METHODIST
COLLEGE OF ENGINEERING & TECHNOLOGY
Accredited by NAAC with A+ and NBA
Estd : 2008 Affiliated to Osmania University & Approved by AICTE

DEPARTMENT OF MECHANICAL ENGINEERING

RULES & REGULATIONS

Scheme of Instruction &Examination

(Autonomous M.E CAD/CAM Curriculum for the Academic Years 2021-2022)

and

Syllabus

M.E. I to IV Semester of

Two Year Post Graduate Degree

Programme in

Mechanical Engineering

Specialization in CAD/CAM

(With effect from the academic year 2021– 2022)

Methodist college of Engineering and Technology

Affiliated by Osmania University Hyderabad, approved by AICTE, New Delhi,

King Koti Road, Abids, Hyderabad, Telangana 500001

1. ELIGIBILITY FOR ADMISSION

An applicant for admission into the M.E. Programme shall have one of the following qualifications:

- A Bachelor's degree in Engineering/Technology of Osmania University or any other qualification which is recognized as equivalent to the Bachelor's degree in Engineering/Technology of Osmania University
- AMIE degree or similar qualification recognized by the UPSC as equivalent to B.E./B.Tech.
- For M.E(Mechanical) programme with specialization in CAD/CAM, candidates with B.E./B.Tech in Mechanical/Production/Automobile/Mechatronics Engineering are eligible

2. ADMISSION PROCESS

The candidates will be admitted strictly in accordance with the merit secured at the PGECET, the Entrance Examination conducted by the State Government of Telangana, strictly adhering to the rules in force regarding the reservations of seats to various categories of candidates. Seats in each Programme in the Institute are made under two categories i.e., Category – A and Category – B as per the GOs.

Category – A Seats

- 70% of the sanctioned seats shall be filled through counselling as below.
  - The Convener, PGECET appointed by TSCHE will conduct the counselling for admission to PG programme based on GATE score.
  - After exhausting the eligible GATE qualified candidates, remaining seats will be filled with non-GATE candidates based on the merit at the Entrance Test conducted by the Convener, PGECET
  - No full-time employee shall be admitted to the M.E. Course unless he/she shows proof of having taken leave for the period of the course.

Category – B Seats

30% of sanctioned seats shall be filled by the Institute as per the GOs issued by the Government of Telangana from time to time.

3. PROGRAMME DURATION

- The duration of M.E. Programme is 4 (2 years) semesters. The total period of study for the purpose of drawing the scholarship amount (if eligible) shall not exceed 24 months. Each semester shall have 16 weeks of instruction.
- As per UGC Guidelines, the maximum duration for completing all the requirements for obtaining the M.E. Programme shall be (N+2) years of study from the date of admission, where 'N' is the stipulated period of study.

4. SCHEME OF INSTRUCTION AND EXAMINATION

- M.E Programme consists of Theory Courses, Laboratory Courses, Dissertation and Seminar etc
- The performance of a student in each semester shall be evaluated course wise with a maximum of 100 marks for theory and 100 marks for practical Courses.

- Performance in each course of study shall be evaluated based on (i) Continuous Internal Evaluation (CIE) throughout the semester and (ii) Semester End Examination (SEE) at the end of the semester.
- Appearance in End Semester Examination is mandatory for all Courses including theory, laboratory and Dissertation work.
- The evaluation shall be based on Outcome Based Education (OBE). For both Theory and Laboratory courses out of 100 marks, 40 marks will be awarded through continuous internal evaluation and 60 marks for semester end examination.
- Out of 40 marks for Continuous Internal Evaluation (CIE), 25 will be awarded for internal tests. Two internal tests are conducted in each semester and the average is considered as internal test marks. 15 marks will be awarded to assignments and technical Seminars and regularity in class work**.** For students having more than 90% of attendance 5 marks may be added.
- The SEE shall be conducted at the end of semester for a total of 60 marks of 3 hours duration. The syllabus for the theory Courses shall be divided into FIVE units and each unit carries equal weightage in terms of marks distribution.

Question paper pattern for SEE (60Marks) shall be as follows:

PART-A: 5 X 2 M = 10 M

- There shall be one question from each unit.
- All questions are compulsory.

PART-B: 5 X 10 M = 50 M

- There shall be 8 questions - one question from each of the five units and 6^{th} question covering 1^{st} and 2^{nd} units, 7th question covering 3^{rd} and 4^{th} units and 8^{th} question covering 5^{th} unit and any other units from 1 to 4 having more weightage. 5 questions are to be answered out of the eight and each question carries 10 marks.
- There could be a maximum of three sub divisions in each of the 8 questions in Part B.
- Course Outcome, Blooms Taxonomy levels and Maximum marks are to be indicated against each question both in CIE and SEE question paper

5. RULES AND REGULATION OF ATTENDANCE

i. A regular course of study for eligibility to appear for any course for which an examination is conducted at the end of the semester shall mean putting in an attendance of not less than 75% in each of the course registered during that semester and registering for the examination.

ii. However, in special cases and for sufficient causes shown, the Principal on the recommendation of the Head of the Department may condone the deficiency of not exceeding 10% attendance for ill-health when an application made for such a condonation is supported by a medical certificate issued by an authorized medical officer. Absence not exceeding two weeks, for activities like N.S.S., Inter University

Competitions and debates will be condoned if the candidate is sponsored by the College for such activities.

iii. If a candidate fails to secure the minimum attendance required in a **course**, then he/she **shall not be eligible to appear for the Semester End Examination in that course** He/she shall be required to prosecute a regular course of study in that course again before appearing for the Semester End Examination in that course.

iv. If a candidate fails to maintain a minimum of 40% attendance in the first semester, his/her admission automatically stands cancelled and has to reappear for PGECET.

6. DISSERTATION EVALUATION PROCESS

i) The evaluation of Dissertation Phase-I consists of 100 marks, of which 50 marks will be awarded by supervisor and 50 marks will be awarded by PRC constituted by Chairperson-BOS.

ii) During Semester IV of regular programme, the candidate will continue his/her dissertation work as Dissertation phase II and complete it by the end of semester. The candidate should examine his/her dissertation work checked for plagiarism by the software available in the department. The candidate can submit his/her dissertation when the similarity index is less than 30%.

iii) The candidates who have passed all the courses and Departmental requirements have to present the Dissertation to the internal Viva-Voce Committee. The Dissertation shall be scrutinized and evaluated by the viva-voice committee consisting of the Chairperson-BoS, two Internal Examiners and Supervisor of the candidate.

iv) The Viva-Voce committee will give a comprehensive report indicating the adequacy or otherwise of the Dissertation. If candidate's Dissertation work is found inadequate by the viva-voce committee, he/she has to appear once again for the viva – voce examination. The candidate will have to revise the Dissertation as per recommendations of the vice-voce committee and submit the final copy within two weeks to the Controller of Examinations, MCET.

v) The Controller of Examinations will send the Dissertation to the External examiner as per the panel of examiners submitted by the Chairperson-BoS. After the receipt of the review report from the external examiner, it shall be referred to the chairperson-BOS for conduction of Viva-voce.

vi) Based on the recommendation of Chairperson-BOS, the examination cell in consultation with the external examiner will schedule the viva-voce. The external Viva-Voce Committee consists of the Chairperson-BoS, ME Coordinator, External Examiner and Supervisor of the candidate. The evaluation of Dissertation phase-II for maximum of 200 marks will be done as per the guidelines given below:

- 70 Marks are allocated for quality of Dissertation work covering (a) Literature review, (b) Innovation / Originality, (c) Research Methodology adopted and (d) Relevance / Practical applications.
- 70 Marks are allocated for Report writing / Documentation.
- 30 Marks are allocated for quality and clarity of presentation of Dissertation work.
- 30 Marks are allocated for candidate's performance in terms of his/her ability to defend the work, his/her ability to answer the queries raised during Viva-Voce examination and overall subject knowledge

7. PROGRAMME REQUIREMENTS

i) The course registration by the candidates should be made within one week from the date of admission for the I-semester and within one week from the date of commencement of classes for subsequent semesters.

ii) A candidate who has registered and undergone a regular course of study and fulfils the attendance requirement is eligible to register for SEE.

iii) Students who attend and fail in the SEE are permitted to register and appear in the failed subjects at the subsequent make-up examination conducted within one month from the date of declaration of the results of the main examination.

iv) Further, a student who has registered for the SEE but not appeared is not eligible to register for makeup examinations

v) A student unsuccessful at both the main and make up examination shall register again for the SEE, in the failed subjects, as and when they are conducted. Transitory regulations shall be applicable in all such cases.

vi) A student who has not registered for SEE either due to lack of attendance or otherwise shall re-register for the course/s as per the time schedules prescribed.

PRESENTATION OF SEMINAR AND DISSERTATION

i) A student is permitted for registration to Semester-III courses, if there are not more than three subjects as backlog from the previous semesters (Backlog for this purpose shall mean Theory courses / Lab courses / Seminar etc).

ii) In the event, the make-up examination results are not declared before commencement of next semester, the candidates may be permitted to register for the course(s)/ Dissertation Phase -I conditionally.

iii) During Semester-III of Regular Programme, student has to present Seminar on Dissertation topic covering progress of Dissertation.

iv) Moreover, the student is permitted for registration to Dissertation Phase-I, if he/she has completed the requirements of Mini- Dissertation.

v) However, if these criteria are not satisfied in case of any student, he/she will be permitted for registration to Dissertation Phase -I in the subsequent even semester and for Dissertation-II in the next odd Semester.

vi) A student is permitted to register for Dissertation Phase -II only if there are not more than TWO courses as backlog from the previous semesters. Backlog for this purpose shall mean Theory courses / Lab courses / Seminars/ etc...

vii) A student, who has successfully completed all the programme requirements, is eligible to submit the M.E Dissertation for its evaluation.

viii) A student who has successfully completed all the course requirements except Dissertation may be permitted to work on his Dissertation at any recognized Institution/R&D Organization with the approval of the Head of the Department and Head of the Organization where he/she wants to carryout dissertation work

ix) Students who fail to submit their Dissertation and complete the examination formalities at the end of fourth semester, need to re-register for their dissertation work in the following semester (in no case not later than the N+2) the period of course duration i.e, 4 years for Regular). They will have to pay the prescribed fee for re-

registration of Dissertation work every semester till the completion of their Dissertation work.

8. MINIMUM QUALIFYING MARKS

i) Each Theory Course (SEE)	50%	D grade
ii) Each Theory Course (CIE+SEE)	50%	D grade
iii) Each Laboratory Course (CIE+SEE)	50%	D grade
iv) Seminar/ Mini Dissertation (CIE)	50%	D Grade
v) Dissertation Phase-I (CIE)	50%	D grade
vi) Dissertation Phase-II (SEE)	50%	D grade

9. GRADING SYSTEM

Grades are awarded based on the combined marks secured in the Semester End Examination (SEE) (Maximum 60%) and Continuous Internal Evaluation (CIE) (Maximum 40%) as per the criteria stated in the following Table:

Academic Performance in % of marks	**Letter Grade**	**Grade Points**
≥95 and above	S+	10
≥90 and <95	S	
≥80 and < 90	A	9
≥70 and < 80	B	8
≥60 and < 70	C	7
≥50 and < 60	D	6
<50	**F**	0

* **Note:**

1. There is no grade E

- The Grade Sheet of a candidate will reflect the grade secured by him/her as per the prescribed grading criteria.
- There is no minimum marks criteria for the Continuous Internal Evaluation (CIE) for theory course(s)
- A minimum Cumulative Grade Point Average (CGPA) of 6.0 is required for the award of Degree. The consolidated Grade Sheet will reflect the credits / grade scored in each course.
- Only CGPA will be shown in the Consolidated grade sheet and Division is not shown. However the conversion table of CGPA into Division will be given on the

back side of the Consolidated memo to facilitate the students to meet the requirements of recruiters.

- Award of division: CGPA>=7.50 in single attempt is awarded with First class with Distinction (If not cleared in single attempt awarded with First class), CGPA>= 6.50 and <7.5 is awarded with FC, CGPA>=6.0 and <6.50is awarded with second class

10. Semester Grade Point Average (SGPA) & Cumulative Grade Point Average(CGPA) Calculation:

a) A student is said to have earned credits if he/she secures letter grade 'D' and above.

b. SGPA = $$\frac{\Sigma\left[\text{Letter Grade Point} \times \text{Credits}\right]}{\Sigma\,\text{Credits}}$$

SGPA is calculated up to second decimal point.
SGPA is calculated only when all subjects in that semester are Cleared / Passed

c.CGPA = $$\frac{\Sigma\left[\left(\text{SGPA}\right) \times \left(\text{Total Credits}\right)\right]}{\Sigma\left(\text{Total Credits}\right)}$$

CGPA at a given point of Semester is calculated up to second decimal point.
CGPA is calculated only when total credits earned are equal to total credits up to a Semester in which the candidate has last appeared for Semester End Examination.

d. Grade Sheet should indicate total number of credits and total number of credits earned up to a point of Semester.

11. AWARD OF DEGREE

The degree of Master of Engineering will be awarded to a candidate who has pursued a regular program of study of two academic years as prescribed in the scheme of instruction and has passed all the examinations as prescribed in the scheme of evaluation.

12. Recounting

A candidate desires to have recounting can apply for it as per the College norms and notification of Examination Cell.

13. Challenge of Valuation

After obtaining the photocopy of the corrected answer book of the theory subjects of SEE, the candidate can go for challenge of valuation on payment of the prescribed fees. The answer book of the candidates in such cases will be referred to an examiner outside the University. In case the candidate gets the benefit in the Challenge valuation as per the rules, 90% of the fees paid by the candidate will be refunded.

14. AWARD OF RANK CERTIFICATE/GOLD MEDAL

(a) A student securing highest CGPA in **single attempt** is eligible for award of Rank Certificate/Gold Medal.

(b) A readmitted student is not eligible for award of Gold Medal.

15. TRANSITORY REGULATIONS

i. Whenever a Course or Scheme of Instruction is revised / modified in a particular semester/year, two more examinations immediately following thereafter shall be conducted according to the old syllabus/regulations, provided the content in the course has changed more than 40%.

ii. Candidates not appearing at the examinations or failing in them shall take the examination subsequently according to the revised syllabus and regulations.

