MASTER OF ENGINEERING

GOVERNMENT COLLEGE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University)
Coimbatore – 641 013

Curriculum and Syllabi For
M.E. (ENGINEERING DESIGN)
(Full Time)

2018

Regulations

OFFICE OF THE CONTROLLER OF EXAMINATIONS
GOVERNMENT COLLEGE OF TECHNOLOGY
THADAGAM ROAD, COIMBATORE – 641 013

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MASTER OF ENGINEERING

VISION AND MISSION OF THE INSTITUTION

VISION

To emerge as a centre of excellence and eminence by imparting futuristic technical education in keeping with global standards, making our students technologically competent and ethically strong so that they can readily contribute to the rapid advancement of society and mankind

MISSION

- To achieve Academic excellence through innovative teaching and learning practices.
- To enhance employability and entrepreneurship
- To improve the research competence to address societal needs
- To inculcate a culture that supports and reinforces ethical, professional behaviors for a harmonious and prosperous society

Department Vision

To drive towards a Global knowledge hub, striving continuously in pursuit of excellence in Mechanical Engineering Education, Entrepreneurship and Innovation.

Department Mission

- To impart total quality education through effective hitech teaching learning techniques and department industries collaboration.
- To mold the young dynamic potential minds to emerge as full-fledged future professionals so as to achieve top ten ranking status in the national level.
- To achieve international standards to fulfill the Government's "Make in India" industrial policy through innovation and research.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs) :

Enable the students to

I. Develop an aptitude to use engineering principles and concepts to create, test and evaluate designs for local and global needs.
II. Become effective and excellent need based engineer, participating in efforts to provide solutions to social and technical challenges.
III. Develop innovative technologies and find solutions to contemporary issues in Engineering Design using basic principles in combination with latest tools and concepts.
IV. Pursue advanced research and development and other innovative efforts in their career.

PROGRAMME OUTCOMES (POs):

On successful completion of the programme the graduates will,

1. Demonstrate knowledge of mathematics, science and engineering for practical usage.
2. Demonstrate the ability to identify, formulate and solve design problems by critical thinking.
3. Demonstrate an ability to design a system, component or process as per the requirements.
4. Demonstrate ability to develop new systems by using research skills.
5. Demonstrate an ability to design and conduct experiments, analyze and interpret data in the area of design engineering by applying latest techniques.
6. Demonstrate skills to use modern engineering tools, software and equipment to analyze multi disciplinary problems.
7. Develop and implement new projects with basic knowledge in project financing.
8. demonstrate the ability to communicate their ideas through documentation and oral presentations
9. Develop confidence for self-education and ability for life-long learning and research.
10. Demonstrate knowledge of professional, ethical and social responsibilities in the field of mechanical design.

Demonstrate knowledge on mechanical design and be able to do individual activities by reflective learning

MASTER OF ENGINEERING

CURRICULUM FOR CANDIDATES ADMITTED DURING 2018-2019 AND ONWARDS
TWO YEAR M.E PROGRAMME
ENGINEERING DESIGN
CHOICE BASED CREDIT SYSTEM-CURRICULUM

CURRICULUM

FIRST SEMESTER

S. No	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Contact Periods	L	T	P	C
Theory											
1	18EDFCZ1	Research Methodology and IPR	FC	50	50	100	3	3	0	0	3
2	18EDPC01	Mechanics of Materials	PC	50	50	100	3	3	0	0	3
3	18EDPC02	Vibration Analysis and Control	PC	50	50	100	3	3	0	0	3
4	18EDPC03	Design and synthesis of Mechanisms	PC	50	50	100	3	3	0	0	3
5	18EDPEXX	Professional Elective I	PE	50	50	100	3	3	0	0	3
6	18EDPEXX	Professional Elective II	PE	50	50	100	3	3	0	0	3
7	18EDACXX	Audit Course I	AC	50	50	100	2	2*	0	0	0
Practical											
8	18EDPC04	Vibration Lab	PC	50	50	100	3	0	0	3	1.5
Total				**400**	**400**	**800**	**23**	**20**	**0**	**3**	**19.5**

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SECOND SEMESTER

S. No	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Contact Periods	L	T	P	C
Theory											
1	18EDPC05	Finite Element Methods in Mechanical Design	PC	50	50	100	3	3	0	0	3
2	18EDPC06	Computer Applications in Design	PC	50	50	100	3	3	0	0	3
3	18EDPC07	Tribology in Design	PC	50	50	100	3	3	0	0	3
4	18EDPEXX	Professional Elective III	PE	50	50	100	3	3	0	0	3
5	18EDPEXX	Professional Elective IV	PE	50	50	100	3	3	0	0	3
6	18EDACXX	Audit Course II	AC	50	50	100	2	2*	0	0	0
Practical											
7	18EDPC08	Simulation Lab	PC	50	50	100	3	0	0	3	1.5
8	18EDEE01	MINI PROJECT	EEC	50	50	100	4	0	0	4	2
Total				**400**	**400**	**800**	**24**	**17**	**0**	**7**	**18.5**

THIRD SEMESTER

S. No	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Contact Periods	L	T	P	C
Theory											
1	18EDPEXX	Professional Elective V	PE	50	50	100	3	3	0	0	3
2	18$OEXX	Open Elective	OE	50	50	100	3	3	0	0	3
Practical											
3	18EDEE02	Project Phase I	EEC	100	100	200	20	0	0	20	10
Total				**200**	**200**	**400**	**26**	**6**	**0**	**20**	**16**

MASTER OF ENGINEERING

FOURTH SEMESTER

S. No	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Contact Periods	L	T	P	C
Practical											
1	18EDEE03	Project Phase II	EEC	200	200	400	32	0	0	32	16
Total				**200**	**200**	**400**	**32**	**0**	**0**	**32**	**16**

TOTAL CREDITS: 70

MASTER OF ENGINEERING

LIST OF PROFESSIONAL ELECTIVES											
S. No	Course Code	Course Title	Category	Continuous Assessment Marks	End Sem Marks	Total Marks	Contact Periods	L	T	P	C
PROFESSIONAL ELECTIVE I											
1	18EDPE01	Applied Mathematics for Engineering Design	PE	50	50	100	3	3	0	0	3
2	18EDPE02	Manufacturing Considerations in Design	PE	50	50	100	3	3	0	0	3
3	18EDPE03	Concepts of Engineering Design	PE	50	50	100	3	3	0	0	3
4	18EDPE04	Composite Materials and Mechanics	PE	50	50	100	3	3	0	0	3
5	18EDPE05	Value and Reengineering	PE	50	50	100	3	3	0	0	3
PROFESSIONAL ELECTIVE II											
6	18EDPE06	Mechanical Behaviour of Materials	PE	50	50	100	3	3	0	0	3
7	18EDPE07	Additive Manufacturing	PE	50	50	100	3	3	0	0	3
8	18EDPE08	Quality Concepts in Design	PE	50	50	100	3	3	0	0	3
9	18EDPE09	Creativity in Design	PE	50	50	100	3	3	0	0	3
PROFESSIONAL ELECTIVE III											
10	18EDPE10	Mechanics of fracture	PE	50	50	100	3	3	0	0	3
11	18EDPE11	Sensors for Intelligent Manufacturing	PE	50	50	100	3	3	0	0	3
12	18EDPE12	Vehicular Vibration	PE	50	50	100	3	3	0	0	3
13	18EDPE13	Life Cycle Design	PE	50	50	100	3	3	0	0	3
PROFESSIONAL ELECTIVE IV											
14	18EDPE14	Condition Monitoring and Vibration Control	PE	50	50	100	3	3	0	0	3
15	18EDPE15	Optimization in Design	PE	50	50	100	3	3	0	0	3

16	18EDPE16	Advanced Machine Tool Design	PE	50	50	100	3	3	0	0	3
17	18EDPE17	Systematic Design Approach	PE	50	50	100	3	3	0	0	3
18	18EDPE18	Principles of Product Design	PE	50	50	100	3	3	0	0	3
PROFESSIONAL ELECTIVE V											
19	18EDPE19	Wear analysis and control	PE	50	50	100	3	3	0	0	3
20	18EDPE20	Computational Fluid Dynamics	PE	50	50	100	3	3	0	0	3
21	18EDPE21	Design of Material Handling equipments	PE	50	50	100	3	3	0	0	3
22	18EDPE22	Experimental Stress analysis	PE	50	50	100	3	3	0	0	3
23	18EDPE23	Fluid Power control and Automation	PE	50	50	100	3	3	0	0	3

LIST OF OPEN ELECTIVES											
SL.No	**Course code**	**Course name**	**Category**	**Continuous Assessment Marks**	**End Sem Marks**	**Total Marks**	**Contacts Periods**	**CREDITS**			
								L	**T**	**P**	**C**
1	18SEOE01	Vastu Science For Building Construction	OE	50	50	100	3	3	0	0	3
2	18SEOE02	Planning of Smart Cities	OE	50	50	100	3	3	0	0	3
3	18SEOE03	Green Building	OE	50	50	100	3	3	0	0	3
4	18EEOE04	Environment, Health and Safety in Industries	OE	50	50	100	3	3	0	0	3
5	18EEOE05	Climate Change and Adaptation	OE	50	50	100	3	3	0	0	3
6	18EEOE06	Waste to Energy	OE	50	50	100	3	3	0	0	3
7	18GEOE07	Energy in built Environment	OE	50	50	100	3	3	0	0	3
8	18GEOE08	Earth and its environment	OE	50	50	100	3	3	0	0	3
9	18GEOE09	Natural hazards and mitigation	OE	50	50	100	3	3	0	0	3
10	18EDOE10	Business Analytics	OE	50	50	100	3	3	0	0	3
11	18EDOE11	Cost Management of Engineering Projects	OE	50	50	100	3	3	0	0	3
12	18EDOE12	Introduction to Industrial Engineering	OE	50	50	100	3	3	0	0	3
13	18MFOE13	Industrial Safety	OE	50	50	100	3	3	0	0	3
14	18MFOE14	Operations Research	OE	50	50	100	3	3	0	0	3

15	18MFOE15	Composite Materials	OE	50	50	100	3	3	0	0	3
16	18TEOE16	Global Warming Science	OE	50	50	100	3	3	0	0	3
17	18TEOE17	Introduction to Nano Electronics	OE	50	50	100	3	3	0	0	3
18	18TEOE18	Green Supply Chain Management	OE	50	50	100	3	3	0	0	3
19	18PSOE19	Distribution Automation System	OE	50	50	100	3	3	0	0	3
20	18PSOE20	Power Quality Assessment And Mitigation	OE	50	50	100	3	3	0	0	3
21	18PSOE21	Modern Automotive Systems	OE	50	50	100	3	3	0	0	3
22	18PEOE22	Virtual Instrumentation	OE	50	50	100	3	3	0	0	3
23	18PEOE23	Energy Auditing	OE	50	50	100	3	3	0	0	3
24	18PEOE24	Advanced Energy Storage Technology	OE	50	50	100	3	3	0	0	3
25	18AEOE25	Design of Digital Systems	OE	50	50	100	3	3	0	0	3
26	18AEOE26	Advanced Processors	OE	50	50	100	3	3	0	0	3
27	18AEOE27	Pattern Recognition	OE	50	50	100	3	3	0	0	3
28	18VLOE28	VLSI Design	OE	50	50	100	3	3	0	0	3
29	18VLOE29	Analog & Mixed Mode VLSI Circuits	OE	50	50	100	3	3	0	0	3
30	18VLOE30	Hardware Description Languages	OE	50	50	100	3	3	0	0	3
31	18CSOE31	Artificial Intelligence and Machine Learning	OE	50	50	100	3	3	0	0	3
32	18CSOE32	Computer Network Engineering	OE	50	50	100	3	3	0	0	3
33	18CSOE33	Big Data Analytics	OE	50	50	100	3	3	0	0	3

LIST OF AUDIT COURCES (AC)											
S. No.	**Subject Code**	**Course Title**	**CAT**	**CA Marks**	**End Sem Marks**	**Total Marks**	**Contact Periods**	**Hours/Week**			
								L	**T**	**P**	**C**
1	18EDACZ1	English for research paper writing	AC	50	50	100	2	2	0	0	0
2	18EDACZ2	Disaster management	AC	50	50	100	2	2	0	0	0
3	18EDACZ3	Value education	AC	50	50	100	2	2	0	0	0
4	18EDACZ4	Constitution of India	AC	50	50	100	2	2	0	0	0
5	18EDACZ5	Pedagogy studies	AC	50	50	100	2	2	0	0	0
6	18EDACZ6	Stress management by yoga	AC	50	50	100	2	2	0	0	0
7	18EDACZ7	Personality development through life enlightenment skills	AC	50	50	100	2	2	0	0	0
8	18EDACZ8	Sanskrit for technical knowledge	AC	50	50	100	2	2	0	0	0

CURRICULUM DESIGN

S.No	Course Work Subject Area	No of Credits					Percentage
		I	II	III	IV	Total	
1.	Foundation Course	3	0	0	0	3	4.29 %
2.	Professional Cores	10.5	10.5	0	0	21	30 %
3.	Professional Electives	6	6	3	0	15	21.43 %
4.	Employability Enhancement Courses	0	2	10	16	28	40 %
5.	Open Elective Courses	0	0	3	0	3	4.29 %
Total Credits		**19.5**	**18.5**	**16**	**16**	**70**	**100 %**

18EDFCZ1 RESEARCH METHODOLOGY AND IPR
(Common to All Branches)

Category : FC

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with:

- Definition and objectives of Research
- Quantitative methods for problem solving
- Data description and report writing

UNIT- I INTRODUCTION (9)

Definition and objectives of Research – Types of research, Various Steps in Research process, Mathematical tools for analysis, Developing a research question-Choice of a problem Literature review, Surveying, synthesizing, critical analysis, reading materials, reviewing, rethinking, critical evaluation, interpretation, Research Purposes, Ethics in research – APA Ethics code

UNIT- II QUANTITATIVE METHODS FOR PROBLEM SOLVING (9)

Statistical Modeling and Analysis, Time Series Analysis Probability Distributions, Fundamentals of Statistical Analysis and Inference, Multivariate methods, Concepts of Correlation and Regression, Fundamentals of Time Series Analysis and Spectral Analysis, Error Analysis, Applications of Spectral Analysis.

