St. PETER'S INSTITUTE OF HIGHER EDUCATION AND RESEARCH
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M.E. (ADVANCED MANUFACTURING TECHNOLOGY)

(Approved by AICTE)

I to IV Semesters

REGULATIONS AND SYLLABI

UNDER CHOICE BASED CREDIT SYSTEM

REGULATIONS 2021

Effective from the Academic Year 2021-2022

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St. Peter's Institute of Higher Education and Research

M.E. (ADVANCED MANUFACTURING TECHNOLOGY)

REGULATION 2021

CHOICE BASED CREDIT SYSTEM

VISION & MISSION OF THE INSTITUTION

Vision

To achieve, Academic Excellence in Engineering, Technology and Science through Teaching, Research and Extension to Society

Mission

By generating, preserving and disseminating knowledge through rigorous academic study, inquisitiveness to understand and explore nature, entrepreneurship with creativity and innovation

VISION & MISSION OF THE DEPARTMENT

Vision

To emerge as dynamic centre for quality education and research, dedicated to produce outstanding Mechanical Engineers through strong theoretical knowledge and practical training.

Mission

M1: Contemporary and effective educational experiences that develop the competent engineers.

M2: Achieving intellectual excellence by providing facilities for students for higher educationand research.

M3: To inculcate technical skills with integrity and ethical standards in students.

M4: To impart entrepreneurship qualities to indulge in promoting sustainable development ofthe society.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO1: Classify, analyze, evaluate, design and develop production system and processes using appropriate advanced manufacturing techniques and approaches.

PEO2: Demonstrate in-depth knowledge of manufacturing systems and work effectively in diverse environments.

PEO3: Build successful careers as per the need of Indian and multinational industries.

PROGRAM OUTCOMES (POs):

Engineering Graduates will be able to:

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: 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.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: 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.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: 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.

PO11: Project management and finance: Demonstrate knowledge and understanding of theengineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engagein independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OBJECTIVES (PSOs):

Master of Engineering Programme in Advanced Manufacturing Technology is designed to prepare the graduates for following outcomes

PSO1: To be able to identify, formulate and develop solution methodology for various issues related to manufacturing processes.

PSO2: To be able to provide cost effective design solutions for various tools and dies in accordance with the manufacturing standards..

PSO3: To be able to apply effectively the automated manufacturing systems for overall productivity improvement.

Contribution 1: Reasonable 2: Significant 3: Strong

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M.E / M. Tech. REGULATIONS (2021)

Regulations – 2021 is applicable to the students admitted to the Degree of Master of Engineering (M.E.), Master of Technology (M.Tech.) (Four Semesters) programme effective from the academic year 2021-2022

1. NOMENCLATURE

- **Programme** : Means Post Graduate Degree Programme (M.Tech. / M.E).
- **Course** : Refers to the course (Subject) that a student would have to undergoduring the study in the Institution
- **Batch** : Refers to the Starting and Completion year of a Programme of study. Eg. Batch of 2021–2023 refers to students belonging to a 2 yearDegree programme admitted in 2021 and completing in 2023.
- **Department** : Each Programme of the Institution is grouped under a department. Eg. M.E Computer Science is grouped under Department of Computer Science and Engineering. This Department offers various Undergraduate and Postgraduate Programmes in Engineering like B.E (Computer Science and Engineering), M.E (Computer Science and Engineering).
- **Dean (Engg)** : Means Dean of Engineering and Technology who administers theacademic matters of Engineering and Technology.
- **HoD** : Refers to the Head of a Department (HoD) offering various UG and PG programmes.
  He/She will be the Head of all staff members and Students belonging to the Department

2. PROGRAMMES OFFERED

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

Degree	Mode of Study
M.E	Full Time
M.Tech	

- Candidates admitted under „Full-Time" should be available in the Institution during the entire duration of working hours for the curricular, co-curricular and extra-curricular activities assigned to them.

- The Full-Time candidates should not attend any other Full-Time programme(s) / course(s) or take up any Full-Time job / Part-Time job in any Institution or Company during the period of the Full-Time programme. Violation of the above rules will resultin cancellation of admission to the PG programme.

3. QUALIFICATION FOR ADMISSION

- Candidates for admission to the first semester of the Post-Graduate Degree Programme shall be required to have passed an appropriate Under-Graduate Degree Examination of St. Peter's Institute of Higher Education and Research as specified in Annexure 1 [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.
- Admission shall be offered only to the candidates who possess the qualification prescribed against each programme.
- Any other relevant qualification which is not prescribed against each programme shall be considered for equivalence by the committee constituted for the purpose. Admission to such degrees shall be offered only after obtaining equivalence to such degrees.
- 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 fromtime to time.

4. STRUCTURE OF PROGRAMME

Every Programme will have a curriculum with syllabi consisting of theory and practical suchas:

Credit Distribution

Total No. of Credits			
Sl. No.	**Course Category**	**No. of courses**	**No. of Credits**
1	Institute Core Courses	1	3
2	Programme Core Courses	12	53
4	Programme Elective Courses	5	15
5	Institute Elective courses	1	3
Total		**19**	**75**

I Semester

Code No.	Course Title	L	T	P	Credit	Marks		
						CA	EA	Total
Theory& Practical								
AMAPT1101	Applied Probability and Statistics	3	1	0	4	40	60	100
AMEPT1101	Modern Manufacturing Process	3	0	0	3	40	60	100
AMEPT1102	Advanced Materials Engineering	3	0	0	3	40	60	100
AMEPT1103	Metal Cutting Theory and Tool Design	3	0	0	3	40	60	100
AMEPT1104	Mechatronics in Manufacturing Systems	3	0	0	3	40	60	100
	Programme Elective-1	3	0	0	3	40	60	100
AMEPL1101	CIM and MechatronicsLaboratory	0	0	4	2	40	60	100
	Total	**18**	**1**	**4**	**21**	**280**	**420**	**700**

II Semester

Code No.	Course Title	L	T	P	Credit	Marks		
						CA	EA	Total
Theory& Practical								
AMEPT1105	Optimization Techniques in Manufacturing	3	1	0	4	40	60	100
AMEPT1135	Manufacturing Automation	3	0	0	3	40	60	100
AMEPT1136	Energy Management	3	0	0	3	40	60	100
AMEPT1108	Modelling and Analysis of Manufacturing Systems	3	0	0	3	40	60	100
	Programme Elective-2	3	0	0	3	40	60	100
	Programme Elective-3	3	0	0	3	40	60	100
AMEPL1102	Simulation and Welding Laboratories	0	0	4	2	40	60	100
	Comprehensive Viva	-	-	-	-	-	-	-
	Total	**18**	**1**	**4**	**21**	**280**	**420**	**700**

III Semester

Code No.	Course Title	L	T	P	Credit	Marks		
						CA	EA	Total
Theory& Practical								
	Programme Elective-4	3	0	0	3	40	60	100
	Programme Elective-5	3	0	0	3	40	60	100
	Institute Elective	3	0	0	3	40	60	100
AMEPP2101	Project Work Phase -I	0	0	12	8	40	60	100
	Total	9	0	12	17	160	240	400

IV Semester

Code No.	Course Title	L	T	P	Credit	Marks		
						CA	EA	Total
Theory& Practical								
AMEPP2102	Project Work Phase -II	0	0	24	16	40	60	100
	Total	**0**	**0**	**24**	**16**	**40**	**60**	**100**

TOTAL CREDITS: 75

(i) Institute Elective courses (IC) which includes General Foundation courses comprising Mathematics and Engineering Courses along with Laboratories.

Institute Elective Applicable to Department of Mechanical Engineering						
S.No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**Credits**
1.	AMEPT2136	Neural Network and Fuzzy Logics	3	0	0	3
2.	AMEPT2137	MEMS and Micro Systems Technology	3	0	0	3
3.	AMEPT2138	Occupational Health And Industrial Hygiene	3	0	0	3
4.	AMEPT2139	Artificial Intelligence & Machine Learning in Manufacturing	3	0	0	3
5.	AMEPT2140	Intellectual Property Rights	3	0	0	3

(ii) Programme Core courses (PC) belonging to the Major Programme of study.

Programme Core Courses			
S.No.	**Course Code**	**Course Title**	**No. of Credits**
1.	AMEPT1101	Modern Manufacturing Process	3
2.	AMEPT1102	Advanced Materials Engineering	3
3.	AMEPT1103	Metal Cutting Theory and Tool Design	3
4.	AMEPT1104	Mechatronics in Manufacturing Systems	3
5.	AMEPL1101	CIM and Mechatronics Laboratory	2
6.	AMEPT1105	Optimization Techniques in Manufacturing	4
7.	AMEPT1106	Production Automation and Trends in Manufacturing	3
8.	AMEPT1107	Design for Manufacture and Assembly	3
9.	AMEPT1108	Modelling and Analysis of Manufacturing Systems	3
10.	AMEPL1102	Simulation and Welding Laboratories	2
11.	AMEPP2101	Project Work Phase -I	8
12.	AMEPP2102	Project Work Phase -II	16
		Total Credits	53

(iii) Programme Electives (PE) offered by the Department related to the Major programme of study. A student should choose at least 6 courses during the programme.

Sl.No.	Course Code	Course Title	L	T	P	Credits
Programme Elective – 1						
1	AMEPT1109	Fluid Power Automation	3	0	0	3
2	AMEPT1110	Micro and Nano Manufacturing	3	0	0	3
3	AMEPT1111	Quality and Reliability Engineering	3	0	0	3
4	AMEPT1112	Vibration Analysis and Condition Monitoring	3	0	0	3
5	AMEPT1113	Computer Integrated Manufacturing Systems	3	0	0	3
6	AMEPT1134	Additive Manufacturing	3	0	0	3
Programme Elective – 2 & 3						
1	AMEPT1114	Finite Element Methods for Manufacturing	3	0	0	3
2	AMEPT1115	Industrial Ergonomics	3	0	0	3
3	AMEPT1116	Polymers and Composite Materials	3	0	0	3
4	AMEPT1117	Non-Destructive Testing and Evaluation	3	0	0	3
5	AMEPT1118	Production and Operation Management	3	0	0	3
6	AMEPT1119	Industrial Robotics	3	0	0	3
7	AMEPT1120	Project Engineering and Management	3	0	0	3
8	AMEPT1121	Metrology and Computer Aided Inspection	3	0	0	3
9	AMEPT1135	Concurrent Engineering	3	0	0	3
10	AMEPT1141	Product Data Management	3	0	0	3
11	AMEPT1142	Advanced Tooling Design	3	0	0	3
Programme Elective – 4 & 5						
1	AMEPT2122	Process Planning and Cost Estimation	3	0	0	3
2	AMEPT2123	Design of Experiment	3	0	0	3
3	AMEPT2124	Manufacturing Information Systems	3	0	0	3
4	AMEPT2125	Research Methodology	3	0	0	3
5	AMEPT2126	Supply Chain and Logistics Management	3	0	0	3
6	AMEPT2127	Materials Testing and Characterization Techniques	3	0	0	3
7	AMEPT2128	Product Design and Development	3	0	0	3
8	AMEPT2129	Flexible Competitive Manufacturing System	3	0	0	3
9	AMEPT2130	Nanotechnology	3	0	0	3
10	AMEPT2131	Advanced Metal Joining Processes Assessment	3	0	0	3
11	AMEPT2132	Industrial Safety	3	0	0	3
12	AMEPT2133	Sustainable Manufacturing	3	0	0	3
13	AMEPT2134	Digital work flow in Manufacturing	3	0	0	3

(iv) **Open Electives (OE)** comprising of Professional elective courses from respective Departments and provides the opportunity to a student to choose any course of any stream. A student should choose atleast 2 courses during the programme.

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(v) **Programme Laboratory courses (PLC).**

(vi) **ONLINE Courses:** The concerned Board of Studies (BoS) shall approve thelist of online courses offered by approved external agencies. While listing the courses, the BoS shall consider the following points:

- The course evaluation is carried out by the same external agency
- Equivalent grading mechanism to be arrived at by the department

A student can register up to a maximum of 12 credits (total) as online courses during the entire programme of study. These shall be treated as Elective courses (program elective or open elective). Students may be allowed to register for one course per semester starting from 1st semester onwards. This online course of 3 credits can be considered instead of one elective course.

(vii) Students may optionally undergo Value Added Courses shall be over and above thetotal credit requirement prescribed in the curriculum for the award of the degree.
One/Two credit courses shall be offered by a Department

(viii) **Internship Training** during the course of study

(ix) **Project Work**
Each semester curriculum shall normally have a blend of lecture courses and practicalcourses.

4.1 MEDIUM OF INSTRUCTION

The medium of instruction, examinations and project report will be in English Language throughout the Programme.

4.2 CREDIT ALLOTMENT TO COURSES

Each course is normally assigned certain number of credits as follows:

- **Lecture Hours (Theory)** : 1 credit per lecture hour per week.
- **Laboratory Hours** : 1 credit for 2 Practical hours, 2 credits for 3 or4 hours of practical per week.
- **Project Work phase I** : 8 credits for 12 hours of project work (Phase - I) perweek.
- **Project Work phase II** : 16 credits for 24 hours of project work (Phase - II) perweek.
- **Internship Training** : 2 credits for 2 weeks of Training

*** All the engineering course having 3 credits may have 4 lecture hours of which one hour will be dedicated for tutorial which will not be accounted as a credit.**

5. DURATION OF THE PROGRAMME

A student is normally expected to complete the M.E./M.Tech. Programme in 4 semesters but in any case, not more than 8 consecutive semesters from the time of commencement of the course.

6. REQUIREMENTS FOR COMPLETION OF A SEMESTER

A candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirement for completion of a semester.

- He / She secures not less than 75% of overall attendance in that semester.
- Candidates who do not have the requisite attendance for the semester will not be permitted to write the semester Examinations.

7. VARIOUS POSITIONS

a. DEAN

All Engineering Departments are headed by a Dean. The Dean is responsible for all activities taking place in coordination with all department heads and all staff members belonging to them. The Dean shall act as a linkage between the HoD's, faculty members and the students. The Dean makes a review of all the academic activities of staff, students and research on a regular time interval and takes steps to improve the morale of all staff and students.

b. HEAD OF THE DEPARTMENT

Each department offering various UG and PG programmes is headed by a Head (HoD). The head of the department (HoD) is responsible for allotting courses to each staff member uniformly in consultation with other HoD's and School Deans. The HoD is responsible for streamlined teaching of courses to students, improvement and assessment of teaching quality within the department on a continuous basis, assessment of staff members, transparent conduct of continuous assessment examinations, interacting with parents, ensuring that all academic and non-academic activities of staff and students are monitored and steps taken for their improvement.

c. FACULTY ADVISOR

To help the students in planning their courses of study and to render general advice regarding either the academic programme or any other activity, the Head of the Department concerned, will assign every year, a certain number of students from the first year to a faculty member who will be called as Faculty Advisor. The set of students thus assigned will continue to be under the guidance of this Faculty Advisor till they complete the programme or replaced by the HOD. The Faculty Advisor gets information about the syllabus coverage by the staff members, requirements of the students academically and otherwise, attendance and progress of

the students from the respective class counselors. The Faculty Advisor also informs the students about the academic schedule including the dates of assessments and syllabus coverage for each assessment,weightage for each assessment, their continuous assessment marks and attendance % details before the commencement of end semester examinations.

d. CLASS COUNSELOR

There shall be a class counselor for each class/section. The class counselor will be one amongthe teachers of the department. He/She will be appointed by the Head of the respective department. The responsibilities for the class counselor shall be:

- To act as the channel of communication between the HoD, dean, year coordinator, course coordinator, staff and students of the respective class.
- To collect and maintain various statistical details of students.
- To help the year coordinator in planning and conduct of the classes.
- To monitor the academic performance of the students including attendance and to inform the year coordinator.
- To take care of the students‟ welfare activities like industrial visits, seminars, awards etc.

e. COURSE COORDINATOR FOR EACH COURSE

Each theory course offered to more than one class or branch or group of branches, shall have a "course coordinator". The course coordinator will be nominated by the school dean in consultation with respective head of the department. The course coordinator will be normally senior staffs who are one among the teachers teaching the course.

- The "Course Coordinator" shall meet the teachers handling the course, as often as possible and ensure
- A common teaching methodology is followed for the course.
- The study materials are prepared by the staff members and communicated to the students periodically.
- The involvement of students in course based projects and assignments.
- To prepare common question paper for continuous assessment exams.
- For uniform evaluation of continuous assessments answer sheets by arriving at a common scheme of evaluation.

The course coordinator is responsible for evaluating the performance of the students in the continuous assessments and end semester examinations and analyse them to find suitable methodologies for improvement in the performance. The analysis should be submitted to the HoD and school dean for suitable action.

f. CLASS COMMITTEE

i. Constitution of the Class Committee

For every class, a class committee shall be constituted by the Heads of Department, as given below:

Chairman	A faculty member not teaching that particular class
Members	• Faculty of all the courses of study • Two student members from the class to be nominated bythe Head of the Department

ii. Functions of the Class Committee

The class committee shall meet thrice during the session. The first meeting will be held within two weeks from the date of commencement of the session in which the nature of the broad assessment procedure for the different courses will be discussed. The second and third meetings will be held six weeks and ten weeks respectively from the commencement of a session to meaningfully interact and express opinions and suggestions to improve the effectiveness of teaching - learning process and analyze the performance of the students in the assessments. The chairperson of the class committee should send the minutes of the class committee meetings to the Dean through the Head of the Department, immediatelyafter the class committee meetings.

During the first meeting of the class committee, all the faculty members shall give their course plan to the class committee chairperson for approval and uploading into the course plan website

Any innovation in any course plan not agreed by the class committee or the HoD will be referred to the Chairman for approval.

8. COURSE PLAN AND DELIVERY

a) The course plan (**IC, PC, PE, OE and PLC**) will have details of the overview of the course, COURSE OBJECTIVES:, course outcome, course teaching and learning activities and course assessment methods and policy on compensation assessment.

b) Each course will have tailor-made assessment models viz. group tasks, assignments, report on field visit, quizzes, open book tests, laboratory exercises, mini-project and end of session summative assessment etc. The course plan will also have details of information on study materials.

c) The number of assessments for a course shall range from 4 to 6.

d) Every course should have a final assessment (End Semester) on the entire syllabus with 60% weightage.

e) The course plan shall be approved by the Class Committee (CC) chairperson and the HoD of the Department offering the course.

f) The Course plans for all courses offered by the Institute will be available in the website for reference by the faculty and students.

9. ATTENDANCE

All courses should have a common attendance policy:

a. At least 75% attendance in each course is mandatory.
b. A maximum of 10% shall be allowed under curricular and extra curricular activities.
c. Students with less than 65% of attendance shall be prevented from writing the End Semester Examination.

10. ASSESSMENT PROCEDURE

Each **COURSE** shall have assessments done according to the Course Plan drawnby the faculty who handles the course. The assessments of a course will depend on the needed course learning outcomes.

There will be a continuous assessment examination and end semester examination for both theory and practical courses of all programmes.

(i) Theory courses

Continuous Assessment (CAE) : 40 Marks
End Semester Exams (ESE) : 60 Marks

(ii) Practical courses

Continuous Assessment (CAE) : 40 Marks
End Semester Exams (ESE) : 60 Marks

10.1 CONTINUOUS ASSESSMENT EXAMS (CAE)

Theory Courses

There will be a minimum of Three continuous assessment exams (Assessment Test I,II and a Model Exam) for each theory course.

Distribution of Continuous Assessment Exam (CAE) Marks for a Theory Course			
Evaluation Component	**Syllabus coverage**	**Duration of the Exam**	**Max. Weightage**
CAE-1	**First 1.5 Units of the syllabus**	**2 Hours**	**25 Marks (20% weightage for CAE 1 & CAE 2 and 60% for ModelExam)**
CAE-2	**Next 1.5 Units of the syllabus**	**2 Hours**	
Model Exam	**Full syllabus**	**3 Hours**	
Assignment	**2 written assignments for each course / Written quiz (or) Presentation of a written Report (or) Case study / Multiple choice Objective Type Test**		**15 Marks**

The total marks secured in the assessment exams out of 100, will be converted to 40 Marks.

- The continuous assessment marks obtained by the candidate in the first appearance shall be retained, considered and valid for all subsequent attempts, till the candidate secures a pass.

Practical Courses

- For practical courses, the student will be evaluated on a continuous basis for 20 Marks (which will include performing all experiments, submitting observation and record note book in scheduled format and time), 20 marks for model exam at the end of the semester
- For practical courses, if a student has been absent for some practical classes or has performed poorly, then the student will have to get permission from the lab incharge and year coordinator to do the experiments, so that he/she meets all the requirements for the course and thereby allowed to appear for model and end semester exams.
- If a student has not done all the experiments assigned for that lab, before the scheduled date or has attendance percentage less than 90%, the student will not be allowed to appear for the model and end semester practical exam. Such students will have to redo the course again by doing all the experiments in the next semester when the course is offered.

11. INTERNSHIP / INDUSTRIAL TRAINING

- Every student is required to undergo Industrial Visits during every semester of the Programme. HoDs shall take efforts to send the students to industrial visits in every semester.
- Every student will have to undergo Internship / Industrial training for a Minimum period of 2-3 weeks during the semester Holidays at the end of second year and Third Year.
- This could be internship in an industry approved by the Dean or Professional Enrichment courses (like attending Summer Schools, Winter Schools, Workshops) offered on Campus or in Registered Off Campus recognised Training Centres approved by the Dean for a minimum period of 3 weeks.
- A report on Training undergone by the student, duly attested by the Coordinator concerned from the industry / Organisation, in which the student has undergone training and the Head of the Department concerned, shall be submitted after the completion of training. The evaluation of report and viva voce examination can be computed as per norms for the End Semester examination.
- The evaluation of training will be made by a three member committee constituted by Head of the Department in consultation with Faculty Advisor and respective Training Coordinator. A presentation should be made by the student before the Committee, based on the Industrial Training or Professional Enrichment undergone.

12. PROJECT WORK

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

- 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 and Dean. 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 attend the review meetings for evaluatingthe progress.

- 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.

- The evaluation of Project Work for Phase-I & Phase-II in the case of M.E. / M.Tech. shall be done independently in the respective semesters and marks shall be allotted as per the weightages.

- There shall be three assessments (each 100 marks) during the Semester by a review committee. The Student shall make presentation on the progress made before the Committee. The total marks obtained in the three assessments shall be reduced to 40 marks and rounded to the nearest integer. The internal examiner and the external examiner shall be appointed by the Controller of Examination.

	Internal (40 marks)			**External (60 marks)**		
	Review 1	**Review 2**	**Review 3**	**Project Evaluation (external)**	**Viva –Voce (30 marks)**	
					External	Internal
Max. Marks	10	10	20	30	15	15

- The Project Report prepared according to approved guidelines duly signed by the supervisor(s) and the Head of the Department concerned shall be submitted to the Dean. If the candidate fails to obtain 50% of the internal assessment marks in the Phase–I and Phase–II / final project, he/she will not be permitted to submit the report for that particular semester and has to re-enroll for the same in the subsequent semester.

- If a candidate fails to submit the project report on or before the specified deadline, he/she is deemed to have failed in the Project Work and shall re-enroll for the same in a subsequent semester. This applies to both Phase–I and Phase–II in the case of M.E. / M.Tech.