16. MALPRACTICES

The punishment to be awarded for Malpractices committed by the students in the SEE is as same as that formulated for BE programme

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Post Graduate Degree Programme
MECHANICAL ENGINEERING

General, Course Structure & Scheme
&
Semester-wise credit distribution

A. Definition of Credit:

1 Hour Lecture (L) per week	1 credit
1 Hour Tutorial (T) per week	1 credit
1 Hour Practical (P) per week 2 Hours Practical (Lab) per week	0.5 credits 1 credit

B. Structure of M.E. CAD/CAM

S. No.	Category	SEM-I	SEM-II	SEM-III	SEM-IV	Total Credits	OU
1	**PC**: Program Core	10	08	-	-	18	15
2	**PE:** Professional Elective	03	03	06	-	12	15
3	**OE**: Open Elective	-	03	-	-	03	03
4	**AD**: Audit Course	00	00	-	-	00	00
5	**MC**: Mandatory Course	03	-	-	-	03	03
6	Innovative Design project	-	04	-	-	04	02
7	Dissertation phase-I	-	-	10	-	10	10
8	Dissertation phase-II	-	-	-	14	14	16
9.	Labs	01	2	-	-	03	03
10.	Seminar	01	-	-	-	01	01
TOTAL		**18**	**20**	**16**	**14**	**68**	**68**

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SCHEME OF INSTRUCTION & EXAMINATION
M.E. (Mechanical Engineering) I – Semester
Specialization in CAD/CAM

S. No.	Course Type/Code	Course Name		Scheme of Instruction				Scheme of Examination			Credits
				L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses		Code	Course Title								
1	Program Core – I	6PC5101ME	Finite Element Techniques	3	1	-	4	40	60	3	4
2	Program Core – II	6PC5102ME	Computer Integrated Manufacturing	3	-	-	3	40	60	3	3
3	Program Core – III	6PC5103ME	Computer Aided Modeling And Design	3	-	-	3	40	60	3	3
4	Elective-I	PE-I	Professional Elective – I	3	-	-	3	40	60	3	3
5	MC	6MC5101ME	Engineering Research Methodology	3	-	-	3	40	60	3	3
6	Audit-I	AD-I	Audit Course – I	-	-	2	2	40	60	2	-
Practical/ Laboratory Courses											
7	Lab-I	6PC5151CD	Finite Element Techniques Lab	-	-	2	2	40	60	3	1
8	Seminar	6PC5154CD	Seminar	-	-	2	2	50	-	2	1
Total				**15**	**01**	**06**	**22**	**330**	**420**	**22**	**18**

PC: Program Core **PE:** Professional Elective **OE**: Open Elective **AD**: Audit Course
MC: Mandatory Course **HS**: Humanities and social science

L: Lecture **T**: Tutorial **P**: Practical **D**: Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination

Professional Elective-1		
S. No.	**Course Code**	**Course Title**
1	6PE5101ME	Additive Manufacturing Design and Applications
2	6PE5102ME	Advanced Metrology
3	6PE5103ME	Failure Analysis and Design
4	6PE5104ME	Design for Manufacture

Audit Course-I		
S. No.	**Course Code**	**Course Title**
1	6AD5101HS	English for Research Paper Writing
2	6AD5102CE	Disaster Management
3	6AD5103HS	Sanskrit for Technical Knowledge
4	6AD5104HS	Value Education

Finite Element Techniques

Semester I	**L**	**T**	**P**	**Credits**
Subject code - 6PC5101ME	**3**	**1**	**0**	**4**

Course Objectives:	**Course Outcomes**:
1. To understand the theory and application of the finite element method for analyzing structural systems 2. To learn Approximation theory for structural problems as the basis for finite element methods 3. To learn formulations for a variety of elements in one, two and three dimensions 4. To understand modeling and analysis of structures using planar, solid, and plate elements	**After completion of the course, the student will be able to** 1. Evaluate the shape functions, stiffness matrices and finite element equations. 2. Analyze the behavior of the trusses and frames. 3. Determine the finite element equations for structural problem. 4. Determine the thermal behavior of different systems. 5. Evaluate the dynamic behavior of the systems

UNIT-I:

Finite Element Methods-Review

Introduction to Finite Element. Stress and Equilibrium. Boundary conditions. Strain-Displacement relations. Stress-strain relations. One Dimensional Problem: Finite element modeling. Local, natural and global coordinates and shape functions. Potential Energy approach. Assembly of matrices. Finite element equations, treatment of boundary conditions.

UNIT-II:

Analysis of trusses and frames

Analysis of plane truss. Analysis of frames with two translations and a rotational degree of freedom at each node. Introduction to different types of element. Analysis of Beams: Element stiffness matrix for two nodded, two degrees of freedom per node for beam element.

UNIT-III:

Finite element modeling

Finite element modeling of two dimensional stress analysis problem with constant strain triangles and treatment of boundary conditions. Two dimensional four node isoparametric elements and numerical integration. Finite element modeling of Axi symmetric solids subjected of axi symmetric loading with triangular elements. Convergence requirements.

UNIT-IV:

Steady state heat transfer analysis:

One dimensional analysis of a fin and two dimensional conduction analysis of thin plate. Time dependent field problems: Application to one dimensional heat flow in a rod.

Dynamic analysis:

Formulation of finite element modeling of Eigen value problem for a stepped bar and beam. Evaluation of Eigen values and Eigen vectors. Analysis of a uniform shaft subjected to torsion using Finite Element Analysis.

UNIT-V: Dynamic Analysis

Finite element formulation of three dimensional problems in stress analysis. Finite Element formulation of an incompressible fluid. Potential flow problems .Introduction to plate theory. Introduction to non- linear problems and Finite Element analysis software.

References:

1. Rao S. S., (2011), The Finite Element Method in Engineering, Elsevier.
2. Tirupathi R Chandraputla and Ashok. D. Belegundu, Introduction of Finite Element in Engineering, Prentice Hall of India, 1997
3. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt,Concepts and Applications of Finite Element Analysis, John Wiley & Sons, Incl.2002.
4. Daryl L. Logan (2011) A First Course in the Finite Element Method, Cengage Learning.

Computer Integrated Manufacturing

Semester I	L	T	P	Credits
Subject code - 6PC5102ME	3	0	0	3

Course Objectives:	Course Outcomes:
1. To study about the need for CIM. 2. To study the concepts of the CIM database. 3. To study various manufacturing systems. 4. To study the fundamental networking concepts and CIM models. 5. To study the new trends in manufacturing systems	**After completion of the course, the student will be able to** 1. Understand the need for CIM. 2. Understand the role of database management of CIM. 3. Understand various types of CIM technologies and systems like Cellular Manufacturing, FMS 4. Understand the fundamental networking concepts that help in integrating all the important components of an enterprise. 5. Understand the concepts of lean manufacturing and agile manufacturing

UNIT-I:

Introduction to CIM: The meaning of Manufacturing, Types of Manufacturing; Basic Concepts of CIM: CIM Definition, Elements of CIM, CIM wheel, concept of technology, Evolution of CIM, Benefits of CIM, Needs of CIM: Hardware and software. Concurrent Engineering: Definition, Sequential Engineering Versus Concurrent Engineering, Benefits of Concurrent Engineering, Characteristics of concurrent Engineering, Framework for integration of Life-cycle ,Concurrent Engineering Techniques, Integrated Product Development(IPD), Product Life-Cycle Management (PLM).

UNIT-II:

CIM database and database management systems: Types, sources; Database Terminology, Database requirements, Database models, Database Management System, DBMS Architecture, Query Language, Structural Query Language (SQL): Basic structure, Data definition Language (Create, Alter, Drop, Truncate, View), Data Manipulation Language (store, retrieve, update, delete). Illustration of Creating and Manipulating a Manufacturing Database. SQL as a Knowledge Base Query Language. Features of commercial DBMS: Oracle, MySQL, SQLAccess, Sybase, DB2.

UNIT-III :

Cellular Manufacturing: Design of Cellular Manufacturing Systems, Cell Formation Approaches: Machine– Component Group Analysis, Similarity Coefficients-Based Approaches. Evaluation of Cell Design. Shop-floor Control: Data Logging and Acquisition, Automated Data Collection, Programmable Logic Controllers, Sensor Technology.

Flexible Manufacturing Systems: Physical Components of an FMS. Types of Flexibility, Layout Considerations: Linear Single Machine Layout, Circular Machine Layout, Cluster Machine Layout, Loop Layout; Operational Problems of FMS. FMS benefits.

UNIT-IV:

Enterprise Wide Integration in CIM: Introduction to Networking, Principles of Networking, Network Terminology, Types of Networks: LAN, MAN, WAN; Selection of Network Technology, Communication medium, Network Topology, Medium access control Methods, Signalling methods; Network Architectures and Protocols: OSI Model, MAP & TOP, TCP/IP, Network Interconnection and Devices, Network Performance. Framework for Enterprise-wide Integration.

CIM Models: ESPRIT-CIMOSAModel, NIST-AMRFModel, Siemens Model of CIM, Digital Equipment Corporation Model, IBM Concept of CIM.

UNIT-V:

Future Trends in Manufacturing Systems: Lean Manufacturing: Definition, Principles of Lean Manufacturing, Characteristics of Lean Manufacturing, Value of Product, Continuous Improvement, Focus on Waste, Relationship of Waste to Profit, Four Functions of Lean Production, Performance Measures, The Supply Chain, Benefits of Lean Manufacturing. Introduction to Agile and Web Based Manufacturing systems.

References:

1. Alavudeen,Venkateshwaran:"ComputerIntegratedManufacturing", Prentice HallIndia.
2. Mikell P. Groover, Automation, Production Systems and Computer Integrated Manufacturing, Pearson Education; Fourth edition .
3. P. Radhakrishnan, S. Subramanyam: CAD/CAM/CIM, New Age International.
4. S. Kant Vajpayee: Principles of Computer Integrated Manufacturing, Prentice-Hall India.

Computer Aided Modeling and Design

Semester I	L	T	P	Credits
Subject code -6PC5103ME	**3**	**0**	**0**	**3**

Course Objectives:	**Course Outcomes**:
1. Study the basics of computer aided design 2. Study the concept of geometric transformations , 3. Study the knowledge on design process 4. Study concept of wireframe and surface entities 5. Study various advanced modelling concepts	**After completion of the course, the student will be able to** 1. Understand the design process, visualize models through graphics standards, and apply principles of computer graphics like geometric transformations. 2. Develop mathematical models to represent curves. 3. Develop mathematical models to represent surfaces. 4. Explain different solid modelling techniques 5. Understand the various advanced modelling concepts.

UNIT-I:

Introduction to CAD: Criteria for selection of CAD workstations, Shigle Design Process, Design criteria, Geometric modeling, entities, 2D & 3D Primitives.

2D & 3D Geometric Transformations: Translation, Scaling, Rotation, Reflection and Shearing, concatenation.

Data exchange formats: IGES, PDES, STL, STEP

UNIT-II:

Wire frame modeling: Curves: Curve representation. Analytic curves – lines, Circles, Ellipse, Conis. Synthetic curves – Cubic, Bezier, B-Spline, NURBS.

UNIT-III :

Surface Modeling: Surface entities, Surface Representation. Analytic Surface – Plane Surface, Ruled Surface, Surface of Revolution, Tabulated Cylinder. Synthetic Surface-Cubic, Bezier, B- spline, Coons.

UNIT-IV:

Solid Modeling Techniques: Graph Based Model, Boolean Models, Instances, Cell Decomposition & Spatial – Occupancy Enumeration, Boundary Representation (B-rep) & Constructive Solid Geometry (CSG).

UNIT-V:

Advanced Modeling Concepts: Feature Based Modeling, Assembling Modeling, Behavioral Modeling, Conceptual Design & Top Down Design,Generative design .

References:

1. Ibrahim Zeid, CAD/CAM, Theory and Practice, McGraw Hill, 2nd edition (25 June 2009)
2. Martenson, E. Michael, Geometric Modelling, John Wiley & Sons, 1995.
3. Nanua Singh: Systems Approach to Computer Integrated Design and Manufacturing- John Wiley.
4. Hill Jr, F.S., Computer Graphics using open GL, Pearson Education, 2003.

Additive Manufacturing Design and Applications

Semester I	**L**	**T**	**P**	**Credits**
Subject code -6PE5101ME	**3**	**0**	**0**	**3**

Course Objectives:	**Course Outcomes**:
1. To understand the fundamentals for additive manufacturing and how it is different and discuss about various types of liquid based, solid based and powder based AM technologies. 2. To understand the various types of Pre-processing, processing, post-processing errors in AM. Also to know the various types of data formats and software"s used in AM. 3. To know the various applications of AM in design analysis, aerospace, automotive, biomedical and other fields.	**After completion of the course, the student will be able to** 1. Understand the fundamentals of prototyping and automated processes. 2. Analyze the utility and application of liquid and solid based AM systems. 3. Understand the concepts of powder based AM systems and Rapid tooling 4. Utilize the AM software"s and Data formats. 5. Utilize the AM for various practical applications.

UNIT-I

Introduction: Prototyping fundamentals: Need for time compression in product development, Need for Additive Manufacturing, Historical development, Fundamentals of Additive Manufacturing, AM Process Chain, Advantages and Limitations of AM, Commonly used Terms, Classification of AM process, Fundamental Automated Processes: Distinction between AM and CNC, other related technologies.

UNIT-II

Liquid-based AM Systems: Stereo lithography Apparatus (SLA): Models and specifications, Process, working principle, photopolymers, photo polymerization, Layering technology, laser and laser scanning, Applications, Advantages and Disadvantages, Case studies. Solid ground curing (SGC): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Polyjet: Process, Principle, working principle, Applications, Advantages and Disadvantages, Case studies. Micro fabrication.

Solid-based AM Systems: Laminated Object Manufacturing (LOM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Fused Deposition Modeling (FDM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Multi-Jet Modeling (MJM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies.

UNIT-III

Powder Based AM Systems: Selective laser sintering (SLS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Three dimensional

Printing (3DP): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Laser Engineered Net Shaping (LENS): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies. Electron Beam Melting (EBM): Models and specifications, Process, working principle, Applications, Advantages and Disadvantages, Case studies

Rapid Tooling: Introduction to Rapid Tooling (RT), Conventional Tooling Vs RT, Need for RT. Rapid Tooling Classification: Indirect Rapid Tooling Methods: Arc Spray Metal Deposition, Investment Casting, Sand Casting, 3D Keltool process. Direct Rapid Tooling: Direct AIM, LOM Tools, DTM Rapid Tool Process, EOS Direct Tool Process and Direct Metal Tooling using 3DP

UNIT-IV

AM Data Formats: Reengineering for Digital Representation, STL Format, STL File Problems, Consequence of Building Valid and Invalid Tessellated Models, STL file Repairs: Generic Solution, Other Translators, Newly Proposed Formats. Mesh Refining by Sub Division Techniques.

AM Software's: Need for AM software, Features of various AM software"s like Magics, Mimics, Solid View, View Expert, 3 D View, Velocity 2, Rhino, STL View 3 Data Expert and 3 D doctor, SurgiGuide, 3- matic, Simplant, MeshLab.