UNIT- III DATA DESCRIPTION AND REPORT WRITING (9)

Tabular and graphical description of data: Tables and graphs of frequency data of one variable, Tables and graphs that show the relationship between two variables , Relation between frequency distributions and other graphs, preparing data for analysis

Structure and Components of Research Report, Types of Report, Layout of Research Report, Mechanism of writing a research report, referencing in academic writing.

UNIT- IV INTELLECTUAL PROPERTY (9)

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT-V PATENT RIGHTS (9)

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCE BOOKS:

1. *Stuart Melville and Wayne Goddard, "**Research methodology: an introduction for science & engineering students**", Juta Academic, 1996.*
2. *Donald H.McBurney and Theresa White, "**Research Methods**", 9th Edition, engageLearning, 2013.*
3. *RanjitKumar, "**Research Methodology: A Step by Step Guide for Beginners**", 4th Edition, 2014.*
4. *Dr. C. R. Kotharia and GauravGarg, "**Research Methodology: Methods and Trends**", New age international publishers, Third Edition, 2014.*

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

CO1:** Develop research question**[Usage]
CO2:** Perform exhaustive literature survey**[Usage]
CO3:** Apply right problem solving methods**[Usage]
CO4:** Prepare data for analysis**[Usage]
CO5:** Write research report**[Usage]

COURSE ARTICULATION MATRIX

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	L	M	L	L	M	L	L	-	M	M	L
CO 2	M	-	-	-	-	-	-	-	-	-	-
CO 3	H	H	H	M	M	M	M	-	L	L	L
CO 4	M	M	M	M	M	H	M	-	L	L	L
CO 5	L	L	L	L	L	-	-	H	-	-	-

L – Low, M – Moderate (Medium), H- High

18EDPC01 MECHANICS OF MATERIALS

Category: PC

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE:

To know the fundamentals of mechanics of materials under various loading conditions.

UNIT- I ELASTICITY (7)

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

UNIT- II SHEAR CENTER AND UNSYMMETRICAL BENDING (10)

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

UNIT- III CURVED FLEXIBLE MEMBERS AND STRESSES IN FLAT PLATES (12)

Circumference and radial stresses - deflections-curved beam with restrained ends-closed ring subjected to concentrated load and uniform load-chain links and crane hooks. Stresses in circular and rectangular plates due to various types of loading and end conditions, buckling of plates.

UNIT- IV TORSION OF NON-CIRCULAR SECTIONS (7)

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

UNIT-V STRESSES DUE TO ROTARY SECTIONS AND CONTACT STRESSES (9)

Radial and tangential stresses in solid disc and ring of uniform thickness and varying thickness. Methods of computing contact stress-deflection of bodies in point and line contact applications.

LECTURE: 45 PERIODS TUTORIAL : 0 PERIODS PRACTICAL : 0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS *:*

1. *Seely and Smith, "**Advanced Mechanics of Materials**", John Wiley International Edn, 1952.*
2. *Sadhusingh, **"Theory of Elasticity",**Khanna Publishers, 2003.*
3. *Timoshenko and Goodier, "**Theory of Elasticity**", McGraw Hill, 2010*
4. *Wang, "**Applied Elasticity**", McGraw Hill, 1963*
5. *Cas, "**Strength of Materials**", Edward Arnold, London 1957.*
6. *Robert D. Cook, Warren C. Young, "**Advanced Mechanics of Materials**", Mc-millan pub. Co., 1985.*

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Appreciate the governing differential equations describing the elastic behavior of three dimensional systems

CO2: Determine the stresses in cases of unsymmetrical bending and curved flexible members (or) Formulate analytical techniques in determining the stresses in cases of unsymmetrical bending and curved flexible members

CO3: Comprehend the elastic theories in determining the stresses relating to contact bodies, non circular shafts and rotary sections.

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**H**	**M**	**M**	**L**	**-**	**L**	**-**	**-**	**L**	**-**	**L**
CO2	**M**	**H**	**M**	**M**	**L**	**L**	**-**	**-**	**M**	**-**	**M**
CO3	**L**	**L**	**L**	**L**	**L**	**-**	**-**	**-**	**L**	**-**	**L**

L – Low, M – Moderate (Medium), H- High

18EDPC02 VIBRATION ANALYSIS AND CONTROL

Category: PC

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE:

To gain knowledge on sources of vibration and to reduce vibration to improve the life and performance of components

UNIT- I FUNDAMENTALS OF VIBRATION (8)

Differential equation, complex exponential method of solution, energy method, power relations, phase relations, Nyquist diagram– Impulse Response function – System Identification from frequency response – Transient Vibration – Laplace transformation formulation.

UNIT- II SINGLE DEGREE OF FREEDOM SYSTEMS (7)

Simple harmonic motion, definition of terminologies, Newton's Laws, D'Alembert's principle, Energy methods. Free vibrations, free damped vibrations, and forced vibrations with and without damping, base excitation.

UNIT- III MULTI-DEGREES OF FREEDOM SYSTEMS (10)

Two degrees of freedom systems, Static and dynamic couplings, eigen values, eigen vectors and orthogonality conditions of eigen vectors, Vibration absorber, Principal coordinates, Principal modes. Hamilton's Principle, Lagrangean equation and their applications.

UNIT- IV VIBRATION CONTROL (10)

Specification of Vibration Limits –Vibration severity standards- Vibration as condition Monitoring tool- Vibration Isolation methods - Dynamic Vibration Absorber, Torsional and Pendulum Type Absorber- Damped Vibration absorbers - Static and Dynamic Balancing-Balancing machines - Field balancing – Vibration Control by Design Modification- - Active Vibration Control

UNIT-V EXPERIMENTAL METHODS IN VIBRATION ANALYSIS (10)

Vibration Analysis Overview - Experimental Methods in Vibration Analysis - Vibration Measuring Instruments - Selection of Sensors - Accelerometer Mountings. Vibration Exciters - Mechanical, Hydraulic, Electromagnetic And Electrodynamics – Frequency Measuring Instruments - System Identification from Frequency Response - Testing for resonance and mode shapes

LECTURE: 45 PERIODS TUTORIAL : 0 PERIODS PRACTICAL : 0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS *:*

1. *Timoshenko, S. "**Vibration Problems in Engineering**", John Wiley & Sons, Inc., 1987.*
2. *Meirovitch, L. "**Elements of Vibration Analysis**", McGraw-Hill Inc., 1986.*
3. *Thomson W.T, Marie Dillon Dahleh, "**Theory of Vibrations with Applications**", Prentice Hall, 1997.*
4. *F.S. Tse., I.F. Morse and R.T. Hinkle, "**Mechanical Vibrations**", Prentice-Hall of India, 1985.*
5. *Rao.J.S. and Gupta.K. "**Theory and Practice of Mechanical Vibrations**", Wiley Eastern Ltd., New Delhi, 1999.*
6. *Fung, Y.C., "**An Introduction to the Theory of Aeroelasticity**", John Wiley & Sons Inc., New York, 1985.*

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Identify the reasons for vibrations in engineering systems

CO2: Design and analyse single and multi degree vibratory systems

CO3: Apply vibration measuring instruments, vibration control and analysis techniques in the engineering field.

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**L**	**L**	**L**	**L**	**-**	**L**	**-**	**-**	**L**	**-**	**-**
CO2	**L**	**L**	**L**	**L**	**L**	**L**	**-**	**-**	**-**	**-**	**L**
CO3	**L**	**H**	**L**	**L**	**-**	**M**	**-**	**-**	**L**	**-**	**-**

L – Low, M – Moderate (Medium), H- High

18EDPC03 DESIGN AND SYNTHESIS OF MECHANISMS

Category: PC

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE:

To develop an understanding of the various mechanisms, its design and synthesis for practical applications.

UNIT- I VELOCITY AND ACCELERATION ANALYSIS OF MECHANISMS (9)

Review of kinematic analysis-mobility, displacement, velocity and acceleration analysis of mechanisms – Plane Complex mechanisms – Goodman Analysis – Auxiliary point method.

UNIT- II PATH CURVATURE THEORY (9)

Fixed and Moving centrodes, Inflection points and Inflection circle. Euler Savary equation, Graphical constructions – Cubic of stationary curvature.

UNIT- III KINEMATIC SYNTHESIS (9)

Kinematic synthesis - Function generation, path generation and rigid body guidance – Type synthesis, Number Synthesis – Cognate Linkage – Coupler curve synthesis – Algebraic methods – application of instant centre in linkage design.

UNIT- IV DYNAMICS OF MACHINES (9)

Static force analysis with friction – Inertia force analysis – combined static and inertia analysis.

UNIT-V SPATIAL MECHANISM AND ROBOTICS (9)

Kinematic analysis of spatial RSSR mechanism – Denavit – Hartenberg parameters. Forward and inverse kinematics of robotic manipulators.

LECTURE: 45 PERIODS TUTORIAL : 0 PERIODS PRACTICAL : 0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS *:*

1. *George N. Sandor and A.G. Erdman, **"Advanced Mechanism Design analysis and Synthesis"**, Vol.1 and 2, Prentice Hall of India, 1984.*
2. *Shigley J.E and Uicker J.J., **"Theory of Machines and Mechanisms"**, McGraw Hill, 1995*
3. *Hall, **"Kinematics and Linkage Design"**, Prentice Hall, 1964.*
4. *Robert L. Norton, **"Design of Machinery"**, McGraw Hill, 2003*
5. *Hartenberg and Denavit, **"Kinematics and synthesis of linkages"**, McGraw Hill, 1964*
6. *J.Hirschhorn, **"Kinematics and Dynamics of Plane Mechanisms"**, McGraw Hill, 1962*

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Design, synthesize and analyze advanced mechanisms for practical applications.

CO2: Perform static and dynamic analysis of machines

CO3: Devise mechanisms for robotic applications.

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	L	H	L	M	M	L	-	-	-	-	L
CO2	L	L	L	L	L	M	-	-	L	-	-
CO3	L	M	L	L	-	L	-	-	L	-	-

L – Low, M – Moderate (Medium), H- High

18EDPC04 VIBRATION LAB

Category: PC

L	T	P	C
0	0	3	1.5

PREREQUISITES: NIL

COURSE OBJECTIVES:

To supplement the principles learnt in vibration and dynamics of machinery and expose to various measuring devices for vibration analysis.

1. To obtain and compare the responses of a vibrating system based on vibration signals and sound signals using FFT analyzer.
2. Vibration control using smart actuators (Piezoelectric actuators)
3. To determine the transmissibility ratio for a given system subjected to forced vibrations.
4. To study the influence of input acceleration on the transmissibility ratio of a given system.
5. To study the nature of random vibrations and determine the Standard deviation, Mean and Median of a specified input random vibration profile.
6. To study the unbalance of rotor system using FFT analyzer.
7. Governors – determination of sensitivity, effort, etc. for Watt, Porter, Proell, Hartnell governors Motorized Gyroscope - verification of laws-determination of gyroscopic couple.
8. Balancing of reciprocating masses and Balancing of rotating masses
9. Vibrating system – spring mass system – determination of damping co-efficient of single degree of freedom system.
10. Determination of torsional frequencies for compound pendulum and flywheel system with lumped Moment of inertia.
11. System identification using dynamic response curves.

LECTURE: 0 PERIODS TUTORIAL: 0 PERIODS PRACTICAL : 45 PERIODS TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Use signal analyzers for vibrating systems.

CO2: Demonstrate the use of gyroscope and governors.

CO3: Use the knowledge for balancing of machine components.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	M	M	L	H	M	-	L	M	L	M
CO2	L	L	L	L	H	M	-	L	L	L	L
CO3	M	M	M	L	H	M	-	L	M	L	M

L – Low, M – Moderate (Medium), H- High

18EDPC05 FINITE ELEMENT METHODS IN MECHANICAL DESIGN

Category: PC

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE:

To develop a thorough understanding of the basic principles of finite element analysis techniques for solving practical design problems in engineering

UNIT- I INTRODUCTION & ONE-DIMENSIONAL PROBLEMS **(9)**

Relevance of finite element analysis in design - Variational principles and methods –Weighted Integral statements – Weak formulations – Ritz method – Method of weighted residuals – Applications of FEA - Finite element modeling – Coordinates and shape functions - Potential energy approach – Galerkin's approach – One dimensional finite element models in Solid mechanics and Heat transfer – Finite element model for beams.