13. END SEMESTER EXAMINATIONS (ESE)

- The end semester examinations shall normally be conducted between October and December during the odd semesters and between March and May during the even semesters for both theory and practical courses of all programmes.
- End semester examinations will be conducted for a maximum of 100 marks. The marks secured in end semester exams will be converted to 60 marks.
- End semester practical exams will be conducted for a maximum of 50 marks.

13.1. WITHDRAWAL FROM EXAMINATIONS

- A candidate may, for valid reasons, (medically unfit / unexpected family situations) be granted permission to withdraw from appearing for the examination in any course or courses in any one of the semester examinations during the entire duration of the degree programme.
- Withdrawal application shall be valid only if the candidate is otherwise normally eligible (if he/she satisfies Attendance requirements and should not be involved in Disciplinary issues or Malpractice in Exams) to write the examination and if it is made within FIVE days before the commencement of the examination in that course or courses and also recommended by the Dean through HoD.
- Notwithstanding the requirement of mandatory FIVE days notice, applications for withdrawal for special cases under extraordinary conditions will be considered based on the merit of the case.
- Withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class with Distinction and First Class.
- Withdrawal is NOT permitted for arrears examinations of the previous semesters.

13.2. REVALUATION OF ANSWER PAPERS

A candidate can apply for revaluation of his/her End semester examination answer paper in a theory course, immediately after the declaration of results, on payment of a prescribed fee along with application to the Controller of Examinations through the Head of the Department. The Controller of Examination will arrange for the revaluation and the result will be intimated to the candidate concerned through the Head of the Department. Revaluation is not permitted for practical courses and for project work.

14. PASSING REQUIREMENTS

- A candidate should secure not less than 50% of total marks **(Minimum 50%** of the grand total of CAE Marks and ESE marks put together) prescribed for the courses,

subject to securing a minimum of 30% marks out of maximum mark in ESE. Then he/she shall be declared to have passed in the examination.

- If a candidate fails to secure a pass in a particular course, it is mandatory that he/she shall register and reappear for the examination in that course during the next semester when examination is conducted in that course. It is mandatory that he/she should continue to register and reappear for the examination till he/she secures a pass.

15. AUTHORIZED BREAK OF STUDY

A student may be permitted by the Dean 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. 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.

16. AWARD OF DEGREE

All assessments of a course will be done on absolute marks basis. However, for the purpose of reporting the performance of a candidate, letter grades, each carrying certain number of points, will be awarded as per the range of total marks (out of 100) obtained by the candidate in each course as detailed below:

RANGE OF MARKS FOR GRADES

Range of Marks	Letter Grade	Grade Points (GP)
90 -100	O	10
80 - 89	A	9
70 - 79	B	8
60 - 69	C	7
50 - 59	D	6
00-49 (Reappear)	RA	0
ABSENT	AAA	0
Withdrawal	W	0
Authorised Break of Study	ABS	0

16.1. CUMULATIVE GRADE POINT AVERAGE CALCULATION

The CGPA calculation on a 10 Point scale is used to describe the overall performance of a student in all courses from first semester to the last semester. RA, AAA and W grades will be excluded for calculating GPA and CGPA.

$$GPA = \frac{\sum_{i=1}^{N} Ci\ GPi}{\sum i\ Ci} \qquad CGPA = \frac{\sum_{i=1}^{n} Ci\ GPi}{\sum i\ Ci}$$

Where

Ci – Credits for the course

GPi – Grade Point for the course

$\sum i$ – Sum of all courses successfully cleared during all the semesters

n – Number of all courses successfully cleared during the particular semester in the case of GPA and during all the semesters in the case of CGPA.

17. GRADE SHEET

After revaluation results are declared in each semester, Grade Sheets will be issued to each student. At the end of programme a consolidated grade sheet also will be issued to each student. The grade sheet and consolidated grade sheet will contain the following details:

- Name of the candidate with date of birth and photograph.
- The programme and degree in which the candidate has studied
- The list of courses enrolled during the semester and the grade secured
- The Grade Point Average (GPA) for the semester.

18. CLASSIFICATION OF DEGREE AWARDED

Final Degree is awarded based on the following:

Range of CGPA	Classification of Degree
≥ 7.50	**First Class with Distinction**
≥ 6.00 <7.50	**First Class**
≥ 5.00 < 6.0	**Second Class**

Minimum requirements for award of Degree: A student should have obtained a minimum of 5.0 CGPA.

1. A candidate who qualifies for the award of the Degree having passed the examination in all the courses of all the 4 semesters in his/her first appearance within a maximum of 4 consecutive semesters securing a overall CGPA of not less than 7.5 (Calculated from 1st

semester) shall be declared to have passed the examination in **First Class with Distinction**. Authorized Break of Study vide Clause 12, will be considered as an Appearance for Examinations, for award of First Class with Distinction. Withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class with Distinction.

2. A candidate who qualifies for the award of the Degree having passed the examination in all the courses of all the 4 semesters within a maximum period of 8 consecutive semesters after his/her commencement of study securing a overall CGPA of not less than 6.0 (Calculated from 1st semester), shall be declared to have passed the examination in **First Class.** Authorized break of study vide Clause 12 (if availed of) or prevention from writing End semester examination due to lack of attendance will not be considered as Appearance in Examinations. For award of First class, the extra number of semesters than can be provided will be equal to the Number of semesters availed for Authorized Break of Study or Lack of Attendance. Withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class.

3. All other candidates who qualify for the award of the Degree having passed the examination in all the courses of all the 4 semesters within a maximum period of 8 consecutive semesters after his/her commencement of study securing a overall CGPA of not less than 5.0, (Calculated from 1st semester) shall be declared to have passed the examination in **Second Class**.

4. A candidate who is absent in semester examination in a course/project work after having registered for the same, shall be considered to have appeared in that examination for the purpose of classification.

19. ELIGIBILITY FOR THE AWARD OF DEGREE

A student shall be declared to be eligible for the award of the M.E/M.Tech. degree, provided the student has successfully completed all the requirements of the programme, and has passed all the prescribed examinations in all the 4 semesters within the maximum period specified in clause 3.

i) Successfully gained the required number of total credits as specified in the curriculum corresponding to his/her programme within the stipulated time.

ii) Successfully completed the programme requirements and has passed all the courses prescribed in all the semesters within a maximum period of 4 years reckoned from the commencement of the first semester to which the candidate was admitted.

iii) Successfully completed any additional courses prescribed by the Institution.

iv) has earned a CGPA of not less than 5

v) has no dues to the Institution, Library, Hostels, etc.,

vi) has no disciplinary action pending against him / her.

vii) No disciplinary action pending against the student.

The award of Degree must have been approved by the Board of Management of the Institution.

20. DISCIPLINE

Every student is required to observe disciplined and decorous behaviour both inside and outside the Institution and not to indulge in any activity which will tend to bring down the prestige of the Institution. If a student indulges in malpractice in any of the end semester theory / practical examination, continuous assessment examinations he/she shall will be liable for disciplinary action as prescribed by the Institution from time to time.

21. POWER TO MODIFY

From time to time, the Institution may revise, amend or change the regulations, scheme of examinations and syllabi if found necessary.

ANNEXURE -1

Student may be offered one of the following PG programmes of study approved by the University. A student of a programme should earn the credits specified against it to enable the student to be eligible to be awarded the degree.

S.No	Name of the Programme	Department offered	Eligibility for admission
1	M.E. Structural Engineering	Civil Engineering	B.E. / B. Tech. Civil Engineering / Structural Engineering/ B.Arch.
2	M.E. Communication Systems	Electronics and Communication Engineering	B.E. / B. Tech. EEE/ ECE / E&I / CSE IT / I&C / Electronics / Instrumentation
3	M.E. Advanced Manufacturing Technology	Mechanical Engineering	B.E. / B.Tech. - Mechanical / Automobile / Manufacturing / Production / Industrial / Mechatronics / Metallurgy / Aerospace /Aeronautical / Material Science / Marine Engineering
4	M.E. Power Electronics and Drives	Electrical and Electronics Engineering	B.E. / B. Tech. EEE/ECE/E&I/I&C / Electronics / Instrumentation
5	M.E. Computer Science and Engineering	Computer Science and Engineering	B.E. / B. Tech. CSE/IT/ECE/EEE/EIE/ICE/ MCA
6	M.Tech. Information Technology	Information Technology	B.E. / B. Tech. IT/CSE/ECE/EEE/EIE/ICE / MCA
7	M.E. Biomedical Engineering	Biomedical Engineering	B.E. BME/ECE/EEE/ICE

I Semester

AMAPT1101- APPLIED PROBABILITY AND STATISTICS

COURSE OBJECTIVES:

- This course is designed to provide the solid foundation on topics in applied probability and various statistical methods which form the basis for many other areas in the mathematical sciences including statistics, modern optimization methods and risk modeling.
- It is framed to address the issues and the principles of estimation theory, testing of hypothesis and multivariate analysis.

UNIT 1 PROBABILITY AND RANDOM VARIABLES 9 hrs.

Probability – Axioms of probability – Conditional probability – Baye‘s theorem - Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a random variable.

UNIT 2 TWO DIMENSIONAL RANDOM VARIABLES 9 hrs.

Joint distributions – Marginal and conditional distributions – Functions of two dimensional random variables – Regression curve – Correlation.

UNIT 3 ESTIMATION THEORY 9 hrs.

Unbiased estimators – Method of moments – Maximum likelihood estimation - Curve fitting by principle of least squares – Regression lines.

UNIT 4 TESTING OF HYPOTHESIS 9 hrs.

Sampling distributions – Type I and Type II errors – Small and large samples – Tests based on Normal, t, Chi square and F distributions for testing of mean, variance and proportions – Tests for independence of attributes and goodness of fit.

UNIT 5 MULTIVARIATE ANALYSIS 9 hrs.

Random vectors and matrices – Mean vectors and covariance matrices – Multivariate normal density and its properties – Principal components - Population principal components – Principal components from standardized variables.

Total : 45 Periods

OURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: Basic probability axioms and rules and the moments of discrete and continuousrandom variables.

CO2: Consistency, efficiency and unbiasedness of estimators, method of maximum likelihood estimation and Central Limit Theorem.

CO3: Use statistical tests in testing hypotheses on data.

CO4: Perform exploratory analysis of multivariate data, such as multivariate normal density, calculating descriptive statistics, testing for multi variate normality.

CO5: The ability to use the appropriate and relevant, fundamental and applied mathematical and statistical knowledge, methodologies and modern computational tools.

REFERENCE BOOKS:

1. Devore, J. L., ―Probability and Statistics for Engineering and the Sciences‖, 8th Edition, Cengage Learning, 2014.
2. Gupta S.C. and Kapoor V.K.,‖ Fundamentals of Mathematical Statistics‖, Sultan and Sons, New Delhi, 2001.
3. Johnson, R.A., Miller, I and Freund J., "Miller and Freund‘s Probability and Statisticsfor Engineers ", Pearson Education, Asia, 8th Edition,2015.
4. Richard A. Johnson and Dean W. Wichern, ―Applied Multivariate Statistical Analysis‖, 5th Edition, Pearson Education, Asia,2002

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	1	3	1	1	1	1	1	1	2	1	2	3	1
CO2	1	3	1	2	1	1	1	1	1	1	2	1	1	1	1
CO3	1	2	1	3	1	1	1	1	1	1	1	1	2	3	1
CO4	1	2	1	2	1	1	1	1	1	1	2	1	1	2	1
CO5	1	3	1	3	1	1	1	1	1	1	1	1	2	1	1
CO	1	2.6	1	2.6	1	1	1	1	1	1	1.6	1	1.6	2	1

1 - low, 2 - medium, 3 – high

AMEPT1101- MODERN MANUFACTURING PROCESS

COURSE OBJECTIVES:

- To analyze and determine material fabrication processes.
- To be aware on latest unconventional machine shop equipments.
- To recognize engine machine tool requirements and be selective in the choice of tools.
- To identify with numerical control machining and computer programming.

UNIT 1 UNCONVENTIONAL MACHINING 9 hrs.

Introduction-Bulk processes - surface processes- Plasma Arc Machining- Laser Beam Machining- Electron Beam Machining-Electrical Discharge Machining – Electro chemical Machining-Ultrasonic Machining- Water Jet Machining-Electro Gel Machining-Anisotropic machining-Isotropic machining- Elastic Emission machining
– Ion Beam Machining.

UNIT 2 PRECISION MACHINING: 9 hrs.

Ultra Precision turning and grinding: Chemical Mechanical Polishing (CMP) - ELID process – Partial ductile mode grinding-Ultra precision grinding- Binderless wheel – Free form optics. aspherical surface generation Grinding wheel- Design and selection of grinding wheel-High-speed grinding- High-speed milling- Diamond turning.

UNIT 3 ADVANCES IN METAL FORMING & WELDING 9 hrs.

Orbital forging, Isothermal forging, Warm forging, Overview of Powder Metal techniques – Hot and Cold isostatic pressing - high speed extrusion, rubber pad forming, Hydroforming, Superplastic forming, Peen forming-micro blanking –Powder rolling – Tooling and process parameters- Advance welding process, techniques, scope and application of friction welding, diffusion welding, cold pressure welding and ultrasonic welding, high energy rate welding, electron beam and laser welding processes, under water welding - process & problem.
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UNIT 4 MICRO MACHINING AND NANO FABRICATION 9 hrs.

Theory of micromachining-Chip formation-size effect in micromachining- micro turning, micro milling, micro drilling- Micromachining tool design-Micro EDM- Micro wire EDM-Nano fabrication: LIGA, Ion beam etching, Molecular manufacturing techniques –Atomic machining- Nano machining techniques – Top/Bottom up Nano fabrication techniques - Sub micron lithographic technique, conventional film growth technique, Chemical etching, Quantum dot fabrication techniques – MOCVD – Epitaxy techniques.

UNIT 5 RAPID PROTOTYPING AND SURFACE MODIFICATIONTECHNIQUES 9 hrs.

Introduction – Classification – Principle advantages limitations and applications- Stereo lithography – Selective laser sintering –FDM, SGC, LOM, 3D Printing-Surface modification Techniques: Sputtering- CVD-PVD-Diamond like carbon coating- Plasma Spraying Technique.-Diffusion coatings-Pulsed layer deposition.

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: To produce useful research output in machining of various materials

CO2: Use this knowledge to develop hybrid machining techniques

CO3: Application of this knowledge to manage shop floor problems

CO4: Develop an understanding of micro and nano-fabrication techniques and their integration into advanced manufacturing processes.

CO5: Apply rapid prototyping and surface modification techniques for innovative product development and performance enhancement.

TEXT / REFERENCE BOOKS:

1. Benedict,G.F., "Non Traditional manufacturing Processes", CRC press,2011
2. Madou, M.J., Fundamentals of Micro fabrication: The Science of Miniaturization, Second Edition, CRC Press (ISBN: 0849308267), 2006.
3. Mc Geough,J.A., "Advanced methods of Machining",Springer,2011
4. Narayana swamy, R., Theory of Metal Forming Plasticity, Narosa Publishers, 1989.
5. Pandey, P.S. and Shah.N., ―Modern Manufacturing Processes‖, Tata McGraw Hill, 1980.
6. Serope Kalpakjian., ―Manufacturing Engineering and Technology, Pearson Education, 2001.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	3	2	2	1	1	1	1	3	2	1	3
CO2	1	1	1	1	2	1	1	1	1	1	1	2	1	1	2
CO3	1	1	1	1	2	1	2	1	1	1	1	2	2	1	2
CO4	1	1	1	1	2	2	1	1	1	1	1	3	1	1	2
CO5	1	1	1	1	3	1	1	1	1	1	1	2	2	1	1
CO	1	1	1	1	2.4	1.4	1.4	1	1	1	1	2.4	1.6	1	2

1 - low, 2 - medium, 3 - high

AMEPT1102- ADVANCED MATERIALS ENGINEERING

COURSE OBJECTIVES:

- This course is designed to provide details about behavior of engineering materials and various strengthening procedures.
- To gain knowledge about different modes of material fracture and procedureof failure analysis.
- To know about properties, processing and applications of both latest metallic and non-metallic.
- To acquire the essential knowledge about the selection of different latest materials for various applications.

UNIT 1 INTRODUCTION 9 hrs.

Elastic and plastic behavior –Elasticity in metals and polymers –Mechanism of plastic deformation, role of dislocation, yield stress, shear strength of perfect and real crystals – Strengthening mechanism ,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 behavior-super plasticity –Deformation of non crystalline material.

UNIT 2 FRACTURE MECHANISM 10 hrs.

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

UNIT 3 MATERIAL SELECTION AND CASE STUDIES 9 hrs.

Selection of materials –Motivation for selection, cost basis and service requirement– Selection of material properties, strength, toughness, fatigue and creep- Selection of surface durability corrosion and wear resistance– Relationship between material selection and processing– case studies in materials election with relevance to aero, auto, marine machinery and nuclear application.

UNIT 4 MODERN METALLIC MATERIALS 8hrs.

Modern metallic materials- alpha steels, Micro alloyed, high strength low alloy (HLSA) steel, Transformation induced in plasticity (TRIP) steel, Maraging steel-Inter metallic Ni and Ti aluminides –Smart materials, shape memory alloys– Metallic glass- Quasi crystal and nano crystalline materials.

UNIT 5 NONMETALLIC MATERIALS 9 hrs.

Non metallic materials –polymeric materials –Formation of polymer structure –production

techniques of fibre, foams, adhesives and coatings– structure, properties and application of engineering polymers– advanced structural ceramics, WC, TiC, TaC, Al_2O_3, SiC, Si_3N_4, CBN and diamond- properties, processing and application.

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects.

CO1: Analyse the fracture mechanism and causes.

CO2: Selection of suitable materials for engineering components.

CO3: Identify and be aware of latest metallic and non metallic materials.

CO4: Understand and evaluate strengthening mechanisms and their impact on the mechanical properties of materials under various conditions.

CO5: Apply knowledge of material properties and processing techniques to enhance the performance and durability of engineering components in diverse applications

REFERENCE BOOKS:

1. Thomas H. Courtney, Mechanical behavior of materials‖, (2nd edition), McGraw-hill, 2000.
2. Charles J.A. Crane, F.A. Aand Furness, J.A.G., Selection and use of engineering materials‖, (3rd edition), Butterworth Heiremann,1977.
3. Flinn,r.a and Trojan, P.K., Engineering materials and their application, (6th edition), Jaico,2000
4. George E.Dieter, Mechanical metallurgy, McGraw Hill, 1988.
5. Metals handbook, vol.10 ‖Failure analysis and prevention, (10th edition), 1994.
6. KennethG. Budinski., Engineering materials: properties and selection, 7th edition, prentice hall of India limited, New Delhi, 2005.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	2	3	3	2	1	1	1	3	2	1	3
CO2	1	1	1	1	1	2	3	2	1	1	1	3	2	1	3
CO3	1	1	1	1	2	2	3	1	1	1	1	3	2	1	3
CO4	1	1	1	1	2	3	2	1	1	1	1	3	2	1	3
CO5	1	1	1	1	1	3	3	2	1	1	1	2	2	1	3
CO	1	1	1	1	1.6	2.6	2.8	1.6	1	1	1	2.8	2	1	3

1 - low, 2 - medium, 3 – high

AMEPT1103- METAL CUTTING THEORY AND TOOL DESIGN

COURSE OBJECTIVES:

- To study the various design considerations for tooling.
- Develop knowledge in metal cutting tooling and work holding devices

UNIT 1 INTRODUCTION 9 hrs.

Manufacturing Processes-objectives of manufacturing processes-classification of manufacturing process-Objectives of Tool design-tool design process-Nature and scope of Tool engineering- principles of economy for tooling-problems of economy in tooling-planning and tooling for economy- Manufacturing principles applicable to process and tool planning-tool control-tool maintenance-tool materials and its selection.

UNIT 2 THEORY OF METAL CUTTING 9 hrs.

Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools – nomenclature, orthogonal metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and machinability.

UNIT 3 TOOLING FOR METAL REMOVAL PROCESSES 9 hrs.

Traditional machining processes -work and tool holding devices-tool nomenclatures-Mechanism of machining-force temperature and tool life of single point tool-multipoint tools -tool design-tool wear- special processes-capstan and turret lathe-tooling layout of automats-tooling in NC and CNC machines-tooling for machining centres-CAD in tool design-Jigs and fixtures-design-Non-traditional material removal processes-mechanical, electrical thermal and chemical energy processes-principles- operation-equipment-tooling parameters and limitations.

UNIT 4 TOOLING FOR METAL FORMING PROCESSES 9 hrs.

Classification of Forming processes-Types of presses-design of -blanking and piercing dies-simple, compound, combination and progressive dies-Drawing dies-Bending dies-forging dies-plastic moulding dies.

UNIT 5 TOOLING FOR METAL CASTING & METAL JOININGPROCESSES 9 hrs.

Tools and Equipment for moulding-patterns –pattern allowances – pattern construction-die casting tools- mechanization of foundries. Tooling for Physical joining processes, Design of welding fixtures – Arc welding, Gas welding, Resistance welding, laser welding fixtures-Tooling for Soldering and Brazing Tooling for Mechanical joining processes.

Total : 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: Demonstrate a comprehensive understanding of tooling principles and their applications in manufacturing and inspection.

CO2: Design and develop advanced tooling systems for flexible manufacturing setups, ensuring efficiency and adaptability.

CO3: Apply the principles of metal cutting theory to optimize machining processes, enhance tool performance, and improve product quality.

CO4: Design and select appropriate tooling for diverse metal forming, casting, and joining processes, considering materials, techniques, and operational parameters.

CO5: Incorporate modern technologies, such as CAD and CNC tooling, to improve precision, productivity, and process flexibility in manufacturing operations..

REFERENCE BOOKS:

1. Cyril Donaldson, Tool Design, Tata McGraw Hill, 1976
2. Hoffman E.G, Fundamentals of tool design SME 1984.
3. Kalpak Jian S., Manufacturing Engineering and Technology Addison Wesley 1995.
4. Wellar, J, Non-Traditional Machining Processes, SME, 1984

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	2	3	1	1	1	1	1	2	3	2	1	2
CO2	1	2	2	1	3	1	1	1	1	1	2	2	2	1	2
CO3	2	2	2	2	3	1	1	1	1	1	2	2	1	2	2
CO4	2	3	2	1	3	1	1	1	1	1	2	2	1	2	1
CO5	1	2	2	2	1	1	1	1	1	1	2	3	2	2	1
CO	1.6	2.4	2	1.6	2.6	1	1	1	1	1	2	2.4	1.6	1.6	1.6

1 - low, 2 - medium, 3 - high

AMEPT1104- MECHATRONICS IN MANUFACTURING SYSTEMS

COURSE OBJECTIVES:

- To provide basic knowledge about different types of sensors, controllers and actuatorsused in Mechatronics system.
- To gain knowledge in signal conditioning principles.
- To gain programming knowledge using microcontroller and PLC in manufacturing systems.

UNIT 1 INTRODUCTION 5 hrs.

Mechatronics – key elements - integrated design issues in Mechatronics – design procedures for Mechatronics systems - advanced approaches in Mechatronics

UNIT 2 SENSORS AND TRANSDUCERS 10 hrs.