Design for AM:AM technology selection ,Build strategies ,Minimum feature size, Surface finish, Elimination of support structures, Guidelines for internal geometry like flow paths, cooling channels, cavities and others, Guidelines for making lightweight objects, Guidelines for making functionally gradient objects

UNIT-V

AM Applications: Application – Material Relationship, Application in Design, Application in Engineering, Analysis and Planning, Aerospace Industry, Automotive Industry, Jewelry Industry, Coin Industry, GIS application, Arts and Architecture. RP Medical and Bioengineering Applications: Planning and simulation of complex surgery, Customised Implants & Prosthesis, Design and Production of Medical Devices, Forensic Science and Anthropology, Visulization of Biomolecules. Web Based Rapid Prototyping Systems.

References:

1. Rapid prototyping: Principles and Applications - Chua C.K., Leong K.F. and LIM C.S, World Scientific Publications, Third Edition, 2010.
2. Rapid Manufacturing – D.T. Pham and S.S. Dimov, Springer, 2001
3. Wholers Report 2000 – Terry Wohlers, Wohlers Associates, 2000
4. Rapid Prototyping & Engineering Applications – Frank W. Liou, CRC Press, Taylor & Francis Group, 2011.

Advanced Metrology

Semester I	L	T	P	Credits
Subject code -6PE5102ME	3	0	0	3

Course Objectives:	Course Outcomes:
1. To learn the concepts, relate to measurements. 2. To study about the gauges and comparators. 3. To learn about measuring machines, thread measurement and forms of errors caused during surface measurement.	**After completion of the course, the student will be able to** 1. Understand the measurement andcalibration standards. 2. Analyze the utility and application of gauges and comparators. 3. Understand the concepts ofmeasuring machines. 4. Determine the form errors. 5. Understand the details of measurement of different parameters of screw threads.

UNIT-I

End & line standards for length, Airy & Bessel points, desirable features of end standards, slip gauge manufacture, calibration of end standards by interferometry. NPL gauge interferometer, calibration of line standards by micrometer microscope – superposition, coincidence and symmetric straddling, photoelectric microscope and Moir fringe techniques, measurement of large displacements using lasers, calibration of Tomlinson gauges by interferometer. Photoelectric Autocollimator, calibration of polygons & circular scales. Types of interchangeability, dimensional chains.

UNIT-II

Fixed & Indicating Gauges: Taylor‟s principles of gauge design, limitations of ring & plug gauges, position and receiver gauges, types of indicating gauges. Comparators: Multirange Sigma comparator, Back pressure and free flow type pneumatic comparators, Differential back pressure gauge, usage of different types of jets, contact & non-contact tooling. Amplification selection. Air to electric transducer, Differential transducer, Variation transducer, Preprocess, In-process & Post process gauging, computation & match gauging. Usage of LVDT & Capacitive type gauge heads, Automatic inspection.

UNIT-III

Measuring Machines: Floating carriage diameter measuring m/c. Universal measuring m/c. Matrix internal diameter measuring machine. Optical dividing head. Coordinate measuring machine, Optical projector-light beam systems, Work tables, measurement techniques, fixturing & accessories. Sources of error in measurement. Design principles of measuring machines Abbe‟s rule, Kelvin coupling, flexible steel strip, advantages & limitations of hydrostatic & aerostatic bearings.

UNIT-IV

Form Errors: Evaluation of straightness & flatness, usage of beam comparator, evaluation of roundness

– intrinsic & extrinsic datums. Talyrond. PGC, RGC, MZC & LSC, methods, roundness evaluation for even & odd number of lobes. Surface Finish: stylus instrument (TALYSURF). M & E Systems, numerical assessment, vertical & horizontal descriptors, profile as a random process, usage of interferograms. Plastic replica technique.

UNIT-V

Screw Threads: Measurement of thread elements for internal & external threads, progressive periodic, drunkenness and irregular pitch errors. NPL pitch measuring machine, virtual effective diameter, thread gauging. Gears: measurement of tooth thickness, involute profile, pitch, concentricity and alignment, rolling gear test.

References:

1. R.K. Jain, Engineering Metrology, Khanna Publishers
2. I.C. Gupta, A Text Book of Engineering Metrology, Dhanpat Rai & Sons.
3. Mahajan, M, A Text Book of Metrology. 2010. Dhanpat Rai& Co (P) Ltd, ISBN 13 : 978-817700051
4. ASTME, Hand Book of Industrial Metrology, Prentice Hall of India Pvt Ltd

METHODIST
COLLEGE OF ENGINEERING & TECHNOLOGY
Approved by AICTE, New Delhi & Affiliated to Osmania University
Accredited by NAAC with A+ and NBA for UG Courses
College Code: 1607

Failure Analysis and Design

Semester I	**L**	**T**	**P**	**Credits**
Subject code - 6PE5103ME	**3**	**0**	**0**	**3**

Course Objectives:	**Course Outcomes**:
1. To explain the importance of Good design and various factors affecting it 2. To explain the importance of Ergonomics and Aesthetics in good design. 3. To understand the importance of various scientific methods available to solve problems arising from product initiation state to product delivery state. 4. To understand the phenomenon & importance of Fracture, its determination by various methods also understand the effect of fatigue on crack propagation.	**After completion of the course, the student will be able to** 1. Understand the design fundamentals. 2. Analyze the utility and application of different design methods. 3. Understand the concepts of fracture mechanics. 4. Understand the service failure analysis. 5. Understand the concepts related to fatigue crack propagation.

UNIT - I

Introduction: Role of failure prevention analysis in mechanical design, Modes of mechanical failure, Review of failure theories for ductile and brittle materials including Mohr‟s theory and modified Mohr‟s theory, Numerical examples. Fatigue of Materials: Introductory concepts, High cycle and low cycle fatigue, Fatigue design models, Fatigue design methods, Fatigue design criteria, Fatigue testing, Test methods and standard test specimens, Fatigue fracture surfaces and macroscopic features, Fatigue mechanisms and microscopic features

UNIT - II

Stress-Life (S-N) Approach: S-N curves, Statistical nature of fatigue test data, General S-N behavior, Mean stress effects, Different factors influencing S-N behavior, S-N curve representation and approximations, Constant life diagrams, Fatigue life estimation using S-N approach. Strain-Life(å-N)approach: Monotonic stress-strain behavior, Strain controlled test methods, Cyclic stress-strain behavior, Strain based approach to life estimation, Determination of strain life fatigue properties, Mean stress effects, Effect of surface finish, Life estimation by å-N approach

UNIT – III

Fracture mechanics: Introduction, Modes of fracture failure Griffith Analysis, Energy release rate, Energy release rate of DCB specimen; Stress Intensity Factor: SIF„s for edge and centre line crack, Fracture toughness, Elastic plastic analysis through J-integral method: Relevance and scope, Definition of J-integral, Path independence, stress strain relation, Strain Energy Release RateVs J-integral. Failure analysis and determination of stress patterns from plastic Flow observations Dynamic loading– Fracture types in tension

UNIT – IV

Applications of fracture mechanics: Introduction –Through cracks emanating from holes – Corner

cracks at holes – Cracks approaching holes-Combined loading-Fatigue crack growth binder- Mixed mode loading-Fracture toughness of weld metals-Service failure analysis

UNIT – V

Fatigue crack propogation: Mechanism of fatigue crack initiation, propagation and growth, Fatigue data representation, Factors influencing Fatigue strength, Fatigue life prediction, prevention of fatigue failures, corrosion fatigue. Cumulative fatigue damage

References:

1. Ibrahim Dieter, George E., Engineering Design - A Materials and Processing Approach, McGraw Hill, International Editions, Singapore, 2000.
2. Pahl, G, and Beitz, W., Engineering Design, Springer Verlag, NY. 1984.
3. Prashant Kumar, Elements of Fracture Mechanics, Wheeler Publishing, 1999.
4. S T. Rolfe and J M Barsom, Fracture and Fatgue control in structure, Prentice Hall.

Design for Manufacture

Semester I	L	T	P	Credits
Subject code - 6PE5104ME	3	0	0	3

Course Objectives:	Course Outcomes:
1. To study about the general design principles for manufacturability 2. To study process of metallic components design. 3. To study process of providing various shapes in metallic components design. 4. To study process of non-metalliccomponents design. 5. To study process related to assembly ofcomponents.	**After completion of the course, the student will be able to** 1. Determine the economic use of the raw materials. 2. Understand the various secondary manufacturing aspects. 3. Understand the underlying principles in creating various shapes in metallic components 4. Determine the principles involved in non-metallic components design. 5. Analyze the economical assemblage process with the aid of computers.

UNIT-I

Introduction: General design principles for manufacturability, strength and mechanical factors, mechanisms selection, evaluation method, geometrical tolerances, tolerance control and utilization. Economic Use of Raw Materials: Ferrous steel, hot rolled steel, cold finished steel, stainless steel, non-ferrous materials aluminum, copper, brass, non-metallic materials, plastics, rubber and composites.

UNIT-II

Metallic Components Design: Metal extrusion, metal stamping, fine blanking, four slide parts, spring and wire forms, spun metal parts, cold headed parts, extruded parts, tube and section bends, rolled formed parts, power metal parts, forging electro forming parts, specialized forming methods, turned parts, machined round holes, drilled parts, milled parts.

UNIT-III

Metallic Components Design: Planned shaped and slotted parts, screw threaded contoured and internal ground parts, center less ground, electrical discharged, rolled furnished parts, electro chemical and advanced machine parts. Sand cast, die cast, investment cast and other cast products.

UNIT-IV

Non Metallic Components Design: Thermosetting plastic, injection moulded and rotational moulded parts, blow moulded, welded plastic articles, ceramics. Assembled Parts Design: Welded parts, arc, resistance, brazed and soldered parts, gear box assembly, bearing assembly.

UNIT-V

Assembled Parts Design: Retension, bolted connection, screwed connections, flanged connections, centred connections, press fitted connections, surface finishing, plated parts, heat treated parts, NC machining, group technology, low cost automation, computer aided manufacture, product design requirements. Case Studies: Identification of economical design and redesign for manufacture.

References:

1. James G. Bralla, ―Hand book of product design for manufacturing‖ McGraw Hill Co., 1986
2. K.G. Swift ―Knowledge based design for Manufacture‖, Kogan page Limited, 1987.
3. Boothroyd, G, Heartz and Nike, Product Design for Manufacture, Marcel Dekker, 1994.
4. Dickson, John. R, and Corroda Poly, Engineering Design and Design for Manufacture and Structural Approach, Field Stone Publisher, USA, 1995.

Engineering Research Methodology

Semester I	L	T	P	Credits
Subject code – 6MC5101ME	**3**	**0**	**0**	**3**

Course Objectives:	Course Outcomes:
1. To learn the research types, methodology and formulation. 2. To know the sources of literature, survey, review and quality journals. 3. To understand the research design for collection of research data. 4. To understand research data analysis, writing research reports and grant proposals.	**After completion of the course, the student will be able to** 1. Demonstrate the knowledge of research processes and define a research problem. 2. Conduct literature surveys for a given research problem and write a critical review. 3. Choose and apply suitable research design and propose an appropriate research plan for the chosen research problem. 4. Gain experience with data collection and sampling techniques and interpret data gathered from field studies or experiments. 5. Prepare a well written and concise research thesis / report/ proposal.

Unit - I

Research Methodology: Objectives and Motivation of Research, Types of Research, Research Approaches, Significance of Research, Research Methods verses Methodology, Research and Scientific Method, Important of Research Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem: Definition of Research Problem, Problem Formulation, Necessity of Defining the Problem, Technique involved in Defining a Problem.

Unit - II

Literature Survey: Importance of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. Literature Review: Need of Review, Guidelines for Review, Record of Research Review.

Unit - III

Research Design: Meaning of Research Design, Need of Research Design, Feature of a Good Design Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Design of Experimental Set-up, Use of Standards and Codes.

Unit - IV

Data Collection: Collection of primary data, Secondary data, Data organization, Methods of data grouping, Diagrammatic representation of data, Graphic representation of data. Sample Design, Need for sampling, some important sampling definitions, Estimation of population, Role of Statistics for Data Analysis, Parametric V/s Non Parametric methods, Descriptive Statistics, Measures of central tendency and Dispersion, Hypothesis testing, Use of Statistical software. Data Analysis: Deterministic and random data, Uncertainty analysis, Tests for significance: Chi-square, student‟s t-test, Regression modeling, Direct and Interaction effects, ANOVA, F-test, Time Series analysis, Autocorrelation and Autoregressive modeling.

Unit – V

Research Report Writing: Format of the Research report, Synopsis, Dissertation, Thesis its Differentiation, References/Bibliography/Webliography, Technical paper writing/Journal report writing, making presentation, Use of visual aids. Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal

References:

1. C.R Kothari, Research Methodology, Methods & Technique‖; New Age International Publishers, 2004
2. R. Ganesan, Research Methodology for Engineers‖, MJP Publishers,2011.
3. Vijay Upagade and Aravind Shende, Research Methodology, S. Chand & Company Ltd., New Delhi, 2009
4. G. Nageswara Rao, Research Methodology and Quantitative methods, BS Publications, Hyderabad, 2012.

English for Research Paper Writing

Semester I	**L**	**T**	**P**	**Credits**
Subject code - 6AD5101HS	**2**	**0**	**0**	**0**

Course Objectives:	**Course Outcomes**:
1. Understand that how to improve your writing skills and level ofreadability. 2. Understand the nuances of language and vocabulary in writing a Research Paper. 3. Develop the content, structure and format of writing a research paper. 4. Produce original research papers without plagiarism.	**After completion of the course, the student will be able to** 1. Interpret the nuances of research paper writing. 2. Differentiate the research paper format and citation of sources. 3. To review the research papers and articles in a scientific manner. 4. Avoid plagiarism and be able to develop their writing skills in presenting theresearch work. 5. Create a research paper and acquire the knowledge of how and where to publish their original research papers.

UNIT - I

Academic Writing: Meaning & Definition of a research paper– Purpose of a research paper – Scope – Benefits, Limitations – outcomes.

UNIT - II

Research Paper Format: Title – Abstract – Introduction – Discussion – Findings, Conclusion – Style of Indentation – Font size/Font types – Indexing – Citation of sources.

UNIT - III

Research Methodology: Methods (Qualitative – Quantitative) Review of Literature. Criticizing, Paraphrasing & Plagiarism.

UNIT - IV

Process of Writing a research paper: Choosing a topic - Thesis Statement – Outline – Organizing notes - Language of Research – Word order, Paragraphs – Writing first draft –Revising/Editing - The final draft and proof reading.

UNIT - V

Research Paper Publication: Reputed Journals – National/International – ISSN No, No. of volumes, Scopus Index/UGC Journals – Free publications - Paid Journal publications – Advantages/Benefits

Presentation Skills: Developing Persuasive Presentations, Structure of Presentation, Presentation Slides, Presentation Delivery, role of the audience, what to search and cite, how to establish credibility.