UNIT- II TWO-DIMENSIONAL PROBLEMS **(9)**

Poisson equation – Laplace equation – Weak form – Element matrices for triangular and rectangular elements – Evaluation of integrals – Assembly – Axi-symmetric problems – Applications – Conduction and convection heat transfer – Torsional cylindrical member – Transient analysis - Theory of elasticity – Plane strain – Plane stress – Axi-symmetric problems – Principle of virtual displacement.

UNIT- III ISOPARAMETRIC ELEMENTS **(9)**

Introduction – Bilinear quadrilateral elements – Quadratic quadrilaterals – Hexahedral elements - Numerical integration – Gauss quadrature – Static condensation – Load considerations – Stress calculations – Examples of 2D and 3D applications.

UNIT- IV STRUCTURAL DYNAMICS APPLICATIONS **(9)**

Dynamic equations – Mass and damping matrices – Natural frequencies and modes – Reduction of number of DOF response history – Model methods – Ritz vectors – Component mode synthesis – Harmonic response – Direct integration techniques – Explicit and implicit methods.

UNIT-V NON-LINEAR PROBLEMS & ERROR ESTIMATES **(9)**

Introduction – Material non-linearity – Elasto Plasticity – Plasticity – Visco plasticity – Geometric non-linearity – Large displacement – Error norms and convergence rates – H-refinement with adaptivity – adaptive refinement.

LECTURE: 45 PERIODS TUTORIAL : 0 PERIODS PRACTICAL : 0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS *:*

1. *Reddy J.N., **"An Introduction to the Finite Element Method"**, McGraw Hill, International Edition, 1993.*
2. *Logan D.L, **"A First Course in the Finite Element Method"**, Third Edition, Thomson Learning, 2002.*
3. *Cook, Robert Davis et al **"Concepts and Applications of Finite Element Analysis"**, Wiley, John & Sons, 1999.*
4. *Segerlind L.J., **"Applied Finite Element Analysis"**, John Wiley, 1984.*
5. *S.S.Rao, **"Finite Element Analysis"**, 2002 Edition.*
6. *Zienkiewicz, O.C. and Taylor, R.L., **"The Finite Element Method"**, Fourth Edition Vol 1 & 2, McGraw Hill International Edition, Physics Services, 1991.*

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Create mathematical models of physical systems and solve using numerical techniques

CO2: Appreciate the usage of the types of elements and apply them suitably for specific applications

CO3: *Solve structural dynamics and non-linear problems through appropriate techniques*

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**H**	**L**	**L**	**-**	**-**	**M**	**L**	**-**	**L**	**-**	**-**
CO2	**-**	**H**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**L**	**H**	**L**	**L**	**L**	**H**	**-**	**-**	**L**	**-**	**-**

L – Low, M – Moderate (Medium), H- High

18EDPC06 COMPUTER APPLICATIONS IN DESIGN

Category: PC

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE

To impart knowledge on computer graphics which are used commonly in distinct areas such as engineering, medicine and science.

UNIT- I INTRODUCTION TO COMPUTER GRAPHICS FUNDAMENTALS (9)

Output primitives (points, lines, curves etc.,), 2-D transformation (Translation, scaling, rotators) windowing, and view ports clipping transformation.

UNIT- II INTRODUCTION TO CAD SOFTWARE (9)

Writing interactive programs to solve design problems and production of drawings, using any languages like Auto LISP/ C/FORTRAN etc., creation of surfaces, solids etc., using solid modeling pack (prismatic and revolved parts).

UNIT- III VISUAL REALISM (9)

Hidden - Line - Surface - solid removal algorithms shading - coloring. Introduction to parametric and variational geometry based on software's and their principles creation of prismatic and lofted parts using these packages

UNIT- IV ASSEMBLY OF PARTS (9)

Assembly of parts, tolerance analysis mass property calculations, mechanism simulation.

UNIT-V SOLID MODELING (9)

Solid modeling - Rapid prototyping - Data exchange - Documentation - Customizing - solid modeling system.

LECTURE: 45 PERIODS TUTORIAL : 0 PERIODS PRACTICAL : 0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS *:*

1. *William .M. Neumann and Robert .F. Sproul "**Principle of Computer Graphics**, "McGraw Hill Book Co. Singapore, 1989.*
2. *Donald Hearn and .M. Pauline Baker "**Computer Graphics** "Prentice Hall, Inc., 1992.*
3. *Mikell .P. Grooves and Emory .W. Zimmers Jr. "**CAD/CAM Computer — Aided Design and Manafacturing**" Prentice Hall, Inc., 1995.*
4. *Ibrahim Zeid "**CAD/CAM — Thoery and Practice**" - McGraw Hill, International Edititon , 1998*

COURSE OUTCOMES

On completion of this course, students will be able to

CO1: Use the computer graphics knowledge in design

CO2: Appreciate visual realism through modeling techniques

CO3: Develop and assemble mechanical systems and document the related information

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	L	L	-	M	M	-	L	M	-	-
CO2	-	L	L	-	-	M	-	-	L	-	-
CO3	-	L	L	-	H	-	-	M	L	-	-

L – Low, M – Moderate (Medium), H- High

18EDPC07 TRIBOLOGY IN DESIGN

Category: PC

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE:

To impart knowledge on the theory of friction, wear and lubrication, design of bearings, condition monitoring techniques and seals

(7)

UNIT- I SURFACES, FRICTION AND WEAR

Nature of surfaces and contact, surface topography, friction control and wear prevention, boundary lubrication, tribological properties of bearing materials and lubricants, theories of friction and wear, instabilities and stick-slip motion, sources of measurement of friction.

(10)

UNIT- II LUBRICANTS AND LUBRICATION REGIMES

Lubricants and their physical properties - Viscosity and other properties of oils - Additives and selection of Lubricants, Lubricants standards ISO,SAE,AGMA, BIS standards - Lubrication Regimes - Solid Lubrication - Dry and marginally lubricated contacts - Boundary Lubrication - Hydrodynamic lubrication - Elasto and plasto hydrodynamic - Magneto hydrodynamic lubrication - Hydro static lubrication - Gas lubrication.

(10)

UNIT- III HYDRODYNAMIC BEARINGS

Fundamentals of fluid film formation, Reynold's equation; hydrodynamic journal bearings - sommerfeld number performance parameters - optimum bearing with maximum load capacity - friction - heat generated and heat dissipated. Hydrodynamic thrust bearings - fixed and tilting pads, single and multiple pads.

(10)

UNIT- IV HYDROSTATIC BEARINGS

Thrust bearings - pad coefficients - optimum film thickness - journal bearings - design procedures. Aerostatic bearings: thrust bearings and journal bearings - design procedure. Hydrostatic lubrication of pad bearing - Pressure, flow, load and friction calculations - Stiffness considerations - restrictors - types of flow restrictors in hydrostatic bearings, selection of pump, filters, piping design, oil changing and oil conservation.

(8)

UNIT-V CONDITION MONITORING AND SEALS

Various condition monitoring techniques of Mechanical Systems. Seals- mechanical seals, lip seals, packed glands, soft piston seals, mechanical piston rod packing, labyrinth seals and throttling bushes, oil flinger rings and drain grooves - selection of mechanical seals.

LECTURE: 45 PERIODS TUTORIAL:0 PERIODS PRACTICAL:0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS*:*

1. *Rabinowicz.E, "**Friction and Wear of materials**", John Willey &Sons ,UK,1995*
2. *Cameron, A. "**Basic Lubrication Theory**", Ellis Herward Ltd., UK, 1981*
3. *Halling, J. (Editor) – "**Principles of Tribology**", Macmillian – 1984.*
4. *Williams J.A. "**Engineering Tribology**", Oxford Univ. Press, 1994.*
5. *S.K.Basu, S.N.Sengupta&B.B.Ahuja ,"**Fundamentals of Tribology**", Prentice –Hall of India Pvt Ltd , New Delhi, 2005*
6. *G.W.Stachowiak& A.W .Batchelor , **Engineering Tribology,** Butterworth-Heinemann, UK, 2005*
7. *Sushil Kumar Srivastava, "**Tribology in Industries**", S.Chand& Company Ltd, New Delhi.*
8. *Moore, D.F, " **Principles and Application of Tribology**", Pregamon Press, New York.*

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Apply knowledge of friction, wear and lubrication in engineering applications

CO2: Design hydrostatic and hydrodynamic bearings for machineries and equipments.

CO3: Monitor the conditions of mechanical systems and appreciate the usage of various types of seals

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	M	H	M	L	L	-	-	L	-	M
CO2	L	H	L	M	H	-	-	-	-	-	M
CO3	-	L	L	L	L	-	-	-	-	-	L

L – Low, M – Moderate (Medium), H- High

18EDPC08 SIMULATION LAB

Category: PC

L	T	P	C
0	0	3	1.5

PREREQUISITES: NIL

COURSE OBJECTIVE:

To impart practical training on simulation and analysis of mechanical systems using advanced software tools.

Analysis of Mechanical Components – Use of FEA Packages like ANSYS and CFD.
Exercises shall include analysis of

i) Machine elements under Static loads
ii) Thermal Analysis of mechanical systems
iii) Modal Analysis
iv) Machine elements under Dynamic loads
v) Non-linear systems
vi) Fluid flow

LECTURE: 0 PERIODS TUTORIAL: 0 PERIODS PRACTICAL: 45 PERIODS TOTAL: 45 PERIODS

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Perform static and dynamic analysis of structures.
CO2: Perform steady state and transient thermal analysis.
CO3: Perform flow simulation analysis of fluid systems.

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	H	H	M	H	-	-	M	-	M
CO2	M	M	H	L	M	H	-	-	M	-	M
CO3	M	M	H	L	M	H	-	-	M	-	M

L – Low, M – Moderate (Medium), H- High

18EDEE01 MINI PROJECT

Category: EEC

L	T	P	C
0	0	4	2

PREREQUISITES: NIL

COURSE OBJECTIVE :

- *To make the student to feel/understand the magnitude of engineering design and then apply*

COURSE CONTENT :

Students can take up small problems in the field of design engineering as mini project. It can be related to solution to an engineering problem, verification and analysis of experimental data available, conducting experiments on various engineering subjects, material characterization, studying a software tool for the solution of an engineering problem etc.

COURSE OUTCOMES :

Learners will be able to

CO1 : Get an opportunity to work in actual industrial environment if they opt for internship.

CO2 : Solve a live problem using software/analytical/computational tools.

CO3 : Learn to write technical reports.

CO4 : Develop skills to present and defend their work in front of technically.

LECTURE: 0 PERIODS TUTORIAL: 0 PERIODS PRACTICAL: 60 PERIODS TOTAL: 60 PERIODS

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	H	H	H	M	M	M	H	H	H
CO2	H	M	H	M	L	M	M	H	M	L	M
CO3	H	M	H	H	H	L	M	H	M	L	L
CO4	L	L	M	L	M	L	M	M	M	M	M

L – Low, M – Moderate (Medium), H- High

18EDEE02 PROJECT PHASE I

Category: EEC

L	T	P	C
0	0	20	10

PREREQUISITES: NIL

COURSE OBJECTIVE:

To identify a specific problem for the current need of the society and collecting information related to the same through detailed review of literature and to develop the methodology to solve the identified problem then publish paper at least in conference.

SYLLABUS:

1. The student individually works on a specific topic approved by the head of the division under the guidance of a faculty member who is familiar in this area of interest.
2. The student can select any topic which is relevant to the area of Engineering Design. The topic may be theoretical or case studies.
3. At the end of the semester, a detailed report on the work done should be submitted which contains clear definition of the identified problem, detailed literature review related to the area of work and methodology for carrying out the work and report on the preliminary study conducted.
4. The students will be evaluated through a viva-voce examination.

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: *Identify the project work scientifically in a systematic way*

CO2: *Analyze the problem and data of literatures clearly to explore the ideas and methods.*

CO3: *Formulate the objectives and methodology to solve the identified problem.*

LECTURE: 0 PERIODS TUTORIAL: 0 PERIODS PRACTICAL: 300 PERIODS TOTAL: 300 PERIODS

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	H	H	H	M	M	M	H	H	H
CO2	H	M	H	H	M	L	M	H	M	L	M
CO3	H	M	H	H	H	L	M	H	M	L	L

L – Low, M – Moderate (Medium), H- High

18EDEE03 PROJECT PHASE II

Category: EEC

L	T	P	C
0	0	32	16

PREREQUISITES: NIL

COURSE OBJECTIVE:

To solve the identified problem based on the formulated methodology and to develop skills to analyze and discuss the test results and make conclusions.

SYLLABUS:

1. The student should continue the phase I work on the selected topic as per the formulated methodology under the same supervisor.
2. At the end of the semester, after completing the work to the satisfaction of the supervisor and review committee, a detailed report should be prepared and submitted to the head of the department.
3. The students will be evaluated based on the report submitted and the viva-voce examination by a panel of examiners including one external examiner

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: *Execute the project work on challenging practical problem in a structured manner*

CO2: *Investigate the findings and infer observations logically*

CO3*: Evaluate the results and confirm the solution to the practical application and social benefit*

LECTURE: 0 PERIODS TUTORIAL: 0 PERIODS PRACTICAL: 480 PERIODS TOTAL: 480 PERIODS

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	M	H	H	M	L	H	H	M	L	M
CO2	H	M	H	H	H	L	H	H	M	L	M
CO3	H	H	H	H	H	L	H	H	M	L	M

L – Low, M – Moderate (Medium), H- High

18EDPE01 APPLIED MATHEMATICS FOR ENGINEERING DESIGN

Category: PE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- *To acquire knowledge of means, variances, correlation and regression related to bivariate probability distributions.*
- *To develop the skill of solving ANOVA based experimental design problems oriented with engineering design and analysis of statistical quality control*
- *To gain the knowledge of solving system of equations numerically.*
- *To attain the fluency to solve ordinary and partial differential equations.*

UNIT- I TWO DIMENSIONAL RANDOM VARIABLES (9)

Joint distributions-Marginal and Conditional distributions- Conditional means and variances – Covariance, Correlation and Regression.

