

MEBY41 ENGINE MANAGEMENT SYSTEM L T P C
3 0 0 3

OBJECTIVES:

- To study the fundamentals of automotive electronics and the use of sensors and actuators in engine management.
- To understand the concept engines and vehicle electronic management system.

MODULE I FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS 9

Components for electronic engine management system, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Parameters to be controlled in SI and CI engines.

MODULE II SENSORS AND ACTUATORS 9

Inductive, Hall Effect, hot wire, thermistor, piezo electric, piezoresistive, based sensors. Throttle position, mass air flow, crank shaft position, cam position, engine and wheel speed, steering position, tire pressure, brake pressure, steering torque, fuel level, c Engine and vehicle design data rash, exhaust oxygen level (two step and linear lambda), knock, engine temperature, manifold temperature and pressure sensors.

MODULE III SI ENGINE MANAGEMENT 9

Three way catalytic converter, conversion efficiency versus lambda. Layout and working of SI engine management systems like Bosch Monojetronic, L-Jetronic and LH-Jetronic. Group and sequential injection techniques. Working of the fuel system components. Advantages of electronic ignition systems. Types of solid state ignition systems and their principle of operation, Contactless electronic ignition system, Electronic spark timing control.

MODULE IV CI ENGINE MANAGEMENT 9

Fuel injection system parameters affecting combustion, noise and emissions in CI engines. Pilot, main, advanced post injection and retarded post injection. Electronically controlled MODULE Injection system. Layout of the common rail fuel injection system. Working of components like fuel injector, fuel pump, rail pressure limiter, flow limiter, EGR valve.

MODULE V DIGITAL ENGINE CONTROL SYSTEM 9

Cold start and warm up phases, idle speed control, acceleration and full load enrichment, deceleration fuel cutoff. Fuel control maps, open loop control of fuel injection and closed loop lambda control – Integrated engine control system, Exhaust emission control engineering, Electromagnetic compatibility – EMI Suppression techniques – Electronic dash board instruments – Onboard diagnosis system.

Total Hours: 45

TEXT BOOKS:

1. William B Ribbens, Understanding Automotive Electronics SAE 1998.
2. Eric Chowanietz, Automobile Electronics, SAE 2001.

REFERENCES:

1. Robert Bosch, Diesel Engine Management, SAE, Publications 3rd Edition, 2004.
2. Robert Bosch,Gasoline Engine Management by, SAE Publications, 2nd Edition, 2004.

OUTCOME:

- Students will learn key project management skills and tools to plan, monitor and control programs, including status/reporting through gate reviews as a mechanism for successful project delivery.

MEBY42 DESIGN AND ANALYSIS OF EXPERIMENTS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the fundamentals experimental design and various kinds of experiments.
- To design and carry out experiments and to analyze the output data using the statistical tools like Taguchi method.

MODULE I EXPERIMENTAL DESIGN FUNDAMENTALS 6

Importance of experiments, experimental strategies, basic principles of design, terminology, ANOVA, steps in experimentation, sample size, normal probability plot, linear regression model.

MODULE II SINGLE FACTOR EXPERIMENTS 9

Completely randomized design, Randomized block design, Latin square design. Statistical analysis, estimation of model parameters, model adequacy checking, pair wise comparison tests.

MODULE III MULTIFACTOR EXPERIMENTS 10

Two and three factor full factorial experiments, 2K factorial Experiments, Confounding and Blocking designs.

MODULE IV SPECIAL EXPERIMENTAL DESIGNS 10

Fractional factorial design, nested designs, Split plot design, Introduction to Response Surface Methodology, Experiments with random factors, rules for expected mean squares, approximate F- tests.

MODULE V TAGUCHI METHODS 10

Steps in experimentation, design using Orthogonal Arrays, data analysis, Robust design- control and noise factors, S/N ratios, parameter design, case studies.