References:

1. R Kothari, Gaurav, Garg, ―Research Methodology Methods and Techniques, 4/e, New AgeInternational Publishers.
2. Day R, ―How to Write and Publish a Scientific Paper**",** Cambridge University Press, 2006
3. MLA Hand book for writers of Research Papers, 7/e, East West Press Pvt. Ltd, New Delhi
4. Lauri Rozakis, Schaum‟s, Quick Guide to Writing Great Research Papers‖, Tata McGrawHills Pvt. Ltd, New Delhi.

Disaster Management

Semester I	**L**	**T**	**P**	**Credits**
Subject code -6AD5102HS	**2**	**0**	**0**	**0**

Course Objectives:	**Course Outcomes**:
1. To impart knowledge in students about the nature, causes, consequences and mitigation measures of the various natural disasters. 2. To enable the students to understand risks, vulnerabilities and human errors associated with human induced disasters. 3. To enable the students to understand and assimilate the impacts of any disaster on the affected area depending on its position/ location, environmental conditions, demographic, etc.	**After completion of the course, the student will be able to** 1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response. 2. Critically evaluate disaster risk reduction and humanitarian response policy and Practice from multiple perspectives. 3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations. **4.** Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in**.** 5. Understand Repercussions of Disasters and Hazards.

UNIT-I

Introduction: Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT-II

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem.

Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

UNIT-III

Disasters Prone Areas in India: Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics

UNIT-IV

Disaster Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT-V

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People‟s Participation in Risk Assessment. Strategies for Survival. Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

References:

1. R. Nishith, Singh AK, “Disaster Management in India: Perspectives, issues and strategies”, New Royal Book Company.
2. Sahni, Pardeep (Eds.), “Disaster Mitigation Experiences and Reflections”, PHI, New Delhi.
3. Goel S. L., “Disaster Administration and Management Text and Case Studies”, Deep & Deep Publication Pvt. Ltd., New Delhi.
4. Modh S. (2010) Managing Natural Disasters, Mac Millan publishers India LTD.

Sanskrit for Technical Knowledge

Semester I	**L**	**T**	**P**	**Credits**
Subject code -6AD5103HS	**2**	**0**	**0**	**0**

Course Objectives:	**Course Outcomes**:
1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world. 2. To make the novice Learn the Sanskrit to develop the logic in mathematics, science & other subjects. 3. To explore the huge knowledge from ancient Indian literature.	**After completion of the course, the student will be able to** 1. Develop passion towards Sanskrit language. 2. Decipher the latent engineering principles from Sanskrit literature 3. Correlates the technological concepts with the ancient Sanskrit history. 4. Develop knowledge for the technological progress. 5. Explore the avenue for research in engineering with aid of Sanskrit.

UNIT-I

Introduction to Sanskrit Language: Sanskrit Alphabets-vowels-consonants- significance of Amarakosa- parts of Speech-Morphology-creation of new words-significance of synonyms-sandhi-samasa-sutras-active and passive Voice-Past/Present/Future Tense-Syntax-Simple Sentences (elementary treatment only)

UNIT-II

Role of Sanskrit in Basic Sciences: Brahmagupthas lemmas (second degree indeterminate equations), sum of squares of n-terms of AP- sulba, sutram or baudhayana theorem (origination of Pythagoras theorem)-value of pie-Madhava‟s sine and cosine theory (origination of Taylor's series).

The measurement system-time-mass-length-temp, Matter elasticity-optics-speed of light (origination of Michaelson and Morley theory).

UNIT-III

Role of Sanskrit in Engineering-I (Civil, Mechanical, Electrical and Electronics Engineering):

Building construction-soil testing-mortar-town planning-Machine definition-crucible-furnace-air blower- Generation of electricity in a cell-magnetism-Solar system-Sun: The source of energy, the earth-Pingala chandasutram (origination of digital logic system)

UNIT-IV

Role of Sanskrit in Engineering-II (Computer Science Engineering & Information Technology): Computer languages and the Sanskrit languages-computer command words and the vedic command words- analogy of pramana in memamsa with operators in computer language-sanskrit analogy of physical sequence and logical sequence, programming.

UNIT-V

Role of Sanskrit in Engineering-III (Bio-technology and Chemical Engineering): Classification of plants- plants, the living-plants have senses-classification of living creatures, Chemical laboratory location and layout- equipment-distillation vessel-kosthi yanthram.

References:

1. M Krishnamachariar, History of Classical Sanskrit Literature, TTD Press, 1937.
2. M.R. Kale, A Higher Sanskrit Grammar: For the Use of School and College Students, Motilal Banarsidass Publishers, 2015.
3. Kapail Kapoor, Language, Linguistics and Literature: The Indian Perspective, ISBN- 10: 8171880649, 1994.
4. Pride of India, Samskrita Bharati Publisher, ISBN: 81-87276 27-4, 2007.

Value Education

Semester I	**L**	**T**	**P**	**Credits**
Subject code - 6AD5104HS	**2**	**0**	**0**	**0**

Course Objectives:	**Course Outcomes**:
1. Understand the need and importance of Values for self-development and for National development. 2. Imbibe good human values and Morals 3. Cultivate individual and National character.	**After completion of the course, the student will be able to** 1. Gain necessary Knowledge for self-development 2. Learn the importance of Human values and their application in day to day professional life. 3. Appreciate the need and importance of interpersonal skills for successful career and social life 4. Emphasize the role of personal and social responsibility of an individual for all-round growth. 5. Develop a perspective based on spiritual outlook and respect women, other religious practices, equality, non-violence and universal brotherhood

UNIT-I

Human Values, Ethics and Morals: Concept of Values, Indian concept of humanism, human values; Values for self-development, Social values, individual attitudes; Work ethics, moral and non- moral behavior, standards and principles based on religion, culture and tradition.

UNIT-II

Value Cultivation, and Self-management: Need and Importance of cultivation of values such as Sense-of Duty, Devotion to work, Self-reliance, Confidence, Concentration, Integrity & discipline, and Truthfulness.

UNIT-III

Spiritual outlook and social values: Personality and Behavior, Scientific attitude and Spiritual (soul) outlook; Cultivation of Social Values Such as Positive Thinking, Punctuality, Love & Kindness, avoiding fault finding in others, Reduction of anger, forgiveness, Dignity of labour, True friendship, Universal brotherhood and religious tolerance.

UNIT-IV

Values in Holy Books: Self-management and Good health; internal & external cleanliness, Holy books versus Blind faith, Character and Competence, Equality, Nonviolence, Humility, Role of Women.

UNIT-V

Dharma, Karma and Guna: Concept of soul; Science of Reincarnation, Character and Conduct, Concept of Dharma; Cause and Effect based Karma Theory; The qualities of Devine and Devilish;

Satwic, Rajasic and Tamasic gunas.

References:

1. Chakroborty, S.K., Values & Ethics for organizations Theory and practice, Oxford University Press,New Delhi, 1998.
2. Venkataiah. N. (1998). Value Education. Delhi: APH Publishing
3. Jaya Dayal Goyandaka, Srimad Bhagavad Gita with Sanskrit Text, Word Meaning and ProseMeaning, Gita Press, Gorakhpur, 2017.
4. Sprod,T. (1998). Philosophical discussion in moral education, The community of ethical inquiry. Routledge – 2001-244 pages, Series: Routledge International Studies in the Philosophy of Education

Finite Element Techniques Lab

Semester I	L	T	P	Credits
Subject code -6PC5151CD	0	0	2	1

Course Objectives:	Course Outcomes:
1. To enable the students understand the mathematical and physical principles underlying the Finite Element Method (FEM) as applied to solid mechanics and thermal analysis. 2. Introduce students to the theory ofelasticity. 3. To teach students the characteristics of various elements in structural and thermal analysis and selection of suitable elements for the problems being solved. 4. To introduce students to various field problems and the discretization of the problem. 5. To make the students drive finite element equations for simple and complex elements.	**After completion of the course, the student will be able to** 1. Determine the stiffness and loading matrices for various applications. 2. Carry out structural analysis of various components. 3. Determine the bending and deflection in components. 4. Analyze static stress analysis in case of plate with a hole. 5. Analyze two dimensional heat conduction in case of a plate.

List of Experiments:

1. To determine the stiffness matrix and loading matrices in Beams.
2. To determine the B matrix, loading matrices in plane.
3. Introduction to Finite Element Analysis Software.
4. Static analysis of a corner bracket.
5. Statically indeterminate reaction force analysis. (Truss/bar element-basic).
6. Determination of Beam stresses and Deflection. (Cantilever and Simply supported beams).
7. To perform ax symmetric analysis.
8. Stress analysis using plane stress and plane strain.
9. Static analysis of plate with hole.
10. To perform 2 dimensional stress analysis in case of composite rectangular plate.
11. To perform explicit analysis of car crash.
12. To perform steady state thermal analysis of two dimensional plate

SCHEME OF INSTRUCTION & EXAMINATION

M.E. (Mechanical Engineering)

II Semester Specialization in

CAD/CAM

S. No.	Course Type/Code	Course Name		Scheme of Instruction				Scheme of Examination			Credits
				L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses		Code	Course Title								
1	Program Core – IV	6PC5204ME	Advanced Material Technology	3	1	-	4	40	60	3	4
2	Program Core – V	6PC5205ME	Automation	3	1	-	4	40	60	3	4
3	Elective-II	PE-II	Professional Elective – II	3	-	-	3	40	60	3	3
4	Open Elective	OE-I	Open Elective – I	3	-	-	3	40	60	3	3
5	Audit-II	AD-II	Audit Course – II	2	-	-	2	40	60	3	-
6	Mini project	6PC5255ME	Innovative Design Project	-	-	8	8	50	-	3	4
Practical/ Laboratory Courses											
7	Lab-II	6PC5252CD	Advanced CAD Lab	-	-	2	2	40	60	3	1
8	Lab-III	6PC5253CD	CAM &Automation Lab	-	-	2	2	40	60	3	1
Total				**14**	**02**	**12**	**28**	**330**	**420**	**24**	**20**

PC: Program Core **PE:** Professional Elective **OE**: Open Elective **AD**: Audit Course
MC: Mandatory Course **HS**: Humanities and social science

L: Lecture **T**: Tutorial **P**: Practical **D**: Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination

Professional Elective-II		
S. No.	**Course Code**	**Course Title**
1	6PE5205ME	Advanced Machine Design
2	6PE5206ME	Optimization Techniques
3	6PE5207ME	Computational Fluid dynamics
4	6PE5208ME	Composite Materials

Open Elective-I		
S. No.	**Course Code**	**Course Title**
1	6OE5201CE	Cost Management of Engineering Projects
2	6OE5202CS	Business Analytics
3	6OE5203EC	Fundamentals of Embedded Systems
4	6OE5204EE	Waste to Energy
5	6OE5205ME	Intellectual Property Rights &Copy Writing

Audit Course-II		
S. No.	**Course Code**	**Course Title**
1	6AD5205HS	Constitution of India and Fundamental Rights
2	6AD5206HS	Pedagogy Studies
3	6AD5207HS	Stress Management by Yoga
4	6AD5208HS	Personality Development through life Enlightenment Skills

Advanced Materials Technology

Semester II	L	T	P	Credits
Subject code - 6PC5204ME	3	1	0	4

Course Objectives:	Course Outcomes:
1. Gives knowledge for material selection based on its properties 2. Provides the knowledge and practice regarding different Material & their behavior. 3. Gives hands on practice regarding Elastic, Plastic & Failure behavior.	**After completion of the course, the student will be able to** 1. Select suitable material for different industrial applications 2. Understand the elastic and plastic behaviour of the material for which it is utilized in industry. 3. Understand the fatigue and fracture behavior of engineering materials 4. Identify applications of all kinds of smart materials. 5. Analyze the mechanical and metallurgical properties of non metallic Materials

UNIT-I

Selection of Materials:

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

UNIT-II

Elastic and Plastic Behavior:

Elasticity in metals and polymers - Mechanism of plastic deformation, role of dislocations, yield stress, shear strength of perfect and real crystals - Strengthening mechanisms, work hardening, solid solution hardening, grain boundary strengthening, poly phase mixture, precipitation, particle, fiber and dispersion strengthening. Effect of temperature, strain and strain rate on plastic behaviors - Super plasticity - Deformation of non-crystalline material.

UNIT-III

Fracture Behavior:

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

UNIT-IV

Smart Materials:

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

induced plasticity (TRIP) steel, Maraging steel - Intermetallics, Ni and Ti - Smart materials, shape memory alloys - Metallic glass - Quasi crystal and nano crystalline materials, bio materials.

UNIT-V

Non metallic Materials:

Polymerization, Structure and properties of thermoplastics and thermosets, Engineering applications, Property modifications, Mechanical, thermal behaviour of composites with polymer matrix. Advanced structural ceramics: WC, TiC, TaC, AI2O3, SiC, Si3N4, CBN and diamond - properties, processing and applications. Adhesives: Properties and applications

References :

1. Thomas H. Courtney, " Mechanical Behavior of Materials ", McGraw-Hill, 2000.
2. Charles J.A., Crane, F.A.A and Furness, J.A.G., “Selection and use of Engineering Materials", 3rd Edition, Butterworth-Heinemann, 1977.
3. Flinn, R.A. and Trojan, P.K., “Engineering Materials and their Applications ", (4th Edition), Jaico Publishing, 1999.
4. George E. Dieter, “Mechanical Metallurgy ", McGraw Hill, 1988.
5. Metals Hand Book, Vol.10, “Failure Analysis and Prevention ", (10th Edition), 1994.
6. Willam D. Callister, Jr., “Material Science and Engineering: An introduction”, John Wiley & Sons, Inc, 2003.
7. Willam F. Smith, “Principles of Materials Science and Engineering”, 3rd edition, McGraw Hill,

Automation

Semester II	L	T	P	Credits
Subject code - 6PC5205ME	3	1	0	4

Course Objectives:	Course Outcomes:
1. Understand the Terminologies used in the Field of Automation. 2. Gain Knowledge about Different Automation Technologies currently in use. 3. Appreciate the Importance of Automation in Improvement of Quality. 4. Identify Impact of Automation on Society & Environment. 5. Appreciate the Significance of Artificial Intelligence for the Future of Automation.	**After completion of the course, the student will be able to** 1. Assess the Need & Feasibility of Automation for the Current Industries. 2. Identify the Technologies to be used for different Types of Industries. 3. Do a detailed analysis of the Effect of Automation on Price & Quality. 4. Explain the ill Effects of Automation on Society & Environment. 5. Do Further Research on Future Technologies like Artificial Intelligence & its Applications in Industries.

UNIT – I

Introduction: Definition of Automation, Types of Production, Functions of Manufacturing, Organization and Information Processing in Manufacturing, Production Concepts and Mathematical Models, Automation Strategies

Production Economics: Methods of Evaluating Investment Alternatives, Costs in Manufacturing, Break-Even Analysis, Unit Cost of Production, Cost of Manufacturing Lead time and Work-in-process.