UNIT- II DESIGN OF EXPERIMENTS AND STATISTICAL QUALITY CONTROL (9)

Randomized Block Design- Completely Randomized Block Design-Latin Square Design. Control charts for variables – Control charts for attributes.

UNIT-III NUMERICAL SOLUTION OF EQUATIONS, LINEAR SYSTEM AND INVERSE OF MATRIX (9)

Newton-Raphson method for single variable and simultaneous equations with two variables- Solution of linear system by Gauss elimination, Gauss-Jordan Crout's and Gauss Seidal Methods – Matrix inversion: Gauss elimination and Gauss-Jordan methods.

UNIT- IV NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS (9)

Single step methods: Taylor's series method – Euler's method – Modified Euler's method – Runge - Kutta method of fourth order - Multi step methods: Miline's Predictor and Corrector methods: Adam Bashforth predictor and corrector method. Numerical solution of ordinary differential equation by finite difference method.

UNIT-V NUMERICAL SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS (9)

Finite difference solution for two dimensional Laplace equation: Gauss Jacobi and Gauss Seidal methods – Poisson equation. Finite difference method for one dimensional heat equation: Parabolic equation – Hyperbolic Equation.

LECTURE: 45 PERIODS TUTORIAL:0 PERIODS PRACTICAL:0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS *:*

1. *Veerarajan T, "**Probability and Random Processes(with Queueing Theory and Queueing Networks)**", McGraw Hill Education(India)Pvt Ltd., New Delhi, Fourth Edition 2016*
2. *S.C. Gupta and V. K. Kapoor, **"Fundamentals of Mathematical Statistics"**, Sultan Chand & Sons, New Delhi – 2014*
3. *P.Kandasamy, K.Thilagavathy, K.Gunavathy, **"Numerical Methods"**, S.Chand and Company Ltd.,Ramnagar, New Delhi, 2010.*
4. *S.R.K.Iyengar, R.K.Jain, **"Numerical Methods"**, NewAge International Publishers, New Delhi, 2009.*

COURSE OUTCOMES:

Upon completion of the course, student will be able to

CO1: Understand the constants of probability for joint probability distributions and analysis and conclusions for design of experiment problems.

CO2: Evaluate control limits using control charts to determine whether the product is within control.

CO3: Understand numerical solution to system of linear equations, first order ordinary differential equations and second order partial differential equations.

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	L	-	-	L	-	-	-	L	-	L
CO2	H	L	L	L	M	-	-	-	L	-	-
CO3	H	-	-	-	-	-	-	-	L	-	-

L – Low, M – Moderate (Medium), H- High

18EDPE02 MANUFACTURING CONSIDERATIONS IN DESIGN

Category: PE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE

To expose the students on manufacturing considerations in design and to create an environment friendly perspective for energy efficiency focusing towards global need.

UNIT- I INTRODUCTION (9)

General design principles for manufacturability –Factors influencing design-Types of problems to be solved-, evaluation of customer's requirements-Systematic working plan for the designer-Types of problems to be solved-Possible solutions Evaluation method- Process capability - Feature tolerances - Geometric tolerances - Assembly limits -Datum features Tolerance stacks-Interchangeable part manufacture and selective assembly.

UNIT- II FACTORS INFLUENCING FORM DESIGN (9)

Materials choice - Influence of basic design, mechanical loading, material, production method, size and weight on form design- form design of welded members and forgings.

UNIT- III CASTING-DESIGN CONSIDERATION (9)

Casting-General design consideration-Specific design consideration- Characteristics of sand cast part-Design recommendation in sand casting, Investment casting: Design consideration of investment casting- Effect of shrinkage- Suitable materials. Design recommendations –Redesign of casting based on parting line considerations- Minimizing core requirements- machined holes , Redesign of cast members top obviate cores

UNIT- IV MACHINING- DESIGN CONDSIDERATION (10)

Design features to facilitate machining - drills - milling cutters - keyways - Doweling procedures, counter sunk screws Reduction of machined area- simplification by separation - simplification by amalgamation - Design for machinability Design for economy - Design for clampability - Design for accessibility - Design for assembly. Identification of uneconomical design - Modifying the design - group technology -Computer Applications for DFMA.

UNIT- V GREEN DESIGN FOR ENVIRONMENT (8)

Introduction – Importance of DFE –Green design methods and tools - Environmental objectives – Global issues – Regional and local issues– Design guidelines for DFE –Lifecycle assessment – EPS system - AT&T's environmentally responsible product assessment - Weighted sum assessment method –Techniques to reduce environmental impact – Design to minimize material usage –Design for disassembly – Design for recyclability – Design for remanufacture –Design for energy efficiency

LECTURE: 45 PERIODS TUTORIAL:0 PERIODS PRACTICAL:0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS *:*

1. *Boothroyd, G, **" Design for Assembly Automation and Product Design"**, New York, Marcel Dekker.1980*
2. *Bralla, "**Design for Manufacture handbook**", McGraw hill, 1999.*
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.*
5. *Fixel, J. "**Design for the Environment**", McGraw hill. 1996.*
6. *Kevien Otto and Kristin Wood, "**Product Design**", Pearson Publication, 2004.*
7. *Dr.ING.RobertMatouslk, "**Engineering Design**".Blackie & son limited,1962.*
8. *Harry peck, "**Designing for manufacture**", Pitman publishing.*

COURSE OUTCOMES

On completion of this course, the student will be able to

CO1: Formulate design features in manufacturing arena and smart development in manufacturability.

CO2: Develop new concepts and methods for re-design of castings and machining focusing towards energy efficiency.

CO3: Develop environment friendly designs to meet the global issues.

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	L	L	L	M	L	L	L	-	L	L	L
CO2	L	L	M	H	H	L	L	-	L	M	M
CO3	M	L	H	H	H	L	M	-	L	H	H

L – Low, M – Moderate (Medium), H- High

18EDPE03 CONCEPTS OF ENGINEERING DESIGN

Category: PE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE:

To impart the ability to design reliable products to satisfy the customer needs using appropriate design techniques through proper material selection and process considerations.

UNIT- I FUNDAMENTALS IN DESIGN (8)

Importance of design - design process - considerations of Good Design – Morphology of Design –Organization for design – Designing to codes and standards – Concurrent Engineering – Product and process development cycles – Technological Forecasting – Market Identification – Competition Bench marking.

UNIT- II DESIGN FOR CUSTOMER NEEDS (10)

Identification of customer needs - customer requirements - Quality Function Deployment - Product Design Specifications - Human Factors in Design – Ergonomics, Aesthetics and Societal consideration – Product liability – Patenting intellectual property – Legal and ethical domains – Codes of ethics - Ethical conflicts – Design for ecological - future trends in interaction of engineering with society.

UNIT- III DESIGN TECHNIQUES (10)

Creativity and Problem Solving – Creativity methods-Theory of Inventive Problem Solving (TRIZ) – Conceptual decomposition - Generating design concepts - Axiomatic Design – Evaluation methods-Embodiment Design - Product Architecture - Configuration Design - Parametric Design - Role of models in design - Mathematical Modelling – Simulation – Geometric Modelling

UNIT- IV MATERIAL SELECTION PROCESSING IN DESIGN (9)

Material Selection Process – Economics – Cost Vs Performance – Weighted Property Index – Value Analysis – Role of Processing in Design – Classification of Manufacturing Process – Design for Manufacture – Design for Assembly – Designing for castings, Forging, Metal Forming, Machining and Welding – Residual Stresses – Fatigue, Fracture and Failure.

UNIT- V PROBABILITY CONCEPTS IN DESIGN FOR RELIABILITY (8)

Probability – Distributions – Test of Hypothesis – Design of Experiments – Reliability Theory – Design for Reliability – Reliability centered Maintenance - Robust Design - Failure mode Effect Analysis.

LECTURE: 45 PERIODS TUTORIAL:0 PERIODS PRACTICAL:0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS*:*

1. *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. *Ray, M.S., "**Elements of Engg. Design**", Prentice Hall Inc. 1985.*
4. *Suh, N.P., "**The principles of Design**", Oxford University Press, NY.1990.*
5. *Karl T. Ulrich and Steven D. Eppinger "**Product Design and Development**" McGraw Hill Edition 2000.*

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Apply appropriate design strategies complying with established standards in devising systems for customer needs

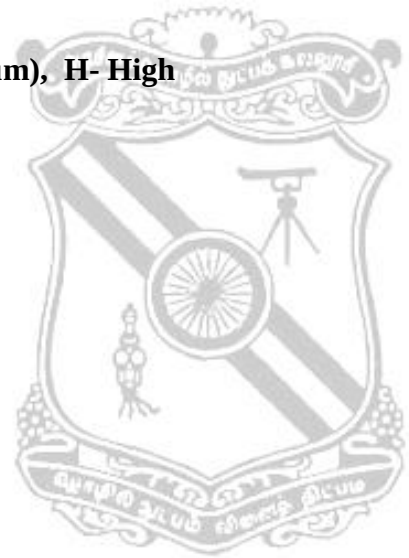
CO2: Apply design techniques to solve real life problems through proper material selection and manufacturing process creatively

CO3: Apply various design and analysis tools for improving the quality, reliability of products performance

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	L	H	H	M	M	H	L	-	L	L	M
CO2	L	H	M	H	M	M	L	-	H	L	M
CO3	L	M	L	H	H	H	-	-	L	L	L

L – Low, M – Moderate (Medium), H- High



18EDPE04 COMPOSITE MATERIALS AND MECHANICS

Category: PE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE

To understand the fundamentals of composite material strength and its mechanical behaviour

UNIT- I INTRODUCTION (10)

Review of Materials and Metallurgy - Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectoid, eutectic, peritectic, and peritectroid reactions, Iron – Iron carbide equilibrium diagram. Classification of steel and cast Iron. Definition – Need – General Characteristics, Applications of Fibers – Glass, Carbon, Ceramic and Aramid fibers. Characteristics of fibers and matrices Smart materials – Types and Characteristics,

UNIT- II MECHANICS AND PERFORMANCE (9)

Characteristics of fiber – reinforced lamina – Laminates – Interlaminar stresses – Static Mechanical Properties – Fatigue and Impact Properties – Environmental effects – Fracture Behavior and damage Tolerance.

UNIT- III MANUFACTURING (9)

Bag Moulding – Compression Moulding – Filament winding – Other Manufacturing Processes – Quality Inspection methods.

UNIT- IV ANALYSIS (9)

Stress Analysis of Laminated composites Beams, Plates and Shells – Vibration and Stability Analysis – Reliability of Composites – Finite Element Method of Analysis – Analysis of Sandwich Structures.

UNIT- V DESIGN (8)

Failure Predictions – Laminate Design Consideration – Bolted and Bonded Joints design Examples.

LECTURE: 45 PERIODS TUTORIAL:0 PERIODS PRACTICAL:0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS *:*

1. *Mallick, P.K., Fiber – "**Reinforced Composites: Materials, Manufacturing and Design**", Maneel Dekker Inc, 1993.*
2. *Halpin, J.C., **"Primer on Composite Materials, Analyis"**, Techomic publishing Co., 1984.*
3. *Agarwal, B.D., and Broutman L.J., **"Analysis and Performance of Fiber Composites"**, John Wiley and Sons, New York, 1990.*
4. *Mallick, P.K. and Newman, S., (edition), **"Composite Materials Technology: Processes and Properties"**, Hansen Publisher, Munish, 1990.*

COURSE OUTCOMES

On completion of this course, the students will be able to

CO1: Appreciate mechanical performance and select suitable composite or smart materials for specific applications

CO2: Identify suitable manufacturing methods for composite materials

CO3: Design and analyse products made of composite materials for engineering applications

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**L**	**L**	**L**	**L**	**-**	**-**	**-**	**-**	**L**	**-**	**L**
CO2	**-**	**-**	**-**	**L**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**-**	**L**	**-**	**M**	**H**	**M**	**-**	**-**	**L**	**-**	**L**

L – Low, M – Moderate (Medium), H- High

18EDPE05 VALUE AND REENGINEERING

Category: PE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE

To impart knowledge about the principles of value and reengineering for industrial applications

UNIT- I FUNDAMENTALS OF VALUE ENGINEERING (8)

Value- Types – Organizing the value engineering study- Value Engineering concepts, Advantages, Applications, Problem recognition, and role in productivity criteria for comparison, element of choice.

UNIT- II VALUE ENGINEERING TECHNIQUES (10)

Selecting products and operation for VE action, VE programmes, determining and evaluating functions assigning rupee equivalents - developing alternate means to required functions - decision making for optimum alternative - Use of decision matrix - Queuing theory and Monte Carlo method, make or buy, Measuring profits - Reporting results - Follow up, Use of advanced technique like FAST (Function Analysis System) Tech.

