B.S. Abdur Rahman Crescent Institute of Science & Technology

Deemed to be University u/s 3 of the UGC Act, 1956

Regulations 2019
Curriculum and Syllabi

(Amendments updated upto June 2020)

M.Tech.
(CAD-CAM)

B.S. Abdur Rahman Crescent Institute of Science & Technology
Deemed to be University u/s 3 of the UGC Act, 1956

REGULATIONS 2019
CURRICULUM AND SYLLABI
(Amendments updated upto June 2020)

M.TECH.
CAD – CAM

VISION AND MISSION OF THE INSTITUTION

VISION

B.S. Abdur Rahman Crescent Institute of Science and Technology aspires to be a leader in Education, Training and Research in multidisciplinary areas of importance and to play a vital role in the Socio-Economic progress of the Country in a sustainable manner.

MISSION

- To blossom into an internationally renowned Institute.
- To empower the youth through quality and value-based education.
- To promote professional leadership and entrepreneurship.
- 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.

DEPARTMENT OF MECHANICAL ENGINEERING

VISION AND MISSION

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

PROGRAMME EDUCATIONAL OBJECTIVES AND OUTCOMES

M.Tech. (CAD – CAM)

PROGRAMME EDUCATIONAL OBJECTIVES:

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

PROGRAMME OUTCOMES:

Graduates will be able to

- Apply the knowledge of mechanical engineering fundamentals, and specialization in CAD-CAM to solve complex engineering problems
- Identify, formulate, review literature, and analyze complex engineering problems to arrive at substantiated conclusions using principles of mathematics and mechanical engineering sciences
- Design solutions for engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health & safety, society, culture and environment
- Use research based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions
- Create, select, and apply appropriate techniques, resources, and modern engineering tools including prediction and modelling to engineering activities with an understanding of the limitations
- Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

- Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
- Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
- Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
- Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
- Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work to manage projects
- Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMME SPECIFIC OUTCOMES:

Graduates will be able to

- Design, analyse and manufacture real life components and systems using latest software in the field of computer aided design and computer aided manufacturing
- Undertake academic and research role to address open ended problems with conceptual knowledge and computational skill in the area of design and manufacturing

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE & TECHNOLOGY, CHENNAI – 600 048.

REGULATIONS - 2019 FOR

M.Tech. / MCA / M.Sc. DEGREE PROGRAMMES

(Under Choice Based Credit System)

1.0 PRELIMINARY DEFINITIONS AND NOMENCLATURE

In these Regulations, unless the context otherwise requires **"Programme"** means Post Graduate Degree Programme (M.Tech. / MCA / M.Sc.)

"Course" means a theory / practical / laboratory integrated theory / mini project / seminar / internship / Project and any other subject that is normally studied in a semester like Advanced Concrete Technology, Electro Optic Systems, Financial Reporting and Accounting, Analytical Chemistry, etc.,

"Institution" means B.S. Abdur Rahman Crescent Institute of Science & Technology.

"Academic Council" means the Academic Council, which is the apex body on all academic matters of B.S. Abdur Rahman Crescent Institute of Science & Technology.

"Dean (Academic Affairs)" means Dean (Academic Affairs) of B.S. Abdur Rahman Crescent Institute of Science & Technology who administers the academic matters.

"Dean (Student Affairs)" means Dean (Student Affairs) of B.S. Abdur Rahman Crescent Institute of Science & Technology, who looks after the welfare and discipline of the students.

"Controller of Examinations" means the Controller of Examinations of B.S. Abdur Rahman Crescent Institute of Science & Technology who is responsible for the conduct of examinations and declaration of results.

2.0 PROGRAMMES OFFERED AND ADMISSION REQUIREMENTS

2.1 Programmes Offered

The various programmes and their mode of study are as follows:

Degree	Mode of Study
M.Tech.	Full Time
MCA	
M.Sc.	

2.2 ADMISSION REQUIREMENTS

2.2.1 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 Institution as specified in the clause 3.2 [Eligible entry qualifications for admission to P.G. programmes] or any other degree examination of any University or authority accepted by this Institution as equivalent thereto.

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

3.0 DURATION, ELIGIBILITY AND STRUCTURE OF THE PROGRAMME

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

Programme	Min. No. of Semesters	Max. No. of Semesters
M.Tech.	4	8
MCA (3 years)	6	12
MCA (Lateral Entry)	4	8
MCA (2 years)	4	8
M.Sc.	4	8

3.1.1 Each academic semester shall normally comprise of 90 working days. Semester End Examinations shall follow within 10 days of the last Instructional day.

3.1.2 Medium of instruction, examinations and project report shall be in English.

3.2 ELIGIBLE ENTRY QUALIFICATIONS FOR ADMISSION TO PROGRAMMES

Sl. No.	Name of the Department	Programmes offered	Qualifications for admission
1.	Aeronautical Engineering	M. Tech. (Avionics)	B.E. / B. Tech. (Aeronautical Engineering)
2.	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) / B. Arch.
3.	Mechanical Engineering	M.Tech. (Manufacturing Engineering)	B.E. / B.Tech. (Mechanical / Automobile / Manufacturing / Production / Industrial / Mechatronics / Metallurgy / Aerospace /Aeronautical / Material Science / Marine Engineering)
		M.Tech. (CAD/CAM)	
4.	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 and Drives)	
5.	Electronics and Communication Engineering	M.Tech. (Communication Systems)	B.E. / B. Tech. (EEE/ ECE / E&I / CSE IT / I&C / Electronics / Instrumentation)
		M.Tech. (VLSI and Embedded Systems)	B.E. / B. Tech. (ECE / E&I / I&C / EEE / CSE / IT)
6.	Electronics and Instrumentation Engineering	M.Tech. (Electronics and Instrumentation Engineering)	B.E. / B. Tech. (EIE/ICE/Electronics/ECE/EEE)
7.	Computer Science and Engineering	M.Tech. (Computer Science and Engineering)	B.E. / B. Tech. (CSE/IT/ECE/EEE/EIE/ICE/ Electronics / MCA)
8.	Information Technology	M.Tech. (Information Technology)	B.E. / B. Tech. (IT/CSE/ECE/EEE/EIE/ICE/ Electronics / MCA)

9.	Computer Applications	MCA (3 years)	Bachelor Degree in any discipline with Mathematics as one of the subjects (or) Mathematics at +2 level
		MCA – (Lateral Entry)	B.Sc. Computer Science / B.Sc. Information Technology / BCA
		MCA (2 years)	Bachelor Degree in any discipline with Mathematics as one of the subjects (or) Mathematics at +2 level or B.Sc. Computer Science / B.Sc. Information Technology / BCA
10.	Mathematics	M.Sc. (Actuarial Science)	Any Degree with Mathematics / Statistics as one of the subjects of study
11.	Physics	M.Sc.(Physics)	B.Sc. (Physics / Applied Science / Electronics / Electronics Science / Electronics & Instrumentation)
12.	Chemistry	M.Sc.(Chemistry)	B.Sc. (Chemistry / Applied Science)
13.	Life Sciences	M.Sc. Molecular Biology & Biochemistry	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.Tech. Biotechnology	B.Tech. (Biotechnology / Chemical Engineering) / M.Sc. in any branch of Life Sciences

3.3. STRUCTURE OF THE PROGRAMME

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

i. Core courses
ii. Elective courses
iii. Laboratory oriented core courses
iv. Project work / thesis / dissertation
v. Laboratory Courses
vi. Seminars
vii. Mini Project
viii. Industrial Internship
ix. Value Added Courses
x. MOOC Courses (NPTEL, SWAYAM, etc.,)

3.3.2 The curriculum and syllabi of all programmes shall be approved by the Academic Council of this Institution.

3.3.3 For the award of the degree, the student has to earn a minimum total credits specified in the curriculum of the respective specialization of the programme.

3.3.4 The curriculum of 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	Range of credits
M.Tech.	74 - 80
MCA (3 years)	118 - 126
MCA (Lateral Entry)	80 - 85
MCA (2 years)	85 - 90
M.Sc.	77- 82

3.3.5 Credits will be assigned to the courses for all programmes as given below:

- One credit for one lecture period per week or 15 periods of lecture per semester
- One credit for one tutorial period per week or 15 periods per semester
- One credit each for seminar/practical session/project of two or three periods per week or 30 periods per semester
- One credit for four weeks of industrial internship or 160 hours per semester.

3.3.6 The number of credits the student shall enroll in a non-project semester and project semester is as specified below to facilitate implementation of Choice Based Credit System.

Programme	Non-project semester	Project semester
M.Tech.	9 to 28	18 to 26
MCA	12 to 33	12 to 26
M.Sc.	9 to 32	10 to 26

3.3.7 The student may choose a course prescribed in the curriculum from any department offering that course without affecting regular class schedule. The attendance will be maintained course wise only.

3.3.8 The students shall choose the electives from the curriculum with the approval of the Head of the Department / Dean of School.

3.3.9 Apart from the various elective courses listed in the curriculum for each specialization of programme, the student can choose a maximum of two electives from any other similar programmes across departments, during the entire period of study, with the approval of the Head of the department offering the course and parent department.

3.4. ONLINE COURSES

3.4.1 Students are permitted to undergo department approved online courses under SWAYAM up to 20% of credits of courses in a semester excluding project semester with the recommendation of the Head of the Department / Dean of School and with the prior approval of Dean Academic Affairs during his/ her period of study. The credits earned through online courses ratified by the respective Board of Studies shall be transferred following the due approval procedures. The online courses can be considered in lieu of core courses and elective courses.

3.4.2 Students shall undergo project related online course on their own with the mentoring of the faculty member.

3.5 PROJECT WORK / DISSERTATION

3.5.1 Project work / Dissertation shall be carried out by the student under the supervision of a Faculty member in the department with similar specialization.

3.5.2 A student may however, in certain cases, be permitted to work for the project in an Industry / Research Organization, with the approval of the Head of the Department/ Dean of School. 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 meetings for evaluating the progress.

3.5.3 The timeline for submission of final project report / dissertation is within 30 calendar days from the last Instructional day of the semester in which Project / Dissertation is done.

3.5.4 If a student does not comply with the submission of project report / dissertation on or before the specified timeline he / she is deemed to have not completed the project work / dissertation and shall re-register in the subsequent semester.

4.0 CLASS ADVISOR AND FACULTY ADVISOR

4.1 CLASS ADVISOR

A faculty member shall be nominated by the HOD / Dean of School 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 / Dean of School of the students shall 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 in every semester.

5.0 CLASS COMMITTEE

5.1 A class committee comprising faculty members handling the classes, student representatives and a senior faculty member not handling the courses as chairman will be constituted in every semester:

5.2 The composition of the class committee will be as follows:

i) One senior faculty member preferably not handling courses for the concerned semester, appointed as chairman by the Head of the Department

ii) Faculty members of all courses of the semester

iii) All the students of the class

iv) Faculty advisor and class advisor

v) Head of the Department – Ex officio member

5.3 The class committee shall meet at least three times during the semester. The first meeting shall be held within two weeks from the date of commencement of classes, in which the nature of continuous assessment for various courses and the weightages for each component of assessment shall be decided for the first and second assessment. The second meeting shall be held within a week after the date of first assessment report, to review the students' performance and for follow up action.

5.4 During these two meetings the student members, shall meaningfully interact and express opinions and suggestions to improve the effectiveness of the teaching-learning process, curriculum and syllabus.

5.5 The third meeting of the class committee, excluding the student members, shall meet within 5 days from the last day of the semester end examination to analyze the performance of the students in all the components of assessments and decide their grades in each course. The grades for a common course shall be decided by the concerned course committee and shall be presented to the class committee(s) by the concerned course coordinator.