Total Hours: 45

REFERENCES

1. Montgomery, D.C., Design and Analysis of experiments, John Wiley and Sons, 2003.
2. Nicolo Belavendram, Quality by Design; Taguchi techniques for industrial experimentation, Prentice Hall, 1995.
3. Phillip J.Rose, Taguchi techniques for quality engineering, McGraw Hill, 1996.

OUTCOME:

- Students will understand the subject and connect it with real life problems, including experimentation in the social and economic sciences.

MEBY43 SUPPLY CHAIN MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

- To study the basic concepts of logistics and supply chain network.
- To understand the various components of supply chain management.

MODULE I INTRODUCTION 6

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 9

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

OUTCOME:

- Students will understand the finer aspects of the supply chain management that can turnaround an organization and can take it to the position of a leader.

MEBY44 PRODUCTION AND INVENTORY MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basics of production management.
- To know the about the forecasting, planning and control of production.
- To understand the types of inventory and inventory control systems.

MODULE I INTRODUCTION **5**

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

MODULE II FORECASTING **10**

The 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.

OUTCOME:

- Students will understand the production planning & control, and effective inventory management.

MEBY45 DESIGN FOR MANUFACTURE

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the design aspects for various manufacturing processes.
- To learn the significance of design for assembly.

MODULE I INTRODUCTION **6**

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 FORMED METAL COMPONENTS AND NON METALLIC PARTS DESIGN **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 MACHINED COMPONENTS DESIGN **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 **9**

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.

OUTCOME:

- Students will be able to apply this study to machining and casting processes.

MEBY46 INDUSTRIAL ROBOTICS AND EXPERT SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

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

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 9

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

MODULE III ROBOT SENSORS 9

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 9

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

MODULE V ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS 8

Methods of Robot Programming – Characteristics of task level languages lead

through programming methods – Motion interpolation. Artificial intelligence – Basics – Goals of artificial intelligence – AI techniques – problem representation in AI – Problem reduction and solution techniques - Application of AI and KBES in Robots.

Total 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 BOOKS:

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.

OUTCOME

- Students will gain knowledge in design of robots applicable to industries.

MEBY47	ADVANCED METROLOGY AND COMPUTER AIDED INSPECTION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the general concepts of measurements.
- To learn the principle, operation and applications of various measuring equipment.
- To learn about various modern measuring techniques.

MODULE I GENERAL CONCEPTS OF MEASUREMENT 8

Definition – Standards of measurement – Errors in measurement – Interchangeability and Selective assembly – Accuracy and Precision – Calibration of instruments.

MODULE II MEASUREMENT OF SURFACE FINISH AND MEASURING MACHINES 9

Definitions – Types of Surface Texture: Surface Roughness Measurement Methods- Comparison, Profilometer, 3D Surface Roughness Measurement – Instruments.

MODULE III INTERFEROMETRY 8

Interferometry – Introduction, Principles of light interference – Interferometers – Measurement and Calibration – Laser Interferometry.

MODULE IV COMPUTER AIDED AND LASER METROLOGY 10

Tool Makers Microscope – Microhite – Co – Ordinate measuring machine – Applications – Laser Micrometer, Laser Scanning gauge, Non contact and in-process inspection, Vision system.

MODULE V IMAGE PROCESSING 10

Overview, Computer imaging systems, Image Analysis, Preprocessing, Human vision system, Image model, Image enhancement, gray scale models, histogram models, Image Transforms

Total Hours: 45

TEXT BOOK:

1. GUPTA, I.C, “A Text Book of engineering metrology”, Dhanpat Rai and Sons, 1996.

REFERENCES:

1. G.N.GALYER F.W. and C.R.SHOTBOLT, “Metrology for engineers”, ELBS, 1990.
2. GRAHAM T.SMITH, “Industrial Metrology”, Springer, 2002
3. “ASTE Handbook of Industries Metrology”, Prentice Hall of India Ltd., 1992.
4. R.K.RAJPUT, “Engineering Metrology and Instrumentations”, Kataria & Sons Publishers, 2001.
5. MILAN SONKA, VACLAV HLAVAC and ROGER BOYLE, “Image Processing, Analysis, and Machine Vision”, Cengage-Engineering; 3 edition (March 19, 2007).