UNIT- III ORGANISATION AND ANALYSIS OF FUNCTION (9)

Level of VE in the organization- Size and skill of VE staff-small plant VE activity - Unique and quantitative evaluation of ideas-Anatomy of the function, Use esteem and exchange values- Basic Vs secondary Vs. unnecessary functions.

UNIT- IV REENGINEERING PRINCIPLES (9)

The 6 R's of organizational transformation and reengineering – process reengineering - preparing the workforce – Methodology – PMI leadership expectation – Production and service improvement model – Process improvement

UNIT- V IMPLEMENTATION OF REENGINEERING (9)

Process analysis techniques – Work flow analysis – Value analysis approach – Nominal group technique – Fish bone diagram – Pareto analysis – team building – Force fields analysis – Implementation.

LECTURE: 45 PERIODS TUTORIAL:0 PERIODS PRACTICAL:0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS*:*

1. *S.S.Iyer, **"Value Engineering"**, New Age Information, 1996.*
2. *Del L. Younker, **"Value Engineering"** Marcel Dekker, Inc. 2003*
3. *M.S.Jayaraman and Ganesh Natarajan, **"Business Process Reengineering"**, Tata McGraw Hill, 1994.*
4. *Dr. Johnson, A. Edosomwan, **"Organizational Transformation and Process reengineering",** British Library Cataloguing in publication data, 1996*
5. *Miles, "**Techniques of Value Analysis and Engineering**", Tata McGraw Hill Publications*

COURSE OUTCOMES

On completion of this course, the students will be able to

CO1: Apply the principles and techniques of value engineering to enhance productivity

CO2: Evaluate the ideas for better function analysis and for effective decision making

CO3: Apply reengineering for process improvement

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	M	L	L	-	-	L	-	L	H	L
CO2	M	M	-	M	-	-	L	-	M	H	L
CO3	L	L	L	L	L	-	L	-	L	M	L

L – Low, M – Moderate (Medium), H- High

18EDPE06 MECHANICAL BEHAVIOUR OF MATERIALS

Category: PE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE

To impart knowledge on the mechanical behaviour of metallic and non-metallic materials under different loading and temperature conditions, and the strengthening mechanisms of materials

UNIT- I PLASTIC DEFORMATION OF MATERIALS (9)

Concepts of crystals, Plastic deformation by slip and twinning, Slip systems in FCC, BCC and HCP lattices, Critical resolved shear stress for slip, Theoretical shear strength of solids, Stacking faults and deformation bands. Observation of dislocations, Climb and cross slip, Dislocations in FCC and HCP lattice, Partial dislocations, Stress fields and energies of dislocations, Forces between dislocations, Interaction of dislocations, Dislocation sources and their multiplications.

UNIT- II STRENGTHENING MECHANISM AND FRACTURE IN MATERIAL (9)

Strengthening from grain boundaries, Grain size measurements, Yield point phenomenon, Strain aging, Solid solution strengthening, Strengthening from fine particles, Fiber strengthening, Cold working and strain hardening, Annealing of cold worked metal. Fracture in metals, Griffith theory of brittle fracture, Metallographic aspects of fracture, Fractography, Dislocation theories of brittle fracture, Ductile fracture, Notch effects, Strain energy release rate in fracture, Fracture toughness and design.

UNIT- III BEHAVIOUR UNDER DYNAMIC LOADS AND DESIGN APPROACHES (9)

Stress intensity factor and fracture toughness – Fatigue, low and high cycle fatigue test, crack initiation and propagation mechanisms and Paris law.- Safe life, Stress life, strain-life and fail - safe design approaches -Effect of surface and metallurgical parameters on fatigue – Fracture of nonmetallic materials – Failure analysis, sources of failure, procedure of failure analysis.

UNIT- IV CREEP AND SELECTION OF MATERIALS (9)

Creep and stress rupture, Creep curve, Stress rupture test, Mechanism of creep deformation, Activation energy for steady state creep, Super plasticity, Fracture at elevated temperature, Creep resistant alloys, Creep under combined stresses. 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

UNIT- V BEHAVIOR OF MATERIALS UNDER TENSION AND HARDNESS (9)

Tension test, Stress-strain curves, Instability in tension, Ductility measurement, Effect of strain rate, temperature and testing machine on flow properties, Stress relaxation testing, Notch tensile test, Anisotropy of tensile properties. Hardness test, Brinnel, Rockwell and Vickers hardness, flow of metal under the indenter, relationship between hardness and flow curve, micro hardness testing, Hardness at elevated temperatures.

LECTURE: 45 PERIODS TUTORIAL:0 PERIODS PRACTICAL:0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS*:*

1. *George E.Dieter," **Mechanical Metallurgy**", McGraw Hill, 2001*
2. *Thomas H. Courtney," **Mechanical Behavior of Materials**", (2nd edition), McGraw Hill,2000*
3. *Charles, J.A., Crane, F.A.A. and Fumess, J.A.G., "**Selection and use of engineering materials**", (34d edition), Butterworth-Heiremann, 1997.*
4. *"**Deformation and fracture mechanics**", Richard W Hertzberg John Wiley & Sons*
5. *"**Mechanical behaviour of Materials**", Frank A Mcclinock and Ali S Argon*
6. *"**Physical Metallurgy Principles**", Reed Hill and Robert E, East West Press*
7. *"**Structure and properties of Materials**", Hyden W. M. Vol. 3, McGraw Hill*
8. *"**Plastic deformation of Metals**", Honeycombe, Arnold Press.*

COURSE OUTCOMES

On completion of this course, students will be able to

CO1: Appreciate the behaviour of materials and to select the materials for engineering application

CO2: Design engineering systems under static and dynamic loading conditions

CO3: Predict hardness of materials under different environments so as to avoid critical failures

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	L	H	L	M	-	-	L	-	L	M	L
CO2	-	H	H	M	L	-	-	-	L	-	M
CO3	L	M	L	-	L	-	-	-	L	M	L

L – Low, M – Moderate (Medium), H- High

18EDPE07 ADDITIVE MANUFACTURING

Category: PE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE

To understand the concepts of rapid product development, apply acquired knowledge to meet global challenges in changing design in time compressed mode

UNIT- I INTRODUCTION (7)

Need for the compression in product development, History of RP systems, Digital prototyping – Virtual prototyping. Survey of applications, Growth of RP industry, Principle of RP technologies and their classification of RP systems.

UNIT- II LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS (10)

Stereo lithography Apparatus, Fused deposition Modeling, Laminated object manufacturing, three dimensional printing: Working Principles, details of processes, products, materials, advantages, limitations - Principle, Process parameters, Process details, Data preparation, Data files and Machine details, Applications - Case studies.

UNIT- III POWDER BASED RAPID PROTOTYPING SYSTEMS (10)

Selective Laser Sintering, Direct Metal Laser Sintering, Three-Dimensional Printing, Laser Engineered Net Shaping, Selective Laser Melting, Electron Beam Melting: Processes, materials, products, advantages, applications and limitations – Case Studies

UNIT- IV RAPID TOOLING (9)

Indirect Rapid Tooling - Silicone rubber tooling, Aluminum filled epoxy tooling, Spray metaltooling, etc. Direct Rapid Tooling - Direct AIM, Quick cast process, Copper polyamide, Rapid Tool, DMILS, ProMetal, Sand casting tooling, Laminate tooling, soft tooling vs hard tooling

UNIT- V SOFTWARE FOR RAPID PROTOTYPING (9)

STL files, Overview of Solid view, Magics, mimics, magics communicator, etc. Internet based software, Collaboration tools. RAPID MANUFACTURING PROCESS OPTIMIZATION -Factors influencing accuracy, Data preparation errors, Part building errors, Errors infinishing, Influence of part build orientation. ALLIED PROCESSES - Vacuum Casting, Surface Digitizing, Surface Generation from point cloud, Surface modification, data transfer to solid models.

LECTURE: 45 PERIODS TUTORIAL:0 PERIODS PRACTICAL:0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS*:*

1. *C K Chua, K F Leong, C S Lim,* ***Rapid Prototyping Principles and Applications,*** *World Scientific, New Delhi, 2010.*
2. *Frank W.Liou,* ***Rapid Prototyping and Engineering Applications****, CRC Press, UK, 2011.*
3. *Terry wohlers,* ***"Wohlers Report 2000"****, Wohlers Associates, USA, 2000.*
4. *Chua Chee Kai and Leong Kah Fai, 1997,* ***"Rapid Prototyping: Principles and Applications in Manufacturing"*** *,John Wiley & Sons*
5. *Paul F. Jacobs, 1996,* ***"Stereo-lithography and Other RP & M Technologies: from Rapid Prototyping to Rapid Tooling"****, SME/ASME*
6. *D. Faux and M. J. Pratt, 1979,* ***"Computational Geometry for design and manufacture"****, John Wiley & Sons*
7. *Pham, D.T. & Dimov.S.S.,* ***"Rapid manufacturing"****, Springer-Verlag, London, 2001.*

COURSE OUTCOMES

At the end of the course the learner should be able to

CO1. Apply the concept of liquid, solid and powder based rapid prototyping techniques for rapid product development.

CO2. Apply the rapid tooling and software for rapid manufacturing to meet international needs

CO3. Select appropriate process for production of a part/component that meet international standards of quality.

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	L	L	L	L	L	L	L	-	L	L	L
CO2	-	L	L	M	-	H	L	-	L	M	L
CO3	-	L	M	M	L	-	-	-	L	H	M

L – Low, M – Moderate (Medium), H- High

18EDPE08 QUALITY CONCEPTS IN DESIGN

Category: PE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE:

To expose the students to the principles of design of experiments and advanced quality concepts in design

UNIT- I DESIGN FOR QUALITY (9)

Quality Function Deployment - House of Quality-Objectives and functions – Targets - Stakeholders-Measures and Matrices-Design of Experiments –design process-Identification of control factors, noise factors, and performance metrics - developing the experimental plan- experimental design –testing noise factors- Running the experiments –Conducting the analysis-Selecting and conforming factor-Set points-reflecting and repeating

UNIT- II BASIC METHODS (9)

Refining geometry and layout, general process of product embodiment- Embodiment checklist- Advanced methods: systems modeling, mechanical embodiment principles-FMEA method- linking fault states to systems modeling-Case study- computer monitor stand for a docking station.

UNIT- III DESIGN OF EXPERIMENTS (9)

Design of experiments-Basic methods- Two factorial experiments-Extended method- reduced tests and fractional experiments, orthogonality, base design method, higher dimensional fractional factorial design-Statistical analysis of experiments: Degree of freedom, correlation coefficient, standard error of the residual t-test, ANOVA-ratio test, other indicators-residual plots, Advanced DOE method for product testing-Product applications of physical modeling and DOE, Blender panel display evaluation, coffee grinder experimental optimization-Taguchi method.

UNIT- IV STATISTICAL CONSIDERATION AND RELIABILITY (9)

Frequency distributions and Histograms- Run charts –stem and leaf plots- Pareto diagrams-Cause and Effect diagrams-Box plots- Probability distribution-Statistical Process control–Scatter diagrams –Multivariable charts –Matrix plots and 3- D plots.-Reliability-Survival and Failure-Series and parallel systems-Mean time between failure-Weibull distributions.

UNIT- V DESIGN FOR SIX SIGMA (9)

Basis of SIX SIGMA –Project selection for SIX SIGMA- SIX SIGMA problem solving- SIX SIGMA in service and small organizations - SIX SIGMA and lean production –Lean SIX SIGMA and services

LECTURE: 45 PERIODS TUTORIAL:0 PERIODS PRACTICAL:0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS *:*

1. *Kevin Otto and Kristin Wood, "**Product Design Techniques in Reverse Engineering and New Product Development**", Pearson Education (LPE), 2001.*
2. *Logothetis, N. "**Managing for total quality from Deming to Taguchi and SPC**", PHI, 1997.*
3. *James R. Evens, William M Lindsay "**The Management and control of Quality**" -6 th edition - Pub:son south-western(www.swlearning.com)*
4. *AmitavaMitra, "**Fundamentals of Quality control and improvement**" 2nd edition, Pearson Education Asia, 2002.*
5. *Park S.H.,"**Robust design and analysis for quality Engineering**" Chapman and Hall, London, 1996*

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: Plan and conduct experiments considering customer requirements in design and optimization.

CO2: Apply the principles of embodiment for reliable product design.

CO3: Utilize the concepts of statistics and six sigma for solving engineering problems.

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	L	H	H	M	M	-	L	-	L	-	L
CO2	L	M	M	L	M	L	-	-	-	-	L
CO3	M	L	L	-	L	H	-	L	L	L	-

L – Low, M – Moderate (Medium), H- High

18EDPE09 CREATIVITY IN DESIGN

Category: PE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE

To expose the students to practice different levels of design, thinking, visualization, creativity and nnovation.

UNIT- I BASICS OF DESIGN **(8)**

Process Design, Emotional Design – Three levels of Design – Viceral, Behavioral and Reflective. Recycling and availability Creativity and customer needs analysis. Innovative product and service designs, future directions in this application of creativity thinking in quality management. Need for design creativity – creative thinking for quality – essential theory about directed creativity.