6.0 COURSE COMMITTEE

6.1 Each common theory / laboratory course offered to more than one group of students shall have a “Course Committee” comprising all the teachers handling 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 handling the common course belong to a single department or from several departments. The Course Committee shall meet as often as possible to prepare a common question paper, scheme of evaluation and ensure uniform evaluation of the assessment tests and semester end examination.

7.0 REGISTRATION AND ENROLLMENT

7.1 The students of first semester shall register and enroll at the time of admission by paying the prescribed fees.

7.2 For the subsequent semesters registration for the courses shall be done by the student one week before the last working day of the previous semester.

7.3 A student can withdraw from an enrolled course at any time before the first assessment test for genuine reasons, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

7.4 A student can change an enrolled course within 10 working days from the commencement of the course, with the approval of the Dean (Academic Affairs), on the recommendation of the Head of the Department of the student.

8.0 TEMPORARY BREAK OF STUDY FROM THE PROGRAMME

8.1 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. A student can avail the break of study before the start of first assessment test of the ongoing semester. However the total duration for completion of the programme shall not exceed the prescribed maximum number of semesters (vide clause 3.1). If any student is debarred for want of attendance or suspended due to any act of indiscipline, it will not be considered as break of study. A student who has availed break of study has to rejoin in the same semester only in the subsequent year. The student availing break of study is permitted to write arrear examinations by paying the prescribed fees.

9.0 MINIMUM REQUIREMENTS TO REGISTER FOR PROJECT / 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.	18
MCA (3 years)	45
MCA (Lateral Entry)	22
MCA (2 years)	22
M.Sc.	18

9.2 If the student has not earned minimum number of credits specified, he/she has to earn the required credits, at least to the extent of minimum credits

specified in clause 9.1 and then register for the project semester.

10.0 ATTENDANCE

10.1 A student shall earn 100% attendance in the contact periods of every course, subject to a maximum relaxation of 25% (for genuine reasons such as medical grounds, representing for the institution 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. The courses in which the student is awarded "I" grade, shall register and redo the course when it is offered next.

10.2 The faculty member of each course shall cumulate the attendance details for the semester and furnish the names of the students who have not earned the required attendance in that course to the Class Advisor. The Class Advisor will consolidate and furnish the list of students who have earned less that 75% attendance, in various courses, to the Dean (Academic Affairs) through the Head of the Department / Dean of School. Thereupon, the Dean (Academic Affairs) shall announce the names of such students prevented from writing the semester end examination in each course.

10.3 A student who has obtained 'I' grade in all the courses in a semester is not permitted to move to next higher semester. Such student shall redo all the courses of the semester in the subsequent academic year. However he / she is permitted to redo the courses awarded with 'I' grade / arrear in previous semesters. They shall also be permitted to write arrear examinations by paying the prescribed fee.

10.4 A student shall register to redo 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 chosen with the approval of Head of the Department / Dean of School.

11.0 REDO COURSES

11.1 A student can register for a maximum of two redo courses per semester in the evening after regular working hours, if such courses are offered by the concerned department. Students may also opt to redo the courses offered during regular semesters, without affecting the regular academic schedule and not exceeding prescribed maximum credits.

11.2 The Head of the Department with the approval of Dean (Academic Affairs) may arrange for the conduct of a few courses in the evening after regular working hours, depending on the availability of faculty members and subject to a specified minimum number of students registering for each of such courses.

11.3 The number of contact hours and the assessment procedure for any redo course will be the same as those during regular semesters except that there is no provision for any substitute examination and withdrawal from an evening redo course.

12.0 ASSESSMENTS AND EXAMINATIONS

12.1 Every theory course shall have a total of three assessments during a semester as given below:

Assessments	Weightage of Marks
Continuous Assessment 1	25%
Continuous Assessment 2	25%
Semester End Examination	50%

12.2 Appearing for semester end theory examination for each course is mandatory and a student should secure a minimum of 40% marks in each course in semester end examination for the successful completion of the course.

Every practical course shall have 75% weightage for continuous assessments and 25% for semester end examination. However a student should have secured a minimum of 50% marks in the semester end practical examination for the award of pass grade.

12.3 For laboratory integrated theory courses, the theory and practical components shall be assessed separately for 100 marks each and consolidated by assigning a weightage of 75% for theory component and 25% for practical component. Grading shall be done for this consolidated mark. Assessment of theory component shall have a total of three assessments with two continuous assessments having 25% weightage each and semester end examination having 50% weightage. The student shall secure a separate minimum of 40% in the semester end theory examination for the award of pass grade. The evaluation of practical component shall be through continuous assessment.

12.4 The components of continuous assessment for theory/practical/laboratory integrated theory courses shall be finalized in the first class committee

meeting.

12.5 In the case of Industrial training, the student shall submit a report, which shall be evaluated along with an oral examination by a committee of faculty members constituted by the Head of the Department. The student shall also submit an internship completion certificate issued by the industry / research organisation. The weightage for Industry internship report shall be 60% and 40% for viva voce examination.

12.6 In the case of project work, a committee of faculty members constituted by the Head of the Department will carry out three periodic reviews. Based on the project report submitted by the student, an oral examination (viva voce) shall be conducted as semester end examination by an external examiner approved by Controller of Examinations. The weightage for periodic reviews shall be 50%. Of the remaining 50%, 20% shall be for the project report and 30% for the Viva Voce examination.

12.7 For the first attempt of the arrear theory examination, the internal assessment marks scored for a course during first appearance shall be considered for grading along with the marks scored in the semester end arrear examination. From the subsequent appearance onwards, full weightage shall be assigned to the marks scored in the semester end examination to award grades and the internal assessment marks secured during the course of study shall not be considered.

In case of laboratory integrated theory courses, after one regular and one arrear appearance, the internal mark of theory component is invalid and full weightage shall be assigned to the marks scored in the semester end arrear examination for theory component. There shall be no arrear or improvement examination for lab component.

13.0 SUBSTITUTE EXAMINATIONS

13.1 A student who is absent, for genuine reasons, may be permitted to write a substitute examination for any one of the two continuous assessment tests of a course by paying the prescribed substitute examination fee. However, permission to take up a substitute examination will be given under exceptional circumstances, such as accidents, admission to a hospital due to illness, etc. by a committee constituted by the Head of the Department / Dean of School for that purpose. However there is no substitute examination for semester end

examination.

13.2 A student shall apply for substitute exam in the prescribed form to the Head of the Department / Dean of School within a week from the date of assessment test. However the substitute examination will be conducted only after the last working day of the semester and before the semester end examination.

14.0 SUPPLEMENTARY EXAMINATION

14.1 Final Year students can apply for supplementary examination for a maximum of three courses thus providing an opportunity to complete their degree programme. Likewise students with less credit can also apply for supplementary examination for a maximum of three courses to enable them to earn minimum credits to move to higher semester. The students can apply for supplementary examination within three weeks of the declaration of results in both odd and even semester.

15. PASSING, DECLARATION OF RESULTS AND GRADE SHEET

15.1 All assessments of a course shall be made on absolute marks basis. However, the Class Committee without the student members shall meet within 5 days after the semester end examination and analyze the performance of students in all assessments of a course and award letter grades. The letter grades and the corresponding grade points are as follows:

Letter Grade	Grade Points
S	10
A	9
B	8
C	7
D	6
E	5
U	0
W	0
I	0
AB	0

"W" denotes withdrawal from the course.

"I" denotes inadequate attendance and hence prevented from appearing for semester end examination

"U" denotes unsuccessful performance in the course.

"AB" denotes absence for the semester end examination.

15.2 A student who earns a minimum of five grade points ('E' grade) in a course is declared to have successfully completed the course. Such a course cannot be repeated by the student for improvement of grade.

15.3 The results, after awarding of grades, shall be signed by the Chairman of the Class Committee and Head of the Department / Dean of School and it shall be declared by the Controller of Examinations.

15.4 Within one week from the date of declaration of result, a student can apply for revaluation of his / her semester end theory examination answer scripts of one or more courses, on payment of prescribed fee to the Controller of Examinations. Subsequently the Head of the Department/ Dean of School offered the course shall constitute a revaluation committee consisting of Chairman of the Class Committee as convener, the faculty member of the course and a senior faculty member knowledgeable in that course as members. The committee shall meet within a week to re-evaluate the answer scripts and submit its report to the Controller of Examinations for consideration and decision.

15.5 After results are declared, grade sheets shall be issued to each student, which contains the following details: a) list of courses enrolled during the semester including redo courses / arrear courses, if any; b) grades scored; c) Grade Point Average (GPA) for the semester and d) Cumulative Grade Point Average (CGPA) of all courses enrolled from first semester onwards.

GPA is the ratio of the sum of the products of the number of credits of courses registered and the grade points corresponding to the grades scored in those courses, taken for all the courses, to the sum of the number of credits of all the courses in the semester.

If C_i, is the number of credits assigned for the i^{th} course and GP_i is the Grade Point in the i^{th} course

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

Where n = number of courses

The Cumulative Grade Point Average (CGPA) is calculated in a similar manner, considering all the courses enrolled from first semester.

“I” and "W" grades are excluded for calculating GPA.

"U", “I”, "AB" and **"W"** grades are excluded for calculating CGPA.

The formula for the conversion of CGPA to equivalent percentage of marks is as follows:

Percentage Equivalent of Marks = CGPA X 10

15.6 After successful completion of the programme, the Degree shall be awarded upon fulfillment of curriculum requirements and classification based on CGPA as follows:

Classification	CGPA
First Class with Distinction	8.50 and above and passing all the courses in first appearance and completing the programme within the minimum prescribed period.
First Class	6.50 and above and completing the programme within a minimum prescribed period plus two semesters.
Second Class	Others

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 period of study and should have completed the P.G. programme within a minimum period (except break of study). To be eligible for First Class, a student should have passed the examination in all the 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 is not considered. The students who do not satisfy the above two conditions shall be classified as second class. For the purpose of classification, the CGPA shall 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.

16.0 DISCIPLINE

16.1 Every student is expected to observe disciplined and decorous behaviour both inside and outside the campus and not to indulge in any activity which tends to affect the reputation of the Institution.

16.2 Any act of indiscipline of a student, reported to the Dean (Student Affairs), through the HOD / Dean shall be referred to a Discipline and Welfare

Committee constituted by the Registrar for taking appropriate action.

17.0 ELIGIBILITY FOR THE AWARD OF THE MASTERS DEGREE

17.1 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.
iii. Enrolled and completed at least one value added course.
iv. Enrollment in at least one MOOC / SWAYAM course (non-credit) before the final semester.

17.2 The award of the degree must have been approved by the Institute.

18.0 POWER TO MODIFY

Not withstanding all that have been stated above, the Academic Council has the right to modify any of the above regulations from time to time.