Introduction to sensors and transducers –performance & characteristics of sensors - sensors for motion, position, force, torque, flow, temperature. Selection of sensors.– Signal conditioning – analog devices – op amp - inverting, non-inverting, comparator, differentiator, integrator - filtering – low, high and band pass filtering – wheat stone bridge. Quantization theory - DAC – ADC conversion

UNIT 3 ACTUATORS 10 hrs.

Mechanical (self study), Hydraulics / pneumatics – actuating devices – DCVs, flow and pressure control systems – cascading circuits. Electrical – AC & DC motors – stepper motors. Selection of actuators, modeling of electromechanical systems, hydraulic – mechanical systems.

UNIT 4 SIGNALS, SYSTEMS AND CONTROLS 10 hrs.

Modeling dynamic systems – first and second order systems – performance measures. Frequency response – sinusoidal input – root locus – bodo plots – stability – performance specifications. Controls –modes – proportional – derivative – integral – PID – digital controllers. Introduction to microcontroller: Architecture, programming, I/O, Computer interfacing, Programmable logic controller basics. PLC – basic structure – input/output processing.

UNIT 5 APPLICATIONS IN MECHATRONICS 10 hrs.

Sensors for condition monitoring, Mechatronics control for automated manufacturing, artificial intelligence in Mechatronics, fuzzy logic application in Mechatronics, micro sensors in Mechatronics.

Total: 45 Periods

COURSE OUTCOMES :

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: The students should be capable to select suitable sensors, control methods and actuatorsfor better manufacturing systems.
CO2: Capable to program using microcontroller and PLC.
CO3: Should be able to design effective Mechatronics system using advanced signal conditioning aspects

CO4: Time and Frequency domain analysis of system model (for control application)
CO5: PID control implementation on real time systems

REFERENCE BOOKS:

1. Isermann Rolf fundamentals, Mechatronic systems [Book].-New Delhi: Springle International Edition, 2005.
2. Modern Control Engineering (5th Edition) by Katsuhiko Ogata.
3. Necsulescu Dan Mechatronics [Book].-NewDelhi: Pearsons,2002.
4. Onwubolu Godfrey C Mechatronics principles and applications [Book].-India:Elsevier,2006.
5. Hist and Micheal B. and Alciatore David G. Introduction to Mechatronics and Measurement systems [Book].-Singapore: McGraw Hill International Ed, 1999.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	3	1	1	1	1	1	1	3	2	2	2
CO2	1	1	1	1	3	1	1	1	1	1	1	2	1	2	2
CO3	1	1	1	1	2	1	1	1	1	1	1	2	1	1	2
CO4	2	1	1	1	2	1	1	1	1	1	1	3	2	2	1
CO5	2	1	1	1	3	1	1	1	1	1	1	3	2	2	2
CO	1.6	1	1	1	2.6	1	1	1	1	1	1	2.6	1.6	1.8	1.8

1 - low, 2 - medium, 3 - high

AMEPL1101- CIM AND MECHATRONICS LABORATORY

COURSE OBJECTIVES:

- To have practical knowledge on Solid modeling, CNC programming and simulations
- To study the definition and elements of mechatronics system.
- To learn how to acquire and process real time signals by using sensors.
- To simulate various mathematical functions and also electronic devices.

CIM LAB

Computer Aided Drafting – Operating Systems – Wire Frame, Surface and Solid Modeling – Pro E Study -Helical Gear Solid Modeling using Pro-E –XL Mill CNC Milling [Projection] - Study of Profile Projector -Measurement of Thread Parameter Using Profile projector - Study of Co-ordinate Measuring Machine - XL Turn CNC Lathe [Turning, Facing, drilling and Contouring] –study of feedback milling machine(linear and circular interpoalation)- Manufacturing Simulation Using LEKIN Scheduling Software Package-MiniProject in LEKIN

FIRST CLYCLE

1. Study of Mechatronics system Design
2. Introduction to Lab view
3. Temperature control system using Lab view
4. Design of Vehicle speed indicator using Lab view
5. Measurement of Pressure using Load cell and Lab view
6. Bio signal measurement and Analysis using Lab view

SECOND CYCLE

1. Resistor simulation
2. Capacitor simulation
3. Simple Servo simulation
4. Simple pendulum Simulation
5. Matlab Simulation for performing simple mathematical functions
6. Matlab Simulation of four bar mechanism.

Total: 60 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in thefollowing aspects

CO1: Firm base of knowledge relevant to mechatronics, and the ability to apply and extend this knowledge.

CO2: Ability to integrate mechanical engineering with electronics and intelligent computer control in designing and manufacturing machines, products, and processes.

CO3: Ability to function effectively on problem-solving teams and to coordinate and provide leadership for teams, including multidisciplinary teams.

CO4: Proficiency in utilizing modern software tools such as Labview, MATLAB, and Pro-E for simulation and analysis of engineering systems.

CO5: Competence in implementing and analyzing real-time systems involving sensors, actuators, and control systems to solve engineering challenges.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	3	2	1	1	1	1	2	2	2	2	3
CO2	2	2	1	1	3	2	1	1	1	1	2	2	2	1	3
CO3	2	2	1	1	2	2	1	1	1	1	2	2	2	2	3
CO4	3	2	1	1	3	2	1	1	1	1	1	2	1	1	3
CO5	3	2	1	1	2	2	1	1	1	1	2	2	2	2	3
CO	2.6	2	1	1	2.6	2	1	1	1	1	1.8	2	1.8	1.6	3

1 - low, 2 - medium, 3 - high

II Semester

AMEPT1105- OPTIMIZATION TECHNIQUES IN MANUFACTURING

COURSE OBJECTIVES:

- To make use of the above techniques while modeling and solving the engineering problemsof different fields.

UNIT 1 INTRODUCTION 9 hrs.

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

UNIT 2 CLASSIC OPTIMIZATION TECHNIQUES 9 hrs.

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

UNIT 3 NON-LINEAR PROGRAMMING 9 hrs.

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

UNIT 4 INTEGER PROGRAMMING AND DYNAMIC PROGRAMMING AND NETWORK TECHNIQUES 9 hrs.

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

UNIT 5 ADVANCES IN SIMULATION 9 hrs.

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

Total: 45 Periods

COURSE OUTCOMES :

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: Ability to adopt suitable optimization techniques for solving industrial problems.
CO2: Apply various optimization techniques in process management, material selection, in-house material movement, and logistics in manufacturing applications.
CO3: Demonstrate problem-solving skills using advanced optimization tools like genetic algorithms, simulated annealing, and fuzzy systems.
CO4: Analyze and solve network optimization problems, including shortest path, minimum spanning tree, and maximal flow problems.
CO5: Integrate simulation techniques with optimization methods to address complex manufacturing challenges efficiently.

REFERENCE BOOKS::

1. Hamdy A. Taha, Operations Research – An Introduction, Prentice Hall of India,1997

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

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	3	3	2	2	1	1	1	1	1	1	3	2	2
CO2	2	3	2	3	2	3	3	1	1	1	1	1	3	2	2
CO3	2	2	3	3	3	3	2	1	1	1	1	1	3	2	2
CO4	1	3	3	3	3	3	2	1	1	1	1	1	3	2	2
CO5	2	3	3	3	2	3	1	2	1	1	1	1	3	2	2
CO	1.6	2.8	2.8	3	2.4	2.8	1.8	1.2	1	1	1	1	3	2	2

1 - low, 2 - medium, 3 - high

AMEPT1135 MANUFACTURING AUTOMATION

COURSE OBJECTIVES:

- The aim of this course is to introduce the students about the advanced automation theories and understanding of its devices.
- This subject is useful to understand the different types of automation and production system used in industries.

UNIT 1 ADVANCED AUTOMATION FUNCTIONS 9 hrs.

Automation and types, Automated Manufacturing System, Reasons for Automating, Strategies for automation and process improvement, automation migration strategies, levels of automations, Types of Automations.

UNIT 2 GROUP TECHNOLOGY 9 hrs.

Part family, Part classification and coding, production flow analysis – OPITZ classification system, cellular manufacturing, quantitative analysis in cellular manufacturing. Rank Order Clustering Technique (ROC), Holier Method –I,II, Single Linkage Cluster Analysis Technique(SLCA). Application of group technology.

UNIT 3 AUTOMATED MACHINERY 9 hrs.

Introductions, Automated transfer machine, automated transfer line, auto-storage and retrieval system, automated guided vehicles, automated material handling system, automated inspection system and CMM.

UNIT 4 MODULAR AUTOMATION DESIGN 9 hrs.

Introduction to modular design, modular automations, Case study for modular design: Casting shop design, Press working shop design, Machine shop design.

UNIT 5 AUTOMATION ECONOMY 9 hrs.

Plant Economy, feasibility of automation on economical sense, effect of automation on economy, feasibility of automation in Indian market, Scope of automation in Indian industries, Break Even point analysis for automation.

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: In manufacturing industries, the engineers would be benefited after having learn the concepts of how the products are manufactured with appropriate automation systems

CO2: Students can think and develop innovative idea in the area of shop floor automation.

CO3: Analyze various automated flow lines, Explain assembly systems and automated inspection system and CMM

CO4: Describe the importance of modular design and modular automations.

CO5: Interpret the importance of adaptive control systems, feasibility of automation on economical sense.

REFERENCE BOOKS:

1. Deb S. R,,Robotics Technology & Flexible Automation- Tata McGraw Hill, 2009.
2. Thomas R. Kurfess, Robotics and Automation Handbook-1 ed., CRC Press 2005.
3. Bolton, W,Mechatronics: A Multidisciplinary Approach- 4th ed., Pearson 2015
4. Viswanathan,N., and Narahari,Y., Performance Modeling and Automated Manufacturing Systems- Prentice Hall of India Pvt. Ltd., 2000

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	3	1	1	1	1	1	2	1	1	1	3
CO2	3	1	1	1	3	1	1	1	1	1	2	1	1	1	3
CO3	3	2	1	1	3	1	1	1	1	1	2	1	1	1	3
CO4	3	3	3	3	3	1	1	1	1	1	2	1	1	1	3
CO5	3	3	3	3	3	1	1	1	1	1	2	1	1	1	3
CO	3	2.2	2	2	3	1	1	1	1	1	2	1	1	1	3

1 - low, 2 - medium, 3 - high

AMEPT1136- ENERGY MANAGEMENT

COURSE OBJECTIVES:

• To provide students with a general awareness on the importance of energy and its conservation, its impact on society, various energy sources, energy conversion processes, energy management, energy audit and energy conservation measures.

UNIT 1 ENERGY RESOURCES 9 hrs.

Energy resources, Energy conversion processes and devices – Energy conversion plants – Conventional - Thermal, Hydro, Nuclear fission , and Non – conventional – Solar, Wind Biomass, Fuel cells, Magneto Hydrodynamics and Nuclear fusion. Energy from waste, Energy plantation.

UNIT 2 ENERGY STORAGE AND DISTRIBUTION 9 hrs.

Energy storage and Distribution – Electrical energy route – Load curves – Energy conversion plants for Base load , Intermediate load, Peak load and Energy displacement – Energy storage plants.

Energy Scenario – Global and Indian –Impact of Energy on economy, development and environment, Energy policies, Energy strategy for future.

UNIT 3 ENERGY MANAGEMENT & AUDIT 9 hrs.

Energy Management – Definitions and significance – objectives –Characterising of energy usage

– Energy Management program – Energy strategies and energy planning Energy Audit – Types and Procedure – Optimum performance of existing facilities – Energy management control systems – Computer applications in Energy management.

UNIT 4 ENERGY MANAGEMENT IN MANUFACTURING 9 hrs.

Working principles of major energy consuming equipment in manufacturing facilities; fundamentals of energy analysis; energy saving measures in industrial facilities; utility analysis for natural gas and electricity; lighting, air conditioning, pumps, fans, motors, process heating and cooling, compressed air, steam.

UNIT 5 ENERGY CONSERVATION 9 hrs.

Energy conservation – Principles – Energy economics – Energy conservation technologies – cogeneration – Waste heat recovery – Combined cycle power generation – Heat Recuperators – Heat regenerators – Heat pipes – Heat pumps – Pinch Technology.Energy Conservation Opportunities – Electrical ECOs – Thermodynamic ECOs in chemical process industry – ECOs in residential and commercial buildings – Energy Conservation Measures.

Total : 45 Periods

COURSE OUTCOMES:

CO1: The students shall have an understanding of the impact of energy on society , the need for sustainable energy, global and Indian energy policies .

CO2: They would have gained knowledge on various techniques of energy management and conservation.

CO3: They would also have gained the basic ideas of conducting an energy audit

CO4: Learn the working of different Instruments/Devices used for Energy Auditing

CO5: Learn about power saving various instruments and controls

REFERENCE BOOKS:

1. Amlan Chakrabarti, Energy Engineering and Management, Prentice Hall India, 2011.
2. Eastop T. D. and D. R. Croft, Energy Efficiency for Engineers & Technologists, Longman, 1990.
3. Albert Thumann P. E. and W. J. Younger, Handbook of Energy Audits, Fairmont Press, 2008.
4. Doty S. and W. C. Turner, Energy Management Hand book, 7/e, Fairmont Press, 2009.
5. Rao S. and B. B. Parulekar, Energy Technology, Khanna Publishers, 2005.
6. Rai G. D., Non-conventional Energy Sources, Khanna Publishers, 2011.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	2	3	3	1	1	1	2	2	1	1	1
CO2	3	1	1	1	1	2	3	1	1	1	2	2	1	1	1
CO3	3	1	1	1	2	2	2	1	1	1	2	2	1	1	1
CO4	3	1	1	1	1	3	3	1	1	1	1	2	1	1	1
CO5	3	1	1	1	2	3	3	1	1	1	2	2	1	1	1
CO	2.8	1	1	1	1.6	2.6	2.8	1	1	1	1.8	2	1	1	1

1 - low, 2 - medium, 3 - high

AMEPT1108- MODELLING AND ANALYSIS OF MANUFACTURING SYSTEMS

COURSE OBJECTIVES:

- Familiarize with methods to characterize dynamical behaviour of mechanical system using the models
- Provide understanding of basic concepts of control theory, along with the various control structures & elements
- Describe a few techniques for designing control systems

UNIT 1 INTRODUCTION TO MODELLING & REPRESENTATION 9 hrs.

Objective, basic modeling concepts & types of models, Models of simple physical systems, linearization of nonlinear models and role of Linear Time Invariant (LTI) forms, I/O form, block diagram representation and manipulation, signal flow graphs, Laplace transform and transfer function concept

UNIT 2 RESPONSE & STABILITY ANALYSES 9 hrs.

Test signals, response of 1st and 2nd order, as well as, higher order systems, Stability / its connection to response, asymptotic and BIBO stability, role of characteristic roots, Routh's stability criterion & procedure

UNIT 3 INTRODUCTION TO CONTROL 9 hrs.

Control objectives, open/ closed loop control and structures, unity negative feedback systems, and basic control actions, Transient & steady-state responses, tracking & transient response features, Proportional control action, relative stability and response, concept of root locus and its application to proportional, PI, PD and PID control actions

UNIT 4 CONCEPT OF FREQUENCY RESPONSE 9 hrs.

Frequency response & its representation using bode', Nyquist plots, Nyquist stability analysis, concepts of gain & phase crossover, gain and phase margins, bandwidth and resonant amplitude as closed-loop system attributes

UNIT 5 DESIGN OF CONTROL ELEMENTS: 9 hrs.

Design of P, PI, PD & PID control elements using both root locus and frequency response techniques, Design of lead, lag and lag-lead compensators using both root locus and frequency response techniques.

Total: 45 Periods

COURSE OUTCOMES :

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: Develop necessary mathematical models from the knowledge of the mechanical engineering discipline, and become familiar with various strategies for their representation

and solution

CO2: Set up a suitable control structure and acquire clarity about various control tasks and the corresponding elements to achieve the tasks

CO3: Interpret the closed-loop control design requirements in terms of simpler quantitative attributes and apply the design procedures to arrive at the required control scheme

CO4: Conceptualize real world situations related to Nyquist plots, Nyquist stability analysis, gain and phase margins, bandwidth and resonant amplitude.

CO5: Develop skills to apply simulation software to PID control elements using both root locus and frequency response techniques.

REFERENCE BOOKS::

1. Ogata, K., Modern Control Engineering, 5th Edition, Prentice-Hall India, (EEE)
2. Nise, N.S., Control Systems Engineering, 6th Edition, John-Wiley India, (WSE)
3. Gopal,M., Control Systems - Principles & Design, 3rd Edition, Tata McGraw-Hill
4. Dorf, R.C. & Bishop, R.H., Modern Control Systems, 11th Edition, Pearson

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	1	3	1	1	1	1	1	1	2	2	1	2
CO2	2	3	2	1	3	1	1	1	1	1	1	1	2	1	2
CO3	2	3	2	1	3	1	1	1	1	1	1	2	2	1	1
CO4	2	3	2	1	3	1	1	1	1	1	1	1	2	1	2
CO5	2	3	2	1	3	1	1	1	1	1	1	2	2	1	2
CO	2	3	2	1	3	1	1	1	1	1	1	1.6	2	1	1.8

1 - low, 2 - medium, 3 - high

AMEPL1102- SIMULATION AND WELDING LABORATORIES

COURSE OBJECTIVES:

- To provide software simulation knowledge for various types of manufacturing systems.
- To make use of various software‘s for simulating and to evaluate and validate the systems, built by simulation.
- To provide exposure to the students on various welding processes and modeling welding processes.

SIMULATION LAB

Introduction to simulation languages-Simulation procedure-simulation of manufacturing systems- use of simulation software‘s – PROMODEL, ARENA, PreActor, CATIA.

WELDINGLAB

1. MIG Welding of T-Joints
2. TIG Welding of Aluminium (Butt Joint)
3. Pulse TIG Welding of S.S.plates
4. Pulse TIG Welding of S.S.MS plates
5. MIGSS Cladding of structural Steel
6. Stelliting by TIG Welding
7. Stelliting by Plasma transformed Arc Welding
8. Measurements of Ferrite Content in Austenitic Stainless Steel Weldments
9. Corrosion Studies of weld components AC Impedance, Cycles weep, Customs weep, Rest Potential, Pitting Corrosion, IGC.

Total: 45 Periods

COURSE OUTCOME

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: To simulate and validate any type of manufacturing systems and flexibly use suitable software.
CO2: To select suitable welding technique for the contemporary issues in manufacturing industries.
CO3: To model and optimize welding processes
CO4: Evaluate the quality and integrity of weldments using advanced measurement techniques.
CO5: Analyze the corrosion behavior of welded components and suggest suitable preventive measures.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	3	1	1	1	1	1	1	2	3	2	2
CO2	2	3	1	2	3	1	1	1	1	1	1	1	2	1	1
CO3	3	2	2	2	3	1	1	1	1	1	1	1	2	2	1
CO4	3	3	2	1	3	1	1	1	1	1	1	2	3	1	2
CO5	2	3	2	2	3	1	1	1	1	1	1	2	1	2	2
CO	2.6	2.8	1.8	1.8	3	1	1	1	1	1	1	1.6	2.2	1.6	1.6

1 - low, 2 - medium, 3 - high

Programme Elective

Elective-I

AMEPT1109- FLUID POWER AUTOMATION

COURSE OBJECTIVES:

- To make the students to learn the basic concepts of hydraulics and pneumatics and their controlling elements in the area of manufacturing process.
- To train the students in designing the hydraulic and pneumatic circuits using various design procedures.

UNIT 1 INTRODUCTION 9 hrs.

Need for Automation, Hydraulic & Pneumatic Comparison – ISO symbols for fluid power elements, Hydraulic, pneumatics – Selection criteria.

UNIT 2 FLUID POWER GENERATING / UTILIZING ELEMENTS 9 hrs.

Hydraulic pumps and motor gears, vane, piston pumps-motors-selection and specification-Drive characteristics – Linear actuator – Types, mounting details, cushioning – power packs – construction. Reservoir capacity, heat dissipation, accumulators – standard circuit symbols, circuit (flow) analysis.

UNIT 3 CONTROL AND REGULATION ELEMENTS 9 hrs.

Direction flow and pressure control valves-Methods of actuation, types, sizing of ports-pressure and temperature compensation, overlapped and underlapped spool valves-operating characteristics- electro hydraulic servo valves-Different types-characteristics and performance.

UNIT 4 CIRCUIT DESIGN 9 hrs.

Typical industrial hydraulic circuits-Design methodology – Ladder diagram-cascade,method-truth table-Karnaugh map method-sequencing circuits-combinational and logic circuit.

UNIT 5 ELECTRO PNEUMATICS & ELECTRONIC CONTROL OF HYDRAULIC AND PNEUMATIC CIRCUITS 9 hrs.

Electrical control of pneumatic and hydraulic circuits-use of relays, timers, counters, Ladder diagram. Programmable logic control of Hydraulics Pneumatics circuits, PLC ladder diagram for various circuits, motion controllers, use of field busses in circuits. Electronic drive circuits for various Motors.

Total: 45 Periods

COURSE OUTCOMES :

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: Familiarize in the area of hydraulics, pneumatic and fluid power components and its functions.

CO2: Create electro, hydraulic and pneumatic circuit design

CO3:Select and size components for electro hydraulic servo systems.
CO4:Implement fluid power systems for industrial automation, including combinational and logic circuit.
CO5: Integrate fluid power systems with Electrical control of pneumatic and hydraulic circuits.

REFERENCE BOOKS::

1. Antony Esposito, Fluid Power Systems and control Prentice-Hall,1988
2. Dudbey. A. Peace, Basic Fluid Power, Prentice Hall Inc, 1967.
3. E.C.Fitch and J.B.Suryaatmadyn. Introduction to fluid logic, McGraw Hill,1978
4. Herbert R. Merritt, Hydraulic control systems, John Wiley & Sons, Newyork,1967
5. Peter Rohner, Fluid Power Logic Circuit Design, Mcmelan Prem,1994.
6. Peter Rohner, Fluid Power logic circuit design. The Macmillan Press Ltd.,London,1979
7. W.Bolton, Mechatronics, Electronic control systems in Mechanical and Electrical Engineering Pearson Education, 2003.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	1	3	1	2	1	1	1	1	1	2	1	3
CO2	3	1	1	2	2	2	1	1	1	1	1	1	2	1	2
CO3	2	1	2	2	2	2	1	1	1	1	1	1	2	1	3
CO4	2	2	2	1	3	2	2	1	1	1	1	1	2	1	2
CO5	3	2	1	2	3	1	2	1	1	1	1	1	2	1	3
CO	2.6	1.6	1.6	1.6	2.6	1.6	1.6	1	1	1	1	1	2	1	2.6

1 - low, 2 - medium, 3 - high

AMEPT1110- MICRO AND NANO MANUFACTURING

COURSE OBJECTIVE:

- To teach important topics in precision, micro/nano manufacturing based on the fundamentals enabling technologies.

UNITI INTRODUCTION TO PRECISION ENGINEERING AND PRACTICES 9 hrs.

Definitions- origin and application of micro and nano manufacturing- scope of precision manufacturing, sources of error.

UNIT 2 BASIC CONCEPTS OF MACHINING AND PRECISION ENGINEERING 9 hrs.