UNIT- II THINKING **(6)**

Definitions and theory of mechanisms of mind heuristics and models: attitudes, Approaches and Actions that support creative thinking - Advanced study of visual elements and principles like line, plane, shape, form, pattern, texture gradation, color symmetry.

UNIT- III VISUALIZATION OF MECHANISM **(7)**

Spatial relationships and compositions in 2 and 3 dimensional space - procedure for genuine graphical computer animation – Animation aerodynamics – virtual environments in scientific Visualization – Unifying principle of data management for scientific visualization – Unifying principle of data management for scientific visualization - Visualization benchmarking

UNIT- IV CREATIVITY **(12)**

Methods and tools for Directed Creativity – Basic Principles – Tools of Directed Creativity – Tools that prepare the mind for creative thought – stimulation of new ideas – Development and Actions: - Processes in creativity ICEDIP – Inspiration, Clarification, Distillation, Perspiration, Evaluation and Incubation – Creativity and Motivation The Bridge between man creativity and the rewards of innovativeness – Applying Directed Creativity to the challenge of quality management

UNIT- V INNOVATION **(12)**

Achieving Creativity – Introduction to TRIZ methodology of Inventive Problem Solving - the essential factors – Innovator's solution – creating and sustaining successful growth – Disruptive Innovation model – Segmentive Models – New market disruption - Commoditation and DE-commoditation – Managing the Strategy Development Process – The Role of Senior Executive in Leading New Growth – Passing the Baton

LECTURE: 45 PERIODS TUTORIAL:0 PERIODS PRACTICAL:0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS*:*

1. ***Rousing Creativity: Think New, NowFloydHurr, ISBN 1560525479****, Crisp Publications Inc. 1999*
2. *Geoffrey Petty," **How to be better at Creativity**", The Industrial Society 1999*
3. *Donald A. Norman," **Emotional Design**", Perseus Books Group New York , 2004*
4. *Clayton M. Christensen Michael E. Raynor," **The Innovator's Solution**", Harvard Business School Press Boston, USA, 2003*
5. *Semyon D. Savransky," **Engineering of Creativity – TRIZ**", CRC Press New York USA," 2000*

COURSE OUTCOMES

On completion of this course, students will be able to

CO1: Apply the concepts of different levels of design and creative thinking for solving real life problems.

CO2: Utilize the principles of spatial relationships, animation aerodynamics and data management in design.

CO3: Obtain solutions for engineering problems by applying different methods of creativity and innovation models.

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	H	H	H	L	L	L	-	H	L	M
CO2	L	M	L	M	-	L	-	-	L	-	L
CO3	M	H	M	H	L	L	L	-	L	M	M

L – Low, M – Moderate (Medium), H- High

18EDPE10 MECHANICS OF FRACTURE

Category: PE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE

The course will treat linear and nonlinear fracture mechanics principles and their applications to structural design. Fracture phenomena in metals and non-metals will be discussed and testing methods will be highlighted.

UNIT- I ELEMENTS OF SOLID MECHANICS (5)

The geometry of stress and strain, elastic deformation, plastic and elastic-plastic deformation – limit analysis.

UNIT- II STATIONARY CRACK UNDER STATIC LOADING (10)

Two dimensional elastic zone fields – Analytical solutions yielding near a crack front – Irwin's approximation – Plastic zone size – Dugdaale model – J integral and its relation to crack opening development.

UNIT- III ENERGY BALANCE AND CRACK GROWTH (8)

Griffith analysis – Linear fracture mechanics – Crack opening displacement – Dynamic energy balance – Crack arrest.

UNIT- IV FATIGUE CRACK GROWTH CURVE (10)

Empirical Relation describing crack growth by fatigue – life calculations for a given load amplitude – effects of changing the load spectrum – Effects of Environment.

UNIT- V ELEMENTS OF APPLIED FRACTURE MECHANICS (12)

Examples of crack- growth Analysis for cyclic loading – leak before break – crack Initiation under large scale yielding – Thickness as a Design parameter – crack instability in Thermal or Residual – Stress fields.

LECTURE: 45 PERIODS TUTORIAL:0 PERIODS PRACTICAL:0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS *:*

1. *David Broek, **"Elementary Engineering Fracture Mechanics"**, Fifthoff and Noerdhoff International Publisher, 1978.*
2. *KAreHellan, **"Introduction of Fracture Mechanics"**, McGraw-Hill Book Company, 1985.*
3. *Preshant Kumar, **"Elements of Fracture Mechanics"**, Wheeler Publishing, 1999.*
4. *R.J.Sanford **"Principles of Fracture Mechanics"**, Prentice Hall Publisher 2003.*

COURSE OUTCOMES

On completion of this course, the student will be able to,

CO1: Appreciate the principles of solid mechanics and analyze material behavior

CO2: Estimate failure conditions and determine the life of structures

CO3: Identify fracture and fatigue nature of materials

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**H**	**M**	**L**	**-**	**-**	**M**	**-**	**-**	**L**	**L**	**L**
CO2	**M**	**M**	**H**	**-**	**L**	**L**	**-**	**-**	**L**	**M**	**H**
CO3	**L**	**H**	**M**	**-**	**L**	**-**	**-**	**-**	**L**	**H**	**M**

L – Low, M – Moderate (Medium), H- High

18EDPE11 SENSORS FOR INTELLIGENT MANUFACTURING

(Common to Manufacturing Engineering)

Category: PE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE

To expose the students to the various sensors and their applications in manufacturing systems

UNIT- I INTRODUCTION (9)

Introduction – role of sensors in manufacturing automation – operation principles of different sensors – electrical, optical, acoustic, pneumatic, magnetic, Electro optical and vision sensors.

UNIT- II CONDITION MONITORING OF MANUFACTURING SYSTEMS (9)

Condition monitoring of manufacturing systems – principles – sensors for monitoring force, vibration and noise, selection of sensors and monitoring techniques

UNIT- III ACOUSTIC EMISSION SENSORS (9)

Acoustic emission – principles and applications – concepts of pattern recognition. Sensors for CNC machine tools – linear and angular position and velocity sensors.

UNIT- IV MACHINE VISION SENSORS (9)

Automatic identification techniques for shop floor control – bar code scanners, radio frequency systems – optical character and machine vision sensors.

UNIT- V ADAPTIVE CONTROL OF MACHINE TOOLS (9)

Smart / intelligent sensors – integrated sensors, Robot sensors, Micro sensors, Nano sensors.
Adaptive control of machine tools.

LECTURE: 45 PERIODS TUTORIAL:0 PERIODS PRACTICAL:0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS*:*

1. "Sensors: Hand Book" *by SabrieSoloman ; McGraw Hill*

2. "Thermal Sensors: Vo. IV, Sensors: A Comprehensive Survey" by JorgScholz (Editor), John wiley&

3. "Mechanical Sensors: Vo. VII, Sensors: A Comprehensive Survey" by H.H. Bau (Editor), John wiley&sons

4. "Sensor Technology & Devices" by LjubisaRistia (Editor), Artech House Publishers.

5. "Sensors and control system in manufacturing" by SabrieSoloman, The McGraw-Hill Companies, Inc.

COURSE OUTCOMES

On completion of this course, students will be able to

CO1: Appreciate the capabilities of various sensors and apply them in condition monitoring.

CO2: Apply advanced sensor based systems for identification and inspection functions in shop floor.

CO3: Appreciate and use special type of sensors for hi-tech manufacturing systems.

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**L**	**L**	**L**	**L**	**L**	**L**	**-**	**-**	**L**	**L**	**L**
CO2	**L**	**L**	**L**	**L**	**L**	**L**	**-**	**-**	**L**	**L**	**L**
CO3	**L**	**L**	**L**	**L**	**L**	**L**	**-**	**-**	**L**	**L**	**L**

L – Low, M – Moderate (Medium), H- High

18EDPE12 VEHICULAR VIBRATION

Category: PE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE

To expose the students to concepts of vibration and control in vehicular systems

(9)

UNIT- I BASIC OF VIBRATION

Classification of vibration, definitions, mechanical vibrating systems, mechanical vibration and human comfort. Single degree of freedom, free, forced and damped vibrations. Magnification factor and transmissibility, Vibration absorber, Vibration measuring instruments, Two degree of freedom system, modal analysis.

(9)

UNIT- II TYRES

Tire forces and moments, rolling resistance of tires, relationship between tractive effort and longitudinal slip of tyres, cornering properties of tyres, ride properties of tyre.

(9)

UNIT- III PERFORMANCE CHARACTERISTICS OF VEHICLE

Equation of motion and maximum tractive effort, Aerodynamics forces and moments, Power plant and transmission characteristics, Prediction of vehicle performance - Braking performance.

(9)

UNIT- IV HANDLING CHARACTERISTICS OF VEHICLES

Steering geometry, Steady state handling characteristics, Steady state response to steering input, Transient response characteristics, Directional stability of vehicle.

(9)

UNIT- V DYNAMICS OF SUSPENSION SYSTEM

Requirements of suspension system, Spring mass frequency, wheel hop, Wheel wobble, wheel shimmy, choice of suspension spring rate. Calculation of effective spring rate, Vehicle suspension in fore and aft, Hydraulic dampers and choice of damping characteristics. Compensated suspension systems, Human response to vibration, vehicle ride model, Load distribution, Stability on a curved track, banked road and on a slope.

LECTURE: 45 PERIODS TUTORIAL:0 PERIODS PRACTICAL:0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS *:*

1. *Groover, "**Mechanical Vibration**", 7th Edition, Nem Chand & Bros, Roorkee, India, 2003.*
2. *W.Steeds, '**Mechanics of road vehicle'**Illiffe Books Ltd, London 1992.*
3. *JG.Giles, **"Steering, Suspension tyres"**, Illife Books Lid London 1975.*
4. *P.M.Heldt, "**Automotive chassis"**, Chilton Co ., Newyork, 1982.*
5. *J. R. Ellis, **"Vehicle Dynamics"**, Business Books, London, 1969.*
6. *J.Y.Wong, **"Theory of ground vehicle"**, John Wiley and Sons Inc., Newyork, 1978.*
7. *Dr. N. K. Giri, "**Automobile Mechanics**", Seventh reprint, Khanna Publishers, Delhi, 2005.*
8. *Rao J.S and Gupta. K "**Theory and Practice of Mechanical Vibrations**", Wiley Eastern Ltd., 2002.*
9. *Thomas D. Gillespie "**Fundamentals of Vehicle Dynamics**" Society of Automotive Engineers HandBook.*

COURSE OUTCOMES

On completion of this course, students will be able to

CO1: Analyze the vibrations occurring in various vehicular systems.

CO2: Perform the vibration analysis in various parts of a vehicle and evaluate the performance of the vehicle.

CO3: Apply the concept of suspension for controlling the vehicular vibrations.

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	M	M	H	L	M	-	-	L	-	M
CO2	M	M	M	M	M	M	-	-	L	-	M
CO3	L	H	L	-	-	L	-	-	L	L	L

L – Low, M – Moderate (Medium), H- High

18EDPE13 LIFE CYCLE DESIGN

Category: PE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE

To understand the concepts of Product Data Management and Life Cycle Management and make suitable design modifications

UNIT- I INTRODUCTION (8)

Introduction to PDM-present market constraints-need for collaboration - internet and developments in server-client computing. Base lines-product structure-configuration management-case studies.

UNIT- II COMPONENTS OF PDM (9)

Components of a typical PDM setup-hardware and software-document management-creation and viewing of documents creating parts-versions and version control of parts and documents-case studies

UNIT- III PROJECTS AND ROLES (12)

Creation of projects and roles-life cycle of a product- life cycle management automating information flow-work flows creation of work flow templates-life cycle work flow integration-case studies.

UNIT- IV CHANGE MANAGEMENT (6)

Change issue- change request- change investigation- change proposal – change activity - case studies.

UNIT- V GENERIC PRODUCTS AND VARIANTS (10)

Data Management Systems for FEA data - Product configurator – comparison between sales configuration and product configurator - generic product modeling in configuration modeller - use of order generator for variant creation-registering of variants in product register-case studies.

LECTURE: 45 PERIODS TUTORIAL:0 PERIODS PRACTICAL:0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS *:*

1. David Bed worth. Mark Henderson & Phillip Wolfe. ***"Computer Integrated Design and Manufacturing "****. McGraw Hill Inc...1991.*

2. Terry Quatrain. ***"Visual Modeling with Rational Rose and UML"****. Addison Wesley...1998.*

3. Kevin Otto, Kristin Wood, ***"Product Design"****, Pearson, 2001.*

4. Daniel Amor, ***"The E-Business Revolution"****, Prentice-Hall, 2000.*

Wind-Chill R5.0 Reference Manuals...2000.

COURSE OUTCOMES

On completion of this course, the students will be able to

CO1: Analyze and apply the concept of product- life cycle management and PDM

CO2: Manage data related to generic products and variants

CO3: Investigate the changes in market needs and suitably make the life cycle design of the product

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**L**	**M**	**M**	**H**	**-**	**-**	**-**	**-**	**L**	**M**	**M**
CO2	**L**	**L**	**L**	**-**	**-**	**-**	**-**	**-**	**L**	**M**	**L**
CO3	**L**	**M**	**M**	**L**	**L**	**L**	**L**	**-**	**L**	**H**	**M**

L – Low, M – Moderate (Medium), H- High

18EDPE14 CONDITION MONITORING AND VIBRATION CONTROL

Category: PE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE

To impart knowledge in vibration control and use condition monitoring techniques for machineries

UNIT- I INTRODUCTION (11)

Review of fundamentals of single degree freedom systems – Two degree freedom systems, Multi Degree Freedom systems, Continuous systems, Determination of Natural frequencies and mode shapes, Numerical methods in vibration Analysis.