****

B.S. ABDUR RAHMAN CRESCENT INSTITUTE OF SCIENCE AND TECHNOLOGY

M.TECH. CAD-CAM

CURRICULUM & SYLLABUS, REGULATIONS 2019

Sl. No.	Course Code	Course Title	L	T	P	C
		SEMESTER I				
1	MAD 6182	Differential Equations and Numerical Methods	**3**	**1**	**0**	**4**
2	MED 6101	Applied Materials Engineering	**3**	**0**	**0**	**3**
3	MED 6102	Computer Graphics and Geometric Modeling (Integrated Lab)	**3**	**0**	**2**	**4**
4	MED 6103	Advanced Metrology and NDT (Integrated Lab)	**3**	**0**	**2**	**4**
5	MED 6104	Additive Manufacturing	**2**	**0**	**0**	**2**
6	MED 6105	Geometric Dimensioning and Tolerance	**1**	**0**	**0**	**1**
7		Professional Electives #				**3**
						21
		SEMESTER II				
1	GED 6201	Research Methodology For Engineers	4	0	0	4
2	MED 6201	Product Design (Integrated Project)	3	0	2	4
3	MED 6202	Advanced Finite Element Analysis (Integrated Lab)	2	1	2	4
4	MED 6203	Digital Manufacturing	3	0	0	3
5		Professional Electives ##				6
6	MED 6204	Advanced Computing Lab	0	0	2	1
7		Value added course	0	0	0	0
						22
		SEMESTER III				
1		General Elective*	3	0	0	3
2	MED 6301	Topology optimization	1	0	0	1
3		Professional Electives ###				6

Sl. No.	Course Code	Course Title	L	T	P	C
4	MED 6302	Industry Internship	0	0	0	1
5	MED 7101	Project Work - Phase I	0	0	18	6**
6		MOOC (Related to project)	0	0	0	0
						11

SEMESTER IV

Sl. No.	Course Code	Course Title	L	T	P	C
1	MED 7101	Project Work - Phase II	0	0	36	18**
		Total credit (Semester IV)				**6 + 18= 24**

GRAND TOTAL CREDIT **78**

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

Professional Electives can be chosen from the list, provided that the cumulative credits should not be less than 6.(Preferably one from CAD and another from CAM)

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

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

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

LIST OF PROFESSIONAL ELECTIVES

Sl. No.	Course Code	Course Title	L	T	P	C
		PROFESSIONAL ELECTIVES ON CAD				
1	MEDY 001	Advanced Mechanisms Design and Simulation	**3**	**0**	**0**	**3**
2	MEDY 002	Advanced Strength of Materials	**3**	**0**	**0**	**3**
3	MEDY 003	Advanced Tool Design	**3**	**0**	**0**	**3**
4	MEDY 004	Computational Fluid Dynamics	**3**	**0**	**0**	**3**
5	MEDY 005	Computer Aided Process Planning	**3**	**0**	**0**	**3**
6	MEDY 006	Design of Hydraulic and Pneumatic Systems	**3**	**0**	**0**	**3**
7	MEDY 007	Design of Material Handling Equipment	**3**	**0**	**0**	**3**
8	MEDY 008	Industrial Robotics and Flexible Automation	**3**	**0**	**0**	**3**
9	MEDY 009	Mechanical Vibrations	**3**	**0**	**0**	**3**
10	MEDY 010	Optimization Techniques in Design	**3**	**0**	**0**	**3**
11	MEDY 011	Tribology	**3**	**0**	**0**	**3**
12	MEDY 012	Mechanics of Composite Materials	**2**	**0**	**0**	**2**
		PROFESSIONAL ELECTIVES ON CAM				
14	MEDY 021	Advances in Manufacturing Technology	**3**	**0**	**0**	**3**
15	MEDY 022	CNC Machines and Computer Aided Manufacturing	**3**	**0**	**0**	**3**
16	MEDY 023	Processing of Polymers and Composites	**3**	**0**	**0**	**3**
17	MEDY 024	Precision Engineering and Nano Technology	**3**	**0**	**0**	**3**
18	MEDY 025	Mechatronics for Manufacturing Systems	**2**	**0**	**0**	**2**
19	MEDY 026	Newer Materials	**2**	**0**	**0**	**2**
20	MEDY 027	Automotive Manufacturing	**1**	**0**	**0**	**1**
21	MEDY 028	Virtual Manufacturing	**1**	**0**	**0**	**1**
		PROFESSIONAL ELECTIVES ON CAD / CAM MANAGEMENT				
22	MEDY 031	Data Communication in CAD/CAM	**3**	**0**	**0**	**3**
23	MEDY 032	Industrial Safety Management	**3**	**0**	**0**	**3**
24	MEDY 033	Integrated Manufacturing Systems and Management	**3**	**0**	**0**	**3**

Sl. No.	Course Code	Course Title	L	T	P	C
25	MEDY 034	Manufacturing Information Systems	**3**	**0**	**0**	**3**
26	MEDY 035	Reliability and Total Productive Maintenance	**3**	**0**	**0**	**3**
27	MEDY 036	Product Life Cycle Management	**1**	**0**	**0**	**1**

GENERAL ELECTIVES FOR M.TECH PROGRAMMES

Sl. No.	Course Code	Course Title	L	T	P	C
1	GEDY 101	Project Management	**3**	**0**	**0**	**3**
2	GEDY 102	Society, Technology & Sustainability	**3**	**0**	**0**	**3**
3	GEDY 103	Artificial Intelligence	**3**	**0**	**0**	**3**
4	GEDY 104	Green Computing	**3**	**0**	**0**	**3**
5	GEDY 105	Gaming Design	**3**	**0**	**0**	**3**
6	GEDY 106	Social Computing	**3**	**0**	**0**	**3**
7	GEDY 107	Soft Computing	**3**	**0**	**0**	**3**
8	GEDY 108	Embedded System Programming	**3**	**0**	**0**	**3**
9	GEDY 109	Principles of Sustainable Development	**3**	**0**	**0**	**3**
10	GEDY 110	Quantitative Techniques in Management	**3**	**0**	**0**	**3**
11	GEDY 111	Programming using MATLAB& SIMULINK	**1**	**0**	**2**	**2**
12	GEDY 112	JAVA Programming	**3**	**0**	**0**	**3**
13	GEDY 113	PYTHON Programming	**3**	**0**	**0**	**3**
14	GEDY 114	Intellectual Property Rights	**1**	**0**	**0**	**1**

SEMESTER I

MAD 6182	DIFFERENTIAL EQUATIONS AND NUMERICAL METHODS	L	T	P	C
		3	1	0	4

OBJECTIVES:

The aim of this course is to

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

MODULE I ONE DIMENSIONAL WAVE AND HEAT EQUATIONS 10+3

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

MODULE II CALCULUS OF VARIATIONS 10+3

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

ODULE III NUMERICAL INTEGRATION 7+3

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

MODULE IV NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS 9+3

Solution of Laplace and Poisson equations on a region by Liebmann's method - diffusion equation by the explicit and Crank Nicolson - implicit methods - stability and convergence criterion - solution of wave equation by explicit scheme.

MODULE V CONFORMAL MAPPING AND APPLICATIONS 9+3

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

L – 45; T – 15; Total Hours: 60

TEXT BOOKS:

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

REFERENCES:

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

OUTCOMES:

Students should be able to solve

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

MED 6101	APPLIED MATERIALS ENGINERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I ELASTIC AND PLASTIC BEHAVIOUR 12

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

MODULE II FRACTURE BEHAVIOUR 12

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 - Fracture of non-metallic materials – Failure analysis – Non destructive testing, Mechanical testing, Microscopic examination of fracture surface, SEM.

MODULE III SELECTION OF MATERIALS 08

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

MODULE IV MODERN METALLIC AND NON METALLICMATERIALS 06

Dual phase steels, High strength low alloy (HSLA) steel, Transformation induced plasticity (TRIP) Steel, Maraging steel, Nitrogen steel – Smart materials, Shape memory alloys – Advanced structural ceramics, WC, TiC, Al_2O_3, SIC and Diamond-properties, processing and applications.

MODULE V NANO MATERIALS AND ITS APPLICATIONS 07

Synthesis of nano materials, top-down and bottom up approaches, mechanical milling, solgel method, CVD, Graphene, preparation of Graphene, fabrication of Carbon nano fibers for hydrogen storage.- Stimulating the production of cartilage in damaged joints -piezoelectric nanofibers that can be woven into clothing to produce electricity for cell phones.

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.

OUTCOMES:

Students should be able to

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

MED 6102	COMPUTER GRAPHICS AND GEOMETRIC MODELLING (INTEGRATED LAB)	L	T	P	C
		3	0	2	4

OBJECTIVES:

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

MODULE I IMAGE GENERATION AND MANIPULATION 10+6

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

Practice on creating CAD models and drawings to realizing transformation and projection.

MODULE II MODELLING OF CURVES AND SURFACES 10+6

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

Practice on modeling of components with free form curves and surfaces using cloud points.

MODULE III MODELLING OF SOLIDS 10+6

Geometry and topology, half-spaces, Boundary Models – Constructive Solid Geometry (CSG) – Sweeps; Feature representation, Constraints – parametric – relations; Feature manipulations; Data associatively; features of Solid modeling packages – latest trends in modeling.

Practice on

1. Simple constrain based models to appreciate their advantages.
2. Realization of Data associatively principles (Edit part model and realize the change in drawing).

3. Parametric modeling and customization of Bolt – Nut assembly, Flange, Gears.
4. Sheet metal modelling of casings covers etc.

MODULE IV IMAGE ENHANCEMENT AND GRAPHICS STANDARDS 7+6

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

Practice on

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

MODULE V COLLABORATIVE ENGINEERING AND APPLICATIONS 8+6

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

Project: Model a real life product with sub-assemblies.

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

REFERENCES:

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

OUTCOMES:

Students should be able to

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

MED 6103	ADVANCED METROLOGY AND NDT (INTEGRATED LAB)	L	T	P	C
		3	0	2	4

OBJECTIVES:

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

MODULE I MEASURING MACHINES AND SQC 12+15

Tool Maker's microscope - Coordinate measuring machine (CMM)- Universal measuring machine - Machine vision technology -Microprocessors in metrology- Nano-metrology -Measurement system analysis.Data presentation - Statistical measures and tools - Process capability - Confidence and tolerance limits - Control charts for variables and attributes.

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

MODULE II LASER METROLOGY 9+10

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

Practices on measuring the quality using linear measuring Instruments

MODULE III LIQUID PENETRATION AND MAGNETIC PARTICLE TESTS 9+5

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

Practices on Liquid Penetrant and Magnetic Particle Tests

MODULE IV RADIOGRAPHY 09

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

MODULE V ULTRASONIC AND ACOUSTIC EMISSION TECHNIQUES 06

Production of ultrasonic waves - Different types of waves – General characteristics of waves - Pulse echo method - A, B, C scans - Principles of acoustic emission techniques - Advantages and limitations – Instrumentation and applications.

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

REFERENCES:

1. Jain, R.K. Engineering Metrology, Khanna Publishers, 1997.
2. Barry Hull and Vernon John, Non Destructive Testing, MacMillan, 1988.
3. American Society for Metals, Metals Hand Book, Vol. II, 1976.
4. I. G. Scott, Basic Acoustic Emission, CRC Press, 1991.
5. M.Mahajan,Statistical Quality Control,, Dhanpat Rai &Co (P) Ltd,2015.

OUTCOMES:

Students should be able to

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

MED 6104 ADDITIVE MANUFACTURING

L	T	P	C
2	0	0	2

OBJECTIVES:

- To learn the fundamentals of additive manufacturing
- To study the latest manufacturing techniques, used in liquid and solid based additive manufacturing systems
- To learn the underlying principles behind the powder based systems
- To acquire knowledge on the selection of suitable 3D printing technique for specific applications and file generation.

MODULE I INTRODUCTION 05

Introduction to Additive Manufacturing (AM) – Generic AM process – Classification - Low-cost AM systems – Reverse Engineering for AM – Direct digital manufacturing - Distinction between AM & CNC – Benefits of AM - Applications and future of AM.

MODULE II LIQUID BASED AND SOLID BASED SYSTEMS 09

Vat polymerization: Materials, Laser Scan, Photo polymerization process, scan patterns. Extrusion based systems: Basic principles, path control, fused deposition, materials and limitations. Sheet lamination process: Bonding techniques, materials, processing methods, Ultrasonic methods.