UNIT – II

Automation Production Lines: Automated Flowlines, Methods of Workpart Transport, Transfer Mechanism, Buffer Storage, Control Functions, Automation for Machining Operations, Design and Fabrication Considerations. *Analysis of Automated Flow Lines*: General Terminology and Analysis, Analysis of Transfer Lines Without Storage, Partial Automation, Automated Flow Lines with Storage Buffers, Computer Simulation of Automated Flow Lines.

UNIT – III

Control Technologies in Automation:

Industrial Control Systems, Process Industries Versus Discrete-Manufacturing Industries, Continuous Versus Discrete Control, Computer Process and its Forms. (SLE: Sensors, Actuators and other Control System Components).

Industrial Applications: Objectives, Automation in Manufacturing, Robot Application in Industry, Task Programming, Robot Intelligence and Task Planning, Modern Robots, Future Application and Challenges and Case Studies. (SLE: Goals of AI Research, AI Techniques)

UNIT –IV

Automated Materials Handling*:*

The Material Handling Function, Types of Material Handling Equipment, Analysis for Material Handling Systems, Design of the System, Conveyor Systems, Automated Guided Vehicle Systems. Automated Storage Systems: Storage System Performance, Automated Storage/Retrieval Systems, Carousel Storage Systems, Work-in-process Storage, Interfacing Handling and Storage with Manufacturing.

UNIT – V

Automated Inspection and Testing:

Inspection and testing, Statistical Quality Control, Automated Inspection Principles and Methods, Sensor Technologies for Automated Inspection, Coordinate Measuring Machines, Other Contact Inspection Methods, Machine Vision, Other optical Inspection Methods. Modeling Automated Manufacturing Systems: Role of Performance Modeling, Performance Measures, Performance Modeling Tools: Simulation Models, Analytical Models. The Future Automated Factory: Trends in Manufacturing, The Future Automated Factory, Human Workers in the Future Automated Factory, The social impact.

References:

1. Mikell P.Groover, Automation, Production Systems and Computer Integrated Manufacturing, Pearson Education Asia.
2. C.Ray Asfahl, Robots and manufacturing Automation, John Wiley and Sons New York.
3. N.Viswanadham and Y.Narahari, Performance Modeling of Automated Manufacturing Systems, Prentice Hall India Pvt. Ltd.
4. Stephen J. Derby, Design of Automatic Machinery, Special Indian Edition, Marcel Decker, New York, YesdeePublishing Pvt. Ltd, Chennai
5. Robotics, control vision and intelligence-Fu, Lee and Gonzalez. McGraw Hill International, 2nd edition.

Advanced Machine Design

Semester II	L	T	P	Credits
Subject code - 6PE5205ME	3	-	0	3

Course Objectives:	Course Outcomes:
1. Know different Design Methods, calculate Weight & Metal Content and improve Rigidity & Strengthening of Mechanical Members and Structures. 2. Learn how to analyze products and be able to improve their manufacturability and lower costs. 3. Design machine components which are subjected to fluctuating loads. 4. Distinguish different design criterions and their procedure to carry out the required design steps for designing mechanical components. 5. To be able to carry out complete mechanical system design of various mechanisms.	**After completion of the course, the student will be able to** 1. Predict failure of engineering components using failure theories 2. Identify and explain the types of fractures of engineered materials and their characteristic features 3. Understand LEFM approach 4. Estimate life of components using stress life and strain life 5. Categorize different types of surface failure

UNIT-I

General Design Procedure: Design Philosophies, Design for Reliability, Concurrent Engineering, Aesthetics and Ergonomics.

Material Selection: Introduction, General characteristics of machine component applications, Material Selection Factors and Process, Material Selection Charts.

Manufacturing Process and Design Considerations: Design of Cast Members, Design of Welded Joints, Design for Forming, Design for Machining

UNIT-II

Stress-Life (S-N) Approach:

S-N curves, Statistical nature of fatigue test data, General S-N behavior, Mean stress effects, Different factors influencing S-N behavior, S-N curve representation and approximations, Constant life diagrams, Fatigue life estimation using S-N approach.

Review of Stresses, Strains and Theories of Failures:

Introduction, Plane Stress, Rotation of Coordinate Axes, Generalised Plane Stress, Principal Stresses and Maximum Shear Stress, 3D state of stress, Stresses on Octahedral plane, Plane strain, Strain gage rosettes. Theories of Failures: Distortion Energy, Maximum-Shear Stress, Maximum Normal Stress, Modified Coulomb-Mohr Theory, Comparison of theories of failures

UNIT-III

Fracture Mechanics:

Introduction, Rise in stresses due to crack, Crack tip opening displacement, LEFM: Effect of crack on strength of ductile and brittle material, Crack opening modes and

Griffith theory, Concept of SIF and Crack Tip Plasticity, Use of K in design and analysis, Determination of plastic zone, size and shape, Limitations of LEFM

UNIT-IV

Fatigue:

Introduction, factors affecting fatigue behaviour, Theoretical stress concentration factor and notch sensitivity factor, Fatigue under complex stresses, cumulative fatigue design, Linear damage (Miner's Rule), Manson's method, Fatigue crack propagation and life estimation for constant and variable amplitude stress. Strain Based Approach to Fatigue: Strain Vs Life Curve, Mean stress effect, Strain-Life Equation, Life estimate for structural component

UNIT-V

Surface Failure:

Introduction, Surface geometry, Mating surface, Friction, Adhesive wear, Abrasive wear, Corrosion wear, Surface fatigue spherical contact, Cylindrical contact, General contact, Dynamic contact stresses, Surface fatigue strength.

References:

1. Mechanical Behaviour of Materials: Engineering Methods for Deformation Fracture an Fatigue 4\e N E Dowling Pearson.
2. Machine Design: An Integrated Approach 3\e R L Norton Pearson Education.
3. Fundamentals of Machine Design 5\e R C Juvinall & K M Marshek Wiley India
4. Metal Fatigue in Engineering R I Stephens, A Fatemi, RR Stephens and H O Fuchs. John-Wiley.
5. Elements of Fracture Mechanics Prashant Kumar McGraw-Hill.
6. Engineering Design Dieter, G McGraw-Hill
7. "Fatigue and Fracture", ASM Hand Book, Vol 19, 2002.
8. Metal Fatigue in Engineering R I Stephens, A Fatemi, R R Stephens and H O Fuchs. John-Wiley.

Optimization Techniques

Semester II	L	T	P	Credits
Subject code - 6PE5206ME	3	-	0	3

Course Objectives:	Course Outcomes:
1. To study about the design types of simulation 2. To study about decision theory 3. To study about integer programming 4. To study about dynamic programming 5. To study about classical optimization	**After completion of the course, the student will be able to** 1. Determine the simulation process required for various applications 2. Analyze the decision making under certainty and uncertainty, risk etc. 3. Utilize the different methods of integer programming 4. Utilize the skills of dynamic programming for different types of problems 5. Analyze and apply the optimization techniques

UNIT-I

Simulation:

Introduction, Types of Simulation, Simulation Models, Monte Carlo Simulation, Random Number, Pseudo Random Number, Mid-Square Method of generating Random Numbers, Application & Limitation, Application of Simulation to Inventory Control and Queuing Problem

UNIT-II

Decision Theory:

Introduction, Decision, Decision Making & Decision Theory, Types of Decisions, decision making process, Types of Decision making Environment: Decision making under certainty – Expected Monetary Value (EMV), Expected Opportunity Loss (EOL) Criterion & Expected Value of Perfect Information (EVPI) Criterion Decision making under risk- Criterion of Pessimism or Manimax, Criterion of Optimism or Maximin, Minimax Regret Criterion, Criterion of Realism & Criterion of Rationality Decision making under uncertainty and Decision tree analysis: Introduction, Procedure of Constructing Decision Trees & Solution through Decision Tree Analysis.

UNIT-III

Integer Programming:

Introduction, Types of Integer Programming Problems, Gomory‟s CuttingPlane method. Branch and Bound method for all Integer Programming Problems & Mixed Integer Programming Problems

UNIT-IV

Dynamic Programming:

Introduction- Bellman‟s principle of Optimality-Application of dynamic Programming-Linear Programming Problem-Capital budgeting problem

UNIT-V

Classical Optimization:

Introduction; Unconstrained problems of maxima and minima, constrained problems of maxima and minima; Constraints in the form of equations – Lagrangian method; Constraints in the form of inequalities -Kuhn-tucker conditions.

References:

1. S.S. Rao, Optimization Theory and Applications, NAI Publishers, Hyderabad, 1995.
2. S.D. Sharma, Operations Research, Kedarnath and Co. Publishers, Meerut, 2004.
3. V. K. Kapoor, Operations Research, S. Chand, New Delhi, 2004.
4. Hamdy A. Taha, Operations Research, Pearson Education, New York, 2001.
5. Bronson-Schaum Series, Operations Research, McGraw Hill, Singapore, 1983.
6. David Goldberg, Genetic Algorithms, S Chand Publications, 2006

Computational Fluid Dynamics

Semester II	L	T	P	Credits
Subject code - 6PE5207ME	3	-	0	3

Course Objectives:	Course Outcomes:
1. To convert the conservation equations of fluid flow in differential form into algebraic equations and apply numerical methods to obtain solutions. 2. To learn the finite difference method. 3. To learn finite volume method and solution methodology for fluid flow problems	**After completion of the course, the student will be able to** 1. Understand the concepts of turbulence and fluid dynamics 2. Determine and develop the partial differential equations for various conditions 3. Design the grid for different applications 4. Determine the finite difference solutions 5. Analyze the systems using finite volume method

UNIT-I

Review of basic equations of fluid dynamics: Continuity, Momentum and Energy equations, Navier Stokes equations, Reynolds and Favre averaged N – S equations. Differential equations for steady and unsteady state heat conduction. Differential equations for diffusion. Introduction to turbulence, Turbulence models mixing length model, K- turbulence Model.

UNIT-II

Classification of PDEs – Elliptic, parabolic and hyperbolic equations. Initial and boundary value problems. Concepts of Finite difference methods – forward, backward and central difference. Errors, Consistency, Stability analysis by von Neumann. Convergence criteria.

UNIT-III

Grid Generation- Types of grid O,H,C. Coordinate transformation, algebraic methods. Unstructured grid generation.

UNIT-IV

Finite difference Solutions-Parabolic PDEs – Euler, Crank Nicholson, Implicit methods, Elliptic PDEs – Jacobi, Gauss Seidel, ADI, methods. FD- solution for Viscous incompressible flow using Stream function – Vorticity method & MAC method.

UNIT-V

Introduction to Finite volume method. Finite volume formulations for diffusion equation, convection diffusion equation. Solution algorithm for pressure velocity coupling in steady flows. Use of Staggered grids SIMPLE Algorithm.

References:

1. Pradip Niyogi, Chakrabartty SK, Laha M.K., „Introduction to Computational Fluid Dynamics", Pearson Education, 2005.
2. Muralidhar K, Sundararajan T, „Computational Fluid flow and Heat transfer", Narosa Publishing House, 2003.
3. Chung, T J, „Computational Fluid Dynamics", Cambridge University Press, 2002.
4. John D Anderson, „Computational Fluid Dynamics", Mc Graw Hill, Inc., 1995.
5. Patankar, S.V, „Numerical Heat transfer and Fluid flow", Hemisphere Publishing Company, New York, 1980.

METHODIST
COLLEGE OF ENGINEERING & TECHNOLOGY
Approved by AICTE, New Delhi & Affiliated to Osmania University
Accredited by NAAC with A+ and NBA for UG Courses
College Code: 1607

Composite Materials

Semester II Subject code - 6PE5208ME	L	T	P	Credits
	3	-	0	3

Course Objectives:	Course Outcomes:
1. Discuss the basic structure of composites 2. Define Elastic constants and Hygro-thermal stresses 3. Identify stress-strain relations in composites 4. Describe the behaviour and Design with composites 5. Demonstrate the basic equations of plate bending	**After completion of the course, the student will be able to** 1. Demonstrate knowledge of composites and their structure 2. Predict the Elastic constants and Hygro thermal stresses 3. Analyze the stress - strain relationship incomposites 4. Summarize and apply the Design procedure andthe failure criteria. 5. Formulate Plate bending equations for various Boundary conditions of composite plates

UNIT-I

Introduction: Fibres, Matrix materials, interfaces, polymer matrix composites, metal matrix composites, ceramic matrix composite, carbon fibre composites.

UNIT-II

Micromechanics of Composites: Mechanical Properties: Prediction of Elastic constant, micromechanical approach, Halpin-Tsai equations, Transverse stresses.

Thermal properties: Hygrothermal stresses, mechanics of load transfer from matrix to fibre.

UNIT-III

Macro mechanics of Composites: Elastic constants of a lamina, relations between engineering constants and reduced stiffness and compliances, variation of lamina properties with orientation, analysis of laminated composites, stresses and strains with orientation, interlaminar stresses and edge effects. Simplified composite beam solutions. Bending of laminated beams.

UNIT-IV

Strength, fracture, fatigue and design: Tensile and compressive strength of unidirectional fibre composites, fracture modes in composites: Single and multiple fracture, de-bonding, fibre pullout and de-lamination failure, fatigue of laminate composites, Effect of variability of fibre strength.

Strength of an orthotropic lamina: Max stress theory, max strain criteria, maximum work (Tsai-Hill) criterion, quadratic interaction criteria. Designing with composite materials.

UNIT-V

Analysis of plates and stress: Plate equilibrium equations, Bending of composite plates, Levy and Navier solution for plates of composite material. Analysis of composite cylindrical shells under axially symmetric loads.

References:

1. Jones, R.M., 'Mechanics of Composite Materials', Mc-Graw Hill Co., 1967.
2. Calcote, L.R., 'The Analysis of Laminated Composite Structures', Van Nostrand, 1969.
3. Whitney. I.M., Daniel, R.B. Pipes, 'Experimental Mechanics of Fibre Reinforced Composite Materials', Prentice Hall, 1984.
4. Hyer. M.W., 'Stress Analysis of Fibre-Reinforced Composite Materials', McGraw Hill Co., 1998.
5. Carl. T. Herakovich, 'Mechanics of Fibrous Composites', John Wiley Sons Inc., 1998.

Cost Management of Engineering Projects

Semester II	L	T	P	Credits
Subject code – 6OE5201CE	3	-	0	3

Course Objectives:	Course Outcomes:
1. To apply modern software packages to conduct analysis of real world data. 2. To understand the technical underpinning of engineering economic analysis. 3. The ability to apply the appropriate analytical techniques to a wide variety of real world problems and data sets. 4. To summarise and present the analysis results in a clear and coherent manner.	**After completion of the course, the student will be able to** 1. Students should be able to learn the cost concepts in decision making 2. Student should be able to do cost planning and Marginal Costing 3. Students should be able to create a database for operational control and decision making

UNIT-I

Introduction and Overview of the Strategic Cost Management Process:

Cost concepts in decision making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

UNIT-II

Project Management

Project: meaning, Different types, why to manage, cost overruns centers, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and nontechnical activities. Detailed Engineering activities. Pre project execution main clearances and documents. Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

UNIT-III

Cost Behaviour and Profit Planning Marginal Costing: Distinction between Marginal Costing and

Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis.

Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints.

UNIT-IV

Activity-Based Cost Management: Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing

UNIT-V

Quantitative techniques :

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory

References:

1. Cost Accounting – A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

Business Analytics

Semester II	L	T	P	Credits
Subject code – 6OE5202CS	3	-	0	3

Course Objectives:	Course Outcomes:
1. Understand the role of business analytics within an organisation. 2. To become familiar with processes needed to develop, report, and analyse business data. 3. Use Decision-making tools/Operations research techniques. 4. Mange business process using analytical and management tools. 5. Analyze and solve problems from different industries such as Manufacturing, service, retail,software, banking and finance, sports, pharmaceutical, aerospace etc	**After completion of the course, the student will be able to** 1. Demonstrate knowledge of data analytics 2. Demonstrate the ability of think critically in making decisions based on data and deep analytics 3. Demonstrate the ability to use technical skills in Predicative and prescriptive modeling to support business decision-making 4. Demonstrate the ability to translate data into clear, actionable insights

UNIT-I

Business analytics:

Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

UNIT-II

Trendiness and Regression Analysis:

Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT-III

Organization Structures of Business analytics,

Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT-IV

Forecasting Techniques:

Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT-V

Decision Analysis:

Formulating Decision Problems, Decision Strategies with the without 8 Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Recent Trends in Embedded and collaborative business intelligence, Visual data 4 recovery, Data Storytelling and Data journalism.

References:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.
2. Business Analytics by James Evans, persons Education

Fundamentals of Embedded Systems

Semester II
Subject code – 6OE5203EC

L	T	P	Credits
3	-	0	3

Course Objectives:	Course Outcomes:
1. To provide an overview of Design Principles of Embedded System. Understand the fundamentals of Microcontroller based systems, basic hardware components, selection methods and attributes of an embedded system 2. To introduce and discuss Interfacing of various real world devices with 8051 microcontroller 3. List the RISC features of ARM core and study its architecture and instruction set. 4. To expose students to the recent trends in embedded system design. Familiarize with the different IDEs for firmware development for different family of processors/controllers and learn about different tools and techniques for embedded hardware debugging;	**After completion of the course, the student will be able to** 1. Demonstrate the role of individual components involved in a typical embedded system. 2. Describe the architectural features and instructions of Intel 8051 Microcontroller 3. Apply the knowledge gained for Programming 4. ARM for different applications. 5. List the various embedded software development tools used in the design of embedded system for variousapplications. Interpret the basic hardware components and their selection method based on the characteristics and attributes of an embedded system.

UNIT-I

Embedded Computing:

Introduction, Complex Systems and Microprocessor; Embedded System Design Process, Design Examples.The 8051 Microcontrollers: Introduction, 8051 Micro Controller Hardware, Input/output Ports and Circuits, External Memory, Counter and Timers, Serial data Input/output, interrupts.

UNIT-II

Basic Assembly Language Programming Concepts:

Assembly Language Programming Process, Programming Tools and Techniques, Programming the 8051, Data Transfer and Logical Instructions. Arithmetic Operations, Decimal Arithmetic, Jump and Call Instructions, Further Details on Interrupts.

UNIT-III

Interfacing real world devices with 8051 microcontroller:

Analog to Digital converters (ADC) & Digital to Analog Converter (DAC) basics. ADC, DAC and Temperature Sensor interfacing with 8051 microcontroller. Stepper motor, LCD and Matrix

Keyboard interfacing with 8051microcontroller.

UNIT-IV

The Arm Processor Fundamentals and Instruction set:

RISC concepts with ARM Processors, Registers, Current Program status register, pipeline, Exception, Exceptions, Conditional execution, Interrupts and vector table, Core extensions, Architectural Revisions, Arm processors Families.

Introduction to ARM Instruction Set: Data processing instructions, Branch instructions, Data transfer instructions, Software interrupt, and Program status register instructions.

UNIT-V

Embedded Software Development Tools:

Host and Target machines, Linker/Locators for Embedded Software, Getting Embedded Software into the Target System.Debugging Techniques: Testing on Host Machine, Using Laboratory Tools, An Example System.

References:

1. Wayne Wolf, Computers as Components-Principles of Embedded Computer System Design, Morgan Kaufmann publishers, Third edition, 2012.
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, The 8051 Microcontroller and Embedded Systems: Using Assembly and C, 2nd Edition, Pearson education, 2011.
3. Raj Kamal, Embedded Systems: Architecture, Programming and Design, 3rd Edition, McGraw Hill Education (India), 2014.

Waste to Energy

Semester II
Subject code – 6OE5204EE

L	T	P	Credits
3	-	0	3

Course Objectives:	Course Outcomes:
1. To enable students to aware about the generation of energy from the waste.	**After completion of the course, the student will be able to** 1. Learn the Classification of waste as a fuel. 2. Learn the Manufacture of charcoal. 3. Carry out the designing of gasifiers and biomass stoves. 4. To learn the Biogas plant technology

UNIT-I

Introduction to Energy from Waste:

Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors. Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT-II

Biomass Gasification:

Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

UNIT-III

Biomass Combustion:

Biomass stoves – Improved chullahs, types, some exotic designs, fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

UNIT-IV

Biogas:

Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass

gasification - pyrolysis and liquefaction

UNIT-V

Biochemical conversion:

Anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References:

1. Non-Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book, Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, TataMcGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

Intellectual Property Rights &Copy Writing

Semester II
Subject code – 6OE5205ME

L	T	P	Credits
3	-	0	3

Course Objectives:	Course Outcomes:
1. To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries. 2. To disseminate knowledge on patents, patent regime in India and abroad and registrationaspects 3. To disseminate knowledge on copyrights and its related rights and registration aspects 4. To disseminate knowledge on trademarks and registrationaspect 5. To aware about current trends in IPR and Govt. steps in fostering IPR	**After completion of the course, the student will be able to** 1. Distinguish and Explain various forms of IPRs. 2. Identify criteria's to fit one's own intellectual work in particular form of IPRs. 3. Apply statutory provisions to protect particular form of IPRs. 4. Analyze rights and responsibilities of holder of Patent, Copyright, Trademark, and Industrial Design etc. 5. Identify procedure to protect different forms of IPRs national and international level.

Unit-I

Overview of Intellectual Property:

Introduction and the need for intellectual property right (IPR) -Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge – Trade Secret - IPR in India : Genesis and development – IPR in abroad - Major International Instruments concerning Intellectual Property Rights: Paris Convention, 1883, the Berne Convention, 1886, the Universal Copyright Convention, 1952, the WIPO Convention, 1967,the Patent Co-operation Treaty, 1970, the TRIPS Agreement, 1994

UNIT-II

Patents:

Patents - Elements of Patentability: Novelty , Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of

Patentee, Assignment and licence , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board

UNIT-III

Copyrights:

Copyright Act, 1957 Terms of Copyright conditions for grant of copyright, extent of rights exception to copyright protection, fair use provision, Copyright in Computer Programme, Author Special Rights, Right of Broadcasting and performers .

UNIT-IV

Nature of Copyright - Subject matter of copyright:

original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and license of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights

UNIT-V

Trademarks

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board

Other forms of IP

Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection

Geographical Indication (GI)

Geographical indication: meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection

References:

1. Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.
2. Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.
3. Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.

Constitution of India and Fundamental Rights

Semester II
Subject code – 6AD5205HS

L3	T	P	Credits
	-	0	-

Course Objectives:	Course Outcomes:
Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective and to address the growth of Indian opinion regarding modern Indian intellectuals' constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism	**After completion of the course, the student will be able to** 1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics. 2. Discuss the intellectual origins of theframework of argument that informed the conceptualization of social reforms leading to revolution in India. 3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution. 4. Discuss the passage of the Hindu Code Bill of 1956.

UNIT-I

History of Making of the Indian Constitution:

History, Drafting Committee, (Composition & Working) Philosophy of the Indian Constitution: Preamble, Salient Features.

UNIT-II

Contours of Constitutional Rights & Duties:

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT-III

Organs of Governance:

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications. Powers and Functions.

UNIT-IV

Local Administration: District's Administration head: Role and Importance, Municipalities:

Introduction, Mayor and role of Elected Representative CEO of Municipal Corporation, Panchayat raj: Introduction, PRI: Zilla Panchayat, Elected officials and their roles, CEO Zilla Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT-V

Election Commission:

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women

References:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Pedagogy Studies

Semester II
Subject code – 6AD5206HS

L	T	P	Credits
3	-	0	-

Course Objectives:	Course Outcomes:
1.To present the basic concepts of design and policies of pedagogy studies. 2. To provide understanding of the abilities and dispositions with regard to teaching techniques, curriculum design andassessment practices. 3.To familiarize various theories of learning and their connection to teaching practice. 4.To create awareness about the practices followed by DFID, other agencies and other researchers. 5.To provide understanding of critical evidence gaps that guides the professional development	**After completion of the course, the student will be able to** 1. Illustrate the pedagogical practices followed by teachers in developing countries both in formal and informal classrooms 2. Examine the effectiveness of pedagogical practices. 3. Understand the concept, characteristics and types of educational research and perspectives of research. 4. Describe the role of classroom practices, curriculum and barriers to learning. 5. Understand Research gaps and learn the future directions

UNIT-I

Introduction and Methodology:

Aims and rationale, Policy background, Conceptual framework and terminology - Theories of learning, Curriculum, Teacher education - Conceptual framework, Research questions, Overview of methodology and Searching.

UNIT-II

Thematic Overview:

Pedagogical practices followed by teachers in formal and informal classrooms in developing countries - Curriculum, Teacher education

UNIT-III

Evidence on the Effectiveness of Pedagogical Practices:

Methodology for the in depth stage: quality assessment of included studies - How can teacher education (curriculum and Practicum) and the school curriculum and guidance material best support effective pedagogy? - Theory of change - Strength and nature of the body of evidence for effective pedagogical practices - Pedagogic theory and pedagogical approaches – Teachers attitudes and beliefs and pedagogic strategies.

UNIT-IV

Professional Development:

Alignment with classroom practices and follow up support – support from the head teacher and the community – curriculum and assessment - barriers to learning:limited resources and large class sizes.

UNIT-V

Research Gaps and Future Directions:

Research design – Contexts – Pedagogy - Teachereducation - Curriculum and assessment – Dissemination and research impact

References:

1. Ackers J, Hardman F, Classroom Interaction in Kenyan Primary Schools, Compare, 31 (2): 245 – 261, 2001.
2. Agarwal M, Curricular Reform in Schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361 – 379, 2004.
3. Akyeampong K, Teacher Training in Ghana – does it count? Multisite teacher education research project (MUSTER), Country Report 1. London: DFID, 2003.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J, Improving teaching and learning of Basic Maths and Reading in Africa: Does teacher Preparation count? International Journal Educational Development, 33 (3): 272- 282, 2013.
5. Alexander R J, Culture and Pedagogy: International Comparisons in Primary Education, Oxford and Boston: Blackwell, 2001.
6. Chavan M, Read India: A mass scale, rapid, learning to read campaign, 2003

Stress Management by Yoga

Semester II
Subject code – 6AD5207HS

L	T	P	Credits
3	-	0	-

Course Objectives:	Course Outcomes:
1. Creating awareness about different types of stress and the role of yoga in the management of stress. 2. Promotion of positive health and overall wellbeing (Physical, mental, emotional, social and spiritual). 3. Prevention of stress related health problems by yoga practice	**After completion of the course, the student will be able to** 1. Understand yoga and its benefits. 2. Enhance Physical strength and flexibility. 3. Learn to relax and focus. 4. Relieve physical and mental tension through asanas. 5. Improve work performance and efficiency.

UNIT - I

Meaning and Definition of Yoga - Historical perspective of Yoga - Principles of Astanga Yoga by Patanjali.

UNIT - II

Meaning and Definition of Stress - Types of stress - Eustress and Distress. Anticipatory Anxiety and Intense Anxiety and depression. Meaning of Management- Stress Management.

UNIT - III

Concept of Stress According to Yoga - Stress assessment methods - Role of Asana, Pranayama and Meditation in the management of stress

UNIT - IV

Asanas- (5 Asanas in each posture) - Warm up - Standing Asanas - Sitting Asanas - Prone Asanas - Supine asanas - Surya Namaskar.

UNIT - V

Pranayama- Anulom and Vilom Pranayama - Nadishudhi Pranayama - Kapalabhati Pranayama - Bhramari Pranayama - Nadanusandhana Pranayama. Meditation Techniques: Om Meditation - Cyclic meditation: Instant Relaxation technique (QRT), Quick Relaxation Technique (QRT), Deep Relaxation Technique (DRT)

References:

1. "Yogic Asanas for Group Training - Part-I", Janardhan Swami Yogabhyasi Mandal, Nagpur.
2. Swami Vivekananda, "Rajayoga or Conquering the Internal Nature", Advaita Ashrama (Publication Department), Kolkata.
3. Nagendra H.R and Nagaratna R, "Yoga Perspective in Stress Management", Swami Vivekananda Yoga Prakashan, Bangalore.

Personality Development through life Enlightenment Skills

Semester II
Subject code – 6AD5208HS

L	T	P	Credits
3	-	0	-

Course Objectives:	Course Outcomes:
1. To learn to achieve the highest goal happily 2. To become a person with stable mind, pleasing personality and determination 3. To awaken wisdom in students	**After completion of the course, the student will be able to** 1. Develop their personality and achieve their highest goal of life. 2. Lead the nation and mankind to peace and prosperity. 3. Practice emotional self-regulation. 4. Develop a positive approach to work and duties. 5. Develop a versatile personality

UNIT – I

Neetisatakam – Holistic Development of Personality - Verses 19, 20, 21, 22 (Wisdom) - Verses 29, 31, 32 (Pride and Heroism) - Verses 26,28,63,65 (Virtue)

UNIT - II

Neetisatakam – Holistic Development of Personality (cont'd) - Verses 52, 53, 59 (don'ts) - Verses 71,73,75 & 78 (do's) - Approach to day to day works and duties.

UNIT - III

Introduction to Bhagavadgeetha for Personality Development - Shrimad Bhagavadgeetha: Chapter 2 – Verses 41, 47, 48 - Chapter 3 – Verses 13,21,27,35 - Chapter 6 – Verses 5,13,17,23,35 - Chapter 18 –Verses 45, 46, 48 Chapter – 6: Verses 5, 13, 17, 23, 35; Chapter – 18: Verses 45, 46, 48

UNIT - IV

Statements of Basic Knowledge - Shrimad Bhagavadgeetha: Chapter 2- Verses 56, 62,68 - Chapter 12 – Verses 13, 14, 15, 16, 17, 18 - Personality of Role model from Shrimad Bhagawat Geeta.