Machine tool variable accuracy, repeatability, stiffness, spindle vibration, flatness, straightness, and smoothness of motion, 1-2 DOF systems, feedback variables, cutting tool variables, workpiece variables, environment effects and thermal errors. Machine design for precision manufacturing, principles of measurement mechanical errors.

UNIT 3 MICRO MACHINING TECHNIQUES 9 hrs.

Diamond micromachining introduction, diamond as a tool material, compatible materials, diamond performance, diamond machining, micro-mechanical applications. Micro-ECM, micro-EDM, Micromilling: micro-milling tools, process results and micro-milling applications. Microdrilling: micro-drilling and macro-drilling techniques. Laser micromachining: laser optics, laser ablation, heat affected zone and laser polymerization.

UNIT 4 JOINING PROCESSES 9 hrs.

Joining processes in similar and dissimilar materials; welding processes like ultrasonic, electron beam, laser beam and associated applications.

UNIT 5 MICRO CASTING 9 hrs.

Casting processes- vacuum, semi-solid state; applications processing of integrated circuits, clean rooms, crystal growing and shaping of wafers, etching, photo and other lithography techniques, impurity introduction, thermal oxidation, CVD etc.

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects

CO1: understand the design and process issues associated with precision machine tools and the fabrication of precision components.

CO2: Develop a conceptual design solution to a precision machine operating in the small scale range

CO3: Understand various fabrication techniques in manufacturing micrometer scaled devices and systems of complicated geometry

CO4: Able to apply the knowledge in similar and dissimilar materials; welding processes like ultrasonic, electron beam, laser beam and associated applications

CO5: Able to understand innovative applications processing of integrated circuits.

REFERENCE BOOKS:

1. Murthy R. L., Precision engineering manufacturing, New Age International, 2005
2. Suryaprakash M. V., Precision Engineering, Narosa publications
3. Venkatesh V. C., Precision Engineering, McGraw Hill Publications
4. Nakazawa H., Principles of precision engineering, Oxford University Press

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	1	3	2	2	1	1	1	1	2	2	2	3
CO2	1	2	1	1	2	2	1	1	1	1	2	2	2	2	2
CO3	1	2	2	1	2	2	1	1	1	1	1	2	1	1	2
CO4	1	2	2	1	3	2	2	1	1	1	2	1	2	1	3
CO5	2	1	2	1	3	2	2	1	1	1	2	2	2	2	3
CO	1.4	1.6	1.8	1	2.6	2	1.6	1	1	1	1.6	1.8	1.8	1.6	2.6

1 - low, 2 - medium, 3 - high

AMEPT1111 - QUALITY AND RELIABILITY ENGINEERING

COURSE OBJECTIVE:

- To make the students to understand the various quality control techniques and to construct thevarious quality control charts for variables and attributes
- The design concepts for reliable system and maintenance aspects in industries.

UNIT 1 QUALITY & STATISTICAL PROCESS CONTROL 9 hrs.

Quality – Definition – Quality Assurance – Variation in process – Factors – process capability – control charts – variables X, R and X, - Attributes P, C and U-Chart tolerance design. Establishing and interpreting control charts – charts for variables – Quality rating – Short run SPC.

UNIT 2 ACCEPTANCE SAMPLING 9 hrs.

Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling plans – OC curves – Producer‘s risk and consumer‘s risk. AQL, LTPD, AOQL, Concepts – standard sampling plans for AQL and LTPD – use of standard sampling plans.

UNIT 3 EXPERIMENTAL DESIGN AND TAGUCHI METHOD 9 hrs.

Fundamentals – factorial experiments – random design, Latin square design – Taguchi method – Loss function – experiments – S/N ratio and performance measure – Orthogonal array.

UNIT 4 CONCEPT OF RELIABILITY 9 hrs.

Definition – reliability vs quality, reliability function – MTBF, MTTR, availability, bathtub curve – time dependent failure models – distributions – normal, weibull, lognormal – Reliability of system and models – serial, parallel and combined configuration – Markove analysis, load sharing systems, standby systems, covarient models, static models, dynamic models.

UNIT 5 DESIGN FOR RELIABILITY AND MAINTAINABILITY 9 hrs.

Reliability design process, system effectiveness, economic analysis and life cycle cost, reliability allocation, design methods, parts and material selection, derating, stress-strength and analysis, failure analysis, identification determination of causes, assessments of effects, computation of criticality index, corrective action, system safety – analysis of down-time – the repair time distribution, stochastic point processes system repair time, reliability under preventive maintenance state dependent system with repair. MTTR – mean system down time, repair vs replacement, replacement models, proactive, preventive, predictive maintenance maintainability and availability, optimization techniques for system reliability with redundancy heuristic methods applied to optimal system reliability.

Total: 45 Periods

COURSE OUTCOMES :

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: Various quality control techniques and applications
CO2: Understand the importance and concept of reliability and maintainability in industries.
CO3: Describe Fundamentals of Taguchi method Loss function
CO4: Acquire basic knowledge of Reliability of system and models serial, parallel and combined configuration
CO5: Understand the concepts of reliability and maintainability

REFERENCE BOOKS:

1. Amata Mitra –Fundamentals of Quality Control and improvement‖ Pearson Education,2002.
2. Bester field D.H., –Quality Control‖ Prentice Hall,1993.
3. Charles E Ebling, An Introduction to Reliability and Maintability Engineering, Tata-McGraw Hill, 2000.
4. David J Smith, Reliability, Maintainability and Risk: Practical Methods for Engineers, Butterworth 2002.
5. Dhillon, Engineering Maintainability – How to design for reliability and easy maintenance, PHI, 2008.
6. Patrick D To‘ corner, Practical Reliability Engineering, John-Wiley and Sons Inc,2002

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	1	1	1	2	1	1	2	2	2	1
CO2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO3	1	2	2	1	2	1	1	1	2	1	1	2	2	2	1
CO4	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO5	1	2	2	1	2	1	1	1	2	1	1	2	2	2	1
CO	1.6	1.6	1.6	1.2	1.6	1	1	1	1.6	1	1	1.6	1.6	1.6	1

1 - low, 2 - medium, 3 - high

AMEPT1112- VIBRATION ANALYSIS AND CONDITIONMONITORING

COURSE OBJECTIVES:

- To gain knowledge about the basic fundamental of CAD.
- To gain knowledge on how computers are integrated at various levels of planning and manufacturing understand computer aided planning and control and computer monitoring.

UNIT 1 COMPUTER AIDED DESIGN 9 hrs.

Concept of CAD as drafting and designing facility, desirable features of CAD package, drawing features in CAD – Scaling, rotation, translation, editing, dimensioning, labeling, Zoom, pan, redraw and regenerate, typical CAD command structure, wire frame modeling, surface modeling and solid modeling (concepts only) in relation to popular CAD packages.

UNIT 2 COMPONENTS OF CIM 9 hrs.

CIM as a concept and a technology, CASA/Sme model of CIM, CIM II, benefits of CIM, communication matrix in CIM, fundamentals of computer communication in CIM – CIM data transmission methods – seriel, parallel, asynchronous, synchronous, modulation, demodulation, simplex and duplex. Types of communication in CIM – point to point (PTP), star and multiplexing. Computer networking in CIM – the seven layer OSI model, LAN model, MAP model, network topologies – star, ring and bus, advantages of networks in CIM

UNIT 3 GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING 9 hrs.

History Of Group Technology – role of G.T in CAD/CAM Integration – part families-classification and coding – DCLASS and MCLASS and OPTIZ coding systems – facility design using G.T – benefits of G.T – cellular manufacturing. Process planning - role of process planning in CAD/CAM Integration – approaches to computer aided process planning – variant approach

UNIT 4 SHOP FLOOR CONTROL AND INTRODUCTIONT OF FMS 9 hrs.

Shop floor control – phases – factory data collection system – automatic identification methods – Bar code technology – automated data collection system. FMS – components of FMS – types – FMS workstation – material handling and storage system – FMS layout-computer control systems – applications and benefits.

UNIT 5 COMPUTER AIDED PLANNING AND CONTROL AND COMPUTER MONITORING 9 hrs.

Production planning and control – cost planning and control – inventory management – material requirements planning (MRP) – shop floor control. Lean and Agile Manufacturing. Types of production monitoring systems – structure model of manufacturing – process control and strategies – direct digital control.

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: To produce useful research output in computer integrated manufacturing
CO2: Use this knowledge to develop computer techniques
CO3: Application of this knowledge to functionalise computer aided planning.
CO4: Identify applications and benefits through automated data collection system
CO5: Monitoring machinery Production planning and control through Lean and Agile Manufacturing

REFERENCE BOOKS::

1. Chris McMahon and Jimmie Browne, ‑CAD CAM Principles, Practice and Manufacturing Management‖, Pearson Education second edition, 2005.Ranky, Paul G., ‑Computer Integrated Manufacturing, Prentice hall of India Pvt. Ltd.,2005.
2. James A. Regh and Henry W. Kreabber, ‑Computer Integrated Manufacturing, Pearson Education second edition, 2005.
3. Mikell. P. Groover―Automation, Production Systems and Computer Integrated Manufacturing, Pearson Education 2001.
4. Mikell. P. Groover and Emory Zimmers Jr.,―CAD/CAM, Prentice hall of India Pvt. Ltd.,199 8.
5. P N Rao, ― CAD/CAM Principles and Applications, TMH Publications, 2007.
6. Yorem Koren, ―Computer Integrated Manufacturing, McGraw Hill, 2005.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	1	1	1	2	1	1	2	2	2	2
CO2	2	2	2	1	1	1	1	1	1	1	1	2	2	1	1
CO3	3	2	2	2	2	1	1	1	2	1	1	2	2	2	2
CO4	3	1	1	2	2	1	1	1	2	1	1	1	1	2	2
CO5	2	2	2	1	2	1	1	1	2	1	1	2	2	2	1
CO	2.6	1.8	1.8	1.6	1.8	1	1	1	1.8	1	1	1.8	1.8	1.8	1.6

1 - low, 2 - medium, 3 - high

AMEPT1113- COMPUTER INTEGRATED MANUFACTURINGSYSTEMS

COURSE OBJECTIVES:

- To gain knowledge about the basic fundamental of CAD.
- To gain knowledge on how computers are integrated at various levels of planning and manufacturing understand computer aided planning and control and computer monitoring.

UNIT 1 COMPUTER AIDED DESIGN 9 hrs.

Concept of CAD as drafting and designing facility, desirable features of CAD package, drawing features in CAD – Scaling, rotation, translation, editing, dimensioning, labeling, Zoom, pan, redraw and regenerate, typical CAD command structure, wire frame modeling, surface modeling and solid modeling (concepts only) in relation to popular CAD packages.

UNIT 2 COMPONENTS OF CIM 9 hrs.

CIM as a concept and a technology, CASA/SME model of CIM, CIM II, benefits of CIM, communication matrix in CIM, fundamentals of computer communication in CIM – CIM data transmission methods – seriel, parallel, asynchronous, synchronous, modulation, demodulation, simplex and duplex. Types of communication in CIM – point to point (PTP), star and multiplexing. Computer networking in CIM – the seven layer OSI model, LAN model, MAP model, network topologies – star, ring and bus, advantages of networks in CIM.

UNIT 3 GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING 9 hrs.

History Of Group Technology – role of G.T in CAD/CAM Integration – part families-classification and coding – DCLASS and MCLASS and OPTIZ coding systems – facility design using G.T – benefits of G.T – cellular manufacturing. Process planning - role of process planning in CAD/CAM Integration – approaches to computer aided process planning – variant approach and generative approaches – CAPP and CMPP systems.

UNIT 4 SHOP FLOOR CONTROL AND INTRODUCTION TO FMS 9 hrs.

Shop floor control – phases – factory data collection system – automatic identification methods – Bar code technology – automated data collection system. FMS – components of FMS – types – FMS workstation – material handling and storage system – FMS layout-computer control systems – applications and benefits.

UNIT 5 COMPUTER AIDED PLANNING & CONTROL AND DIGITAL MANUFACTURING 9 hrs.

Production planning and control – cost planning and control – inventory management – material requirements planning (MRP) – shop floor control. Lean and Agile Manufacturing. Types of production monitoring systems – structure model of manufacturing – process control and strategies – direct digital control. Concept and features of digital manufacturing and smart manufacturing systems- Smart Connected System Design.

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: To produce useful research output in computer integrated manufacturing
CO2: Use this knowledge to develop computer techniques
CO3: Application of this knowledge to functionalise computer aided planning.
CO4: To acquire knowledge of CAD-CAM engineering Shop floor control
CO5: To understand programs for Smart Connected System Design..

REFERENCE BOOKS::

1. Chris McMahon and Jimmie Browne, ‐CAD CAM Principles, Practice and Manufacturing Management‖, Pearson Education second edition, 2005.Ranky, Paul G.,‐Computer Integrated Manufacturing, Prentice hall of India Pvt. Ltd.,2005.
2. James A. Regh and Henry W. Kreabber, ‐Computer Integrated Manufacturing, Pearson Education second edition, 2005.
3. Mikell.P. Groover ‐Automation, Production Systems and Computer Integrated Manufacturing‖, Pearson Education 2001.
4. Mikell. P. Groover and Emory Zimmers Jr.,―CAD/CAM‖, Prentice hall of India Pvt.Ltd., 1998.
5. P N Rao, ― CAD/CAM Principles and Applications‖, TMH Publications, 2007.
6. Yorem Koren, ‐Computer Integrated Manufacturing‖, McGraw Hill, 2005.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	3	2	1	1	2	1	2	1	2	2	2
CO2	1	2	2	1	2	1	1	1	1	1	2	1	1	1	1
CO3	1	1	1	1	3	2	1	1	2	1	2	1	2	1	1
CO4	2	2	2	1	3	2	1	1	1	1	2	1	1	2	2
CO5	2	2	2	1	3	2	1	1	1	1	2	1	2	1	1
CO	1.6	1.6	1.6	1	2.8	1.8	1	1	1.4	1	2	1	1.6	1.4	1.4

1 - low, 2 - medium, 3 - high

AMEPT1134- ADDITIVE MANUFACTURING

COURSE OBJECTIVES:

- To acquaint the students with the concept of AM, various AM technologies, selection of materials for AM, modeling of AM processes, and their applications in various fields.
- Understand the modeling in AM, relevant case studies have been included to introduce the students to the mathematical models for AM to describe the transport phenomena.
- The course will also cover AM process plan including building strategies.

UNIT 1 OVERVIEW OF ADDITIVE MANUFACTURING 9 hrs.

Introduction to Additive Manufacturing (AM): General overview Introduction to reverse engineering Traditional manufacturing vis AM Computer aided design (CAD) and manufacturing (CAM) and AM Different AM processes and relevant process physics AM process chain Application level: Direct processes - Rapid Prototyping, Rapid Tooling. Rapid Manufacturing; Indirect Processes - Indirect Prototyping. Indirect Tooling, Indirect Manufacturing.

UNIT 2 Materials science for AM 9 hrs.

Discussion on different materials used Use of multiple materials, multifunctional and graded materials in AM Role of solidification rate Evolution of non-equilibrium structure property relationship Grain structure and microstructure

UNIT 3 AM technologies 9 hrs.

Powder-based AM processes involving sintering and melting (selective laser sintering, shaping, electron beam melting. involvement). Printing processes (drop!et based 3D Solid-based AM processes - extrusion based fused deposition modeling object Stereolithography Micro- and nano-additive.

UNIT 4 Mathematical models for AM 9 hrs.

Transport phenomena models (temperature, fluid flow and composition, buoyancy driven tension driven free surface flow pool) Case studies: Numerical Modeling of 06 AM process, Powder bed melting based process, Droplet based printing process Residual stress, part fabrication time, cost, optimal orientation and optimal Defect in AM and role of transport Simulations (choice of parameter, Model validation for different.

UNIT 5 Process Selection control for AM 9 hrs

Selection of AM technologies using, decision methods planning, Additive manufacturing process plan: strategies and post processing. Monitoring and control of defects, transformation

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: Able to develop models for AM to describe the transport phenomena
CO2: Able to develop process plan for AM
CO3: Apply the AM in various fields
CO4: To understand concept Mathematical model
CO5: To acquire knowledge of AM technologies using Additive manufacturing process plan

REFERENCE BOOKS:

1. Ian Gibson, David W. Rosen, Brent Stucker, Additive manufacturing technologies: rapid prototyping to direct digital manufacturing Springer, 2010.
2. 2. Andreas Gebhardt, Understanding additive manufacturing: rapid prototyping, rapid tooling, rapid manufacturing, Hanser Publishers, 2011.
3. 3. J.D. Majumdar and I. Manna, Laser-assisted fabrication of materials, Springer Series in Material Science, e-ISBN: 978-3-642- 28359-8.
4. 4. L. Lu, J. Fuh and Y.-S. Wong, Laser-induced materials and processes for rapid prototyping, Kluwer Academic Press, 2001.
5. 5. Zhiqiang Fan and Frank Liou, Numerical modeling of the additive manufacturing (AM) processes of titanium alloy, lnTech, 2012.
6. 6. C.K. Chua, K.F. Leong and C.S. Lim, Rapid prototyping: principles and applications, 3rd Edition, World Scientific, 2010.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	3	2	2	1	1	1	1	2	2	1	2
CO2	2	1	1	1	2	2	1	1	1	1	1	1	1	1	1
CO3	1	1	1	1	2	2	1	1	1	1	1	1	2	1	1
CO4	2	1	1	1	3	2	2	1	1	1	1	2	1	1	1
CO5	2	1	1	1	2	2	1	1	1	1	1	1	2	1	2
CO	1.8	1	1	1	2.4	2	1.4	1	1	1	1	1.4	1.6	1	1.4

1 - low, 2 - medium, 3 - high

Programme Elective

Elective II & III

AMEPT1114- FINITE ELEMENT METHODS FOR MANUFACTURING

COURSE OBJECTIVE:

- To study the fundamentals of one dimensional and two dimensional problems using FEA in manufacturing.

UNIT 1 INTRODUCTION 9 hrs.

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

UNIT 2 ONEDIMENSIONALANALYSIS 9 hrs.

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

UNIT 3 SHAPE FUNCTIONS AND HIGHER ORDER FORMULATIONS 9 hrs.

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

UNIT 4 COMPUTER IMPLEMENTATION 9 hrs.

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

UNIT 5 ANALYSIS OFPRODUCTION PROCESSES 9 hrs.

FE analysis of metal casting – special considerations, latent heat incorporation, gap element – Time stepping procedures – Crank – Nicholson algorithm – Prediction of grain structure – Basic concepts of plasticity and fracture – Solid and flow formulation – small incremental deformation formulation – Fracture criteria – FE analysis of metal cutting, chip separation criteria, incorporation of strain rate dependency – FE analysis of welding.

Total: 45 Periods

COURSE OUTCOMES :

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: To achieve an understanding of the fundamentals of the FEA
CO2: Ability to develop the governing FE equations for systems in manufacturing
CO3: Ability to successfully use of the basic finite elements for structural applications using truss, beam, frame, and plane elements;

CO4: Ability to use FEA for fluid mechanics and heat transfer problems

CO5: Ability to formulate two-dimensional and three-dimensional elements in FEA design process

REFERENCE BOOKS::

1. Bathe, K.J., Finite Element procedures in Engineering Analysis,1990
2. Kobayashi,S, Soo-ik-Oh and Altan,T, Metal Forming and the Finite Element Methods, Oxford University Press,1989.
3. Lewis R.W. Morgan, K, Thomas, H.R. and Seetharaman, K.N. The Finite Element Method in Heat Transfer Analysis, John Wiley, 1994.
4. Rao, S.S., Finite Element method in engineering, Pergammon press,2005.
5. Reddy, J.N. An Introduction to the Finite Element Method, McGrawHill,2005.
6. Seshu P., Textbook of Finite Element Analysis, PHI Learning Pvt. Ltd,2004.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	3	2	2	1	1	1	1	2	2	2	2
CO2	1	2	2	1	3	1	2	1	1	1	1	1	1	2	1
CO3	2	2	2	1	2	1	2	1	1	1	1	2	2	2	2
CO4	2	1	1	2	3	2	2	1	1	1	1	2	2	1	2
CO5	2	1	1	2	2	2	1	1	1	1	1	1	2	1	2
CO	1.8	1.6	1.6	1.6	2.6	1.6	1.8	1	1	1	1	1.6	1.8	1.6	1.8

1 - low, 2 - medium, 3 - high

AMEPT1115- INDUSTRIAL ERGONOMICS

COURSE OBJECTIVE:

- To introduce the concepts of Ergonomics and to indicate the scope of applications in manufacturing.

UNIT 1 INTRODUCTION 9 hrs.

Concepts of human factors engineering and ergonomics – Man – machine system and design philosophy – Physical work – Heat stress – manual lifting – work posture – repetitive motion.

UNIT 2 ANTHROPOMETRY 9 hrs.

Physical dimensions of the human body as a working machine – Motion size relationships – Static and dynamic anthropometry – Anthropometric aids – Design principles – Using anthropometric measures for industrial design – Procedure for anthropometric design.

UNIT 3 DESIGN OF SYSTEMS 9 hrs.

Displays – Controls – Workplace – Seating – Work process – Duration and rest periods – Hand tool design – Design of visual displays – Design for shift work.

UNIT 4 ENVIRONMENTAL FACTORS IN DESIGN 9 hrs.

Temperature – Humidity – Noise – Illumination –Vibration – Measurement of illumination and contrast – use of photometers – Recommended illumination levels. The ageing eye – Use of indirect (reflected) lighting – cost efficiency of illumination – special purpose lighting for inspection and quality control – Measurement of sound – Noise exposure and hearing loss – Hearing protectors – analysis and reduction of noise – Effects of Noise on performance – annoyance of noise and interference with communication – sources of vibration discomfort.

UNIT 5 WORK PHYSIOLOGY 9 hrs.

Provision of energy for muscular work – Role of oxygen physical exertion – Measurement of energy expenditure Respiration – Pulse rate and blood pressure during physical work – Physical work capacity and its evaluation.

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: Various concepts of Ergonomics and design of systems with ergonomics aspect
CO2: Apply the concepts of ergonomics to design of man – machine system
CO3: Ability to understand the design of system.
CO4: Apply annoyance of noise and interference with communication.
CO5: Ability to understand Physical work capacity and its evaluation.

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REFERENCE BOOKS::

1. E.J. McCormic & Mark S. Sangers, Human factors in engineering design, McGraw Hill.2007.
2. Martin Helander, A guide to the ergonomics of manufacturing, East West press,2007
3. R.S. Bridger Introduction to Ergonomics, McGraw Hill,1995.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	3	2	2	1	1	1	1	2	1	2	2
CO2	2	1	1	2	2	2	1	1	1	1	1	1	1	1	1
CO3	2	2	1	1	2	1	1	1	1	1	1	1	1	2	2
CO4	1	1	1	1	3	1	2	1	1	1	1	2	2	1	2
CO5	2	2	2	2	3	1	1	1	1	1	1	1	1	1	2
CO	1.8	1.6	1.4	1.6	2.6	1.4	1.4	1	1	1	1	1.4	1.2	1.4	1.8

1 - low, 2 - medium, 3 - high

AMEPT1116- POLYMERS AND COMPOSITE MATERIALS

COURSE OBJECTIVE:

- To impart knowledge on types, physical properties and processing of polymer matrix composites, metal matrix composites and ceramics matrix composites.