UNIT- II VIBRATION CONTROL (12)

Introduction – Reduction of vibration at the source – control of vibration – by structural design – Material selection – Localized additions – Artificial damping – Resilient isolation, Vibration isolation, Vibration absorbers.

UNIT- III ACTIVE VIBRATION CONTROL (6)

Introductions – Concepts and applications, Review of smart materials – Types and characteristic review of smart structures – Characteristic Active vibration control in smart structures

UNIT- IV CONDITION BASED MAINTENANCE PRINCIPLES AND APPLICATIONS (10)

Introduction – condition monitoring methods – The design of Information system, Selecting method of monitoring, Machine condition monitoring and diagnosis – Vibration severity criteria – Machine Maintenance Techniques – Machine condition monitoring techniques – Vibration monitoring techniques – Instrumentation systems – choice of monitoring parameter.

UNIT- V DYNAMIC BALANCING AND ALLIGNMENT OF MACHINERY (6)

Introduction, Dynamic balancing of Rotors, Field Balancing in one plane, Two planes and in several planes, Machinery alignment, Rough alignment methods, The face peripheral dial indicator method, Reverse indicator method, shaft-to coupling spool method.

LECTURE: 45 PERIODS TUTORIAL: 0 PERIODS PRACTICAL: 0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS*:*

1. *Timoshenko, S. "**Vibration Problems in Engineering**", John Wiley & Sons, Inc., 1987.*
2. *Meirovitch, L. "**Elements of Vibration Analysis**", McGraw-Hill Inc., 1986.*
3. *Thomson W.T, Marie Dillon Dahleh, "**Theory of Vibrations with Applications**", Prentice Hall, 1997.*
4. *F.S. Tse., I.F. Morse and R.T. Hinkle, "**Mechanical Vibrations**", Prentice-Hall of India, 1985.*
5. *Rao.J.S. and Gupta.K. "**Theory and Practice of Mechanical Vibrations**", Wiley Eastern Ltd., New Delhi, 1999.*
6. *Fung, Y.C., "**An Introduction to the Theory of Aeroelasticity**", John Wiley & Sons Inc., New York, 1985.*

COURSE OUTCOMES

On completion of this course, the students will be able to

CO1: Obtain vibration characteristics of mechanical systems

CO2: Control vibration using active and passive control techniques

CO3: Design and develop dynamically balanced systems with condition monitoring setup

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**M**	**M**	**H**	**M**	**L**	**L**	**L**	**-**	**L**	**L**	**H**
CO2	**M**	**M**	**H**	**M**	**L**	**L**	**L**	**-**	**L**	**L**	**H**
CO3	**M**	**M**	**H**	**M**	**M**	**L**	**-**	**-**	**L**	**L**	**H**

L – Low, M – Moderate (Medium), H- High

18EDPE15 OPTIMIZATION IN DESIGN

Category: PE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE

To impart knowledge on conventional and non-traditional optimization techniques and methods for designing static and dynamic systems

UNIT- I UNCONSTRAINED OPTIMIZATION TECHNIQUES (9)

Introduction to optimum design - General principles of optimization – Problem formulation and their classifications Single variable and multivariable optimization, Techniques of unconstrained minimization – Golden section, Random, pattern and gradient search methods – Interpolation methods.

UNIT- II CONSTRAINED OPTIMIZATION TECHNIQUES (9)

Optimization with equality and inequality constraints - Direct methods – Indirect methods using penalty functions, Lagrange multipliers - Geometric programming

UNIT- III ADVANCED OPTIMIZATION TECHNIQUES (9)

Multi stage optimization – dynamic programming; stochastic programming; Multi-objective optimization, Genetic algorithms, Simulated Annealing algorithm and particle swarm optimization algorithm; Neural network principles in optimization.

UNIT- IV STATIC APPLICATIONS (9)

Structural applications – Design of simple truss members - Design applications – Design of simple axial, transverse loaded members for minimum cost, weight – Design of shafts and torsionally loaded members – Design of springs

UNIT- V DYNAMIC APPLICATIONS (9)

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

LECTURE: 45 PERIODS TUTORIAL:0 PERIODS PRACTICAL:0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS*:*

1. *Rao, Singaresu, S., "**Engineering Optimization – Theory & Practice**", New Age International (P) Limited, New Delhi, 2000.*
2. *Johnson Ray, C., "**Optimum design of mechanical elements**", Wiley, John & Sons, 1990.*
3. *Kalyanamoy Deb, "**Optimization for Engineering design algorithms and Examples**", Prentice Hall of India Pvt. 1995.*
4. *Goldberg, D.E., "**Genetic algorithms in search, optimization and machine**", Barnen, Addison Wesley, New York, 1989.*
5. *Chan and Tiwari, "**Swarm Intelligence – Focus on Ant and Particle Swarm Optimization**", Wiley, John & Sons, 2003.*

COURSE OUTCOMES

On completion of this course, students will be able to

CO1: Solve engineering problems through constrained and unconstrained optimization techniques

CO2: Identify and apply suitable advanced optimization techniques for solving combinatorial engineering problems

CO3: Make optimized design of static and dynamic systems

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**M**	**M**	**M**	**L**	**L**	**L**	**L**	**-**	**M**	**-**	**M**
CO2	**M**	**M**	**M**	**L**	**L**	**L**	**L**	**-**	**M**	**-**	**M**
CO3	**L**	**M**	**M**	**L**	**H**	**-**	**L**	**-**	**L**	**-**	**M**

L – Low, M – Moderate (Medium), H- High

18EDPE16 ADVANCED MACHINE TOOL DESIGN

Category: PE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE

Expose students to the art of designing machine tools with control over vibration and meeting technical standards

UNIT- I STATIC AND DYNAMIC STIFFNESS, FORCE ANALYSIS (9)

Static stiffness and compliance- deformation caused by weight, Forces- deformation caused by cutting forces - forced vibrations, self-excited vibrations, Force distribution in different parts of Lathe, Drilling machine, Milling machine.

UNIT- II DESIGN OF STRUCTURES (9)

Beds, columns and housing for maximum strength and rigidity – cast and welded construction – CNC machine tools structure – main drive and feed drive- ball screws- automatic tool changers- chip conveyors- tool magazines- tool turrets.

UNIT- III DESIGN OF SLIDE WAYS (9)

Selection of materials- integrated and attached ways- hydro-static guide ways, aero-static guide ways- antifriction guide ways- design of friction guide ways- plastic inserted guide ways and LM guide ways.

UNIT- IV DESIGN OF MACHINE TOOL SPINDLES AND DRIVES (9)

Design requirements – standards – selection of spindle bearings- materials for spindles- typical spindle design - design consideration of Electrical, Mechanical and Hydraulic drives in machine tools.

UNIT- V MACHINE TOOL CHATTER (9)

The Dynamics of cutting process - physical causes of chatter- theory of machine tool chatter- chatter in different types of machine tools- milling machines, lathes and grinding machines - the theory of chatter with several degree of freedom - chatter suppression. Design of control mechanisms – selection of standard components - dynamic measurement of forces and vibrations in machine tools - use of vibration dampers

LECTURE: 45 PERIODS TUTORIAL:0 PERIODS PRACTICAL:0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS*:*

1. *Mehta. N.K, **"Machine Tool Design"** Tata McGraw Hill, 1989*
2. Koenisberger.F. "Design principles of Metal cutting Machine Tools".Pergamon press, 1964.
3. *Acherkan.N., **"Machine Tool Design"**. Vol. 3 & 4, MIR Publishers, Moscow, 1968.*
4. *Sen.G. and Bhattacharya.A., **"Principles of Machine Tools"**. Vol.2, NCB. Calcutta, 1973.*
5. *Tobias.S.A., **"Machine tool Vibration"** Blackie and Son Limited, London,1965.*

COURSE OUTCOMES

On completion of this course, students will be able to

CO1: Evaluate force distribution and deflection in different parts of machine tools.
CO2: Design machine tool structures and allied components meeting technical standards.
CO3: Use appropriate methods for vibration measurement and its control.

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	H	H	M	L	L	-	-	L	L	M
CO2	L	M	H	M	L	M	L	-	L	L	H
CO3	L	H	-	L	L	L	-	-	L	M	M

L – Low, M – Moderate (Medium), H- High

18EDPE17 SYSTEMATIC DESIGN APPROACH

Category: PE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE

To study the systematic design concepts, analysis, synthesis and reliability of real world system.

UNIT- I SYSTEM CONCEPTS (9)

Concurrent design approach - Life Cycle Design (LCD), Life Cycle Costs (LCC); Introduction to three phases of design - Conceptual, Embodiment and Detailed Design stage; Conceptual Design Stage (CDS) - Feasibility phase of design- Customer requirements / Need analysis, Social status, Market survey, political based; Analysis of Product Concept hunt - actual needs, Problem formulation, Innovation, creativity, Brain storming, Feasibility analysis, physical reliability, Economic viability, Financial and Social acceptability; Evaluation of concepts- decision making methods, Weighted sum method, Fuzzy decision making serviceability, safety, recycling / disposal / reuse.

UNIT- II SYSTEM ANALYSIS (9)

Reliability Analysis - Failure rate, Reliability of mechanical and Mechatronic systems, Reliability of series and parallel systems, Reliability modelling, Redundancy; Linear modelling and nonlinear modelling, Reliability of new and old systems, weight and cost at conceptual design stage; Maintainability Analysis - Diagnosability, Identification and Isolation of Faults, Failure cause analysis, (FCA), Fault tree analysis (FTA), Failure mode and effects analysis (FMEA), and Failure mode, effects and criticality analysis (FMECA) through functions.

UNIT- III SYSTEM SYNTHESIS (9)

Synthesizing - use of space, components and assembly packaging, use of tables for determining relationship for synthesis with examples such as hospital rooms; Synthesis of small systems - Heat convector, Washing machine. Detailed design stage - prototyping, Pilot plant level, Documentation, Drawings, Trouble shooting.

UNIT- IV MATERIAL SELECTION (9)

Material Selection Process – Economics – Cost Vs Performance – Weighted property Index – Value Analysis – Role of Processing in Design – Classification of Manufacturing Process – Design for Manufacture – Design for Assembly –Designing for castings, Forging, Metal Forming, Machining and Welding – Residual Stresses – Fatigue, Fracture and Failure.

UNIT- V PROBABILITY CONCEPTS IN SYSTEM DESIGN (9)

Probability – Distributions – Test of Hypothesis – Design of Experiments – Reliability Theory – Design for Reliability – Reliability Centered Maintenance - Robust Design - Failure mode Effect Analysis.

LECTURE: 45 PERIODS TUTORIAL:0 PERIODS PRACTICAL:0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS *:*

1. *Pahl, G. and Beitz,W., "**Engineering Design**," Springer Verlag, London, 1984.*
2. *Ullman, D.G., "**The Mechanical Design process**," McGraw Hill, N.Y. 1992.*
3. *Suh,N.P., " **The Principles of Design**", Oxford University Press, N.Y.1990.*
4. *Newton, D. and Broomley, R., "**Practical Reliability Engineering**," John Wiley & Sons India, 2002.*
5. *Karl T. Ulrich and Steven D. Eppinger "**Product Design and Development**" McGraw Hill Edition 2000.*
6. *Ray, M.S., "**Elements of Engg. Design**", Prentice Hall Inc. 1985.*
7. *Logothetis, N. "**Managing for total quality from Deming to Taguchi and SPC**", PHI, 1997.*
8. *Dale H. Besterfield, "**Total Quality Management**" , Prentice Hall Inc. 2003.*

COURSE OUTCOMES

On completion of this course, students will be able to

CO1: Apply concurrent design approach in system design and analyze the system failures.
CO2: Select the suitable materials and manufacturing processes for engineering systems.
CO3: Apply the knowledge of probability distributions and reliability concepts for real world systems.

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	L	H	M	M	M	M	L	-	L	M	L
CO2	L	H	M	L	-	L	L	-	L	L	M
CO3	H	L	L	L	-	-	M	-	M	-	M

L – Low, M – Moderate (Medium), H- High

18EDPE18 PRINCIPLES OF PRODUCT DESIGN

Category: PE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE

To impart the concepts in product design, development and prototyping techniques

UNIT- I BASIC CONCEPTS (7)

Product lifecycle management-concepts, benefits, value addition to customer. Lifecycle models- creation of projects and roles, users and project management, system administration, access control and its use in life cycle. Product development process and functions.

UNIT- II COLLABORATIVE PRODUCT DESIGN (8)

Data transfer - Variants of e-commerce - Multisystem information sharing. Workgroup collaboration - Development of standard classification for components and suppliers. Model assembly process - link product and operational information. Customization factors - creation of business objects, user interfaces, search facile ties as designed by the enterprise.

UNIT- III PRODUCT DEVELOPMENT (10)

Quality function deployment - quality project approach and the problem solving process. Design creativity-innovations in design alternatives. Industrial design principles. Product development versus design, types of design and redesign, modern production development process, reverse engineering and redesign product development process, examples of product development process, scoping product development – S-curve, new product development.