UNIT – V

Role of Bhagavadgeetha in the Present Scenario - Chapter 2 – Verses 17 - Chapter 3 – Verses 36, 37, 42 - Chapter 4 – Verses 18, 38, 39 - Chapter 18 – Verses 37, 38, 63.

References:

1. Srimad Bhagavad Gita, Swami Swarupananda Advaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya), P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delh

Advanced CAD Lab

Semester II	L	T	P	Credits
Subject code – 6PC5252CD	-	-	2	1

Course Outcomes
At the end of this course, students will be able to
Model Products involving Surface Modeling Techniques.
Model Products involving Sheet Metal Techniques.
Model Parts & Assemble them using Solid Modeling Techniques.
Generate Orthographic views of Products with Detailing, Sections, Dimensions & Tolerances

List of Exercises:

1. Model a Body with a Complex Surface Shape. For example, Plastic Blow-Molded Bottle etc…
2. Model an Outer Body of a Product with a Complex Surface Shape. For example, Car Hood etc…
3. Convert a Solid Shape into Sheet Metal & Develop its Flattened Shape. For example, cabinets etc…
4. Model a Sheet Metal Component from scratch & Develop its Flattened Shape.
5. Model all the Parts of a Mechanical Assembly & Assemble them with Suitable Constraints. Forexample, Screw Jack etc…
6. Model a Part with Parameters Controlled by Configurations &Microsoft Excel Sheet. Forexample, Knuckle Joint for different diameters.
7. Generate Suitable Views to Show all the Necessary Details, Dimensions & Tolerances of a Mechanical Component for Manufacturing. For example, Stuffing Box etc…
8. Optimize a Mechanical Component to have a Particular Area in a Defined Cross-Section.

CAM &Automation Lab

Semester II	L	T	P	Credits
Subject code – 6PC5253CD	-	-	2	1

Course Outcomes

At the end of this course, students will be able to
Write the CNC Code for simple operations on Lathe Machine.
Generate the CNC Code for complex operations using suitable software.
Plan Integration of CNC, Robots & Material Handling for Optimum Production.
Execute the PLC Programming for various Applications

List of Exercises:

1. Facing & Step Turning on a CNC Lathe Machine.
2. Taper Turning, Contouring on a CNC Lathe Machine.
3. Threading & Knurling on a CNC Lathe Machine.
4. Simulation and Development of NC Code using suitable CAM Software.
5. Implementation of Logic Gates(AND, OR, XOR, NAND) using PLC.
6. Implementation of Stepper Motor Control using PLC.
7. PLC Program to Latch and Unlatch Output with Time Delay.
8. PLC Program to Drive Motors Simultaneously with Interlocking

Innovative Design project

Semester II	L	T	P	Credits
Subject code – 6PC5255ME	-	-	8	4

Course Objectives:

Innovation Design Project is to realize the design in various fields of interest related to the mechanical engineering profession that solves an existing problem, improves an existing technology, process or product and bring in innovative ideas that can be implemented through design. Students have to understand the importance of design and how to do it as this is the main professional goal.

This course is planned to understand the various segments of activities connected with simple design and to encourage students to think differently and formulate design solutions to meet society needs. Further, students are encouraged to take up mini-projects to realize the designs. They also get exposed to availability and usage of various engineering tools to be used to meet the final objective of design. These include CAD, Analysis Tools, Simulation Tools, Optimization Tools and the like.
The main objective of this course is to use the knowledge acquired in Mechanical Engineering and take up a mini project, which allows the students to come up with design / analyse and fabrication of models/ prototypes expressing their ideas in a novel way. The course enables the students to get experience in solving various design problems related to mechanical Engineering and to impart and improve the design capability of the student.

Course outcomes:

1. The student shall have knowledge on using and adapting existing methods and learn new methods, for problem solving in practical development projects.
2. The student shall also know how systematic technical problem solving and research shall be reported.
3. The student must be able to prepare a project plan with milestones, report partial results and write a project report in accordance with established standards.
4. S/he shall master writing of technical reports and communication, technically as well as on a more general basis.
5. The student shall on general basis be able to apply captured knowledge, competence and skills in a project setting where s/he works with others with different competence.
6. Furthermore, s/he should know how to work in a practical development project, within given circumstances and limitations, and deliver results.

Guidelines:

As part of the curriculum in the II- semester of the programme each student shall do a mini project, generally comprising about three to four weeks of prior reading, twelve weeks of active research, and finally a presentation of their work for assessment.

Each student will be allotted to a faculty supervisor for mentoring.

Mini projects should present students with an accessible challenge on which to demonstrate competence in research techniques, plus the opportunity to contribute something more original.

Mini projects shall have inter-disciplinary/ industry relevance.

The students can select a mathematical modeling based/Experimental investigations or Numerical modeling

All the investigations should be clearly stated and documented with the reasons/explanations.

The mini-project shall contain a clear statement of the research objectives, background of work, literature review, techniques used, prospective deliverables, and detailed discussion on results, conclusions and reference.

Guidelines for awarding marks in CIE (Continuous Internal Evaluation): Max. Marks: 50		
Evaluation by	Max.Marks Evaluation	Criteria / Parameter
Supervisor	20	Progress and Review
	05	Report
Departmental Committee	05	Relevance of the Topic
	05	PPT Preparation
	05	Presentation
	05	Question and Answers
	05	Report Preparation

SCHEME OF INSTRUCTION & EXAMINATION

M.E. (Mechanical Engineering) III Semester

Specialization in CAD/CAM

S. No.	Course Type/Code	Course Name		Scheme of Instruction				Scheme of Examination			Credits
				L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses		Code	Course Title								
1	Elective-III	PE-III	Professional Elective – III	3	-	-	3	40	60	3	3
2	Elective-IV	PE-IV	Professional Elective – IV	3	-	-	3	40	60	3	3
3	Project Dissertation	6PC5356ME	Dissertation Phase – I	-	-	20	20	100	-	3	10
Total				**06**	**-**	**20**	**26**	**180**	**120**		**16**

Professional Elective-III		
S. No.	**Course Code**	**Course Title**
1	6PE5209ME	Tribology
2	6PE5210ME	Product Design &Process Planning
3	6PE5211ME	Non Destructive Testing and Evaluation
4	6PE5212ME	Flexible Manufacturing Systems

Professional Elective-IV		
S. No.	**Course Code**	**Course Title**
1	6PE5213ME	Robotic Engineering
2	6PE5214ME	Advanced Manufacturing Processes
3	6PE5215ME	Advanced Engineering Materials
4	6PE5216ME	Integrated Product Design And Development

PC: Program Core **PE:** Professional Elective **OE**: Open Elective **AD**: Audit Course
MC: Mandatory Course **HS**: Humanities and social science

L: Lecture **T**: Tutorial **P**: Practical **D**: Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination

SCHEME OF INSTRUCTION & EXAMINATION

M.E. (Mechanical Engineering)
IV Semester Specialization in
CAD/CAM

S. No.	Course Type/Code	Course Name	Scheme of Instruction				Scheme of Examination			Credits
			L	T	P/D	Contact Hrs/Wk	CIE	SEE	Duration in Hrs	
Theory Courses										
1	6PC5457ME	Dissertation Phase – II	-	-	28	28	-	200	3	14
Total			**-**	**-**	**28**	**28**	**-**	**200**		**14**

PC: Program Core **PE:** Professional Elective **OE**: Open Elective **AD**: Audit Course
MC: Mandatory Course **HS**: Humanities and social science

L: Lecture **T**: Tutorial **P**: Practical **D**: Drawing
CIE: Continuous Internal Evaluation **SEE:** Semester End Examination

Tribology

Semester III	L	T	P	Credits
Subject code - 6PE5209ME	3	-	0	3

Course Objectives:	Course Outcomes:
To understand the application of Tribology in modern machinery for designing, manufacturing and exploration for new and better products.	**After completion of the course, the student will be able to** 1. Apply theories of friction and wear to various practical situationsby analyzing the physics of the process. 2. Understand the various surface measurement techniques and effect of surfacetexture on tribological behavior of a surface 3. Select materials and lubricants to suggest a tribological solution to aparticular situation. 4. Design a hydrodynamic bearing using various bearingcharts 5. Understand the recent developments in the field and understand modern research material

UNIT I:
Friction, theories of friction, Friction control, Surface texture and measurement, genesis of friction, instabilities and stick-slip motion.

UNIT II:
Wear, types of wear, theories of wear, wear prevention.

UNIT III:
Tribological properties of bearing materials and lubricants. Lubrication, Reynolds's equation and its limitations, idealized bearings, infinitely long plane pivoted and fixed show sliders, infinitely long and infinitely short (narrow) journal bearings, lightly loaded infinitely long journal bearing (Petroff's solution), Finite Bearings, Design of hydrodynamic journal bearings

UNIT IV:
Hydrostatic, squeeze film Circular and rectangular flat plates, variable and alternating loads, piston pin lubrications, application to journal bearings and design of Journal bearings.

NITV:
Elasto-hydrodynamic lubrication – pressure viscosity term in Reynolds's equation, Hertz' theory, Ertel-Grubin equation, lubrication of spheres, gear teeth and rolling element bearings, Air lubricated bearings, Tilting pad bearings, design of rolling contact bearings.

References:

1. Cameron, "Basic Lubrication Theory", Ellis Horwood Ltd, 1981. Principles in Tribology, Edited by J. Halling, 1975
2. Fundamentals of Fluid Film Lubrication – B. J. Hamrock, McGraw Hill International,1994

Product Design & Process Planning

Semester III	L	T	P	Credits
Subject code - 6PE5210ME	3	-	0	3

Course Objectives:	Course Outcomes:
1. To learn the essential factors with innovative ideas to develop successive right product. 2. To know the product reliability, copyrights, value Engineering in product design and cost estimation of product. 3. To understand the various machining processes, improving tolerances methods, selection of materials and their importance. 4. To understand the modern approaches, ergonomics considerations in product design, integration of design, manufacturing and production control.	**After completion of the course, the student will be able to** 1. Understand the functions related to the product design and process design 2. Estimate the product reliability 3. Determine the manufacturing process based on the application 4. Design as per the industrial ergonomics 5. Utilize the computers for the management of the manufacturing process

UNIT-I

Product design and process design functions, selection of a right product, essential factors of product design, Morphology of design, sources of new ideas for products, evaluation of new product ideas. Product innovation Procedure-Flow chart. Qualifications of product design Engineer. Criteria for success/failure of a product. Value of appearance, colours and Laws of appearance.

UNIT-II

Product reliability, Mortality Curve, Reliability systems, Manufacturing reliability and quality control. Patents: Definitions, classes of patents, applying for patents. Trademarks and copyrights. Cost and quality sensitivity of products, Elements of cost of a product, costing methods, cost reduction and cost control activities. Economic analysis, Break even analysis Charts. Value engineering in product design, creativity aspects and techniques. Procedures of value analysis – cost reduction, material and process selection.

UNIT-III

Various manufacturing processes, degree of accuracy and finish obtainable, process capability studies. Methods of improving tolerances. Basic product design rules for Casting, Forging, Machining, Sheet metal and Welding. Physical properties of engineering materials and their importance on products. Selection of plastics, rubber and ceramics for product design.

UNIT-IV

Industrial ergonomics: Man- machine considerations, ease of maintenance. Ergonomic considerations in product Design-Anthropometry Design of controls, man-machine

information exchange. Process sheet detail and their importance, advanced techniques for higher productivity. Just -in -time and Kanban System. Modern approaches to product design; quality function development, Rapid prototyping.

UNIT-V

Role of computer in product design and management of manufacturing, creation of manufacturing data base, Computer Integrated Manufacturing, communication network, production flow analysis, Group Technology, Computer Aided product design and process planning. Integrating product design, manufacture and production control.

References:

1. Niebel, B.W., and Draper, A.B., Product design and process Engineering, Mc Graw Hill Kogalkusha Ltd., Tokyo, 1974.
2. Chitale, A.K, and Gupta, R.C., Product Design and Manufacturing, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
3. Mahajan, M. Industrial Engineering and Production Management, Dhanpath Rai & Co., 2000.

Non Destructive Testing and Evaluation

Semester III	L	T	P	Credits
Subject code - 6PE5211ME	3	-	0	3

Course Objectives:	Course Outcomes:
To study and understand the various non destructive evaluation and testing methods theory and their industrial applications	**After completion of the course, the student will be able to** 1. Obtain the fundamental knowledge about various non destructive testing and testing methods. 2. Understand and perform tests like Liquid Penetrate Test and Magnetic Penetrate Test of industrial components 3. Understand the testing procedure of Thermography and eddy current. 4. Describe the knowledge about Ultrasonic testing (UT) and acousticemission (AE). 5. Understand the principle of radiographic testing in industry environment.

UNIT-I

Overview of NDT:

NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterization. Relative merits and limitations, various physical characteristics of materials and their applications in NDT, Visual inspection – Unaided and aided.

UNIT-II

Surface NDE methods:

Liquid Penetrant Testing - Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods, Testing Procedure, Interpretation of results. Magnetic Particle Testing Theory of magnetism, inspection materials Magnetization methods, Interpretation and evaluation of test indications, Principles and methods of demagnetization, Residual magnetism.

UNIT-III

Thermography and eddy current testing (ET):

Thermography- Principles, Contact and son contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation infrared radiation and infrared detectors, Instrumentations and methods, applications Eddy Current Testing-Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation.

UNIT-IV

Ultrasonic testing (UT) and acoustic emission (AE):

Ultrasonic Testing-Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A/Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight Diffraction. Acoustic Emission Technique-Principle, AE parameters, Applications.

UNIT-V

Radiography (RT):

Principle, interaction of X-Ray with matter, imaging, film and film less- techniques, types and use of filters and screens, geometric factors, Inverse square, law, characteristics of graininess, density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radiographic Tomography. equivalence. Fluoroscopy- Xero-Radiography, Computed Radiography, Computed tomography

References:

1. Baldev Raj, T-Jayakumar, M.Thavasimuthu "Practical Non-Destructive Testing", Naro Publishing House, 2009.
2. Ravi Prakash, "Non-Destructive Testing Techniques", 1st revised edition, New Age International Publishers, 2010
3. ASM Metals Handbook, "Non-Destructive Evaluation and Quality Control", American Society of Metals, Metals Park, Ohio, USA, 200, Volume-17.
4. 4.Paul E Mix, "Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition NewJersey, 2005
5. Charles, J. Hellier," Handbook of Nondestructive evaluation", McGraw Hill, New York 2001.
6. ASNT, American Society for Non Destructive Testing, Columbus, Ohio, NDT Handbook, Vol. 1, Leak Testing, Vol. 2, Liquid Penetrant Testing, Vol. 3, Infrared and Thermal Testing Vol. 4, Radiographic Testing, Vol. S, Electromagnetic Testing, Vol. 6, Acoustic Emission Testing, Vol. 7, Ultrasonic Testing

Flexible Manufacturing Systems

Semester III	L	T	P	Credits
Subject code - 6PE5212ME	3	-	0	3

Course Objectives:	Course Outcomes:
1. To Improve Understanding of the Evolution of Flexible Manufacturing Systems and the Layouts of Human Resources Involvement. 2. To Impart Knowledge on Manufacturing driving force, design scheduling of jobs, classification, andcoding technique. 3. To Familiarize students with Design Models for Processing and Quality Assurance, Automated Manufacturing and Measuring Systems. 4. To Improve the understanding of Automated Movement, Storage Systems, Tool Management, Fault 5. Detection and Relationship with Workstations.	**After completion of the course, the student will be able to** 1. Apply the concepts of PPC and GT for the Development of FMS. 2. Explain the Planning and Scheduling Methods used in FMS. 3. Identify various Workstations, System Support Equipment. 4. Identify Hardware and Software Components of FMS. 5. Explain Modern Manufacturing conceptssuch as JIT, Supply Chain Management and Lean Manufacturing.