MODULE III POWDER BASED SYSTEMS 09

Powder bed fusion: Materials, fusion mechanism, sintering, powder handling, advantages. Three Dimensional Printing: Principle, process, advantages and applications. Directed energy deposition process - Electron Beam Melting - Direct write technologies.

MODULE IV PROCESSING TECHNIQUES AND APPLICATIONS 07

STL file Generation, File Verification & Repair – Part Orientation and support generation – Model Slicing – Tool path Generation – Applications: Design, Concept Models, Form & fit checking, Ergonomic Studies, Functional testing, CAD data verification, Rapid Tooling, rapid manufacturing, Science & Medicine, Archeology, Paleontology & forensic Science, miniaturization.

Total Hours: 30

REFERENCES:

1. Brent Stucker, Ian Gibson, David W. Rosen, Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, Springer, 2015.
2. Chua C.K., Leong K.F., and Lim C.S., Rapid prototyping: Principles and applications, second edition, World Scientific Publishers, 2003.
3. Andreas Gebhardt, Hanser Gardener, Rapid prototyping, Publications, 2003.
4. LiouW.Liou, Frank W.Liou, Rapid Prototyping and Engineering applications: A tool box for prototype development, CRC Press, 2007.
5. Ali K. Kamrani, Emad Abouel Nasr, Rapid Prototyping: Theory and practice, Springer, 2006.
6. Peter D.Hilton, Hilton/Jacobs, Paul F.Jacobs,Rapid Tooling: Technologies and Industrial Applications, CRC press, 2000.

OUTCOMES:

Students should be able to

- Identify the currently available additive manufacturing systems
- Apply the fundamental operating principles of liquid and solid based additive manufacturing techniques
- Demonstrate the powder based additive manufacturing processes commonly used in the industry
- Select the appropriate manufacturing technique for a given prototyping task and generate STL file

MED 6105 GEOMETRIC DIMENSIONING AND TOLERANCE

L	T	P	C
1	0	0	1

OBJECTIVES:

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

MODULE I INTRODUCTION 05

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

MODULE II PRINCIPLES OF MEASUREMENT FOR GEOMETRIC CHARACTERISTICS 10

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

Total Hours: 15

REFERENCES

1. ASME Y – 14.5
2. Rao Ming, Harry Peck, “Designing for Manufacture” , Pitman Publications, London, 1983.
3. James D. Meadows, ‘Geometric Dimensioning and Tolerancing”, Marcel Dekker Inc., 1995.
4. Krulikowski. A, “Fundamentals of Geomtric Dimensioning and Tolerancing”, Delmar Publishers – New York, 1997
5. Spotts.M.F, “Dimensioning and Tolerance for Quality Production”, Prentice Hall Inc., New Jersey, 1983.
6. Oliver R Wade, “Tolerance Control in Design and Manufacturing”, Industrial Press Inc., New York, 2008.

OUTCOMES:

Students should be able to

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

SEMESTER II

GED 6201	RESEARCH METHODOLOGY FOR ENGINEERS	L	T	P	C
		4	0	0	4

OBJECTIVES:

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

MODULE I RESEARCH PROBLEM FORMULATION 10

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

MODULE II HYPOTHESIS FORMULATION 11

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

MODULE III STATISTICAL TECHNIQUES 15

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

MODULE IV STATISTICAL ANALYSIS OF DATA 13

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

MODULE V RESEARCH REPORT 11

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

Patenting, Intellectual Property Rights.

Total Hours: 60

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 should be able to

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

MED 6201	PRODUCT DESIGN (Integrated Project)	L 3	T 0	P 2	C 4

OBJECTIVES:

- To provide knowledge on scientific approach to product design that integrates technology, human and business concerns
- To understand the tools and methods of concept development with focus on the front end processes of new product development
- To learn product architecture design for developing geometrical layout
- To expertise on innovative design, integration of computerized tools and quality design
- To gain knowledge on multiple functional areas like design for manufacturing, prototyping and intellectual property.

MODULE I PRODUCT DEVELOPMENT 11+6

Strategic importance of product design and development – product life cycle -role of innovation in product design - characteristics and challenges of product development - a generic product development process - concept of concurrent engineering - plan for products - understanding the market opportunity - understanding and identifying customer needs - establishing product specifications - competitive benchmarking analysis - house of quality.

Project: Selection and justification of problem for product design.

MODULE II CONCEPT GENERATION, SELECTION AND TESTING 9+6

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

Project: Generate and select concepts for addressing the problem identified.

MODULE III PRODUCT ARCHITECTURE 7+6

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

Project: Develop suitable architecture for the product.

MODULE IV PRODUCT DESIGN 9+6

CAD / CAM tools - Modelling, analyzing and manufacturing using CAD, CAEand CAM tools - industrial design process - design optimization - geometric dimensioning and tolerance – preparation of 2D drawing.

Project: Model and analyze the product.

MODULE V IMPLEMENTATION OF DESIGN 9+6

Design for 'X' (DFX) - estimation and reductionof manufacturing cost - prototyping - principles of prototyping - planning for prototypes.

Project: Develop a virtual prototypeof the product.

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

REFERENCES:

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

OUTCOMES:

Student should be able to:

- Describe the basic concepts of product design and development
- Apply systematic approach to generate, select and test the design concepts
- Construct the geometrical layout of product
- Demonstrate the computer aided design, analysis and manufacturing techniques
- Develop prototype of a product

MED 6202	ADVANCED FINITE ELEMENT ANALYSIS (Integrated Lab)	L	T	P	C
		2	1	2	4

OBJECTIVES:

- To learn the mathematical and physical principles underlying the Finite Element Method (FEM).
- To impart the elementary concepts of plate bending behaviour and theory.
- To educate time dependent finite element procedure
- To gain knowledge on error norms and convergence rates
- To understand the basic conceptsofnon-linear problems

MODULE I FINITE ELEMENT BASICS 9+6

Set Notation, Function Notation, Vectors, Matrices, Tensors, Partial Differential Equations, Variational Calculus, Weak Form of PDEs, Finite Element Basis Functions, Finite element formulation based on weighted residual method and stationary of a functional - Iso-parametric formulation - Review of static analysis using 1D,2D, 3D element .

Practice on FEA analysis of Machine elements under steady and transient state.

MODULE II BENDING OF PLATES & SHELLS 9+6

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

Practice on FEA analysis of Modal analysis, Harmonic analysis

MODULE III STRUCTURAL DYNAMICS 9+6

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

Practice on FEA analysis of Plate bending analysis

MODULE IV ERROR ESTIMATES AND ADAPTIVE REFINEMENT 9+6

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

Practice on FEA analysis of Error estimation and convergence tests

MODULE V NONLINEAR ANALYSIS 9+6

Basic Continuum Mechanics of Solids, large deformation problems (Nonlinear Bending of Beams & Plates and shells), Material Nonlinearities, (Nonlinear Elasticity, Viscoelasticity,Plasticity, Viscoplasticity), Objective Rates,Dynamic Fracture

Practice on FEA analysis of non linear multi-physics problems

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

REFERENCES:

1. Reddy J.N. An Introduction to the Finite Element Method, McGraw Hill, International Edition, 1993.
2. Cook, Robert Davis et al “Concepts and Applications of Finite Element Analysis”, Wiley, John & Sons, 1999.
3. Nitin S.Gokhale , Sanjay S.Deshpande and Sanjeev V.Bedekar, “Practical Finite Element Analysis”, Amazon India, 2008.
4. Chandrupatla&Belagundu, “Finite Elements in Engineering”, Prentice Hall of India Private Ltd., 1997.
5. Zienkiewicz.O.C, Taylor.R.L “The Finite Element Method” McGraw Hill International Editions, Fourth Edition, 1991, Volume 2.
6. Bathe, K.J., “Finite Element Procedures in Engineering Analysis, 1990.
7. Reddy, J. N., An Introduction to Nonlinear Finite Element Analysis, Oxford
8. David V Hutton “Fundamentals of Finite Element Analysis”. McGraw-Hill International Edition, 2004.

OUTCOMES:

Students should be able to

- Apply mathematical and physical principles to solve structural and thermal problems
- Solve problems in bending of plate and composite structures
- Perform Modal analysis, Harmonic analysis and transient analysis
- Interpret the convergence and error in results
- Model and solve non-linear multi-physics problems

MED 6203 DIGITAL MANUFACTURING L T P C
3 0 0 3

OBJECTIVES:

- To learn the basics of digital manufacturing science
- To impart the role and integration of CAD/CAE/CAM in digital manufacturing
- To educate the students about intelligent manufacturing.
- To introduce and learn the various key technologies for Industry 4.0
- To understand the research opportunities and applications in digital manufacturing.

MODULE I INTRODUCTION 07

Evolution of manufacturing systems - research and development status of digital manufacturing - basic concept and connotation - operation and architecture - supporting systems.

MODULE II ROLE OF CAD/CAE/CAM 10

Digital modeling –Integration of CAD.CAE/CAM- CAM preprocessing - tool selection, defining operation and tool path generation - CAM post processing - CAxtechnologyintegration - software - product data - manufacturing data systems - digital database - process planning - PLM system - functions and features of PLM system - data sharing and integration.

MODULE III MANUFACTURING INTELLIGENCE 10

Flexible manufacturing system - layout of FMS – intelligence of processing stations: machine centers, robots, coordinate measuring machine, automated guided vehicle, automated storage and retrieval system - digital assembly - digital logistic technology - digital maintenance and diagnosis - concept of virtual manufacturing - virtual factory simulations.

MODULE IV INTRODUCTION TO INDUSTRY 4.0 10

Introduction - comparison of industry 4.0 and today's factory - Industrial emerging issues and challenges - sensing and actuation - communication and networking - technological drivers and enablers for industry 4.0 - cyber physical systems - internet of things - industrial internet of things - internet of services - cloud computing - collaborative and autonomous robots - cyber security.

MODULE V FUTURE APPLICATIONS 08

Basics of artificial intelligence, machine learning and big data analytics - augmented reality - virtual reality - MEMS and NEMS for digital manufacturing - environmentally conscious manufacturing - digital green manufacturing system - application domains: factories and assembly line, facility management, plant safety and security, health care, food industry , power plants, oil and chemical industries etc.

.

Total Hours: 45

REFERENCES:

1. Zude Zhou, Shane, Xie, Dejun Chen," Fundamentals of digital manufacturing science", Springer Series in Advanced Manufacturing, Springer-Verlag London publishers, 2012.
2. Sabina Jeschke, Christian Brecher, Houbing Song, Danda B. Rawat, "Industrial Internet of Things, cyber manufacturing system", Springer Series in Wireless Technology, Springer International Publishing Switzerland, 2017.
3. Ibrahim Zeid and Sivasubramanian R, "CAD/CAM - Theory and Practice", Tata McGraw Hill Education, 2011.
4. Pham D T and Dimov S S, "Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping", Springer -Verlag, 2001.
5. Mirjana Stankovic, Ravi Gupta and Juan E. Figueroa, "Industry 4.0, opportunities behind the challenge" UNIDO general conference, 2017.
6. Gibson, I., Rosen, D.W. and Stucker, B., "Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.

OUTCOMES:

Students should be able to:

- Describe the basics of digital manufacturing science
- Apply CAD/CAM/CAE working process and technology for various digital manufacturing activities
- Use different technologies to establish intelligent manufacturing system
- Apply the knowledge to implement Industry 4.0 concept in a factory
- Use the basic theories and key technologies to enhance the factory by digital manufacturing system

MED 6204	ADVANCED COMPUTING LAB	L	T	P	C
		0	0	2	1

OBJECTIVES:

- To know the basics of MATLAB and PYTHON software.
- To write, test, and debug simple MATLAB and PYTHON programs.
- To implement MATLAB and PYTHON programs for kinematic, thermal and vibration analysis

.