UNIT 1 PROCESSING OF POLYMERS 9 hrs.

Chemistry and Classification of Polymers – Properties of Thermo plastics – Properties of Thermosetting Plastics - Extrusion – Injection Moulding – Blow Moulding – Compression and Transfer Moulding – Casting – Thermo Forming. General Machining properties of Plastics – Machining Parameters and their effect – Joining of Plastics – Thermal bonding – Applications.

UNIT 2 FIBERS AND MATRIX MATERIALS 9 hrs.

Fibers – Fabrication, Structure, properties and applications – Glass fiber, Boron fiber, carbon fiber, organic fiber, ceramic and metallic fibers - whiskers–Fabrication of Matrix materials – polymers, metals and ceramics and their properties – interfaces – Wettability – Types of bonding at the interface – Tests for measuring interfacial strength - Physical and chemical properties.

UNIT 3 PROCESSING OF POLYMER MATRIX COMPOSITES 9 hrs.

Thermoset matrix composites: hand layup, spray, filament winding, Pultrusion, resin transfer moulding, autoclave moulding - bag moulding, compression moulding with Bulk Moulding Compound and sheet Moulding Compound – thermoplastic matrix composites – film stacking, diaphragm forming, thermoplastic tape laying, injection moulding – interfaces in PMCs - structure, properties and application of PMCs –recycling ofPMCs.

UNIT 4 PROCESSING OF METAL MATRIX COMPOSITES 9 hrs.

Metallic matrices: aluminium, titanium, magnesium, copper alloys – processing of MMCs: liquid state, Solid state, in situ fabrication techniques – diffusion bonding – powder metallurgy techniques- interfaces in MMCs – mechanical properties – machining of MMCs – Applications.

UNIT 5 PROCESSING OF CERAMIC MATRIX COMPOSITES AND CARBON-CARBON COMPOSITES 9 hrs.

Processing of CMCs: cold pressing, sintering, reaction bonding, liquid infiltration, lanxide process – in situ chemical reaction techniques: chemical vapour deposition, chemical vapour impregnation, sol-gel – interfaces in CMCs – mechanical properties and applications of CMCs– Carbon-carbon Composites –applications.

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: To study matrix material, reinforcements of polymer matrix composites, MMC and ceramic matrix composites.

CO2: To develop knowledge on processing, interfacial properties and application of composites.

CO3: To develop knowledge on properties and application of PMCs

CO4: Apply Metallic matrices: aluminium, titanium, magnesium, copper alloys

CO5: To identify Processing of CMCs: cold pressing, sintering, reaction bonding, liquid infiltration, lanxide process

REFERENCE BOOKS:

1. ASM Handbook – Composites, Vol-21, 2001, ISBN: 978-0-87170-703-1.
2. Harold Belofsky, Plastics, Product Design and Process Engineering, Hanser Publishers,2002.
3. Jamal Y. Sheikh-Ahmad, Machining of Polymer Composites, Springer, USA, 2009. ISBN: 978-0- 387-35539-9.
4. Krishnan K Chawla, Composite Materials: Science and Engineering, International Edition, Springer, 2012,ISBN:978-0-387-74364-6.
5. Mallick P.K., Fiber Reinforced Composites: Materials, Manufacturing and Design, CRC press, New Delhi, 2010, ISBN:0849342058.
6. Mallick, P.K. and Newman.S., Composite Materials Technology, Hanser Publishers,2003.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	2	2	2	1	1	1	1	2	2	1
CO2	2	1	1	1	1	2	2	2	1	1	1	1	2	2	1
CO3	2	1	1	1	1	2	2	2	1	1	1	1	2	2	1
CO4	1	1	1	1	1	2	2	2	1	1	1	1	2	2	1
CO5	1	1	1	1	1	2	2	2	1	1	1	1	2	2	1
CO	1.6	1	1	1	1	2	2	2	1	1	1	1	2	2	1

1 - low, 2 - medium, 3 - high

AMEPT1117- NON-DESTRUCTIVE TESTING AND EVALUATION

COURSE OBJECTIVE:

- Understanding the various Non-Destructive Evaluation and Testing methods, theory and theirindustrial applications

UNIT 1 NON-DESTRUCTIVE TESTING: AN INTRODUCTION, VISUAL INSPECTION & LIQUIDPENETRANTTESTING 9 hrs.

Introduction to various non-destructive methods, Comparison of Destructive and Non destructive Tests, Visual Inspection, Optical aids used for visual inspection, Applications. Physical principles, procedure for penetrant testing, Penetrant testing materials, Penetrant testing methods-water washable, Post – Emulsification methods, Applications.

UNIT 2 EDDY CURRENT TESTING &ACOUSTICEMISSION 9 hrs.

Principles, Instrumentation for ECT, Absolute, differential probes, Techniques – High sensitivity techniques, Multi frequency, Phased array ECT, Applications. Principle of AET, Instrumentation, Applications - testing of metal pressure vessels, Fatigue crack detection in aerospace structures.

UNIT 3 MAGNETIC PARTICLE TESTING & THERMOGRAPHY 9 hrs.

Principle of MPT, procedure used for testing a component, Equipment used for MPT, Magnetizing techniques, Applications. Principle of Thermography, Infrared Radiometry, Active thermography measurements, Applications – Imaging entrapped water under an epoxy coating, Detection of carbon fiber contaminants.

UNIT 4 ULTRASONIC TESTING 9 hrs.

Principle, Ultrasonic transducers, Ultrasonic Flaw detection Equipment, Modes of display A-scan, B- Scan, C- Scan, Applications, Inspection Methods - Normal Incident Pulse-Echo Inspection, Normal Incident Through-transmission Testing, Angle Beam Pulse-Echo testing, TOFD Technique, Applications of Normal Beam Inspection in detecting fatigue cracks, Inclusions, Slag, Porosity and Intergranular cracks - Codes, standards, specification and procedures and case studies in ultrasonics test.

UNIT 5 RADIOGRAPHY 9 hrs.

Principle of Radiography, x-ray and gamma ray sources- safety procedures and standards, Effect of radiation on Film, Radiographic imaging, Inspection Techniques – Single wall single image, Double wall Penetration, Multiwall Penetration technique, Real Time Radiography - Codes, standards, specification and procedures and case studies in

Radiography test. Case studies on defects in cast, rolled, extruded, welded and heat treated components - Comparison and selection of various NDT techniques.

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: Know non-destructive testing methods and their importance.
CO2: Undertake projects related to surface NDE methods.
CO3: Identify the major areas of thermography and eddy current testing.
CO4: Understand the problems and issues in ultrasonic testing and acoustic emission.
CO5: Apply the knowledge in applying radiography techniques.

REFERENCE BOOKS::

1. Baldev Raj, Jeyakumar,T., Thavasimuthu,M., –Practical Non Destructive Testing Narosa publishing house, New Delhi,2002
2. Krautkramer. J., –Ultra Sonic Testing of Materials‖, 1st Edition, Springer – Verlag Publication, New York,1996.
3. Peter J. Shull –Non Destructive Evaluation: Theory, Techniques and Application‖ Marcel Dekker, Inc., New York,2002

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	3	2	2	1	1	1	1	2	1	2	2
CO2	1	2	2	2	2	2	2	1	1	1	1	1	2	2	1
CO3	2	2	2	1	2	1	1	1	1	1	1	2	1	2	2
CO4	2	1	1	1	2	2	2	1	1	1	1	2	1	1	1
CO5	2	2	2	2	3	1	1	1	1	1	1	1	1	1	2
CO	1.8	1.8	1.8	1.6	2.4	1.6	1.6	1	1	1	1	1.6	1.2	1.6	1.6

1 - low, 2 - medium, 3 - high

AMEPT1118- PRODUCTION AND OPERATION MANAGEMENT

COURSE OBJECTIVES:

- Recognizing and describing the concept of Production and Operations Management in creating and enhancing a firm‘s competitive advantages.
- Relate the interdependence of the operations function with the other key functional areas of a firm and apply scheduling and Lean Concepts for improving System Performance.

UNIT 1 INTRODUCTION 9 hrs.

Objectives of Operations Management, Scope of Operations Management, Relationship of Operations with other Functional areas, Manufacturing Vs Service sector, Operations Decision making, Phases in Product Design and Development, Product Life Cycle, Process Selection.

UNIT 2 FORECASTING 9 hrs.

Need, Determinants of Demand, Demand Patterns, Qualitative Forecasting Methods-Delphi techniques. Market Research, Nominal Group Technique. Quantitative Forecasting methods – Moving Average Methods, Exponential Smoothing Methods, Regression methods, Monitoring and Control of Forecasts, Requirements and Selection of Good forecasting methods.

UNIT 3 AGGREGATE PLANNING AND MATERIAL REQUIREMENT PLANNING 9 hrs.

Role of aggregate Product planning, Managerial inputs to Aggregate planning, Pure and Mixed strategies, Mathematical Models for Aggregate planning – Transportation Method, Linear programming Formulation, Linear Decision Rues, Master Production Schedule(MPS), Procedure for developing MPS, MRP -Lot sizing methods – Implementation issues, MRP – II, Introduction to ERP.

UNIT 4 CAPACITY MANAGEMENT 9 hrs.

Measures of capacity, Factors affecting capacity, Capacity Planning, Systematic approach to capacity planning, Long-term and short-term capacity decisions, Tools for capacity planning, Capacity Requirement Planning- Business Process Outsourcing.

UNIT 5 PRODUCTION ACTIVITY CONTROL AND LEAN MANUFACTURING 9 hrs.

Objectives and Activities of Production Activity Control -JIT- Kanban- Introduction to Scheduling in different types of Production Systems. Lean Manufacturing - Principles – Activities - Tools and techniques - Case studies.

Total: 45 Periods

COURSE OUTCOMES

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: Know the role of Production and Operations management in enabling and enhancing a firm‘s competitive advantages.
CO2: Undertake projects related to forecast demand for Production and Service Systems.
CO3: Identify the Formulae and Assess Aggregate Planning strategies.
CO4: Understand and calculate capacity requirements
CO5: Apply the knowledge in scheduling and Lean Concepts.

REFERENCE BOOKS:

1. Panneerselvam. R, –Production and operations Management, PHI, 3rd Edition, (2012).
2. Lee J. Krajewski, Manoj K. Malhotra, Larry P. Ritzman, Operations Management:Processes and Supply Chains Pearson Education, 11th Edition, (2015).
3. Norman Gaither, Greg Frazier.–Operations Management, Thomson Learning, 9th Edition, (2002).
4. William J Stevenson, –Operations Management, McGraw Hill,13th Edition, (2018).

CO’s-PO’s & PSO’s MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2	2	1	1	1	3	2	1	2	2
CO2	1	1	2	2	2	2	2	1	1	1	3	1	2	2	1
CO3	2	2	1	1	1	2	2	1	1	1	2	2	1	1	2
CO4	2	1	1	1	2	1	1	1	1	1	2	2	2	1	2
CO5	1	2	1	2	1	1	1	1	1	1	3	2	1	1	2
CO	1.6	1.6	1.4	1.6	1.6	1.6	1.6	1	1	1	2.6	1.8	1.4	1.4	1.8

1 - low, 2 - medium, 3 - high

AMEPT1119- INDUSTRIAL ROBOTICS

COURSE OBJECTIVE:

- To teach students the basics of robotics, construction features, sensor applications, robot cell design, robot programming and application of artificial intelligence and expert systems in robotics.

UNIT 1 INTRODUCTION 9 hrs.

Automation and Robotics, Robot configuration, motions, joint notation, work volume, robot drive system, Robot actuators: Internal & External Sensors, Positions sensors, velocity sensors - Desirable features, tactile, proximity and range sensors, uses sensors in robotics. End Effectors: Types, operation, mechanism, force analysis, consideration in gripper selection and design. Robot Vision: Basics and steps, Robot Programming Methods.

UNIT 2 MOTION ANALYSIS AND CONTROL 10 hrs.

Manipulator kinematics, position representation, Basic and Composite Rotation Matrices, Equivalent Axis and Angle – Euler Angles - Homogeneous transformation, D-H Notation, D-H Transformation Matrix, Forward & Inverse transformations, problems on planar & spatial manipulators.

UNIT 3 KINEMATICS IN ROBOATICS 10 hrs.

Differential Kinematics, Jacobian Formulation, problems, manipulator path control: Slew, Joint Interpolated & Straight line motions, trajectory planning: Joint space scheme, Cartesian space scheme, Cubic Polynomial fit without and with via point, blending.

UNIT 4 ROBOT DYNAMICS 7 hrs.

Lagrange – Euler & Newton - Euler formulations, problems on two link planar manipulators.

UNIT 5 ROBOT CELL DESIGN AND CONTROL 9 hrs.

Robot cell layouts-Robot centered cell, In-line robot cell, Considerations in work cell design, Work cell control, Inter locks, Error detection, Work cell controller. Robot Applications: Material transfer, Machine loading/unloading. Processing operations, Assembly and Inspection, Future Applications.

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: Understand the evolution, classification, structures and drives for robots.
CO2: To teach the students about the kinematic arrangement of robots and its applications in the area of manufacturing sectors
CO3: To expose the students to build a robot for any type of application
CO4: To understandRobot dynamics using Euler problems on two link planar manipulators
CO5: To learn Robot Applications: Material transfer, Machine loading/unloading

REFERENCE BOOKS::

1. Robot Analysis and Control /Asada H. and J. E. Slotin, Wiley, New York.
2. Theory of Applied Robotics: Kinematics , Dynamics and Control/ Reza N. Jazar, Springer, India.
3. Industrial robotics / MikellP.Groover / McGraw Hill 2. Robotics / K.S.Fu / McGraw Hill.
4. Introduction to Robotics Mechanics & Control/ John J.Craig/Pearson 4. RobotAnalysis/Lung Wen Tsai/John Wiley & Sons.
5. Robotics & Control/RK Mittal & IJ Nagrath/ Tata Mc-GrawHill.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	2	2	2	1	1	1	2	3	2	2	1	3
CO2	2	1	1	2	2	2	1	1	1	2	3	1	2	2	2
CO3	2	1	1	2	1	2	1	1	1	1	2	2	1	1	3
CO4	1	1	1	1	1	2	1	1	1	1	2	2	2	1	2
CO5	2	1	1	1	1	2	1	1	1	2	3	2	1	1	3
CO	1.8	1	1	1.6	1.4	2	1	1	1	1.6	2.6	1.8	1.6	1.2	2.6

1 - low, 2 - medium, 3 - high

AMEPT1120- PROJECT ENGINEERING AND MANAGEMENT

COURSE OBJECTIVE:

- This course examines project management in theory and practice and the roles and responsibilities of the project manager.
- The course offers a practical approach to managing projects, focusing on organizing, planning, and controlling the efforts of the project.

UNIT 1 INTRODUCTION 9 hrs.

Introduction to Project management, Characteristics of projects, Definition and objectives of Project Management, Stages of Project Management, Project Planning Process, Establishing Project organization, role of Project Manager-.

UNIT 2 SCREENING AND SELECTION TECHNIQUES 9 hrs.

Project screening and Selection Techniques - Structuring concepts and Tools - Work Breakdown Structure, Organisation Breakdown Structure, and Linear Responsibility Chart - Project Planning Tools- Bar charts, Line of Balance – Critical Path Method, and Project Evaluation and Review Technique- Risk Analysis and Management

UNIT 3 PROJECT ESTIMATION 9 hrs.

Types of Estimates and Estimating Methods- Capital Cost Estimation - Project Budgeting - Project cash flow analysis Project Scheduling with Resource Constraints- Resource Leveling- Resource constrained scheduling with multiple resources- linear programming formulation – Introduction to staff scheduling and rostering

UNIT 4 MONITORING TECHNIQUES 9 hrs.

Monitoring Techniques and time control System- Project Cost Control -Time cost Tradeoff procedure, lowest cost schedule Computer applications in project management

UNIT 5 PROJECTMANAGEMENT 9 hrs.

Management of Software Engineering Projects, New Product Development Projects, R&D Projects and Large Scale Construction Projects -Case Studies

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: A thorough understanding of the principles of project management;
CO2: The ability to lead a project team;
CO3: The ability to accomplish projects on schedule without cost and time overruns;
CO4: The knowledge on the procedure for implementing big and special projects.
CO5: To undergo project such as New Product Development Projects, R&D Project

REFERENCE BOOKS::

1. Shtub, Bard and Globerson Project Management: Processes, Methodologies, and Economics, 2/E, Prentice Hall Inc, 2005.
2. Lock, Project Management Handbook, Gover Publishing Ltd, 1981.

3. Cleland and King, Project Management Handbook 2nd Edition, Wiley, 1988.
4. Wiest and Levy, A Management Guide to PERT/CPM Prentice Hall of India NewDelhi.
5. Horald Kerzner, Project Management: A Systemic Approach to Planning, Scheduling and Controlling, CBS Publishers, 2002.
6. S. Choudhury, Project Scheduling and Monitoring in Practice, South Asian Publishers, Delhi, 1983.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	2	1	2	2	1	2	1	3	1	2	1	2
CO2	2	1	1	2	1	2	2	1	2	1	2	1	2	1	2
CO3	1	1	1	2	1	2	2	1	2	1	3	1	2	1	2
CO4	1	1	1	2	1	2	2	1	2	1	2	1	2	1	2
CO5	2	1	1	2	1	2	2	1	2	1	3	1	2	1	2
CO	1.6	1	1	2	1	2	2	1	2	1	2.6	1	2	1	2

1 - low, 2 - medium, 3 - high

AMEPT1121- METROLOGY AND COMPUTER AIDED INSPECTION

COURSE OBJECTIVES:

- To make the students to understand the various quality control techniques .
- To understand thevarious quality control charts for variables and attributes.
- To help them develop the design concepts for reliable system and maintenance aspects in industries.

UNIT 1 QUALITY & STATISTICAL PROCESS CONTROL 9 hrs.

Quality – Definition – Quality Assurance – Variation in process – Factors – process capability – control charts – variables X, R and X, - Attributes P, C and U-Chart tolerance design. Establishing and interpreting control charts – charts for variables – Quality rating – Short run SPC.

UNIT 2 ACCEPTANCE SAMPLING 9 hrs.

Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling plans – OC curves – Producer‘s risk and consumer‘s risk. AQL, LTPD, AOQL, Concepts – standard sampling plans for AQL and LTPD – use of standard sampling plans.

UNIT 3 EXPERIMENTAL DESIGN & SIX SIGMA 9 hrs.

Fundamentals – factorial experiments – random design, Latin square design – Taguchi method – Loss function – experiments – S/N ratio and performance measure – Orthogonal array. Value of Six Sigma in manufacturing- Design for Six Sigma (DFSS) in the Organization Quality function Deployment (QFD), Design and Process Failure Mode and Effect Analysis (DFMEA and PFMEA) , Roadmaps for DFSS

UNIT 4 CONCEPT OF RELIABILITY 9 hrs.

Definition – reliability vs quality, reliability function – MTBF, MTTR, availability, bathtub curve – time dependent failure models – distributions – normal, weibull, lognormal – Reliability of system and models – serial, parallel and combined configuration – Markove analysis, load sharing systems, standby systems, covarient models, static models, dynamic models.

UNIT 5 DESIGN FOR RELIABILITY AND MAINTAINABILITY 9 hrs.

Reliability design process, system effectiveness, economic analysis and life cycle cost, reliability allocation, design methods, parts and material selection, derating, stress-strength and analysis, failure analysis, identification determination of causes, assessments of effects, computation of criticality index, corrective action, system safety – analysis of down-time – the repair time distribution, stochastic point processes system repair time, reliability under preventive maintenance state dependent system with repair. MTTR – mean system down time, repair vs replacement, replacement models, proactive, preventive, predictive maintenance maintainability and availability, optimization techniques for system reliability with redundancy heuristic methods applied to optimal system reliability.

Total: 45 Periods

COURSE OUTCOMES :

After completing this course, students will be able to demonstrate competency in thefollowing aspects:

CO1: Various quality control techniques and applications
CO2: Understand the importance and concept of reliability and maintainability in industries.
CO3: Describe the scope, outcomes, evolution on Design for Six Sigma
CO4: Use standards for Reliability of system and models on serial, parallel and combined configuration
CO5: Describe Reliability design process, system effectiveness

REFERENCE BOOKS::

1. Amata Mitra ―Fundamentals of Quality Control and improvement‖ Pearson Education,2002.
2. Bester field D.H., ―Quality Control‖ Prentice Hall,1993.
3. Charles E Ebling, An Introduction to Reliability and Maintability Engineering, Tata-McGraw Hill, 2000.
4. David J Smith, Reliability, Maintainability and Risk: Practical Methods for Engineers, Butterworth 2002.
5. Dhillon, Engineering Maintainability – How to design for reliability and easy maintenance, PHI, 2008.
6. Patrick D To‘ corner, Practical Reliability Engineering, John-Wiley and Sons Inc, 2002

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	3	2	2	1	1	1	3	1	2	2	1
CO2	2	1	1	1	3	2	2	1	1	1	3	1	2	2	1
CO3	2	1	1	1	3	1	1	1	1	1	3	1	2	2	1
CO4	2	1	1	1	3	1	2	1	1	1	2	1	2	2	1
CO5	2	1	1	1	3	2	1	1	1	1	3	1	2	2	1
CO	2	1	1	1	3	1.6	1.6	1	1	1	2.8	1	2	2	1

1 - low, 2 - medium, 3 - high

AMEPT1135- CONCURRENT ENGINEERING

Prerequisites: Computer-Aided Design

Course objective: To provide a systematic approach to the integrated, concurrent design of products and their related processes, including manufacture and support.

UNIT-I:

Introduction: Extensive definition of CE - CE design methodologies - Organizing for CE - CE tool box collaborative product development

Use Of Information Technology: IT support - Solid modeling - Product data management - Collaborative product commerce - Artificial Intelligence - Expert systems - Software hardware co- design.

UNIT-II:

Design Stage: Life-cycle design of products - opportunity for manufacturing enterprises - modality of Concurrent Engineering Design.

Automated analysis idealization control - Concurrent engineering in optimal structural design - Real time constraints.

UNIT-III:

Manufacturing Concepts and Analysis: Manufacturing competitiveness - Checking the design process - conceptual design mechanism – Qualitative, physical approach - An intelligent design for manufacturing system.

UNIT-IV:

JIT system - low inventory - modular - Modeling and reasoning for computer based assembly planning

- Design of Automated manufacturing.

Project Management: Life Cycle semi realization - design for economics - evaluation of design for manufacturing cost.

UNIT-V:

Concurrent mechanical design – decomposition in concurrent design - negotiation in concurrent engineering design studies - product realization taxonomy - plan for Project Management on new product development – bottleneck technology development.

Course Outcomes:

CO1: Understand the need of concurrent engineering and strategic approaches for product design.

CO2: Apply concurrent design principles to product design.

CO3: Design assembly workstation using concepts of simultaneous engineering.

CO4: Design automated fabricated systems – Case studies.