Unit - I

Evolution of Manufacturing Systems:

FMS: Definition and Description, General FMS Considerations, Manufacturing Cells, Comparison between Cellular and Flexible Manufacturing Systems.

Planning: Objectives, Introduction to Planning, Preparation of Guidelines, Project Team, Supplier Selection, System Description and Sizing, Facility Preparation Planning, FMS Layouts.

Human Resources: Staff Considerations, Team Work, Communication and Involvement, Supervisor's Role, Personnel Selection, Job Classifications, Employee Training.

Unit – II

Manufacturing Driving Force: Definitions, Description and Characteristics.

Just-In-Time Manufacturing: Definition and Description, Benefits and Relationship with FMS, Implementation Cornerstones, Quality and Quantity Application Principles.

Single Manufacture Cell: Design Scheduling of Jobs.

Group Technology: Concepts, Classification and Coding, Benefits and Relationship with FMS, Design of Group Technology using Rank Order Clustering Technique.

Unit - III

FMS Design: Using Bottleneck, Extended Bottleneck Models, Processing and Quality **Assurance:** Turning Centers, Machining Center, Construction and Operations Performed, Axes, Programming, and Format Information, Work-Holding and Work-Changing Equipment, Automated Features and Capabilities, Cleaning and Deburring – Station Types and Operation Description, Importance to Automated Manufacturing

Coordinate Measuring Machines: Types, Construction, and General Function, Operation Cycle Description, Importance to Flexible Cells and Systems.

Unit - IV

Automated Movement and Storage Systems: AGVs, Robots, Automated Storage and Retrieval Systems, Storage Space Design, Queuing Carousels and Automatic Work Changers, Coolant, Chip Disposal and Recovery Systems, Auxiliary Support Equipment.

Cutting Tools and Tool Management: Introduction, Getting Control of Cutting Tools, Tool Management, Tool Strategies, Data Transfer, Tool Monitoring and Fault Detection, Guidelines, Work Holding Considerations, General Fixturing, Modular Fixturing.

FMS and Relationship with Workstations: Manual & Automated Transfer Lines, Design Aspects

Unit – V

FMS: Computer Hardware, Software, Communications Networks.

Nanotechnology: General Functions and Manufacturing Usages, Hardware Configuration, Programmable Logic Controllers, Cell Controllers, Communications Networks. FMS Implementation.

References:

1. Parrish, D.J., "Flexible Manufacturing", - Butter Worths – Heinemann, Oxford.
2. Groover, M.P., "Automation, Production Systems and CIM", - Prentice Hall India.
3. Kusiak, A., "Intelligent Manufacturing Systems", - Prentice-Hall.
4. Considine,D.M., & Considine,G.D., "Standard Handbook of Industrial Automation"- Chapman & Hall
5. Ranky, P.G. "Design and Operation of FMS", - IFS Publishers, UK

Robotic Engineering

Semester III	L	T	P	Credits
Subject code - 6PE5213ME	3	-	0	3

Course Objectives:	Course Outcomes:
1. To Develop the Understanding of Robot Structures and their Workspaces. 2. To Develop Student's Skills in Performing Kinematic Analysis of Robot Systems. 3. To Provide the Student with Understanding of the Singularity Issues Associated with the Operation of Robotic Systems. 4. To Provide the Student with Analyzing Skills associated with Trajectory Planning. 5. To Provide the Student with an Understanding of Sensors used in Robot Control.	**After completion of the course, the student will be able to** 1. Explain the significance Robotic Subsystems & their Functions. 2. Analyze the Robotic System using Direct Kinematics. 3. Explain the concepts of Inverse Kinematics in Robots. 4. Determine the Forces and Control the Robots using Concepts of Mechanical Dynamics. 5. Control the Robots using VariousSensors and Controllers.

UNIT-I

Introduction: Brief History, Types of Robots, Overview of Robot Subsystems, Resolution, Repeatability and Accuracy, Degrees of Freedom of Robots, Robot Configurations and Concept of Workspace, Mechanisms and Transmission, End Effectors and Types of Grippers, Methods of Gripping, Pneumatic, Hydraulic and Electrical Actuators, Applications of Robots, Specifications of Different Industrial Robots.

UNIT-II

Rotation Matrices: Euler Angle and RPY Representation, Homogeneous Transformation Matrices

Denavit Hartenberg Notation: Representation of Absolute Position and Orientation in terms of Joint Parameters, Direct Kinematics.

UNIT-III

Inverse Control: Inverse Kinematics, Inverse Orientation, Inverse Locations, Singularities, Jacobian,

Trajectory Planning: Joint Interpolation, Task Space Interpolation, Executing User Specified Tasks.

UNIT-IV

Force Analysis: Static Force Analysis of RP type and RR type Planar Robots, Dynamic Analysis using Lagrangian and Newton-Euler formulations of RR and RP type Planar Robots, Independent Joint Control, PD and PID Feedback, Actuator Models, Non-Linearity of Manipulator Models, Computed Torque Control, Force Control, Hybrid Control.

UNIT-V

Sensors and Controllers: Internal and External Sensors, Position, Velocity and Acceleration Sensors, Proximity Sensors, Force Sensors, LASER Range Finder.

Robot Vision: Image Processing Fundamentals for Robotic Applications, Image Acquisition, and Pre-Processing. Segmentation and Region Characterization Object Recognition by Image Matching and Based on Features.

References:

1. Nagrath and Mittal, "Robotics and Control", Tata McGraw-Hill.
2. Spong and Vidhyasagar, "Robot Dynamics and Control", John Wiley and Sons.
3. Fu. K.S, Gonzalez, R.C., Lee, C.S.G, Robotics, Control, Sensing, Vision and Intelligence, McGraw Hill International
4. Harry Asada &Slotine "Robot Analysis & Control", Wiley Publications
5. S K Saha, "Introduction to Robotics ", TMH

Advanced Manufacturing Processes

Semester III Subject code - 6PE5214ME	L	T	P	Credits
	3	-	0	3

Course Objectives:	Course Outcomes:
1. To make acquainted the various unconventional manufacturing processes. 2. To know about the applications of advanced manufacturing processes (which are exceptional). To encourage the students for developing the models of Advanced Manufacturing Processes	**After completion of the course, the student will be able to** 1. Understand the working principle of Electron beam, laser beam and laser beam processes. 2. Understand different types of composite material characteristics, types of micro & macro machining processes. 3. Understand the e-manufacturing & nano materials.

UNIT-I

Surface treatment:

Scope, Cleaners, Methods of cleaning, Surface coating types, and ceramic and organic methods of coating, economics of coating. Electro forming, Chemical vapour deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding.

UNIT-II

Non-Traditional Machining:

Introduction, need, AJM, Parametric Analysis, Process capabilities, USM –Mechanics of cutting, models, Parametric Analysis, WJM –principle, equipment, process characteristics, performance, EDM – principles, equipment, generators, analysis of R-C circuits, MRR, Surface finish, WEDM.

UNIT-III

Laser Beam Machining:

Principle of working, equipment, Material removal rate, Process parameters, performance characterization, Applications. Plasma Arc Machining – Principle of working, equipment, Material removal rate, Process parameters, performance characterization, Applications. Electron Beam Machining - Principle of working, equipment, Material removal rate, Process parameters, performance characterization, Applications. Electro Chemical Machining – Principle of working, equipment, Material removal rate, Process parameters, performance characterization, Applications.

UNIT-IV

Processing of ceramics:

Applications, characteristics, classification. Processing of particulate ceramics, Powder preparations, consolidation, Drying, sintering, Hot compaction, Area of application, finishing of ceramics.

Processing of Composites:

Composite Layers, Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites

UNIT-V

Fabrication of Microelectronic devices:

Crystal growth and wafer preparation, Film Deposition oxidation, lithography, bonding and packaging, reliability and yield, Printed Circuit boards, computer aided design in microelectronics, surface mount technology, Integrated circuit economics. E-Manufacturing, nanotechnology, micromachining and High-speed Machining, basic principles, working, applications, advantages.

References:

1. Manufacturing Engineering and Technology by Kalpakijian, Adisson Wesley, 1995.
2. Foundation of MEMS by Chang Liu, Pearson, 2012. 3. Advanced Machining Processes by V. K. Jain, Allied Publications.
3. Process and Materials of Manufacturing by R. A. Lindburg, 4th edition, PHI 1990.
4. Introduction to Manufacturing Processes by John A Schey, Mc Graw Hill.
5. Micro Machining of Engineering Materials by J. Mc Geough, CRC Press.
6. Non Traditional Manufacturing Processes by Gary F Benedict, CRC Press.
7. Advanced Methods of Machining by J. A Mc Geough, Springer

Advanced Engineering Materials

Semester III	L	T	P	Credits
Subject code - 6PE5215ME	3	-	0	3

Course Objectives:	Course Outcomes:
1. The main objective of this course is to impart knowledge in material science with modes of manufacturing process involved in construction of various technologies employed in automobile Industries. 2. Students been focused on basics related to Nano technological developments which sustainably develop their skill in selection of materials for the process of manufacturing	**After completion of the course, the student will be able to** 1. Demonstrate an understanding of mechanics, physical and chemical properties of materials including metals, ceramics, polymers and composites 2. Understand existence of imperfections and their effects on mechanical properties of materials and cause of failure 3. Demonstrate understanding of phase diagrams and their use in predicting phase transformation and microstructure 4. Understand and predict various types of failures using concept of fracture mechanics, creep and effect of impact 5. Know Electrical, Thermal, Optical and Magnetic Properties of metals, ceramics, polymers and composites Understand the economic considerations in usage and recycling of materials

UNIT:I

Introduction, Atomic Structure, Interatomic Bonding and Structure of Crystalline Solids:

Historical perspective of Materials Science. Why study properties of materials? Classification of materials. Advanced Materials, Future materials and modern materials, Atomic structure. Atomic bonding in solids, Crystal structures, Crystalline and non crystalline materials. Miller indices. Anisotropic elasticity. Elastic behaviour of composites. Structure and properties of polymers. Structure and properties of ceramics.

UNIT:II

Imperfections in Solids and Mechanical Properties of Metals, Diffusion, Dislocations and Strengthening Mechanisms:

Point defects. Theoretical yield point. Line defects and dislocations. Interfacial defects. Bulk or volume defects. Atomic vibrations; Elastic deformation. Plastic deformation. Interpretation of tensile stress-strain curves Yielding under multiaxial stress. Yield criteria and macroscopic aspects of plastic deformation. Property variability and design factors, Diffusion mechanisms. Steady and nonsteady state diffusion. Factors that influence diffusion. Non-equilibrium transformation and microstructure, Dislocation and plastic deformation. Mechanisms of strengthening in metals. Recovery, recrystallization and grain growth. Strengthening by second phase particles. Optimum distribution of particles. Lattice resistance to dislocation

motion.

UNIT:III

Phase Diagrams

Equilibrium phase diagrams. Particle strengthening by precipitation. Precipitation reactions. Kinetics of nucleation and growth. The iron-carbon system. Phase transformations. Transformation rate effects and TTT diagrams. Microstructure and property changes in iron carbon system

UNIT:IV

Failure:

Fracture. Ductile and brittle fracture. Fracture mechanics. Impact fracture. Ductile brittle transition. Fatigue. Crack initiation and propagation. Crack propagation rate. Creep. Generalized creep behaviour. Stress and temperature effects

UNIT:V

Applications and Processing of Metals and Alloys, Polymers, Ceramics and composites: Types of metals and alloys. Fabrication of metals. Thermal processing of metals. Heat treatment. Precipitation hardening. Types and applications of ceramics. Fabrication and processing of ceramics, Mechanical behaviour of polymers. Mechanisms of deformation and strengthening of polymers. Crystallization, melting and glass transition. Polymer types. Polymer synthesis and processing, Particle reinforced composites. Fibre reinforced composites. Structural composites. Thermal properties of materials.

References:

1. Materials Science and Engineering, William D. Callister, Jr, John Wiley & sons.
2. Modern Physical Metallurgy and Material Engineering, Science, Process, application, Smallman R.E., Bishop R J, Butterworth Heinemann, Sixth Ed., 1999

Integrated Product Design and Development

Semester III Subject code - 6PE5216ME	L	T	P	Credits
	3	-	0	3

Course Objectives:	Course Outcomes:
1. The main objective of this course is to impart knowledge in safety and comfort systems inautomotive vehicles. 2. It also clearly describes the basic ergonomic need in developing various vehicle applications through in putting bio thermal and bio mechanical systems	**After completion of the course, the student will be able to** 1. To Know and to study about Biomechanics And Bio Thermal systems 2. To Study about the basics of various safety aspects and comfort systems in vehicle 3. To learn about Vehicle Ergonomics 4. To learn about the utilization of human factors and applications in automotive field 5. To study on advance safety systems and ergonomic factors.

UNIT – I

Fundamentals of design

Product development – marketing design & production – design process – morphology of design – Asimov's models – problem statement – product design specification – concept selection techniques.

UNIT – II

Product strategies

Product strategies – product analysis – standardization, simplification & specialization – creativity – aesthetics – ergonomics – functional design – hierarchy of needs – needs analysis.

UNIT – III

Economic analysis

Customer & competitors – product value – economic analysis – qualitative & quantitative analysis – profit consideration – break even analysis – profit volume charts.

UNIT – IV

Product architecture

Product architecture – modularity – product change – product variety – component standardization – performance – manufacturability – establishing the architecture – variety & supply chain – platform planning.

UNIT – V

Industrial practices

Conventional practices – recent trends – technology & user driven products advertisements – patents – case studies.

Reference:

1. G.E Dieter – Engineering Design –Mc Graw Hill, 1991.
2. Kart.T. Ulrich, Steven .D. Eppinger – product design & development – Mc Graw Hill, 2000. 3. Chitale. Gupta – product design & Mfg – Prentice Hall 1997.