MATLAB:

Introduction to MATLAB: Introduction, installation of MATLAB, key features, basic commands, assigning and operations with variables, arrays and vectors.

Basic Operations: Arithmetic operations, solving arithmetic equations, matrix operations, solving matrix, trigonometric functions, solving real and complex numbers.

Script files and plotting: Working with script files, m files, plotting vector and matrix data, plot labelling, curve labeling and editing, creating a plot, displaying multiple plots in one figure, controlling the axes, creating a 3d plot (mesh and surface).

Simulink: Introduction of simulink, simulink environment & interface, study of library, equation oriented design, model, connect call back to subsystem, application.

Programming: Forward kinematics simulator, air standard cycle simulator, vibration and dynamics, genetic algorithms, examples.

Image Processing: Importing and visualizing images, converting between image types, obtaining pixel intensity values, extracting a region of interest, computing pixel statistics, measuring object sizes, preprocessing images adjusting image contrast and noise.

PYTHON:

Introduction To Python: Installation and working with python, understanding python variables, python basic operators, understanding python blocks, declaring and using numeric data types: int, float, complex, use of tuple data type.

Python Functions: Modules and packages, organizing python codes using functions, organizing python projects into modules, understanding packages, powerful lamda function in python programming using functions.

Simple programs to solve mechanical systems.

Total Hours: 30

OUTCOMES:

Students should be able to

- Develop algorithmic solutions to simple computational problems using MATLAB and PYTHON.
- Execute simple MATLAB and PYTHON programs.
- Apply knowledge in MATLAB and PYTHON programming for mechanical systems.

VALUE ADDED COURSE	L	T	P	C
	0	0	0	0

OBJECTIVES:

- To expose the latest technology / tools used in the industry and enable the students acquire knowledge and skill set in the same.

GENERAL GUIDELINES:

- Students should undergo any relevant certification course offered by theinstitutionor other institutions / universities / IIT / IISc etc. for a minimum of 40 hours.
- Selection and completion of value added course by the students shall be endorsed by Head of the Department.

OUTCOMES:

- Students should be exposed and gained knowledge in any one latest technology used in the industry

SEMESTER III

MED 6301	TOPOLOGY OPTIMIZATION	L	T	P	C
		1	0	0	1

OBJECTIVES:

- To understand the basics and importance of structural optimization
- To learn the formulation and solution techniques for topology optimization

.

MODULE I INTRODUCTION 07

Structural optimization - Basic ideas - Design process - Mathematical form of a structural optimization - Types of structural optimization - sizing, shape and topology optimization - Discrete and distributed parameter systems - Examples of weight optimization of discrete parameter systems - Two bar truss, Three bar truss, Two beam cantilever subjected to stress, instability, displacement and stiffness constraints.

MODULE II TOPOLOGY OPTIMIZATION OF ELASTIC STRUCTURES 08

Topology optimization of distributed parameter systems - formulation and solution techniques for topology optimization - optimality criteria method, penalizations, occurrence of ill-posedness of formulations and numerical instabilities, relaxation and restrictions, engineering applications of optimization.

Total Hours: 15

REFERENCES:

1. Peter W. Christensen · Anders Klarbring, “An introduction to structural optimization”, Springer; 2009.
2. Moritz Diehl, Francois Glineur, Elias Jarlebring, WimMichiels, "Recent Advances in Optimization and its Applications in Engineering”, Springer; 2010.
3. Martin Grötschel, Klaus Lucas, Volker Mehrmann,”Production Factor Mathematics", Springer, 2010.

OUTCOMES:

Students should be able to

- Explain the basics of topology optimization
- Formulate and implement topology optimization of structures

MED 6302	INDUSTRY INTERNSHIP	L	T	P	C
		0	0	0	1

OBJECTIVES:

- To expose the activities carried out in typical mechanical industries and enable them gain knowledge on the tasks taken up by professionals in their field.
- To impart hands on practice in facing and solving the problems experiencing in the Industry.

GENERAL GUIDELINES:

- The students individually undertake training in reputed mechanical engineering companies in the fields like CAD, CAM, CAE etc., during the summer vacation for a minimum duration of two weeks.
- The students should submit a certificate and evaluation form filled by concerned authority giving training during that period.
- At the end of training, a detailed report on the work done should be submitted within one month from the commencement of the semester.
- The students will be evaluated through a viva-voce examination by a team of internal staff assigned by the Professor In-charge or Head of the Department.

OUTCOMES:

Students will be able to

- Face the Industry requirements with more courage and confidence.
- Apply their knowledge in practical real-world problems and get industry ready

MED 7101	PROJECT WORK - PHASE I	L	T	P	C
		0	0	18	6

OBJECTIVES:

- To provide opportunity for the students to exhibit their capacity in executing a project work and provide meaningful solution to a research or real world problem related to CAD-CAM.

GENERAL GUIDELINES:

- At post graduate level project work shall be carried out by the student individually
- Studentshall select a project topic of his/her interest relevant to CAD-CAM and approach any faculty member of the department with expertise in that field and get his willingness to supervise the project.
- Studentsare permitted to carry out their project in an Industry / Research organization, with the approval 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. Proper permission and approvals should be obtained from the industry and documented.
- The information related to proposed topic and the faculty member willing to act as guide shall be informed to the project co-ordinator within 15 days from the commencement of the semester.
- Supervisor identified by the student shall be approved by the Professor in-charge or Head of the Department considering the guidelines followed in the department to allot supervisor for student projects
- The project co-ordinator in consultation with Professor in-charge or Head of the Department shall give initial approval to start the project work.
- A project review team comprising of minimum two senior faculty members of the department preferably doctorates shall be appointed by the Head of the Department.
- Project review schedules, weightage for each review and rubrics for evaluation will be prepared by the project co-ordinator in line with the academic calendar and informed to the students in advance.
- A minimum of three reviews shall be conducted to evaluate the progress of the students. All the members of the review committee shall evaluate the students individually and the mean value shall be taken for grading.

- Student should meet the supervisor periodically and attend the review committee meetings for evaluating the progress. Proper documents shall be maintained by the supervisor to ensure the attendance and progress of the students.
- In the project phase I, students are expected to identify a suitable topic, draw the need for present study and scope of the investigation, review at least 10 journal papers in the related field, formulate the experimental / analytical methodology and conduct preliminary studies.
- At the end of project work phase I, students should submit a report based on the preliminary studies and the future work to be carried out.

OUTCOMES:

Students will be able to

- Apply their practical knowledge and skill in MechanicalEngineeringwith specialization in CAD-CAM to solve real time problems
- Utilize the creative ability and inference capability to prepare an appropriate scientific document and make effective presentations

MOOC course

L	T	P	C
0	0	0	0

OBJECTIVES:

- To learn the basics principles and concepts of the topic in which a project work is undertaken by the student.

GENERAL GUIDELINES:

- Students shall identify a MOOC course related to his/her project topic in consultation with the project supervisor.
- Student shall register for a MOOC course with minimum two credit offered by any recognized organization during the project phase I.
- Selection and completion of MOOC course by the students shall be endorsed by Head of the Department.

OUTCOMES:

Students will be able to

- Familiarize the basic principles and concepts related to the topic of his/her project work.
- Utilize the knowledge gained in the field of study to perform literature review with ease.
- Formulate the experimental / analytical methodology required for the project work

SEMESTER IV

MED7101	PROJECT WORK - PHASE II	L	T	P	C
		0	0	36	18

OBJECTIVES:

- To provide opportunity for the students to exhibit their capacity in executing a project work and provide meaningful solution to a research or real world problem related to CAD-CAM.

GENERAL GUIDELINES:

- Project work phase II is a continuation of phase I following the same guidelines.
- The project co-ordinator shall arrange to conduct three reviews to ascertain the progress of the work and award the marks based on the performance.
- Detailed experimental investigation / in-depth analytical study / fabrication of equipment /Development of CAD-CAM Models have to be performed in-line with the scope of investigation.
- The students are expected to analyse the obtained results and discuss the same in an elaborate manner by preparing necessary charts / tables / curves to get an inference.
- The important conclusions need to be drawn and scope for further research also to be highlighted.
- The outcome of project work shall be published in journals / conference of National or International importance.
- At the end, students should submit a report covering the various aspects of Project work.
- The typical components of the project report are Introduction, Need for present study, Scope of the Investigation, Literature review, Methodology / Experimental investigation / development of software packages, Results & discussion of experimental and analytical work, Conclusions, References etc.
- The deadline for submission of final Project Report / Thesis / Dissertation is within 30 calendar days from the last Instructional day of the semester.
- The project co-ordinator in consultation with head of the department and controller of examination shall arrange for an external expert member to conduct the final viva-voce examination to ascertain the overall performance of the students in Project work.

OUTCOMES:

Students will be able to

- Apply their practical knowledge and skill in Mechanical Engineering with specialization in CAD-CAM to solve real time problems
- Utilize the creative ability and inference capability to prepare an appropriate scientific document and make effective presentations

PROFESSIONAL ELECTIVES ON CAD

MEDY 001	ADVANCED MECHANISMS DESIGN AND SIMULATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I INTRODUCTION 09

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

MODULE II KINEMATIC ANALYSIS 09

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

MODULE III PATH CURVATURE THEORY, COUPLER CURVE 09

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

MODULE IV SYNTHESIS OF FOUR BAR MECHANISMS 09

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

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

Cognate Linkages-parallel motion Linkages. Design of six bar mechanisms-single dwell-double dwell-double stroke. Geared five bar mechanism-multi-dwell. Cam Mechanisms- determination of optimum size of cams. Mechanism defects. Study and use of Mechanism using Simulation Soft-ware packages. Students should design and fabricate a mechanism model as term project.

Total Hours: 45

REFERENCES:

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

OUTCOMES:

Students should be able to

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

MEDY 002 ADVANCED STRENGTH OF MATERIALS

L	T	P	C
3	0	0	3

OBJECTIVES:

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

MODULE I ELASTICITY 09

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

MODULE II SHEAR CENTER AND UNSYMMETRICAL BENDING 10

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

MODULE III CURVED FLEXIBLE MEMBERS AND STRESSES IN FLAT PLATES 10

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

MODULE IV TORSION OF NON-CIRCULAR SECTIONS 07

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

MODULE V STRESSES IN ROTARY SECTIONS AND CONTACT STRESSES 09

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

bodies in point and line contact applications.