OUTCOME:

- Students will be able to apply the measurements and inspection knowledge in quality control of products/ components.

MEBY48 CORROSION AND SURFACE ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- The main objective of the course is to develop fundamental and deep knowledge in the theory for degradation and corrosion of materials in various environments and to present existing protection strategies for prevention of corrosion in different contexts.
- To provide fundamental and practical understanding of corrosion behavior of metallic materials and surface engineering and to train and motivate the students for discovery and innovation in the related areas.

MODULE I MECHANISMS AND TYPES OF CORROSION 9

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 9

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 9

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

MODULE IV SURFACE ENGINEERING FOR WEAR AND CORROSION RESISTANCE 9

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 THIN LAYER ENGINEERING PROCESSES 9

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.

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.

OUTCOMES:

After taken the course, the student should be able to:

- Describe the basis of electrochemistry, passivation and corrosion rates.
- Contrast the basis of various forms of corrosion, breakdown of passivation and materials selection.
- Apply the various surface engineering techniques, and participate in discovery and innovation in the related areas.

MEBY49 MANUFACTURING OF AUTOMOTIVE COMPONENTS L T P C
3 0 0 3

OBJECTIVES:

- To make the students to understand the behavior of engineering material and how its phases will be changed under micro structure while manufacturing as a component.
- To Know how to manufacturing a component and how to select the specific process from various manufacturing processes to manufacture a particular automotive component.
- To bring the awareness on latest manufacturing technologies belongs to world class manufacturing systems in automotive engineering.

MODULE I ELASTIC AND PLASTIC BEHAVIOUR OF MATERIALS 9

Elasticity-forms - Stress and strain relationship in engineering materials - Deformation mechanism - Strengthening material - Strain hardening, alloying, polyphase mixture, martensitic precipitation, dispersion, fiber and texture strengthening - iron carbon diagram.

MODULE II POWDER METALLURGY AND PROCESSING OF PLASTICS 6

Powder metallurgy process, process variables, Manufacture of friction lining materials for clutches and brakes – plastics-raw material –automobile components – molding – injection, compression and blow – PU foam molding - Machining of plastics.

MODULE III FORGING AND EXTRUSION PROCESS 10

Forging materials - process flow chart, forging of valves, connecting rod, crank shaft, cam shaft, propeller shaft, transmission gear blanks, steering column. Extrusions: Basic process steps, extrusion of transmission shaft, housing spindle, steering worm blanks, piston pin and valve tappets. Hydro forming - Process, hydro forming of manifold and comparison with conventional methods- Hydro forming of tail lamp housing – forming of wheel disc and rims. Stretch forming - Process, stretch forming of auto body panels –Super plastic alloys for auto body panels.

MODULE IV CASTING AND MACHINING **10**

Sand casting of cylinder block and liners - Centrifugal casting of flywheel, piston rings, bearing bushes, and liners, permanent mould casting of piston, pressure die casting of carburetor other small auto parts. 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 V RECENT TRENDS IN MANUFACTURING OF AUTO COMPONENTS **10**

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: 45

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.

OUTCOMES:

- At the completion of this course the students can be able to understand the behavior of materials during the manufacturing process.

- Students can be realized the various manufacturing processes involved in development of automotive components.
- Students would be stimulated towards the latest manufacturing techniques to adopt with automotive engineering.

SSBY01 SOCIETY, TECHNOLOGY AND SUSTAINABILITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- Aware of new technologies through advances in Science and Engineering.
- To make them realise the profound impact on society.
- 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 **9**

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 **9**

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 **9**

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 9

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 9

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.

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.