CO5: To plan for Project Management on new product development

TEXT BOOK:

1. Concurrent Engineering: Automation Tools and Technology by Andrew Kusaik, Wiley John and Sons Inc., 1992.

REFERENCE BOOKS:

1. Integrated Product Development by Anderson MM and Hein, L. Berlin, Springer Verlog, 1987.
2. Design for Concurrent Engineering by Cleetus, J.Concurrent Engineering Research Centre, Morgantown W V, 1992.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2	2	2	2	1	1	1	2	2	2	2	1
CO2	2	2	1	2	2	2	2	1	1	1	2	2	1	1	1
CO3	2	2	1	2	1	2	1	1	1	1	2	2	2	2	1
CO4	2	2	1	2	2	2	1	1	1	1	2	2	1	1	1
CO5	2	2	1	2	1	2	1	1	1	1	2	2	2	2	1
CO	2	2	1	2	1.6	2	1.4	1	1	1	2	2	1.6	1.6	1

1 - low, 2 - medium, 3 - high

AMEPT1141- PRODUCT DATA MANAGEMENT

Prerequisites: Management Science

Course Objectives:

- Competence with a set of tools and methods for product design and development.
- Confidence in own abilities to create a new product.
- Awareness of the role of multiple functions in creating a new product (e.g. marketing, finance, industrial design, engineering, production).
- Ability to coordinate multiple, interdisciplinary tasks in order to achieve a common objective.
- Reinforcement of specific knowledge from other courses through practice and reflection in an action-oriented setting.
- Enhanced team working skills.

UNIT- I:

Need for **Integrated Product and Process Development (**IPPD) – strategic importance of product development – integration of customer, designer, material supplier and process planner, Competitor and costumer – behavior analysis. Understanding customer – promoting customer understanding – involve customer in development and managing requirements – Organization – process management and improvement – Plan and establish product specification.

UNIT – II:

Concept Generation and Selection: Task – Structured approaches – Clarification – Search – Externally and internally – explore systematically – reflect on the solutions and process – concept selection – methodology – benefits**. Product Architecture:** Implications – Product change – variety – component standardization – product performance – manufacturability.

UNIT - III:

Product Development Management**:** Establishing the architecture – creation – clustering – geometric layout development – fundamental and incidental interactions – related system level design issues – secondary systems – architecture of the chunks – creating detailed interface specifications. Industrial Design: Integrate process design – Managing costs – Robust design – Integrating CAE, CAD, CAM tools – simulating product performance and manufacturing processing electronically – Need for industrial design – impact – design process.

UNIT – IV:

Investigation of customer needs – conceptualization – refinement – management of the industrial design process – technology driven products – user – driven products – assessing the quality of industrial design.

UNIT – V:

Design for Manufacturing and Product Development: Definition – Estimation of manufacturing cost – reducing the component costs and assembly costs – Minimize system

complexity. Prototype basics – Principles of prototyping – planning for prototypes – Economics analysis – Understanding and representing tasks – baseline project planning – accelerating the project execution.

Course Outcomes:

CO1: Students will understand the strategic importance of integrating customers, designers, suppliers, and process planners in product development while managing customer requirements.

CO2: Students will learn structured approaches for concept generation and selection, including systematic exploration and assessment of product architecture implications.

CO3: Students will acquire skills to establish product architecture, integrate industrial design, and utilize CAE, CAD, and CAM tools to simulate performance and manage design costs.

CO4: Students will develop the ability to investigate customer needs, manage the industrial design process, and assess the quality of both technology-driven and user-driven products.

CO5: Students will gain proficiency in estimating manufacturing costs, reducing complexity, prototyping, and applying efficient project planning for product development execution.

TEXT BOOKS:

1. Product Design and Development / Kari T. Ulrich and Steven D. Eppinger / McGraw Hill International Edns. 1999.
2. Concurrent Engg/integrated Product development / Kemnneth Crow / DRM Associates, 26/3, Via Olivera, Palos Verdes, CA 90274(310)377-569, Workshop Book.

REFERENCES:

1. Effective Product Design and Development / Stephen Rosenthal / Business One Orwin, Homewood, 1992, ISBN, 1-55623-603-4.
2. Tool Design–Integrated Methods for Successful Product Engineering / Staurt Pugh / Addsion Wesley Publishing, Neyourk, NY, 1991, ISBN 0-202-41369-5.
3. Production and Operations Management/Chase/TMH

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	2	1	1	1	1	2	1	3	2	2	2	1
CO2	1	1	1	1	1	1	1	1	2	1	2	2	2	1	1
CO3	1	1	1	2	1	1	1	1	2	1	3	1	1	2	1
CO4	1	1	1	2	1	1	1	1	2	1	3	1	2	2	1
CO5	1	1	1	2	1	1	1	1	2	1	2	2	2	1	1
CO	1	1	1	1.8	1	1	1	1	2	1	2.6	1.6	1.8	1.6	1

1 - low, 2 - medium, 3 - high

AMEPT1142- ADVANCED TOOLING DESIGN

Course Objective

- To provide a comprehensive understanding of tool engineering principles and design objectives in manufacturing.
- To equip students with the skills to design, analyze, and select various tooling systems, fixtures, and flexible tooling methods for modern production environments.

UNIT- I:

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

UNIT- II:

Introduction to: Fixed Gauges, Gauge Tolerances, Selection of material for gauges – Indicating gauges, Automatic gages, Principles of location, Locating methods and devices, Principles of clamping, Drill jigs – Chip formation in drilling, General considerations in the design of drill jigs, Drill bushings, Methods of construction, Thrust and Turning Moments in drilling, Drill jigs and modern manufacturing, Types of Fixtures – Vise Fixtures, Milling Fixtures, Boring Fixtures, Broaching Fixtures, Lathe Fixtures, Grinding Fixtures, Modular Fixtures

UNIT- III:

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

UNIT- IV:

Introduction to Tooling requirements for Numerical control systems, Fixture design for CNC machine tools, Sub plate and tombstone fixtures, Universal fixtures, Cutting tools,Tool holding methods, Automatic tool changers and tool positioners, Tool presetting.

UNIT- V:

Introduction to Flexible Tooling and its Importance in Modern Manufacturing Key Components of Flexible Tooling Systems: Modular and Quick-Change Tooling Flexible Fixturing Systems:

Adaptive Fixtures and Reconfigurable Clamps Application of Flexible Tooling in CNC and Automated Systems.

Course Outcome:

On completing this course students will be able to:

CO1: Understand the principles of tool engineering, including classifications, objectives, materials, and the relationship between design and heat treatment.

CO2:Gain the ability to design and select appropriate gauges, locating methods, and drill jigs, while understanding their applications in various types of fixtures.

CO3: Design different types of dies, perform clearance and cutting force calculations, and create designs for piercing, bending, and forming dies.

CO4: Develop the skills to design fixtures for CNC machine tools and understand the principles of tool holding, automatic tool changers, and tool presetting systems.

CO5: Gain proficiency in designing flexible tooling and fixturing systems, applying modular and quick-change tools, and adapting them to CNC and automated systems.

REFERENCES:

1. Tool Design By Cyrll Donaldson, George H. LeCain, V. C. Goold Tata McGraw Hill Publishing Company Ltd, 1943.
2. Jig and Fixture Design By E.G.Hoffman, Thomson Asia Pvt Ltd, Singapore, 1980.
3. Tooling data By Prakash Hiralal Joshi, Wheeler Publishing, 2001.
4. Design of Jigs, Fixtures andPresstools By Venkataraman K. 2005.
5. Manufacturing Technology By Haslehurst M., The ELBS, 1978. An introduction to Jig and tool design by M. H. A. Kempster, Butterworth-Heinemann, 1998

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	1	2	2	2	1	1	1	1	2	2	2	1
CO2	2	1	2	1	2	2	2	1	1	1	1	2	1	2	1
CO3	2	2	2	1	1	2	2	1	1	1	1	1	2	1	1
CO4	1	1	3	1	2	2	2	1	1	1	1	1	2	1	1
CO5	1	2	2	1	1	2	2	1	1	1	1	2	1	2	1
CO	1.6	1.6	2.4	1	1.6	2	2	1	1	1	1	1.6	1.6	1.6	1

1 - low, 2 - medium, 3 - high

Programme Elective

Elective IV & V

AMEPT2122- PROCESS PLANNING AND COST ESTIMATION

COURSE OBJECTIVE:

- To introduce the process planning concepts to make cost estimation for various products afterprocess planning

UNIT I INTRODUCTION TO PROCESS PLANNING 9 hrs.

Introduction- methods of process planning-Drawing interpretation-Material evaluation – steps in process selection-.Production equipment and tooling selection

UNIT 2 PROCESS PLANNING ACTIVITIES 9 hrs.

Process parameters calculation for various production processes-Selection jigs and fixtures election of quality assurance methods – Set of documents for process planning-Economics of process planning- case studies.

UNIT 3 INTRODUCTION TO COST ESTIMATION 9 hrs.

Importance of costing and estimation –methods of costing-elements of cost estimation – Types of estimates – Estimating procedure- Estimation labor cost, material cost- allocation of over head charges- Calculation of depreciation cost

UNIT 4 PRODUCTION COST ESTIMATION 9 hrs.

Estimation of Different Types of Jobs – Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop

UNIT 5 MACHINING TIME CALCULATION 9 hrs.

Estimation of Machining Time – Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations ,Drilling and Boring – Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: Using the concepts of process planning and cost estimation for various products.
CO2: Ability to perform machining time calculation.
CO3: Analyze and estimate production costs for various manufacturing setups, including forging, welding, and foundry operations.
CO4: Develop process planning documentation, including material evaluation, tooling selection, and quality assurance methods.
CO5: Apply costing and estimation techniques to optimize resource allocation and improve economic feasibility in production processes.

REFERENCE BOOKS:

1. Chitale A.V. and Gupta R.C., –Product Design and Manufacturing‖, 2nd Edition, PHI, 2002.
2. Ostwalal P.F.and MunezJ.,—Manufacturing Processes and systems‖, 9th Edition,JohnWiley, 1998.
3. Peter scalon, –Process planning, Design/Manufacture Interface‖, Elsevier science technology Books, Dec, 2002.
4. Robert G. Seippel, Optoelectronics for Technology and Engineering, Prentice Hall India

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	2	1	2	1	1	1	2	2	1	3	1
CO2	1	1	1	1	2	2	1	1	1	1	1	2	1	3	1
CO3	1	1	1	1	2	1	2	1	1	1	2	1	2	3	1
CO4	1	1	1	1	2	2	1	1	1	1	2	2	1	2	1
CO5	1	1	1	1	2	1	2	1	1	1	2	2	1	2	1
CO	1	1	1	1	2	1.4	1.6	1	1	1	1.8	1.8	1.2	2.6	1

1 - low, 2 - medium, 3 - high

AMEPT2123- DESIGN OF EXPERIMENT

COURSE OBJECTIVES:

- The students will learn the production planning and control system, the databases required to handle records and their maintenance, various methods of collecting data from the shop floor in order to analyze and improve the performance of the manufacturing system.
- They also understand the importance of information system along with scheduling techniques for customer requirement. They are also exposed to different case studies.

UNIT I OVERVIEW OF DOE 9 hrs.

History of design of experiment; strategy, principle and application of DOE; basic statistical concepts, sampling techniques and distributions; inferences about means and standard deviations and considerations of different hypothesis; Experiments with single factorial design and application of ANOVA; randomized blocking and Latin squares An Introduction to Design of Experiments; The problem of interpreting experimental results; The purpose of randomization; A rationale for randomization, Restricted randomization.

UNIT 2 DOE TERMINOLOGY 9 hrs.

Hypothesis Testing rationale; Comparing two methods experimentally; Introduction to Factorial Experiments and DOE Terminology; Yate's algorithm for calculation of effects in a 2k design; Testing significance of effects in a 2k factorial experiment; Normal Probability Plot on ordinary graph paper.

UNIT 3 DEVELOPMENT OF MATHEMATICAL MODEL 9 hrs.

Developing a mathematical model; Residual Analysis, testing for model adequacy; Finding the Alias Structure of a Fractional Factorial; strategy, principle and application of DOE; basic statistical concepts, sampling techniques and distributions.

UNIT 4 FACTORIAL DESIGN. 9 hrs.

Inferences about means and standard deviations and considerations of different hypothesis; Factorial design, 2k and 3k factorial design; blocking and confounding techniques in 2k factorial design.

UNIT 5 ROBUST DESIGN 9 hrs.

Concept of fractioning of factorial design; Response surface method; Introduction to robust design, robust parameter design for single response system.

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: Get the basic idea of Factorial design, 2k and 3k factorial design; blocking and confounding techniques in 2k factorial design.

CO2: Get familiarized with the purpose of randomization.

CO3: Interpret experimental results

CO4: Develop mathematical models and perform residual analysis to test model adequacy.

CO5: Apply robust design principles, including fractional factorial design and response surface methodology, to optimize single response systems.

REFERENCE BOOKS:

1. LucaG.Sartori,"Manufacturing Information Systems", Addision-Wesley Publishing Company, 2003.
2. Date.C.J, "An Introduction to Database Systems",Narosa PublishingHouse,2004.
3. Orlicky.G, "Material Requirements Planning", McGraw-hill Publishing & Co., 2002.
4. Kerr.R, "Knowledge Based Manufacturing Management", Addison Wesley,2003.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	1	2	2	2	1	1	1	2	2	1	2	1
CO2	2	2	1	1	2	1	2	1	1	1	1	2	2	2	1
CO3	1	3	1	1	2	2	2	1	1	1	2	1	2	1	1
CO4	1	3	1	1	2	2	1	1	1	1	1	1	1	1	1
CO5	2	3	1	1	2	1	1	1	1	1	1	2	2	2	1
CO	1.6	2.8	1	1	2	1.6	1.6	1	1	1	1.4	1.6	1.6	1.6	1

1 - low, 2 - medium, 3 - high

AMEPT2124- MANUFACTURING INFORMATION SYSTEMS

COURSE OBJECTIVES:

- This course comprises an introduction to the foundations, technology and applications ofManagement Information Systems (MIS).
- It is intended to provide a critical understanding of the context within which IS professionalsperform specific technical tasks.

UNIT 1 BASICS OF INFORMATION SYSTEMS 9 hrs.

Management Information Systems- Building blocks in information systems-input, output, model, technology, database, and control blocks, System view of business and information system design forces, Information systems development life cycle, Information systems for strategic planning

UNIT 2 SYSTEM DESIGN AND REQUIREMENTS 9 hrs.

System Investigation and requirements engineering, System requirements specification documents, Feasibility studies, System analysis and general system design, Charting tools in data base design, Data flow diagrams and E-R diagrams, Decision tools and models, Prototyping, Detailed system design, Form design, Code design, Database normalisation, Introduction to data structures and relational database.

UNIT 3 SOFTWARE DESIGN TECHNIQUES 9 hrs.

Modern software design techniques, Verification and validation methods, Performance of software systems, Software metric and models, Software standards, Introduction to Capability Maturity Model (CMM) and Quality Management in software organizations.

UNIT 4 SOFTWARE TESTING 9 hrs.

Software testing, Review, walkthrough and inspection, Testing approaches, Software reliability, Errors, faults, repair and availability, Reliability and maintenance.

UNIT 5 IMPLEMENTATION 9 hrs.

System implementation issues and solution procedures, training and post implementation audit, System fine-tuning, Monitoring and updating Multimedia technology, Distributed data management, Data mining and warehousing, Security features in global information system

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects

CO1: Understand the basic components of a management information systems.
CO2: Gather and document the system requirements
CO3: Design and develop an Information System

CO4: Test, Implement and maintain a management information system
CO5: Apply data mining, warehousing, and security strategies to enhance the efficiency and security of information systems in a global context.

REFERENCE BOOKS:

1. Burch and Gruditski, Information Systems-Theory and Practice, Fifth edition, John Wiley & Sons, New York, 1989.
2. Hawryszkiewycz, I.T., Introduction to Systems Analysis and Design, Prentice Hall of India, 1989.
3. Ian Sommerville, Software Engineering, 6 th . Edition, Pearson Education Asia, 2001.
4. Lucas, Henry C., Analysis, Design, and Implementation of Information Systems, 4th Edition, McGraw Hill, New York, 1992.
5. O'Brien J.A., Management Information Systems, 4/e, Tata McGraw Hill, 1999.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	2	2	2	1	1	1	2	2	2	1	2
CO2	2	2	1	1	2	1	2	1	1	1	1	2	2	2	1
CO3	2	2	1	1	2	2	2	1	1	1	2	1	2	1	2
CO4	2	2	1	1	2	2	1	1	1	1	1	1	2	2	1
CO5	2	2	1	1	2	1	1	1	1	1	1	2	2	2	1
CO	2	2	1	1	2	1.6	1.6	1	1	1	1.4	1.6	2	1.6	1.4

1 - low, 2 - medium, 3 - high

AMEPT2125- RESEARCH METHODOLOGY

COURSE OBJECTIVE:

- To impart scientific, statistical and analytical knowledge for carrying out researchwork effectively.

UNIT 1 INTRODUCTION TO RESEARCH 9 hrs.

The hallmarks of scientific research – Building blocks of science in research – Concept of Applied and Basic research – Quantitative and Qualitative Research Techniques – Need for theoretical frame work – Hypothesis development – Hypothesis testing with quantitative data. Research design – Purpose of the study: Exploratory, Descriptive, Hypothesis Testing.

UNIT 2 EXPERIMENTAL DESIGN 9 hrs.

Laboratory and the Field Experiment – Internal and External Validity – Factors affecting Internal validity. Measurement of variables – Scales and measurements of variables. Developing scales – Rating scale and attitudinal scales – Validity testing of scales – Reliability concept in scales being developed – Stability Measures.

UNIT 3 DATA COLLECTION METHODS 9 hrs.

Interviewing, Questionnaires, etc. Secondary sources of data collection. Guidelines for Questionnaire Design – Electronic Questionnaire Design and Surveys. Special Data Sources: Focus Groups, Static and Dynamic panels. Review of Advantages and Disadvantages of various Data-Collection Methods and their utility. Sampling Techniques – Probabilistic and non- probabilistic samples. Issues of Precision and Confidence in determining Sample Size. Hypothesis testing, Determination of Optimal sample size.

UNIT 4 MULTIVARIATE STATISTICAL TECHNIQUES 9 hrs.

Data Analysis – Factor Analysis – Culster Analysis -Discriminant Analysis – Multiple Regression and Correlation – Canonical Correlation – Application of Statistical (SPSS) Software Package in Research.

UNIT 5 RESEARCH REPORT 9 hrs.

Purpose of the written report – Concept of audience – Basics of written reports. Integral parts of a report – Title of a report, Table of contents, Abstract, Synopsis, Introduction, Body of a report – Experimental, Results and Discussion – Recommendations and Implementation section – Conclusions and Scope for future work.

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency

CO1: Understand and apply different research techniques and effectively prepare a research report.

CO2: Develop and test hypotheses using quantitative and qualitative data.

CO3: Design and validate measurement scales and attitudinal scales with a strong focus on reliability and stability.

CO4: Select and employ appropriate data collection methods, including questionnaires, interviews, and focus groups, tailored to specific research needs.

CO5: Analyze data using advanced multivariate statistical techniques such as factor analysis, cluster analysis, and multiple regression, leveraging statistical software like SPSS.

REFERENCE BOOKS:

1. C.R.Kothari, Research Methodology, Wishva Prakashan, New Delhi, 2001.
2. Donald H.McBurney, Research Methods, Thomson Asia Pvt. Ltd. Singapore, 2002.
3. Donald R. Cooper and Ramela S. Schindler, Business Research Methods, Tata McGraw- Hill Publishing Company Limited, New Delhi, 2000
4. G.W.Ticehurst and A.J.Veal, Business Research Methods, Longman,1999.
5. Ranjit Kumar, Research Methodology, Sage Publications, London, New Delhi,1999.
6. Raymond-Alain Thie'tart, et.al., Doing Management Research, Sage Publications, London, 1999
7. Uma Sekaran, Research Methods for Business, John Wiley and Sons Inc., NewYork, 2000.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	2	2	1	1	2	1	1	2	2	2	1	1
CO2	1	1	1	2	2	1	1	2	1	1	2	2	2	1	1
CO3	1	1	1	2	2	1	1	2	1	1	2	2	2	1	1
CO4	1	1	1	1	2	1	1	2	1	1	2	2	2	1	1
CO5	1	1	1	1	2	1	1	2	1	1	2	2	2	1	1
CO	1	1	1	1.6	2	1	1	2	1	1	2	2	2	1	1

1 - low, 2 - medium, 3 - high

AMEPT2126- SUPPLY CHAIN AND LOGISTICS MANAGEMENT

COURSE OBJECTIVE:

- This module is to provide a basic and a deeper understanding about supply chain management and the role of supply chain in an industry for meeting end user needs.
- To provide a detailed knowledge on product and process management.
- Focused to provide an insight of supply chain management from both industrial andend-user perspective.

UNIT 1 INTRODUCTION 9 hrs.

Supply Chain, Objectives & Stages, power of SCM – Process views of a supply chain– Strategic planning, Achieving a strategic fit in a supply chain and factors affecting the strategic fit – Value chain, supply chain flowlines –Product lifecycle, Fishers classification of products – Effective and responsive supplychains

UNIT 2 SUPPLY CHAIN PROCESS 9 hrs.

Forecasting in supply chain, characteristics, components, methods and approaches, collaborative forecasting–time series methods of forecasting-fore caste distribution order quantity and reorder point-Demand Management in MPC– MTS – ATO– MTO, customer order lead time– Postponement. Lean – elements of lean, lean techniques, agility, leagility. Mapping business processes using lean. Supply chain process optimization.

UNIT 3 PRODUCT PROCUREMENT & INVENTORY MANAGEMENT 9 hrs.

Procurement process–Sourcing in a supply chain–deciding factors for in-house or outsourcing–3PL–4PL – Supplier selection and assessment - Inventory, economies of scale to exploit fixed costs, Economies of scale to exploit quantity discounts, Managing multi-echelon cycle inventory–Bullwhip effect Safety inventory, Managing safety inventory practice – Product substitution. EOQ - Order Timing Decisions, safety stock, continuous distributions, probability of stocking out criterion, customer service criterion, time period correction factor. General inventory models, dynamic order quantity, deterministic and stochastic inventory models.

UNIT 4 DESIGNING A SUPPLY CHAIN 9 hrs.

Supply chain drivers - Supply chain performance measures- SCOR Model - Network design in a supply chain, factors influencing design, Framework for network design network, models for facility location and capacity allocation - Uncertainty in network design – Discounted

cash flow analysis, Decision trees in evaluating network design. Distribution, factors influencing distribution, design options for a distribution network.

UNIT 5 IT IN SUPPLYCHAIN 9 hrs.

Dynamic supply chain design, Impact of technology on SCM, Key trends in SCM, IT in supply chain co ordination, IT in supply chain design – MRP, record processing, technical issues, using MRP and system dynamics– ERP – Performance metrics – Functional Silo approach – Integrated supply chain metrics – cash to cash time –CRM –ISCM –Discussion on supply chain adopted by primary industrial sectors and case studies.

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in in the following aspects:

CO1: Students are expected to understand the entire spectrum of activities undergone by manufacturers in meeting end-user needs.

CO2: Viewing from manufacturer‘s perspective, the aimed outcome of this module is to enhance innovative ideas in students, to effectively meet the end user needs.

CO3: To be able to solve industrial case studies in supply chain management.