Total Hours: 45

REFERENCES:

1. Arthur P Boresi, Richard J. Schmidt, “Advanced mechanics of materials”,John Wiley, 2002.
2. Timoshenko and Goodier, "Theory of Elasticity", McGraw Hill.
3. Robert D. Cook, Warren C. Young, "Advanced Mechanics of Materials", Mc millan pub. Co., 1985.
4. Srinath. L.S., “Advanced Mechanics of solids”, Tata McGraw Hill, 1992.
5. Ryder G H ,Strength of Materials Macmillan, India Ltd, 2007

OUTCOMES:

Students should be able to

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

MEDY 003	ADVANCED TOOL DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I TOOL DESIGN METHODS 05

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

MODULE II TOOLING MATERIALS AND HEAT TREATMENT 09

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

MODULE III DESIGN OF DRILL JIGS 09

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

MODULE IV DESIGN OF FIXTURES AND DIES 14

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

MODULE V TOOL DESIGN FOR NUMERICALLY CONTROLLED MACHINE TOOLS 08

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

Total Hours: 45

REFERENCES:

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

OUTCOMES:

Students should be able to

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

MEDY 004	COMPUTATIONAL FLUID DYNAMICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I GOVERNING DIFFERENTIAL EQUATION AND FINITE DIFFERENCE METHOD 10

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

MODULE II CONDUCTION HEAT TRANSFER 10

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

MODULE III INCOMPRESSIBLE FLUID FLOW 10

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

MODULE IV CONVECTION HEAT TRANSFER AND FEM 10

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

MODULE V TURBULENCE MODELS 05

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

Total Hours: 45

REFERENCES:

1. Muralidhar, K., and Sundararajan, T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House, New Delhi, 1995.
2. Ghoshdasdidar, P.S., "Computer Simulation of flow and heat transfer" Tata McGraw-Hill Publishing Company Ltd., 1998.
3. Subas, V.Patankar "Numerical heat transfer fluid flow", Hemisphere Publishing Corporation, 1980.
4. Taylor, C and Hughes, J.B. "Finite Element Programming of the Navier-Stokes Equation", Pineridge Press Limited, U.K., 1981.
5. Anderson, D.A., Tannehill, J.I., and Pletcher, R.H., "Computational fluid Mechanics and Heat Transfer " Hemisphere Publishing Corporation, New York, USA,1984.
6. Fletcher, C.A.J. "Computational Techniques for Fluid Dynamics 1" Fundamental and General Techniques, Springer – Verlag, 1987.
7. Fletcher, C.A.J. "Computational Techniques for fluid Dynamics 2" Specific Techniques for Different Flow Categories, Springer – Verlag, 1987.Bose, T.X., "Numerical Fluid Dynamics" Narosa Publishing House, 1997.

OUTCOMES:

Students should be able to

- Solve heat conduction problems numerically
- Describe the methods of discretize a partial differential equation
- Understand standard algorithms applied for solving incompressible fluid flow
- Apply FEM to solve a convection heat transfer problem
- Choose the best turbulence model for the flow analysis encounters turbulence

MEDY 005 COMPUTER AIDED PROCESS PLANNING

L	T	P	C
3	0	0	3

OBJECTIVES:

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

MODULE I INTRODUCTION 09

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

MODULE II PART DESIGN REPRESENTATION 09

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

MODULE III PROCESS ENGINEERING AND PROCESS PLANNING 09

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

MODULE IV COMPUTER AIDED PROCESS PLANNING SYSTEMS 09

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

MODULE V AN INTERGRADED PROCESS PLANNING SYSTEMS 09

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

Total Hours: 45

REFERENCES:

1. Gideon Halevi and Roland D. Weill, “Principles of Process Planning ", A logical approach, Chapman & Hall, 1995.
2. Tien-Chien Chang, Richard A.Wysk, "An Introduction to automated process planning systems ", Prentice Hall, 1985.
3. Chang, T.C., “An Expert Process Planning System ", Prentice Hall, 1985.
4. Nanua Singh, “Systems Approach to Computer Integrated Design and Manufacturing ", John Wiley & Sons, 1996.
5. Rao, “Computer Aided Manufacturing ", Tata McGraw Hill Publishing Co., 2000.

OUTCOMES:

At the end of the course students should be able to

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

MEDY 006	DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I OIL HYDRAULIC SYSTEMS AND ACTUATORS 05

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

MODULE II CONTROL AND REGULATION ELEMENTS 10

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

MODULE III HYDRAULIC CIRCUITS 08

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

MODULE IV PNEUMATIC SYSTEMS AND CIRCUITS 15

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

MODULE V INSTALLATION, MAINTENANCE AND SPECIAL CIRCUITS 07

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

Total Hours: 45

REFERENCES:

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

OUTCOMES:

Students should be able to

- Classify the various fluid power system and their applications
- Illustrate important components of fluid power used in power packs
- Design and analyze hydraulic power circuits for a specific application
- Design and analyze pneumatic power circuits for a specific application
- Summarize the modern controls for fluid power system and their maintenance

MEDY 007 DESIGN OF MATERIAL HANDLING EQUIPMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

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

MODULE I MATERIALS HANDLING EQUIPMENT 05

Types, selection and applications

MODULE II DESIGN OF HOISTS 10

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

MODULE III DRIVES OF HOISTING GEAR 10

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

MODULE IV CONVEYORS 10

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

MODULE V ELEVATORS 10

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

Total Hours: 45

REFERENCES:

1. Rudenko, N., Materials handling equipment, ELnvee Publishers, 1970.
2. Spivakovsy, A.O. and Dyachkov, V.K., Conveying Machines, Volumes I and II, MIR Publishers, 1985.
3. Alexandrov, M., Materials Handling Equipments, MIR Publishers, 1981.
4. Boltzharol, A., Materials Handling Handbook, The Ronald Press Company, 1958.
5. P.S.G. Tech., “Design Data Book”, KalaikathirAchchagam, Coimbatore, 2003.
6. Lingaiah. K. and Narayana Iyengar, “Machine Design Data Hand Book”, Vol.1 & 2, Suma Publishers, Bangalore, 1983

OUTCOMES:

Students should be able to

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

MEDY 008	INDUSTRIAL ROBOTICS AND FLEXIBLE AUTOMATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I INTRODUCTION AND ROBOT KINEMATICS 10

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

MODULE II ROBOT DRIVES AND CONTROL 09

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

MODULE III ROBOT SENSORS 09

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

MODULE IV ROBOT FOR FLEXIBLE AUTOMATION 09

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

MODULE V ROBOT PROGRAMMING, AI & EXPERT SYSTEMS 08

Methods of Robot Programming – Characteristics of task level languages lead through programming methods – Motion interpolation. Artificial intelligence – Basics

– Goals of artificial intelligence – AI techniques – problem representation in AI – Problem reduction and solution techniques - Application of AI and KBES in Robots.

Total Hours: 45

REFERENCES:

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

OUTCOMES:

Students should be able to

- Analysekinematically the operation of robots
- Design various drives and controls for robotics
- Identify typical sensors in robotics as per their applications
- Identify suitable automation systems in robotics
- Write programs for intelligent robots

MEDY 009	MECHANICAL VIBRATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I FUNDAMENTALS OF VIBRATION 08

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

MODULE II TWO - DEGREE FREEDOM SYSTEMS 08

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

MODULE III MULTI-DEGREE FREEDOM SYSTEM 12

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

MODULE IV VIBRATION OF CONTINUOUS SYSTEMS 08

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

MODULE V VIBRATION MEASURMENT AND CONTROL 09

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

Total Hours: 45

REFERENCES:

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

OUTCOMES:

Students should be able to

- Write the basic equations of motion of vibratory systems
- Predict Eigen values and Eigen vectors of two -degrees of freedom systems
- Apply numerical methods to solve a multi degree freedom subjected to different types of excitation
- Obtain solution for a continuous system
- Measure and process vibration signals and employ methods of vibration control

MEDY 010 OPTIMIZATION TECHNIQUES IN DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

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

MODULE I INTRODUCTION 05

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

MODULE II OPTIMIZATION TECHNIQUES 10

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

MODULE III MULTI OBJECTIVE OPTIMIZATION 10

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

MODULE IV STATIC APPLICATIONS 10

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

MODULE V DYNAMIC APPLICATIONS 10

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

Total Hours: 45

REFERENCES:

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

OUTCOMES:

Students should be able to

- Describe the needs of optimization
- Identify suitable optimization technique
- Perform multi objective optimization
- Analyse the various static applications of optimization
- Analyse the various dynamic applications of optimization

MEDY 011 TRIBOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

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

MODULE I SURFACES, FRICTION AND WEAR 08

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

MODULE II LUBRICATION THEORY 08

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

MODULE III DESIGN OF FLUID FILM BEARINGS 12

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

MODULE IV ROLLING ELEMENT BEARINGS 10

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

MODULE V TRIBO MEASUREMENT IN INSTRUMENTATION 07

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

Total Hours: 45

REFERENCES:

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

OUTCOMES:

Students should be able to

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

MEDY 012 MECHANICS OF COMPOSITE MATERIALS

L	T	P	C
2	0	0	2

OBJECTIVES:

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

MODULE I INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS 10

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

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

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

MODULE III THERMAL ANALYSIS 10

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

Total Hours: 30

REFERENCES:

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

OUTCOMES:

Students should be able to

- Apply constitutive equations of composite materials and understand mechanical behavior at micro and macro level
- Determine stresses and strains in composites.
- Analyze mechanical behavior of composites due to variation intemperature and moisture.

PROFESSIONAL ELECTIVES ON CAM

MEDY 021	ADVANCES IN MANUFACTURING TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I METAL CUTTING AND TOOL MATERIALS 12

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

MODULE II SPECIAL MACHINING 09

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

MODULE III UNCONVENTIONAL MACHINING 09

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

MODULE IV MICROFABRICATION 06

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

MODULE V ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS 09

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

Total Hours: 45

REFERENCES:

1. Armarego E.J.A. and Brown R.H., “The machining of metals ", Prentice Hall, 1982.
2. Battacharya," Theory of metal cutting ", NCB Agency, 1984.
3. HMT Manual, “Non-traditional machining methods ", 1975.
4. More Madon, Fundamentals of Microfabrication, CRC Press, 1997.
5. Rich E. and Knight K., “Artificial Intelligence ", McGraw Hill Inc, 1991.
6. Pham D.T., “Expert Systems in Engineering ", IFS Publishers, Springer-Verlag, 1988.
7. Durvent W.R., “The Lithographic hand book ", Narosa Publishers, 1995.
8. Pandey P.S. and Shah N. “Modern Manufacturing Processes ", 1980.
9. Sadasivan T.A. and Sarathy D. “Cutting tools for Productive Machining ", Widia (India) Limited, 1999.

OUTCOMES:

Students should be able

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

MEDY 022	CNC MACHINES AND COMPUTER AIDED MANUFACTURING	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I INTRODUCTION TO CNC MACHINE TOOLS 07

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

MODULE II STRUCTURE OF CNC MACHINE TOOL 09

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

MODULE III DRIVES AND CONTROLS 09

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

MODULE IV CNC PROGRAMMING 10

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

MODULE V TOOLING AND MAINTENANCE OF CNC 10

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

Total Hours: 45

REFERENCES:

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

OUTCOMES:

Students should be able to

- Describe the basics of CNC machines
- Design and analyse the structure of CNC machine tools
- Identify appropriate accessories for CNC machines based on requirements
- Write part programs for CNC machining
- Identify tools and maintenance methods of CNC machines

MEDY 023	PROCESSING OF POLYMERS AND COMPOSITES	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I INTRODUCTION 05

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

MODULE II PROCESSING OF PLASTICS 12

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

MODULE III MACHINING AND JOINING OF PLASTICS 07

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

MODULE IV COMPOSITE MATERIALS AND PROCESSING 12

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

MODULE V PROCESSING OF METAL MATRIX COMPOSITES 09

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

Total Hours: 45

REFERENCES:

1. Harold Belofsky, Plastics: “Product Design and Process Engineering”, Hanser Publishers, 1995.
2. Bera, E and Moet, A, “High Performance Polymers ", Hanser Publishers, 1991.
3. Hensen, F, “Plastics Extrusion technology ", Hanser Publishers, 1988.
4. Johannaber F, “Injection Moulding Machines ", Hanser Publishers, 1983.
5. Rauwendaal, C, “Polymer extrusion ", Hanser Publishers, 1990.
6. Rosatao, D.V., “Blow Moulding Handbook, Hanser Publisher, 1989.
7. Seamour,E.B., " Modern Plastics Moulding ", John Wiley.
8. John Dalmonte, “Plastics Moulding ", John Wiley.
9. Akira Kobyashi, “Machining of Plastics ", Mc-Graw Hill.
10. Krishan K.Chawla, “Composite Materials science and Engineering ", springer-Verlag, 1987.
11. Agarwal. D. and Broutman L.J., “Analysis and Performance of Fiber Composites ", Wiley, 1990.
12. Mallick, P.K. and Newman, S. “Composite Materials Technology ", Hanser Publishers, 1990.