CO4: Apply knowledge of supply chain drivers and network design principles to optimize performance and achieve strategic goals.

CO5: Leverage IT tools and technologies, such as ERP and CRM systems, to design, coordinate, and monitor supply chain processes.

REFERENCE BOOKS:

1. Ayers,J.,(2000), Hand Book of Supply Chain Management, The StLencie Press/APICS Series on Resource Management.
2. Burt,N.D., Dobler, W.D. and Starling, L.S.(2005),World Class Supply Chain Management,The Key to Supply Chain Management, Tata McGraw Hill Publishing Company Limited.
3. Chopra,S.,Meindl,P.andKalra,D.V.(2008),SupplyChainManagement,Strategy,Plannin g and Operation, Pearson Education, Inc.
4. Fredendall, D.L.and Hill,E.,(2001),Basics of Supply Chain Management, The StLucie Press /APICS Series on Resource Management.
5. Monczka,R.,Trent,R. and Handfield,R.(2007), Purchasing and Supply Chain Management, 3rd edition, Thompson Learning Inc.
6. Taha,H.A (2007), Operations research: An Introduction, Prentice Hall.
7. Vollmann,T.E., Berry,L.W, & Whybark,D.C (2008), Manufacturing Planning and Control for Supply Chain Management, Tata McGraw Hill Publishing Ltd.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	2	2	2	1	2	1	1	1	2	2	2	1
CO2	2	1	1	2	2	2	1	2	1	1	1	2	2	2	1
CO3	1	1	1	2	2	1	1	2	1	1	1	2	2	2	1
CO4	2	1	1	1	2	2	1	2	1	1	1	2	2	2	1
CO5	2	1	1	1	1	1	1	2	1	1	1	2	2	2	1
CO	1.8	1	1	1.6	1.8	1.6	1	2	1	1	1	2	2	2	1

1 - low, 2 - medium, 3 - high

AMEPT2127- MATERIALS TESTING AND CHARACTERIZATION TECHNIQUES

COURSE OBJECTIVE:

- This course aims to impart knowledge on various techniques of material characterization.

UNIT 1 MICRO AND CRYSTALSTRUCTURE ANALYSIS 9 hrs.

Principles of Optical Microscopy – Specimen Preparation Techniques – Polishing and Etching – Polarization Techniques – Quantitative Metallography – Estimation of grain size – ASTM grain size numbers – Microstructure of Engineering Materials - Elements of Crystallography – X- ray Diffraction – Bragg's law – Techniques of X-ray Crystallography – Debye – Scherer camera – Geiger Diffractometer – analysis of Diffraction patterns – Inter planer spacing – Identification of Crystal Structure, Elements of Electron Diffraction.

UNIT 2 ELECTRON MICROSCOPY 9 hrs.

Interaction of Electron Beam with Materials – Transmission Electron Microscopy – Specimen Preparation – Imaging Techniques – BF & DF – SAD – Electron Probe Microanalysis – Scanning Electron Microscopy – Construction & working of SEM – various Imaging Techniques – Applications- Atomic Force Microscopy- Construction & working of AFM - Applications .

UNIT 3 CHEMICAL AND THERMAL ANALYSIS 9 hrs.

Basic Principles, Practice and Applications of X-Ray Spectrometry, Wave Dispersive X-Ray Spectrometry, Auger Spectroscopy, Secondary Ion Mass Spectroscopy, Fourier Transform Infra Red Spectroscopy (FTIR)- Proton Induced X-Ray Emission Spectroscopy, Differential Thermal Analysis, Differential Scanning Calorimetry (DSC) And Thermo Gravitymetric Analysis (TGA)

UNIT 4 MECHANICAL TESTING – STATIC TESTS 9 hrs.

Hardness – Brinell, Vickers, Rockwell and Micro Hardness Test – Tensile Test – Stress – Strain plot Proof Stress – Torsion Test - Ductility Measurement – Impact Test – Charpy & Izod – DWTT - Fracture Toughness Test, Codes and standards for testing metallic and composite materials.

UNIT 5 MECHANICAL TESTING – DYNAMIC TESTS 9 hrs.

Fatigue – Low & High Cycle Fatigues – Rotating Beam & Plate Bending HCF tests – S-N curve – LCF tests – Crack Growth studies – Creep Tests – LM parameters – AE Tests-modal analysis - Applications of Dynamic Tests.

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: In microstructure evaluation and Crystal structure analysis.
CO2: Usage of electron microscopy equipment's
CO3: Expertise in Conducting Chemical Thermal Analysis, static and dynamic mechanical testing methods.
CO4: Conduct and analyze results of static mechanical testing methods such as tensile, impact, and fracture toughness tests, adhering to industry standards.
CO5: Perform dynamic mechanical testing, including fatigue and creep tests, and interpret failure mechanisms in materials.

REFERENCE BOOKS:

1. ASM Hand book-Materials characterization, Vol – 10, 2004.
2. Culity B.D., Stock S.R& Stock S., Elements of X ray Diffraction, (3rd Edition). Prentice Hall, 2001.
3. Davis J. R., Tensile Testing, 2nd Edition, ASM International, 2004.
4. Dieter G.E., Mechanical Metallurgy, (3rd Edition), ISBN: 0070168938, McGraw Hill, 1988.
5. Goldsten,I.J., Dale.E., Echin.N.P.& Joy D.C., Scanning Electron Microscopy & X ray- Micro Analysis, (2nd Edition), ISBN – 0306441756, Plenum Publishing Corp.,2000.
6. Morita.S, Wiesendanger.R, and Meyer.E, –Non-contact Atomic Force Microscopy‖ Springer,2002,
7. Newby J., Metals Hand Book- Metallography & Micro Structures, (9th Edition), ASM International, 1989.
8. Suryanarayana A. V. K., Testing of metallic materials, (2nd Edition), BS publications, 2007.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	2	3	1	1	2	1	1	1	2	1	2	1
CO2	2	1	1	2	3	1	1	2	1	1	1	2	1	2	1
CO3	2	1	1	2	3	1	1	2	1	1	1	2	1	2	1
CO4	2	1	1	2	3	1	1	2	1	1	1	2	1	2	1
CO5	2	1	1	2	3	1	1	2	1	1	1	2	1	2	1
CO	2	1	1	2	3	1	1	2	1	1	1	2	1	2	1

1 - low, 2 - medium, 3 - high

AMEPT2128- PRODUCT DESIGN AND DEVELOPMENT

COURSE OBJECTIVES:

- To gather the information about Flexible manufacturing system concept in detail.
- To understand modern manufacturing methodology
- To learn the recent trends in Scheduling and Simulation

UNIT 1 INTRODUCTION 9 hrs.

Manufacturing in a competitive environment - Automation of manufacturing process – types of automation -material handling and movement - industrial robots - Sensor technology-flexible, fixturing - Design for assembly, disassembly and services.

UNIT 2 GROUP TECHNOLOGY AND CELLDESIGN 9 hrs.

Group technology - Part families generation - classification and coding - Production flow analysis - Machine cell design–Benefits.

UNIT 3 FLEXIBLE MANUFACTURING SYSTEM AND APPLICATIONS 9 hrs.

Flexible Manufacturing System - Introduction - Components of FMS - Application work stations – Computer control and functions - Planning, scheduling and control of FMS - Scheduling – Knowledge based scheduling –Agile manufacturing.

UNIT 4 SOFTWARE INTEGRATION WITH FMS 9 hrs.

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

UNIT 5 LEAN MANUFACTURING 9 hrs.

Just in time - Characteristics of JIT – batch size concepts - work station loads - close supplier ties - flexible workforce-line flow strategy. Total productive maintenance –Kanban system-strategic implications- implementation issues-MRDJIT- Lean manufacturing.

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: The graduates will be able to implement the concepts of group technology, know the techniques of part family generation and improve the performance of manufacturing system.

CO2: Apply newer techniques in real time manufacturing environment methodologies in order to reduce total manufacturing lead time and down time in the production shop floor.

CO3: Analyze and apply flexible manufacturing system (FMS) components, scheduling techniques, and agile manufacturing principles to optimize production workflows.

CO4: Use simulation software and database systems effectively for the integration and planning of FMS in a manufacturing setup.

CO5: Implement lean manufacturing principles, including Just-in-Time (JIT), Kanban, and Total Productive Maintenance (TPM), to enhance efficiency and reduce waste in production processes.

REFERENCE BOOKS:

1. GrooverM.P.,"Automation,Production Systems and Computer Integrated Manufacturing" ,Prentice-Hall of India Pvt Ltd., New Delhi, 2010
2. Jha,N.K. "Hand book of Flexible Manufacturing Systems", Academic Press Inc.,1991.
3. Kalpakjain,"Manufacturing Engineering and Technology", Addision- Wesley Publishing Co.1995.
4. Talichi Ohno, Toyoto, "Production System Beyond Large- Scale production", Productivity Press (India) PvtLtd.,1992.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	1	2	1	2	2	1	1	1	2	2	2	1
CO2	1	1	1	1	1	1	2	1	1	1	1	2	2	1	1
CO3	1	1	2	1	2	1	1	2	1	1	1	1	2	2	1
CO4	2	1	1	1	1	1	2	2	1	1	1	2	1	2	1
CO5	1	1	2	1	2	1	1	1	1	1	1	2	2	1	1
CO	1.4	1	1.6	1	1.6	1	1.6	1.6	1	1	1	1.8	1.8	1.6	1

1 - low, 2 - medium, 3 - high

AMEPT2129- FLEXIBLE COMPETITIVE MANUFACTURINGSYSTEM

COURSE OBJECTIVES:

- FMS Designing and analyzing the same using simulation and different analytical techniques.
- Helps to learn the tool management in FMS & to handle the production management problems in planning, loading, scheduling, routing and breakdown in a typical FMS

UNIT 1 UNDERSTANDING OF FMS 9 hrs.

Evolution of Manufacturing Systems, Definition, objective and Need, Components, Merits, Demerits and Applications Flexibility in Pull and Push type

UNIT 2 CLASSIFICATION OF FMS LAYOUT 9 hrs.

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

UNIT 3 PROCESSING STATIONS 9 hrs.

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

UNIT 4 MATERIAL HANDLING SYSTEM 9 hrs.

An introduction, Conveyor, Robots, Automated Guided Vehicle (AGV), Automated Storage Retrieval System (ASRS) Management technology: Tool Management, tool magazine, Tool preset, identification, Tool monitoring and fault detection, routing, Production Planning and Control, Scheduling and loading of FMS.

UNIT 5 DESIGN OF FMS 9 hrs.

Performance Evaluation of FMS, Analytical model and Simulation model of FMS Case studies: Typical FMS problems from research papers.

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in in the followingaspects:

CO1: Classify and distinguish FMS and other manufacturing systems including job-shop and mass production systems.

CO2: Explain processing stations and material handling system used in FMS environments.

CO3: Design and analyze FMS using simulation and analytical techniques.

CO4: Understand tool management in FMS.

CO5: Analyze the production management problems in planning, loading, scheduling,routing and breakdown in a typical FMS.

REFERENCE BOOKS::

1. William W Luggen, –Flexible Manufacturing Cells and System‖ Prentice Hall of Inc New Jersey, 1991
2. Reza A Maleki –Flexible Manufacturing system‖ Prentice Hall of Inc New Jersey, 1991
3. John E Lenz –Flexible Manufacturing‖ marcel Dekker Inc New York ,1989. References
4. Groover, M.P –Automation, Production Systems and Computer Integrated Manufacturing, Prentice Hall

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	1	1	1	1	1	1	1	2	2	2	3
CO2	2	2	1	1	1	1	1	1	1	1	1	2	2	1	3
CO3	2	2	2	1	1	1	1	1	1	1	1	2	2	1	3
CO4	2	2	2	1	1	1	1	1	1	1	1	2	1	2	2
CO5	2	2	2	1	2	1	1	1	1	1	1	2	2	1	3
CO	2	2	1.6	1	1.2	1	1	1	1	1	1	2	1.8	1.4	2.8

1 - low, 2 - medium, 3 - high

AMEPT2130- NANOTECHNOLOGY

COURSE OBJECTIVE:

- To inspire the students to expect to the trends in development and synthesizing of nano systems and measuring systems to nano scale.

UNIT 1 OVER VIEW OF NANOTECHNOLOGY 9 hrs.

Definition – historical development – properties, design and fabrication Nano systems, ,working principle ,applications and advantages of nano system. Nano materials – ordered oxides – Nano arrays – potential health effects

UNIT 2 NANO DEFECTS, NANO PARTILES AND NANO LAYERS 9 hrs.

Nano defects in crystals – applications – Nuclear Track nano defects. Fabrication of nano particles – LASER ablation – sol gels – precipitation of quantum dots. Nano layers – PVD,CVD ,Epitaxy and ion implantation – formation of Silicon oxide- chemical composition – doping properties – optical properties.

UNIT 3 NANO STRUCTURING 9 hrs.

Nano photolithography – introduction – techniques – optical – electron beam – ion beam – X-ray and Synchrotron – nanolithography for microelectronic industry – nano polishign of Diamond – Etching of Nano structures – Nano imprinting technology – Focused ion beams - LASER interference Lithography nano arrays –Near-Field Optics - case studies and Trends

UNIT 4 SCIENCE AND SYNTHESIS OF NANO MATERIALS 9 hrs.

Classification of nano structures – Effects of nano scale dimensions on various properties – structural, thermal, chemical, magnetic, optical and electronic properties fluid dynamics – Effect of nano scale dimensions on mechanical properties - vibration, bending, fracture 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 – Diamond like carbon coating. Top down and bottom up processes.

UNIT 5 CHARACTERIZATION OFNANO MATERIALS 9 hrs.

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

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: To evaluate Nano systems, to the various fabrication techniques.

CO2: Also to have deep knowledge in nano materials and various nano measurements techniques.

CO3: Analyze the impact of nano-scale dimensions on material properties, including mechanical, chemical, and electronic behaviors.

CO4: Apply advanced synthesis methods, such as sol-gel, plasma synthesis, and carbon nanotube fabrication, in real-world scenarios.

CO5: Use advanced characterization tools like electron microscopy, Raman spectroscopy, and 3D surface analysis to investigate nano-materials comprehensively.

REFERENCE BOOKS::

1. Charles P Poole, Frank J Owens, Introduction to Nano technology, John Wiley and Sons, 2003
2. Fahrner W.R., Nanotechnology and Nanoelectronics, Springer (India) Private Ltd., 2011.
3. Julian W. Hardner Micro Sensors, Principles and Applications, CRC Press1993.
4. Mark Madou , Fundamentals of Microfabrication, CRC Press, New York,1997.
5. Mohamed Gad-el-Hak, MEMS Handbook, CRC press, 2006, ISBN :8493-9138-5
6. Norio Taniguchi, Nano Technology, Oxford University Press, New York,2003
7. Sami Franssila, Introduction to Micro fabrication , John Wiley & sons Ltd, 2004.ISBN:470-85106-6
8. Tai – Ran Hsu, MEMS and Microsystems Design and Manufacture, Tata-McGraw Hill, New Delhi, 2002.
9. Waqar Ahmed and Mark J. Jackson, Emerging Nanotechnologies for Manufacturing, Elsevier Inc.,2013,ISBN :978-93-82291-39-8

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	3	1	2	1	1	1	1	2	2	2	3
CO2	2	1	1	1	3	1	2	1	1	1	1	2	2	2	2
CO3	2	1	1	1	3	1	2	1	1	1	1	2	1	2	3
CO4	2	1	1	1	3	1	2	1	1	1	1	2	1	1	2
CO5	2	1	1	1	3	1	2	1	1	1	1	2	2	1	3
CO	2	1	1	1	3	1	2	1	1	1	1	2	1.6	1.6	2.6

1 - low, 2 - medium, 3 - high

AMEPT2131- ADVANCED METAL JOINING PROCESSES ASSESSMENT

COURSE OBJECTIVES:

- To provide knowledge about the principle and applications of latest welding processes.
- To acquire essential significance of thermal effects of welding and subsequent remedial measures to reduce residual stresses and distortion in weldments.
- To gain knowledge about the Weldability of different commercially available materials, their corresponding weld joints design and automation of welding processes.

UNIT 1 SPECIAL WELDING PROCESSES 8 hrs.

Electron beam welding, laser beam welding, ultrasonic welding, explosion welding, electro slag and electro gas welding, cold pressure welding, Friction Stir welding, diffusion bonding and adhesive bonding.

UNIT 2 HEAT EFFECTS OF WELDING 9 hrs.

Metallurgical effects of heat flow in welding-TTT curve- continuous cooling transformation diagrams-development of residual stress, methods of relieving or controlling welding residual stresses, types and control of distortion, pre-heat and post welding heat treatment.

UNIT 3 WELDABILITY OFFERROUS ANDNON-FERROUS ALLOYS 10 hrs.

Weldability of carbon and alloy steels, stainless steels, cast irons, copper and its alloys, aluminum and its alloys, titanium and its alloys, Ni and its alloys, weldability tests.

UNIT 4 WELDINGDESIGN 9 hrs.

Typical joints for different welding processes, principles of welding joint design and location of joint within the member, evolving good weld design, welding symbol- Blue print reading, welding design for static and fatigue loading fracture toughness.

UNIT 5 AUTOMATIONINWELDING 9 hrs.

Welding sequence and classification of processes, manual and semi-automatic, automatic, automated welding- adaptive controls- remote welding, robotic welding- selecting welding system, gravity welding and firecracker welding, underwater welding- wet and dry.

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the followingaspects:

CO1: To select suitable welding process and technique to join a given material.
CO 2: To identify and minimize the distortion and residual stresses induced in weldments.
CO3: To evolve better design for both static and fatigue loading conditions.
CO4: To select suitable welding automation for the production of engineering components.
CO5: To assess and ensure the weldability of various ferrous and non-ferrous alloys, applying suitable techniques to optimize weld quality and performance.

REFERENCE BOOKS::

1. RoaP.N. "Manufacturing Technology", Tata McGraw-Hill,2005.
2. Avitzur,"Metal Forming Processes and Analysis",Tata Mc Graw-Hill ,2005.
3. Dieter," Mechanical Metallurgy", Tata McGraw -Hill,2005.
4. Harris,J.N., "Mechanical working of Metals- Theory and Practice‖, Pergamon Press,1995
5. AltanT.," Metal forming–Fundamentals and applications", American Society of Metals,Metalspark, 2003.
6. ASM Hand book, Forming and Forging, Ninth edition, Vol – 14, 2003
7. Parmar.R.S, Welding Processes and technology‖, 3rd Edition, Khanna Publishers,2013.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	3	1	2	1	1	1	1	2	2	2	2
CO2	2	1	1	1	3	1	2	1	1	1	1	2	1	2	2
CO3	2	1	1	1	3	1	2	1	1	1	1	2	2	2	2
CO4	2	1	1	1	2	1	2	1	1	1	1	2	2	2	2
CO5	2	1	1	1	2	1	2	1	1	1	1	2	2	2	3
CO	2	1	1	1	2.6	1	2	1	1	1	1	2	1.8	2	2.2

1 - low, 2 - medium, 3 - high

AMEPT2132- INDUSTRIAL SAFETY

COURSE OBJECTIVES:

- To develop and strengthen the industrial safety concept and ideas
- Motivate the students to impart basic safety skills and understandings to run an industry efficiently and effectively

UNIT 1 OPERATIONAL SAFETY 9 hrs.

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. 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.

UNIT 2 SAFETY APPRAISA L AND ANALYSIS 9 hrs.

Human side of safety – personal protective equipment – causes and cost of accidents. Accidents prevention program – specific hazard control strategies – HAZOP training and development of employees – first aid – fire fight devices – accident reporting, investigation. Measurement of safety performance, accident reporting and investigation – plant safety inspection, job safety analysis – safety permit procedures. Product safety – plant safety rules and procedures – safety sampling – safety inventory systems. Determining the cost effectiveness of safety measurement.

UNIT 3 OCCUPATIONAL HEALTH 9 hrs.

Concept and spectrum of health functional units and activities of operational health service – occupational and related disease – levels of prevention of diseases – notifiable occupational diseases Toxicology Lead – Nickel, chromium and manganese toxicity – gas poisoning (such as CO, Ammonia Chlorise, So2, H2s.) their effects and prevention – effects of ultra violet radiation and infrared radiation on human system.

UNIT 4 SAFETY AND HEALTH REGULATIONS 9 hrs.

Safety and health standards – industrial hygiene – occupational diseases prevention welfare facilities. The object of factories act 1948 with special reference to safety provisions, model rules 123a, history of legislations related to safety – pressure vessel act – Indian boiler act – the environmental protection act – electricity act – explosive act.

UNIT 5 SAFETY MANAGEMENT 9 hrs.

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.

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: At the end of this course the students are expected to gain knowledge and skills needed to run an industry with utmost safety precautions.

CO2: Awareness on occupational health and practice

CO3: Refer and follow and safety and health regulations

REFERENCE BOOKS::

1. John V Grimaldi, Safety Management. AITB publishers,2003.
2. John.V .Grimaldi and Rollin. H Simonds, –Safety Managenent, All India traveler book seller, New Delhi –1989.
3. Krishnan N.V, –Safety in Industry, Jaico Publisher House,1996.
4. Singh, U.K and Dewan, J.M., –Sagety, Security And Risk Management‖, APH publishing company, New Delhi,1996.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	2	1	2	1	1	1	1	1	2	2	2
CO2	2	1	1	1	2	1	2	1	1	1	1	1	1	1	1
CO3	2	1	1	1	2	1	2	1	1	1	1	1	1	2	2
CO4	2	1	1	1	2	1	2	1	1	1	1	1	2	1	1
CO5	2	1	1	1	2	1	2	1	1	1	1	1	1	2	3
CO	2	1	1	1	2	1	2	1	1	1	1	1	1.4	1.6	1.8

1 - low, 2 - medium, 3 - high

AMEPT2133- SUSTAINABLE MANUFACTURING

COURSE OBJECTIVES:

- To provide students with knowledge of key environmental and sustainability issues relevant to modern manufacturing.
- To provide a set of tools and skills that may be used to design, analyze, and improve manufacturing processes, products, and business operations.

UNIT 1 INTRODUCTION 9 hrs.

Need for Sustainable Manufacturing Introduction to the environmental issues pertaining to the manufacturing sector – pressure to reduce costs – processes that minimize negative environmental impacts – environmental legislation and energy costs – acceptable practice in society – adoption of low carbon technologies – need to reduce the carbon footprint of manufacturing operations.

UNIT 2 ACCOUNTING AND ESTIMATION 9 hrs.

Techniques for non-market valuation Cost and income based approaches, demand estimation methods – expressed and revealed preference, choice modeling – Multi-criteria analysis- Stakeholder analysis – Environmental accounting at sector and national levels

UNIT 3 DESIGN APPROACHES 9 hrs.

Strategies and Design Approaches Concepts of Competitive Strategy and Manufacturing Strategies and development of a strategic improvement programme – Manufacturing strategy in business - success Strategy formation and formulation – Structured strategy formulation – Sustainable manufacturing system design options – Approaches to strategy formulation – Realization of new strategies/system designs

UNIT 4 CHALLENGES AND OPPORTUNITIES 9 hrs.