OUTCOMES:

Students should be able to

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

MEDY 024	PRECISION ENGINEERING AND NANO TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I MATERIALS FOR PRECISION ENGINEERING 08

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

MODULE II PRECISION MACHINING AND ERRORS 12

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

MODULE III PRECISION MACHINE ELEMENTS 06

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

MODULE IV NANOMATERIALS SYNTHESIS AND CHARACTERIZATION 10

Amorphous, crystalline, microcrystalline, quasi-crystalline and nano-crystalline materials. Historical development of nanomaterials – Issues in fabrication and characterization of nanomaterials Methods of production of Nanoparticles, Sol-gel synthesis, Inert gas condensation, High energy Ball milling, Plasma synthesis, Electro deposition and other techniques. Synthesis of Carbon Nanotubes – Solid carbon source based production techniques, Gaseous carbon source based production techniques - Growth mechanisms-Nano wires. Scanning Probe Microscopy (SPM), Transmission electron microscope, Scanning transmission electron microscope, Atomic force microscope, Scanning thermal microscopy Nano indentation.

MODULE V APPLICATIONS OF NANOMATERIALS 09

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

Total Hours: 45

REFERENCES:

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

OUTCOMES:

Students should be able to

- Identify precision engineering materials
- Analyse various types of Precision machining techniques
- Identify precision machining tools as per requirement
- Perform characterization of Nano materials
- Describe the various applications of Nano materials

MEDY 025	MECHATRONICS FOR MANUFACTURING SYSTEMS	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To study the basics and application of mechatronics systems
- To choose appropriate sensors for manufacturing applications
- To select the required actuator for an application

MODULE I MECHATRONICS AND ITS APPLICATION 08

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

MODULE II SENSORS AND TRANSDUCERS 12

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

MODULE III ACTUATORS 10

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

Total Hours: 30

REFERENCES:

1. Bolton.W, “Mechatronics” , Pearson education, second edition, fifth Indian Reprint, 2003.
2. Smaili.A and Mrad.F , "Mechatronics integrated technologies for intelligent machines", Oxford university press, 2008.
3. Devadas Shetty and Richard A.Kolk, “Mechatronics systems design”, PWS Publishing Company, 2007.
4. Godfrey C. Onwubolu, "Mechatronics Principles and Applications", Elsevier, 2006.
5. NitaigourPremchandMahalik, “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.

OUTCOMES:

Student will be able to

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

MEDY 026	NEWER MATERIALS	L	T	P	C
		2	0	0	2

OBJECTIVES:

- To learn the physical properties of various smart materials
- To acquire knowledge on synthesis of newer materials.
- To acquire knowledge on applications of smart sensor, actuator and transducer technologies.

MODULE I SMART BEHAVIOURS AND MATERIALS 12

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

MODULE II MATERIAL SYNTHESIS 06

Solid state reaction, sol-gel process.

MODULE III APPLICATIONS 12

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

Total Hours: 30

REFERENCES:

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

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

OUTCOMES:

Students should be able to

- Summarize the properties of newer materials
- Perform synthesis and characterization of smart materials.
- Explain the development of actuators and sensors and their integration into a smart structure

MEDY 027 AUTOMOTIVE MANUFACTURING

L	T	P	C
1	0	0	1

OBJECTIVES:

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

MODULE I MACHINING PROCESS 08

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

MODULE II FORMING PROCESS 07

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

Total Hours: 15

REFERENCES

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

OUTCOMES:

Students should be able to

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

MEDY 028	VIRTUAL MANUFACTURING	L	T	P	C
		1	0	0	1

OBJECTIVES:

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

MODULE I FUNDAMENTALS OF VIRTUAL MANUFACTURING 08

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

MODULE II FACETS OF VIRTUAL MANUFCATURING 07

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

Total Hours: 15

REFERENCES

1. Warim Ahmed Khan Abdul Raouz, Kari Chens, Virutal Manufacturing, Springer Series in Advanced Manufacturing.
2. Crabb, C. H., The Virtual Engineer-21st Century Product Development, Society of Manufacturing Engineers, 1998.
3. Rao Ming, Qun Wang, Jianzhong Cha, Integrated Distributed Intelligent Systems in Manufacturing (Intelligent Manufacturing), Chapman & Hall1993.
4. Prasant Banerjee, Virtual manufacturing a willey, I addition 2001.

OUTCOMES:

Students should be able to

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

PROFESSIONAL ELECTIVES ON CAD / CAM MANAGEMENT

MEDY 031 DATA COMMUNICATION IN CAD/CAM

L	T	P	C
3	0	0	3

OBJECTIVES:

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

MODULE I DIGITAL COMPUTERS & MICRO PROCESSORS 09

Block diagram - register transfer language - arithmetic, logic and shift micro operations - instruction code - training and control instruction cycle - I/O and interrupt design of basic computer. Machine language - assembly language - assembler.
Registers ALU and Bus Systems - timing and control signals - machine cycle and timing diagram - functional block diagrams of 80 x 86 and modes of operation.Features of Pentium Processors.

MODULE II OPERATING SYSTEM & ENVIRONMENTS 09

Types - functions - UNIX & WINDOWS - Architecture - Graphical User Interfaces- Compilers - Analysis of the Source program - the phases of a compiler - cousins of the compiler, the grouping of phases - compiler construction tools.

MODULE III COMMUNICATION MODEL 09

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

MODULE IV COMPUTER NETWORKS 09

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

MODULE V INTERNET 09

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

Total Hours: 45

REFERENCES:

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

OUTCOMES:

Students should be able to

- Describe various digital computers and microprocessors
- Identify and explain typical components of operating systems and environments
- Design necessary data communication system for CAD/CAM
- Incorporate various networking and remote computing systems
- Identify and select suitable internet services and tools for communication

MEDY 032 INDUSTRIAL SAFETY MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

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

MODULE I SAFETY MANAGEMENT 09

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

MODULE II OPERATIONAL SAFETY 09

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

MODULE III SAFETY MEASURES 09

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

MODULE IV ACCIDENT PREVENTION 09

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

MODULE V SAFETY, HEALTH, WELFARE & LAWS 09

Safety and health standards - Industrial hygiene - occupational diseases prevention - Welfare facilities - History of legislations related to Safety-pressure vessel act-Indian boiler act - The environmental protection act - Electricity act - Explosive act.

Total Hours: 45

REFERENCES:

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

OUTCOMES:

Students should be able to

- Demonstrate safety concepts practiced in Industry
- Analyze the required safety precautions under worst operating conditions
- Evaluate the possible safety prevention measures while handling hazardous substances
- Demonstrate an understanding of work place injury prevention and incident investigations
- Implement safety laws to be followed at various workplaces

MEDY 033	INTEGRATED MANUFACTURING SYSTEMS AND MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I FIELD OF MANUFACTURING MANAGEMENT 09

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

MODULE II PRODUCTION PROCESSES DESIGN 09

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

MODULE III DESIGN OF FACILITIES AND JOBS 09

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

MODULE IV INVENTORY SYSTEMS AND MRP 09

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

MODULE V INFORMATION SYSTEM FOR MANUFACTURING 09

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

Total Hours: 45

REFERENCES:

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

OUTCOMES:

Students should be able to

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

MEDY 034 MANUFACTURING INFORMATION SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

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

MODULE I INTRODUCTION 05

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

MODULE II DATABASE 07

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

MODULE III DESIGNING DATABASE 13

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

MODULE IV MANUFACTURING CONSIDERATION 10

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

MODULE V INFORMATION SYSTEM FOR MANUFACTURING 10

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

Total Hours: 45

REFERENCES:

1. Luca G. Sartori, “Manufacturing Information Systems”, Addison-Wesley Publishing Company, 1988.
2. Date.C.J., “An Introduction to Database systems”, Narosa Publishing House, 1997.
3. Orlicky.G., “Material Requirements Planning”, McGraw-Hill Publishing Co., 1975.
4. Kerr.R, “Knowledge based Manufacturing Management”, Addison-wesley, 1991.

OUTCOMES:

Students should be able to

- Describe MRP and the role of production organization
- Explain the various types and components of database
- Utilize various approaches and design the database
- Analyse various components of manufacturing database organization
- implement the Information management system for manufacturing

MEDY 035	RELIABILITY AND TOTAL PRODUCTIVE MAINTENANCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I RELIABILITY CONCEPT AND FAILURE DATA ANALYSIS 11

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

MODULE II RELIABILITY ASSESSMENT AND MONITORING 09

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

MODULE III RELIABILITY IMPROVEMENT 06

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

MODULE IV MAINTENANCE MODELS 10

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

MODULE V MAINTENANCE LOGISTICS, QUALITY AND TPM 09

Maintenance staffing – Human factors –Resource requirements: Optimal size of service facility – Optimal repair effort – Maintenance planning and scheduling – Spares planning – Capital spare. Five Zero concept –FMECA – Maintainability prediction– Design for maintainability – Maintainability allocation – Reliability Centered Maintenance. TPM fundamentals – Chronic and sporadic losses – Six big losses – OEE as a measure – TPM pillars– Autonomous maintenance –TPM implementation.

Total Hours: 45

REFERENCES:

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

OUTCOMES:

Students should be able to

- Analyse reliability and failure in mechanical systems
- Assess reliability
- Implement various monitoring and reliability improvement techniques
- Incorporate maintenance models forequipment
- Handle various maintainability issues and remedies

MEDY 036 PRODUCT LIFE CYCLE MANAGEMENT

L	T	P	C
1	0	0	1

OBJECTIVES:

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

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

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

MODULE II PLM CONCEPTS AND PROCESSES 05

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

MODULE III PLM STRATEGY AND ASSESSMENT 05

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

Total Hours: 15

REFERENCES:

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

OUTCOMES:

Students should be able to

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

GENERAL ELECTIVES

GEDY 101	PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

The objectives of the course would be to make the students

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

MODULE I INTRODUCTION & PROJECT INITIATION 09

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

MODULE II RISK ANALYSIS 09

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

MODULE III PROJECT PLANNING & IMPLEMENTATION 09

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

MODULE IV TECHNICAL ANALYSIS 09

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

MODULE V PROJECT MANAGEMENT TECHNIQUES 09

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

Total Hours: 45

REFERENCES:

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

OUTCOMES:

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

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

GEDY 102	SOCIETY, TECHNOLOGY & SUSTAINABILITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I TECHNOLOGY AND ITS IMPACTS 09

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

MODULE II TECHNOLOGY AND ITS ADVANCEMENT 09

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

MODULE III SOCIETY AND TECHNOLOGY 09

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

MODULE IV IMPACT OF A SPECIFIC TECHNOLOGY ON HUMAN WELFARE 09

Impact of the following technologies on Human life – Medical and Biomedical – Genetics Technology – Electronics and Communications – Electronic media Technology – Information Systems Technology – Nanotechnology – Space Technology and Energy Technology.

MODULE V THE IMPORTANCE OF SUSTAINABILITY 09

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

Total Hours: 45

REFERENCES:

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

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.