Challenges in logistics and supply chain – developing the rightsupply chain strategy for the products – need to align the supply network around the strategy
– Tools that can be used systematically to identify areas for improvement in supply chains – Specific challenges and new thinking in the plan, source and delivering of sub-processes9 hrs.

UNIT 5 SUSTAINABLE OPERATIONS 9 hrs.

Principles of sustainable operations 7 hours Life cycle assessment Manufacturing and service activities –Influence of product design on operations – Process analysis – Capacity management – Quality management –Inventory management – Just-In-Time systems – Resource efficient design – Consumerism and sustainable well-being. Lean manufacturing, concepts. Primary Tools of Lean manufacturing: 5-S, Workplace organization, Total Productive Maintenance, Process mapping/ Value stream mapping, Work cell- Just-In-Time systems

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects

CO1: Understand the need for sustainability assessment and their types.
CO2: Develop sustainability assessment framework model depending on the process under investigation.
CO3: To Frame Strategic polices and implement sustainability approaches
CO4: Leverage sustainability concepts in a supply chain.
CO5: Apply knowledge of lean and other sustainability concepts in a typical sustainable manufacturing setup

REFERENCE BOOKS:

1. Seliger, G,(2012), Sustainable Manufacturing: Shaping Global Value Creation, Springer
2. Dornfeld, David.(2012), Green Manufacturing, Springer-Verlag, New York
2. Davim, J.P.(2010), Sustainable Manufacturing, John Wiley & Sons.
3. Gupta, S.M. and Lambert, A.J.D.(2008), Environment Conscious Manufacturing, CRC Press.
4. Douglas C.Montgomery, ―Design and Analysis of Experiments‖, 5th Edition, John Wiley & Sons, 2012

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	2	1	3	2	1	1	1	1	2	2	2
CO2	2	1	1	1	2	1	3	2	1	1	1	1	2	1	1
CO3	2	1	1	1	2	1	3	2	1	1	1	1	2	2	2
CO4	2	1	1	1	2	1	3	2	1	1	1	1	2	2	2
CO5	2	1	1	1	2	1	3	2	1	1	1	1	1	2	3
CO	2	1	1	1	2	1	3	2	1	1	1	1	1.8	1.8	2

1 - low, 2 - medium, 3 - high

AMEPT2134- DIGITAL WORK FLOW IN MANUFACTURING

COURSE OBJECTIVES:

1. To provide foundational knowledge of digital workflow management using Enterprise Resource Planning (ERP) tools and Value Stream Mapping (VSM).
2. To enable students to design, implement, and monitor integrated digital workflows for resource planning and management in real-time environments.

UNIT 1
Introduction to Digital Workflow Management using a Resource Planning Tool - Introduction and Overview of Enterprise Resource Planning (ERP) - Utilization of Digital Workflow Management Tools for Enterprise Resource Planning (ERP) applications - Core Features and Requirements of a Digital Workflow Management Tool for Resource Planning - Inventory Management and Resource Planning Strategies using Digital Workflow Management Tools

UNIT 2: Value Stream Mapping
Value Stream Mapping and Resource Planning System-• Understanding the theory of VSM - Draw VSM in class based on given case study. User Setup - Customer Relationship Management. (CRM) Setup •-Production Setup -Human Resource Setup - Warehouse Setup

UNIT 3: Digital Workflow Management-I
Digital Workflow Management for Sales Flow (Quotation to Sales Order)- Procurement Flow (Inventory Management, Stock Entry, Warehouse Management)

UNIT 4 : Digital Workflow Management-II
Digital Workflow Management for Manufacturing Flow (Work Order, Job Card) • Delivery Flow (Packing list, Delivery Order) -Material traceability and handling using Barcode Scanning System (BCS) - Hardware and Software Integration

UNIT 5: Digital Workflow Status
Dashboard Visualization of Digital Workflow Status - Setting up a dashboard for monitoring resource planning workflow status Digital Workflow Process Integration (Process Integration of an integrated workflow cycle) - Manufacturing Order Cycle: Sales, Procurement, Manufacturing, and Delivery Cycle - Real-time monitoring and Visualization on dashboard - Barcode Scanning Integration throughout the workflow cycle

After completing this course, students will be able to:

CO1: Utilize digital workflow management tools for effective resource planning, inventory management, and enterprise operations.
CO2: Develop and implement workflow processes for sales, procurement, manufacturing, and delivery flows using ERP systems.
CO3: Apply Value Stream Mapping (VSM) techniques to optimize resource planning and operational efficiency.

CO4: Integrate hardware and software solutions, including barcode scanning systems, for material traceability and workflow management.
CO5: Create and monitor dashboards for real-time visualization of resource planning and workflow status across the enterprise.

REFERENCES BOOKS:

1. S. Anil Kumar and N. Suresh, "Production and Operations Management", New Age International Pvt Ltd Publishers, 2009
2. Alexis Leon, Enterprise Resource Planning, McGraw Hill Education, 2008.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	1	2	2	2	1	1	1	1	1	2	2	3
CO2	1	2	1	1	2	2	2	1	1	1	1	1	2	2	3
CO3	1	2	1	1	2	2	2	1	1	1	1	1	2	2	3
CO4	1	2	1	1	2	2	2	1	1	1	1	1	2	2	3
CO5	1	2	1	1	2	2	2	1	1	1	1	1	2	2	3
CO	1	2	1	1	2	2	2	1	1	1	1	1	2	2	3

1 - low, 2 - medium, 3 - high

Open Elective

AMEPT2136- NEURAL NETWORK AND FUZZY LOGICS

COURSE OBJECTIVES:

- Understand the concepts of artificial neural Networks.
- Understand the concepts of fuzzy logics.

UNIT1 EVOLUTION OF NEURAL NETWORKS 9 hrs.

Artificial Neural Network: Basic model, Classification, Feed forward and Recurrent topologies, Activation functions; Learning algorithms: Supervised, Un-supervised and Reinforcement; Fundamentals of connectionist modeling: Mc Culloach – Pits model, Perceptron, Adaline, Madaline.

UNIT 2 ALGORITHM 9 hrs.

Topology of Multi-layer perceptron, Back propagation learning algorithm, limitations of Multilayer perceptron. Radial Basis Function networks: Topology, learning algorithm; Kohenen's self-organising network: Topology, learning algorithm; Bidirectional associative memory Topology, learning algorithm, Applications.

UNIT 3 RECURRENT NEURAL NETWORKS 9 hrs.

Basic concepts, Dynamics, Architecture and training algorithms, Applications; Hopfield network: Topology, learning algorithm, Applications; Industrial and commercial applications of Neural networks: Semiconductor manufacturing processes, Communication, Process monitoring and optimal control, Robotics, Decision fusion andpattern recognition.

UNIT 4 CLASSICAL AND FUZZY SETS 9 hrs.

Introduction, Operations and Properties, Fuzzy Relations: Cardinality, Operations and Properties, Equivalence and tolerance relation, Value assignment: cosine amplitude and max-min method; Fuzzification: Membership value assignment- Inference, rank ordering, angular fuzzy sets. Defuzzification methods, Fuzzy measures, Fuzzy integrals, Fuzziness and fuzzy resolution; possibility theory and Fuzzy arithmetic; composition and inference; Considerations of fuzzy decision-making.

UNIT 5 FUZZY LOGIC CONTROL SYSTEMS 9 hrs.

Basic structure and operation of Fuzzy logic control systems; Design methodology and stability analysis of fuzzy control systems; Applications of Fuzzy controllers. Applications of fuzzy theory.

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects

CO1: Develop neural networks and fuzzy logic systems and analyze their behavior.
CO2: Understand and apply the topology of multi-layer perceptrons.

CO3: Apply recurrent neural networks in the manufacturing domain.
CO4: Design and implement fuzzy logic control systems for real-world applications.
CO5: Utilize fuzzy decision-making techniques to solve complex engineering problems.

REFERENCE BOOKS:

1. Limin Fu, –Neural Networks in Computer Intelligence, McGraw Hill, 2003.
2. Fakhreddine O. Karray and Clarence De Silva., –Soft Computing and Intelligent Systems Design, Theory, Tools and Applications, Pearson Education, India, 2009.
3. Timothy J. Ross, ―Fuzzy Logic with Engineering Applications, McGraw Hill,1995.
4. B.Yegnanarayana, –Artificial Neural Networks, PHI, India, 2006.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	2	1	1	1	1	1	1	1	2	2	1
CO2	2	2	1	1	2	1	1	1	1	1	1	1	2	2	1
CO3	2	2	1	1	2	1	1	1	1	1	1	1	2	2	1
CO4	2	2	1	1	2	1	1	1	1	1	1	1	2	2	1
CO5	2	2	1	1	2	1	1	1	1	1	1	1	2	2	1
CO	2	2	1	1	2	1	1	1	1	1	1	1	2	2	1

1 - low, 2 - medium, 3 - high

AMEPT2137- MEMS AND MICRO SYSTEMS TECHNOLOGY

COURSE OBJECTIVES:

- Cover fundamental understanding of miniaturization and related functional advantages in various engineering disciplines and corresponding systems/devices
- Teach overview/working principles, modeling, analysis, design, manufacture and packaging of Microsystems along with the state of the art awareness of this domain

UNIT 1 INTRODUCTION 9 hrs.

Fundamentals and applications to Microsystems, Engineering Mechanics For Microsystems Design: Static Bending of Thin Plates, Mechanical Vibration, Thermo-mechanics, Thin-Film Mechanics, Stress Analysis Problems

UNIT 2 FLUID MECHANICS AT SMALL SCALES 9 hrs.

Viscosity of Fluids, Basic Equations in Continuum Fluid Dynamics, Incompressible Fluid Flow in Micro-conduits, Heat Conduction in Solids: General Principle of Heat Conduction, Fourier law of Heat Conduction, Newton‘s Cooling Law, Solid-Fluid Interaction, Heat Conduction in Multilayered Thin Films Scaling Laws in Miniaturization,

UNIT 3 MATERIALS FOR MEMS AND MICROSYSTEMS 9 hrs.

Silicon as Substrate Material, Silicon Compounds, Gallium Arsenide, Quartz, Polymers, Packaging Materials, polymer MEMS

UNIT 4 MICROSYSTEMS FABRICATION PROCESSES 9 hrs.

Photolithography, micro molding/replica molding process, 3D printing for polymer processing, Diffusion, Oxidation, Chemical/Physical Vapor Deposition, Deposition by Epitaxy, Etching, Bulk and Surface Micro manufacturing. Characterization techniques: Overview of various visualization techniques such as FESEM, TEM, Optical microscope etc.

UNIT 5 WORKING PRINCIPLES OF MICROSYSTEMS DEVICES 9 hrs.

Working Principles, Design, Manufacturing and Packaging of Micro-sensors, Actuators, Inertial Sensors and Fluidic devices microsystems Design Considerations: Selection of Materials, Manufacturing Processes, Signal Transduction, processing with respect to microsystem Packaging, modeling & simulation aspects.

Total: 45 Periods

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects:

CO1: Practical and simulation exposure to understand the complexity in design and manufacturing of Microsystems.

CO2: Basic Microsystems based research and training to develop Micro-systems modules for commercial and futuristic applications.

CO3: Develop an understanding of fluid mechanics at micro scales, enabling the design of efficient and effective microfluidic devices for diverse engineering applications.
CO4: Gain expertise in selecting and utilizing advanced materials such as silicon, polymers, and silicon compounds for MEMS and Microsystems fabrication.
CO5: Apply comprehensive knowledge of fabrication techniques, such as photolithography, chemical vapor deposition, and etching, to innovate in microsystem manufacturing and packaging.

REFERENCE BOOKS:

1. Tai-Ran, H. (2002). MEMS & microsystems: design and manufacture. ME Series.Madou, M. J. 2002.
2. Fundamentals of Micro-fabrication: the science of miniaturization. CRC Campbell, S. A. 2001.
3. The Science and Engineering of Microelectronic Fabrication (The Oxford Series in Electrical and Computer Engineering)

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	2	1	1	1	1	1	1	1	2	2	2
CO2	2	1	1	1	2	1	1	1	1	1	1	1	2	2	2
CO3	2	1	1	1	2	1	1	1	1	1	1	1	2	2	2
CO4	2	1	1	1	2	1	1	1	1	1	1	1	2	2	2
CO5	2	1	1	1	2	1	1	1	1	1	1	1	2	2	2
CO	2	1	1	1	2	1	1	1	1	1	1	1	2	2	2

1 - low, 2 - medium, 3 - high

AMEPT2138- OCCUPATIONAL HEALTH AND INDUSTRIAL HYGIENE

COURSE OBJECTIVE:

- To understand the basic knowledge on anatomy of few important human organs and its basic functions.
- To enable the students to learn about various functional and activities of occupational health services.
- To enable the students to compare the hazards of chemicals with the permissible levels.
- To acquire knowledge about types of hazards arising out of physical, chemical and biological agents. occupation and to suggest methods for the prevention of such diseases.

UNIT 1 ANATOMY, PHYSIOLOGY, HAZARD AND PATHOLOGY 7 hrs

Definition- Anatomy and Physiology of human organs – The lungs, Skin, Ear , Eyes and skin – Functions of organs –Impairment of organs – Effects of various hazards on organs - Cardio pulmonary resuscitation - audiometric tests,eye tests, vital functional tests. Exposure routes of toxic materials and protective mechanisms, Recognition of healthhazards, Methods for measuring and evaluating health hazards.

UNIT 2 PHYSICAL HAZARDS 10 hrs

Noise, compensation aspects, noise exposure regulation, properties of sound, occupational damage, risk factors, sound measuring instruments,octave band analyzer, noise networks, noise surveys, noise control program, industrial audiometry, hearing conservation programs-ibration, types, effects, instruments, surveying procedure, permissible exposure limit. Ionizing radiation, types, effects, monitoring instruments, control programs, OSHA standard-non-ionizing radiations, effects, types, radar hazards, microwaves and radio waves, lasers, TLV- cold environments, hypothermia, wind chill index, control measures of hot environments, thermal comfort, heat stress indices, Methods for controlling thermal exposures, acclimatization, estimation and control, Industrial illumination and design of lighting system.

UNIT 3 CHEMICAL HAZARDS 9 hrs

Recognition of chemical hazards-dust, fumes, mist, vapour, fog, gases, types, concentration, Exposure vs. Dose, TLV - Methods of Evaluation, process or operation description, Field Survey, Sampling methodology, Industrial Hygiene calculations, Comparison with OSHAS Standard. Air Sampling instruments, Types, Measurement Procedures, Instruments Procedures, Gas and Vapour monitors, dust sample collection devices, personal sampling Methods of Control - Engineering Control, Design maintenance considerations, design specifications - General Control Methods - training and education. Toxicology, classes of toxicants, metals, agriculture chemicals, solvents, food additives, cosmetics.– human health

risk assessment and Environmental risk assessment.

UNIT 4 BIOLOGICAL AND ERGONOMICAL HAZARDS 7 hrs

Classification of Bio-hazardous agents – examples, bacterial agents,rickettsial and chlamydial agents, viral agents, fungal, parasitic agents, infectious diseases – Biohazard control program, employee health program-laboratory safety program-animal care and handling-biological safety cabinets - building design. Work Related Musculoskeletal Disorders –Carpal Tunnel Syndrome CTS- Tendon pain disorders of the neck- back injuries.

UNIT 5 OCCUPATIONAL HEALTH, PHYSIOLOGY AND TOXICOLOGY 12 hrs

Concept and spectrum of health - functional units and activities of occupational health services, pre-employment and post-employment medical examinations – occupational related diseases, levels of prevention of diseases, notifiable occupational diseases such as silicosis, asbestosis, pneumoconiosis, siderosis, anthracosis, aluminosis and anthrax. Man as a system component – allocation of functions – efficiency – occupational work capacity – aerobic and anaerobic work – evaluation of physiological requirements of jobs – parameters of measurements – ategorization of job heaviness – work organization – stress – strain – fatigue – rest pauses – shift work – personal hygiene. Industrial toxicology, local, systemic and chronic effects, temporary and cumulative effects, carcinogens entry into human systems. Lead-nickel, chromium and manganese toxicity, gas poisoning (such as CO, ammonia, coal and dust etc…) their effects and prevention.

COURSE OUTCOMES:

After completing this course, students will be able to demonstrate competency in the following aspects

CO1: To understand the various physiological functions of our body , exposure roots of toxic materials into the body and the test methods for periodical monitoring of health.
CO2: To understand the various effects of physical hazards on human health and the various control measures taken to rectify the same.
CO3: To identify and analyse various types of hazards present in the chemicals processing and testing methodology followed monitoring and controlling the same.
CO4: To identify and analyse various types of hazards caused by the biological agents and Work related activities.
CO5: To identify and understand the notifiable occupational diseases and the impact of toxicity arising out

REFERENCE BOOKS:

1. Danuta Koradecka, Hand book of "Occupational Safety and Health", CRC Press, 2010.Mepco
2. Hand book of "Occupational Safety and Health", National Safety Council, Chicago, 1982.
3. Barbara A.Plog, Patricia J.Quinlan, MPH, CIH and Jennifer Villareal "Fundamentals of Industrial Hygiene", 6th edition 2012, National Safety Council, 2012.
4. Jearnne Mager Stellman, "Encyclopedia of Occupational Health and Safety", Vol.I and II, published by International LabourOrganisation, Geneva, 1998.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	2	2	3	2	1	1	1	1	1	2	1
CO2	1	1	1	1	2	2	3	2	1	1	1	1	1	2	1
CO3	1	1	1	1	2	2	3	2	1	1	1	1	1	2	1
CO4	1	1	1	1	2	2	3	2	1	1	1	1	1	2	1
CO5	1	1	1	1	2	2	3	2	1	1	1	1	1	2	1
CO	1	1	1	1	2	2	3	2	1	1	1	1	1	2	1

1 - low, 2 - medium, 3 - high

AMEPT2139- ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN MANUFACTURING

COURSE OBJECTIVES:

- To enable the students to integrate Artificial Intelligence and Expert system into manufacturing.
- To introduce students to the basic concepts and techniques of Machine Learning.

UNIT 1 BASICS OF ARTIFICIAL INTELLIGENCE 9 hrs.

Artificial intelligence, definition, components, scope, application areas, knowledge-based systems (expert systems), definition, justification, structure, characterization.

UNIT 2 AI KNOWLEDGE BASE 9 hrs.

Knowledge sources, expert knowledge acquisition, knowledge representation, knowledge base, interference strategies, forward and backward chaining.

UNIT 3 EXPERT SYSTEMS 9 hrs.

Expert system languages, ES building tools or shells, typical examples of shells, expert system software for manufacturing applications in CAD, CAPP, MRP , adaptive control.

UNIT 4 MACHINE LEARNING 9 hrs.

Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm – Linear Discriminants – Perceptron – Linear Separability – Linear Regression.

UNIT 5 CASE STUDIES 9 hrs.

Process control and office automation, case studies of typical applications in tool selection, process selection, part classification, inventory control, process planning etc.

Total: 45 Periods

COURSE OUTCOMES:

CO1: Utilize expert system and AI in manufacturing system analysis
CO2: Use commercial software packages for manufacturing system analysis.
CO3: Distinguish between, supervised, unsupervised and semi-supervised learning
CO4: Apply the apt machine learning strategy for any given problem
CO5: Suggest supervised, unsupervised or semi-supervised learning algorithms for any given problem.

REFERENCE BOOKS:

1. Famili, Dana S. Nau and Steven H. Kim (Ed) Artificial Intelligence Applications in Manufacturing, AAAI Press.
2. Robert J. Schalkoff, Artificial Intelligence: An Engineering Approach, McGraw Hill.
3. Stephen Marsland, ―Machine Learning – An Algorithmic Perspective‖, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
4. Tom M Mitchell, ―Machine Learning‖, First Edition, McGraw Hill Education, 2013.

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	3	2	1	2	1	1	1	1	2	2	2
CO2	2	1	1	1	3	2	1	2	1	1	1	1	1	1	1
CO3	1	1	1	1	3	2	1	2	1	1	1	1	2	2	1
CO4	2	1	1	1	3	2	1	2	1	1	1	1	1	1	2
CO5	2	1	1	1	3	2	1	2	1	1	1	1	2	2	2
CO	1.8	1	1	1	3	2	1	2	1	1	1	1	1.6	1.6	1.6

1 - low, 2 - medium, 3 - high

AMEPT2140- INTELLECTUAL PROPERTY RIGHTS

COURSE OBJECTIVES:

- To understand the concepts IPR
- To understand Trademarks, Trade Secretes and GI of goods.
- To understand Copyrights, Patents and Industrial Designs.
- To learn about how to manage IP rights and legal aspects.
- To understand the concepts of Cyber laws in IPR.

UNIT 1 INTRODUCTION 9 hrs.

Introduction to Intellectual Property Rights, types of intellectual property, importance of intellectual property rights, Evolution of IP acts and treaties, Agencies responsible for IPR registrations, Role and value of IP in international commerce, Issues affecting IP internationally.

UNIT 2 TRADE MARKS 9 hrs.

Purpose and function of trademarks, Acquisition of trade mark rights, transfer of rights, Selecting and evaluating trademark, registration of trademarks, claims. Trade Secrets: Trade secret law, determination of trade secret status, liability for misappropriation of trade secrets, trade secret litigation. Geographical Indication of Goods: Basic aspects and need for the registration

UNIT 3 COPYRIGHTS, PATENTS & INDUSTRIAL DESIGN 9 hrs.

Fundamentals of copyright law, originality of material, right of reproduction, right to perform the work publicly, copyright ownership issues, notice of copyright. Patents: Foundation of patent law, patent searching process, Basic Criteria of Patentability Industrial Designs: Kind of protection provided in Industrial design.

UNIT 4 MANAGING IP RIGHTS 9 hrs.

Acquiring IP Rights: letters of instruction, joint collaboration agreement, Protecting IP Rights: non disclosure agreement, cease and desist letter, settlement memorandum. Transferring IP Rights: Assignment contract, license agreement, deed of assignment.

UNIT 5 INTRODUCTION TO CYBER LAW 9 hrs.

Information Technology Act, cyber crime and e-commerce, data security, confidentiality, privacy, international aspects of computer and online crime.

COURSE OUTCOMES:

CO1: Learner should be able to demonstrate understanding of basic concepts of IPR.
CO2: Able to differentiate between Trademarks, Trade secrets and GI of goods.
CO3: Able to understand Copyrights, Patents and Industrial Designs..
CO4: Able to manage and protect IP
CO5: Will gain Knowledge on Cyber law

REFERENCES BOOKS:

1. Intellectual property right by Deborah E Bouchoux.
2. Cyber law, Text and cases South western special topics collection.
3. Intellectual property rights by N.K Acharya
4. Fundamentals of IPR for engineers, by komal bansal.
5.Intellectual property rights by P. Radhakrishnan

CO's-PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	1	1	2	2	2	3	1	1	1	1	3	3	2
CO2	1	1	1	1	2	2	2	3	1	1	1	1	3	2	2
CO3	1	1	1	1	2	2	2	3	1	1	1	1	3	3	1
CO4	1	1	1	1	2	2	2	3	1	1	1	1	2	3	2
CO5	1	1	1	1	2	2	2	3	1	1	1	1	2	2	2
CO	1	1	1	1	2	2	2	3	1	1	1	1	2.6	2.6	1.8

1 - low, 2 - medium, 3 - high