GEDY 103	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I HISTORY AND FOUNDATIONS 08

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

MODULE II SEARCH 10

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

MODULE III KNOWLEDGE REPRESENTATION AND REASONING 10

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

MODULE IV REPRESENTING AND REASONING WITH UNCERTAIN KNOWLEDGE 08

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

MODULE V CASE STUDY AND FUTURE APPLICATIONS 09

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

Total Hours: 45

TEXT BOOK:

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

OUTCOMES:

Students who complete this course will be able to

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

GEDY 104	GREEN COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I INTRODUCTION 08

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

MODULE II CONSUMPTION ISSUES 10

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

MODULE III NEXT-GENERATION VIRTUAL DATA CENTERS 09

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

MODULE IV TECHNOLOGIES FOR ENABLING GREEN AND VIRTUAL DATA CENTERS 08

Highly Effective Data Center Facilities and Habitats for Technology - Data Center Electrical Power and Energy Management - HVAC, Smoke and Fire Suppression - Data Center Location - Virtual Data Centers Today and Tomorrow - Cloud Computing, Out-Sourced, and Managed Services.

MODULE V SERVERS AND FUTURE TRENDS OF GREEN COMPUTING 10

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

Total Hours: 45

REFERENCES:

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

OUTCOMES:

Students who complete this course will be able to

- Demonstrate issues relating to a range of available technologies, systems and practices to support green computing.
- Select appropriate technologies that are aimed to reduce energy consumption.

- Address design issues needed to achieve an organizations' green computing objectives.
- Analyze the functionality of Data Centers.
- Critically evaluate technologies and the environmental impact of computing resources for a given scenario.
- Compare the impact of Green Computing with other computing techniques.

GEDY 105	GAMING DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I INTRODUCTION 09

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

MODULE II THE DESIGNER CREATES AN EXPERIENCE 09

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

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

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

MODULE IV GAMES THROUGH AN INTERFACE 09

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

MODULE V BALANCED GAME MECHANICS 10

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

Total Hours: 45

REFERENCES:

1. Jesse Schell, "The Art of Game Design: A Book of Lenses", 2nd Edition ISBN-10: 1466598646, 2014.
2. Ashok Kumar, Jim Etheredge, Aaron Boudreaux, “Algorithmic and Architectural Gaming Design: Implementation and Development", 1st edition, Idea Group, U.S ISBN-10: 1466616342, 2012.
3. Katie SalenTekinba, Melissa Gresalfi, Kylie Peppler, Rafi Santo, "Gaming the System - Designing with Gamestar Mechanic" MIT Press , ISBN-10: 026202781X, 2014.
4. James M. Van Verth, Lars M. Bishop "Essential Mathematics for Games and Interactive Applications", Third Edition,A K Peters/CRC Press, ISBN-10: 1482250926, 2015.

OUTCOMES:

Students who complete this course will be able to

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

GEDY 106	SOCIAL COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I BASIC CONCEPTS 09

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

MODULE II SOCIAL LINK 09

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

MODULE III SOCIAL MEDIA 08

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

MODULE IV SOCIAL INFORMATION FILTERING 09

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

MODULE V SOCIAL NETWORK STRATEGY 10

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

Total Hours: 45

REFERENCES:

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

OUTCOMES:

Students who complete this course will be able to

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

GEDY 107	SOFT COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

The aim of the course is to

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

MODULE I SOFT COMPUTING - BASICS 06

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

MODULE II ARTIFICIAL NEURAL NETWORK 12

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

MODULE III FUZZY SYSTEMS 09

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

MODULE IV NEURO FUZZY SYSTEMS 09

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

MODULE V EVOLUTIONARY COMPUTING 09

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

Total Hours: 45

TEXTBOOKS:

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

OUTCOMES:

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

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

GEDY 108	EMBEDDED SYSTEM PROGRAMMING	L	T	P	C
		3	0	0	3

OBJECTIVES:

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

MODULE I INTRODUCTION OF EMBEDDED SYSTEM 09

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

MODULE II SOFTWARE TECHNOLOGY 09

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

MODULE III INPUT/OUTPUT PROGRAMMING 09

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

MODULE IV DATA REPRESENTATION IN EMBEDDED SYSTEMS 09

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

MODULE V EMBEDDED C 09

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

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

Total Hours: 45

REFERENCES:

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

OUTCOMES:

On completion of this course the student will be able to

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

GEDY 109 PRINCIPLES OF SUSTAINABLE DEVELOPMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

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

MODULE I CONCEPT OF SUSTAINABLE DEVELOPMENT 09

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

MODULE II COMPONENTS AND DIMENSIONS OF SUSTAINABLE DEVELOPMENT 09

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

MODULE III FRAMEWORK FOR ACHIEVING SUSTAINABILITY 09

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

MODULE IV SUSTAINABLE DEVELOPMENT OF SOCIO ECONOMIC SYSTEMS 09

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

Agriculture –sustainable livelihoods.

MODULE V SUSTAINABLE DEVELOPMENT AND INTERNATIONAL RESPONSE 09

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

Total Hours: 45

REFERENCES:

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

OUTCOMES:

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

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

GEDY 110	QUANTITATIVE TECHNIQUES IN MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVE:

To impart knowledge on

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

MODULE I OPERATIONS RESEARCH 09

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

MODULE II PRODUCTION MANAGEMENT 09

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

MODULE III FINANCIAL MANAGEMENT 09

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

MODULE IV DECISION THEORY 09

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

MODULE V MANAGERIAL ECONOMICS 09

Cost concepts–Breakeven Analysis–Pricing techniques–Game Theory applications.

Total Hours: 45

REFERENCES:

1. Vohra, N.D. , Quantitative Techniques in Management, Tata McGraw Hill Co., Ltd, New Delhi, 2009.
2. Seehroeder, R.G., Operations Management, McGraw Hill, USA, 2002.

3. Levin, R.I, Rubin, D.S., and Stinsonm J., Quantitative Approaches to Management, McGraw Hill Book Co., 2008.
4. Frank Harrison, E., The Managerial Decision Making Process, Houghton Miffin Co. Boston, 2005.
5. Hamdy A. Taha, Operations Research- An Introduction, Prentice Hall, 2002.

OUTCOME:

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

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

GEDY 111 PROGRAMMING USING MATLAB & SIMULINK

L	T	P	C
1	0	2	2

OBJECTIVES:

The aim of this course is to:

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

MODULE I INTRODUCTION TO MATLAB AND DATA PRESENTATION 10

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

Lab Experiments

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

MODULE II ROOT FINDING AND MATLAB PLOT FUNCTION 10

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

Lab Experiments

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

MODULE III LINEAR AND NON-LINEAR DIFFERENTIAL EQUATIONS 13

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

Lab Experiments

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

b. Euler method

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

MODULE IV INTRODUCTION OF SIMULINK 12

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

Lab Experiments

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

Total Hours (Including Practicals): 45

REFERENCE:

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

OUTCOMES:

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

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

- Make use of Maltab visual capabilities for all engineering applications.
- An ability to identify, formulate, and solve engineering problems. This will be accomplished by using MATLAB to simulate the solution to various problems in engineering fields

GEDY 112 JAVA PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study the syntax and necessity of decision making and iterative statements.
- To create a class and invoke the methods with ability handle abnormal conditions.
- To learn to work with various string methods and collection framework.
- To establish a connection to database from java application.
- To understand why Java is useful for the designing web applications.
- To design a graphical user interface (GUI) with Java Swing.

MODULE I INTRODUCTION TO JAVA PROGRAMMING 06

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

MODULE II METHODS AND CLASSES 08

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

MODULE III STRING HANDLING AND COLLECTIONS 07

String Handling - Special String Operations - String Literals- String Conversion - Collections Overview - The Collection Interfaces -The Collection Classes - Accessing a collection Via an Iterator - Working With Maps, Comparators.

MODULE IV DATABASE CONNECTIVITY 08

JDBC - JDBC Driver Types - JDBC Packages - Database Connection - Associating the JDBC/ODBC Bridge with the Database - Statement Objects – Result Set - Transaction Processing – Metadata - Exceptions.

MODULE V SERVER PROGRAMMING 09

The Life Cycle of a Servlet - Using Tomcat for Servlet Development -The Servlet API - Handling HTTP Requests and Responses - Using Cookies - Session Tracking - Java Server Pages (JSP)-Session Objects

MODULE VI SWING PROGRAMMING 07

Concepts of Swing - Java Foundation Class (JFC) - Swing Packages and Classes - Working with Swing - Swing Components

L – 45; TOTAL HOURS-45

REFERENCES :

1. Herbert Schildt, “Java The Complete Reference”, 11th Edition, McGraw Hill, 2018, ISBN: 9781260440249.
2. Joshua Bloch , “Effective Java Paperback”,3rd Edition, Addison Wesley,2017,ISBN: 978-0134685991.
3. E Balagurusamy, “Programming with Java”, 6th Edition, Tata Mcgraw Hill, 2019,ISBN: 978-9353162344.

OUTCOMES:

Students who complete this course will be able to

- Understand the fundamentals java programming language
- Use the Java programming language for various programming technologies.
- Perform various string operations on any given text from user.
- Connect any database with java program and manipulate the contents.
- Write a server side programming which can evaluate the input and respond to user request
- Develop user interface using java swings.

GEDY 113 PYTHON PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES :

- To study the control statements and string functions of python.
- To practice python data structures - lists, tuples, dictionaries.
- To organize input/output with files in Python.
- To learn the python tools as well as Unicode process.
- To explore advance python including decorators and metaclasses.
- To integrate python with embedded systems.

MODULE I INTRODUCTION TO PYTHON PROGRAMMING 07

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

MODULE II LISTS, TUPLES AND DICTIONARIES 08

Lists - list operations - list slices - list methods - list loop – mutability- aliasing - cloning lists - list parameters - Tuples: tuple assignment- tuple as return value- Dictionaries- operations and methods- advanced list processing - list comprehension- selection sort - insertion sort- merge sort- histogram.

MODULE III FILES, MODULES AND PACKAGES 08

Files and exception - text files - reading and writing files - format operator - command line arguments - errors and exceptions - handling exceptions – modules – packages - word count- copy file.

MODULE IV UNICODE AND BYTE STRINGS 07

String basics - coding basic strings –coding Unicode strings- 3.X bytes objects- 3.X/2.6+ byte array object- text and binary files – Unicode files

MODULE V DECORATORS AND METACLASS 08

Decorator basics- coding function decorators- coding class decorators – managing functions and classes –the metaclass model- declaring metaclasses-coding metaclasses-inheritance and instance-metaclass methods

MODULE VI EMBEDDED PROGRAMMING USING PYTHON 07

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

L – 45; Total Hours : 45

REFERENCES :

1. Guido van Rossum and Fred L. Drake Jr, “An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
2. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist‘‘, 2nd edition, Updated for Python 3, Shroff/O‘Reilly Publishers, 2016, ISBN-13:978-1491939369.
3. Nick Goddard, “Python Programming”, 2nd edition, ISBN: 1533337772, 2016.
4. Mark Lutz, Learning Python: Powerful Object-Oriented Programming, 5th Edition, O'Reilly Media, 2013.
5. Pratik Desai, “Python Programming for Arduino”, 1st edition, Packt publishing, 2015, ISBN: 9781783285938.
6. Richard H. Barnett, Sarah Cox, Larry O'Cull, “Embedded C Programming and the Atmel AVR”, 2nd edition, 2006.
7. Michael Barr, Anthony Massa, “Programming Embedded Systems”, 2nd Edition, O'Reilly Media, 2006.

OUTCOMES :

Students to complete this course will be able to

- Implement date and time function programming using python.
- Represent compound data using Python lists, tuples, dictionaries
- Read and write data from/to files in Python Programs.
- Instrument the unicode process using python tools
- Build advance python programs using decorators and metaclass.
- Develop embedded system with python programming.

GEDY 114 INTELLECTUAL PROPERTY RIGHTS

L	T	P	C
1	0	0	1

OBJECTIVES:

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

MODULE I INTRODUCTION 07

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

MODULE II PATENT 08

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

Total Hours: 15

REFERENCES

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

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

OUTCOMES:

Students should be able to

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