UNIT- IV PRODUCT TEAR DOWN AND EXPERIMENTATION (10)

Gathering customer needs, organizing and prioritizing customer needs, establishing product function, FAST method, establishing system functionality. Tear down method, post teardown report, benchmarking and establishing engineering specifications, product portfolios.

UNIT- V GENERATING CONCEPTS AND PHYSICAL PROTOTYPES (10)

Information gathering, brain ball, C-sketch/6-3-5 method, morphological analysis, concept selection, technical feasibility, ranking, measurement theory, DFMA, design for robustness. Types of prototypes, use of prototypes, rapid prototyping technique scale, dimensional analysis and similitude, physical model and experimentation-design of experiments, statistical analysis of experiments.

LECTURE: 45 PERIODS TUTORIAL:0 PERIODS PRACTICAL:0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS *:*

*1. John W Gosnay and Christine M Mears, "**Business Intelligence with Cold Fusion**", Prentice Hall India, New Delhi, 2000.*

*2. David S Linthicum, "**B2B Application Integration**", Addison Wesley, Boston, 2001.*

*3. Alexis Leon, "**Enterprise Resource Planning**", Tata McGraw Hill, New Delhi, 2002.*

*4. David Ferry and Larry Whipple, "**Building and Intelligent e-business**", Prima Publishing, EEE Edition, California, 2000.*

*5. David Bedworth, Mark Hederson and Phillip Wolfe, "**Computer Integrated Design and Manufacturing**" McGraw Hill Inc., New York, 1991.*

*6. Kevin Otto and Kristin Wood, "**Product Design – Techniques in Reverse Engineering and New Product Development**", Pearson Education, New Delhi, 2004.*

*7. Karl T Ulrich and Stephen D Eppinger, "**Product Design and Development**", McGraw Hill, New York, 1994.*

COURSE OUTCOMES

On completion of this course, students will be able to

CO1: Apply the concept of collaborative product design and development in engineering

CO2: Develop products according to the customer requirements

CO3: Design different experimentation and prototyping techniques

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	L	M	M	L	L	L	L	-	L	L	L
CO2	L	H	H	-	M	-	L	-	L	M	L
CO3	L	L	L	L	H	L	L	-	L	-	L

L – Low, M – Moderate (Medium), H- High

18EDPE19 WEAR ANALYSIS AND CONTROL

(Common to Manufacturing Engineering)

Category: PE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE

To know the fundamentals of mechanism, prediction and control of wear under different working conditions

UNIT- I INTRODUCTION TO WEAR (8)

Types of wear, Adhesive wear, two-body and three-body abrasive wear, erosive wear, cavitation wear, wear due to surface fatigue – chemical reaction.

UNIT- II SURFACE ROUGHNESS AND WEAR MEASUREMENTS (10)

Tribo systems and tribo-elements, Measurement of Surface roughness Re, Rz, Experimentalstudies on friction on various tribo systems using pin-on-ring (POR) and pin-on-disc (POD) machines. Sample preparation, wear measurement of various tribo - elements, using POR and POD machines. Calculation of wear volume and wear coefficient, comparison with existing data.

UNIT- III WEAR IN LUBRICATED CONTACTS (9)

Rheological lubrication regime, Functional lubrication regime, Fractional film defect, Load sharing in lubricated contacts, Adhesive wear equation, Fatigue wear equation, Numerical example.

UNIT- IV DIAGNOSIS AND CONTROL OF WEAR (9)

Diagnosis of wear mechanisms using optical microscopy and scanning electron microscopy, Wear resistant materials, wear resistant coatings, eco-friendly coatings designing for wear, systematic wear analysis, wear coefficients, filtration for wear control.

UNIT- V WEAR IN MECHANICAL COMPONENTS (9)

Component wear, bushings, lubricated piston rings and cylinder bore wear, dry piston rings, rolling bearings, seal wear, gear wear, gear couplings, wear of brake materials, wear of cutting tools, chain wear.

LECTURE: 45 PERIODS TUTORIAL:0 PERIODS PRACTICAL:0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS*:*

*1. Czichos, H., **"Tribology:A system approach to the science & technology of friction,lubrication and wear",** Series 1, Elsevier Publications,1982.*
*2. Glaeser,W. A., **"Tribology series – Vol. 20,"** Elsevier Publications,1992.*
*3. Neale, M.J., **"The Tribology Hand Book,"** Butterworth Heinemann, London, 1995.*
*4. Peterson, M. B., Winer, W.O., **"Wear Control Handbook,"** ASME, NY. 1980.*
*5. Stolarski.T.A. **"Tribology in Machine Design"**Buttorworth Heinemann, Oxford, 2000.*

COURSE OUTCOMES

On completion of this course, the student will be able to

CO1: Appreciate wear behavior of materials under different environment
CO2: Diagnose and control wear in metallic parts
CO3: Assess wear in different mechanical components

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	H	L	-	M	L	-	-	L	M	L
CO2	L	H	-	-	-	-	-	-	L	L	L
CO3	L	H	-	-	-	-	-	-	L	L	L

L – Low, M – Moderate (Medium), H- High

18EDPE20 COMPUTATIONAL FLUID DYNAMICS

Category: PE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE

To expose the students to the concepts of Computational Fluid Dynamics and application of fluid flow algorithms

UNIT- I INTRODUCTION (9)

CFD as the third dimension of fluid mechanics. Numerical Discretization methods such as Finite Difference, FEM and FVM. Why FVM as preferred method in CFD.

UNIT- II BASIC EQUATIONS OF FLUID DYNAMICS (9)

Potential flow, Nonlinear Potential flow, In-viscid flows and viscous flows. Navier-Stokes Equations. Primitive variable and conservation form. Dimensional form and Non dimensional form.

UNIT- III NUMERICAL METHODS FOR CONVECTION-DIFFUSION (9)

Up winding and central difference schemes. Stability condition in terms of Courant number.

UNIT- IV NUMERICAL METHODS FOR INVISCID FLOWS (9)

Characteristic form of equations. Flux difference splitting. Application to 2-D flows such as flow through a nozzle.

UNIT- V TWO DIMENSIONAL RANDOM VARIABLES (9)

The continuity equation divergence constraint. Poisson eqn. for pressure. Schemes such as SIMPLE due to Patankar and Spalding.

LECTURE: 45 PERIODS TUTORIAL:0 PERIODS PRACTICAL:0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS *:*

1. *Veersteeg and Malalasekara, **"CFD: The Finite Volume Method"** Prentice Hall, 1996*
2. *Anderson, Tannehill and Pletcher, **"Computational Fluid Mechanics and Heat Transfer"** Hemisphere Publishers, 1984.*
3. *C A J Fletcher: **"Computational Methods for Fluid dynamics"**, Vol 1 and 2.Springer Verlag, 1987*
4. *C. Hirsch: **"Numerical Computation of Internal and External Flows"**, Vol.1 and 2.*
5. *D C Wilcox: **"Turbulence Modeling for CFD"**, DCW Industries.*

COURSE OUTCOMES

On completion of this course, students will be able to

CO1: Select and apply appropriate discretization methods for flow simulation

CO2: Appreciate and apply stability criteria for convection-diffusion problems

CO3: *Apply advanced algorithms for solving fluid flow problems*

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**H**	**H**	**L**	**L**	**L**	**H**	**-**	**-**	**L**	**-**	**L**
CO2	**L**	**M**	**L**	**L**	**-**	**L**	**-**	**-**	**L**	**L**	**L**
CO3	**H**	**H**	**L**	**L**	**L**	**H**	**-**	**-**	**L**	**-**	**L**

L – Low, M – Moderate (Medium), H- High

18EDPE21 DESIGN OF MATERIAL HANDLING EQUIPMENTS

Category: PE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE

To know the need for use, application and design of different material handling techniques, equipments and machines for common use and in industrial sector

UNIT- I MATERIALS HANDLING EQUIPMENT (8)

Introduction – Importance of material handling – Principle of material handling – Factors influences the choice of material handling - Types - Selection and applications – Scope of material handling

UNIT- II DESIGN OF HOISTS (10)

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

UNIT- III DRIVES OF HOISTING GEAR (9)

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

UNIT- IV CONVEYORS (9)

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

UNIT- V ELEVATORS (9)

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

LECTURE: 45 PERIODS TUTORIAL:0 PERIODS PRACTICAL:0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS *:*

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

COURSE OUTCOMES

On completion of this course the students will be able to

CO1: To select suitable material handling equipment.

CO2: To design material handling equipment for industrial applications

CO3: Handle various loads in varied equipment's.

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	M	L	M	L	-	L	-	L	M	L
CO2	M	M	M	M	H	L	L	-	L	L	M
CO3	L	-	L	M	-	-	-	-	L	M	M

L – Low, M – Moderate (Medium), H- High

18EDPE22 EXPERIMENTAL STRESS ANALYSIS

Category: PE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE

To expose the students to the concepts of stress, vibration, fluid flow, distress measurements and NDT methods.

UNIT- I FORCES AND STRAIN MEASUREMENT (9)

Strain gauge, principle, types, performance and uses. Photo elasticity – principle and applications - Moire Fringe - Hydraulic jacks and pressure gauges –Electronic load cells – Proving Rings – Calibration of Testing Machines.

UNIT- II VIBRATION MEASUREMENTS (9)

Characteristics of Structural Vibrations – Linear Variable Differential Transformer (LVDT) – Transducers for velocity and acceleration measurements. Vibration meter – Seismographs – Vibration Analyzer – Display and recording of signals – Cathode Ray Oscilloscope – XY Plotter – Chart Plotters – Digital data Acquisition systems.

UNIT- III ACOUSTICS AND WIND FLOW MEASURES (9)

Principles of Pressure and flow measurements – pressure transducers – sound level meter – venturimeter and flow meters – wind tunnel and its use in structural analysis – structural modeling – direct and indirect model analysis

UNIT- IV DISTRESS MEASUREMENTS (9)

Diagnosis of distress in structures – crack observation and measurements – corrosion of reinforcement in concrete – Half-cell, construction and use – damage assessment – controlled blasting for demolition.

UNIT- V NON DESTRUCTIVE TESTING METHODS (9)

Load testing on structures, buildings, bridges and towers – Rebound Hammer – acoustic emission – ultrasonic testing principles and application – Holography – use of laser for structural testing – Brittle coating

LECTURE: 45 PERIODS TUTORIAL:0 PERIODS PRACTICAL:0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS*:*

1. *Sadhu Singh – **"Experimental Stress Analysis"**, Khanna Publishers, New Delhi, 1996.*
2. *JW Dalley and WF Riley, **"Experimental Stress Analysis"**, McGraw Hill Book Company, N.Y. 1991*
3. *L.S.Srinath et al, **"Experimental Stress Analysis"**, Tata McGraw Hill Company, New Delhi, 1984*
4. *R.S.Sirohi, HC Radhakrishna, **"Mechanical Measurements"**, New Age International (P) Ltd. 1997*
5. *F.K Garas, J.L. Clarke and GST Armer, **"Structural assessment"**, Butterworths, London, 1987*

COURSE OUTCOMES

On completion of this course, students will be able to

CO1: Familiarize the student with various techniques for the measurement of force, strain, vibrations acoustic and wind flow.

CO2: To make the student acquaint with distress measurements and their methods.

CO3: To familiarise the student with principles and methods of non destructive testing.

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**M**	**L**	**-**	**M**	**-**	**-**	**-**	**L**	**L**	**M**	**M**
CO2	**M**	**L**	**-**	**M**	**-**	**-**	**-**	**L**	**L**	**M**	**M**
CO3	**M**	**L**	**-**	**M**	**-**	**-**	**-**	**L**	**L**	**M**	**M**

L – Low, M – Moderate (Medium), H- High

18EDPE23 FLUID POWER CONTROL AND AUTOMATION

Category: PE

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

To impart knowledge on the basics and application of hydraulics and pneumatics to develop low cost automation systems

UNIT- I OIL HYDRAULIC SYSTEMS AND HYDRAULIC ACTUATORS (8)

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

UNIT- II CONTROL AND REGULATION ELEMENTS (8)

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

UNIT- III HYDRAULIC CIRCUITS (10)

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

UNIT- IV PNEUMATIC SYSTEMS AND CIRCUITS (10)

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

UNIT- V INSTALLATION, MAINTENANCE AND SPECIAL CIRCUITS (9)

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

Lecture: 45 Periods Tutorial:0 Periods Practical:0 Periods Total: 45 Periods

REFERENCE BOOKS *:*

1. *Antony Espossito, "**Fluid Power with Applications**", Prentice Hall, 1980.*
2. *Dudleyt, A. Pease and John J. Pippenger, "**Basic fluid power**", Prentice Hall, 1987.*
3. *Michael J., Pinches and John G.Ashby, "**Power Hydraulics**", Prentice Hall, 1989.*
4. *Bolton. W., "**Pneumatic and Hydraulic Systems** ", Butterworth –Heinemann, 1997.*
5. *Joji P., "**Pneumatic Controls**", Wiley India Pvt. Ltd., New Delhi, 2008.*
6. *Andrew Parr, "**Hydraulic and Pneumatics**" (HB), Jaico Publishing House, 1999.*

Web References :

1. *http:// www.pneumatics .com*
2. *http:// www.fluidpower.com.tw*

COURSE OUTCOMES

On completion of this course, students will be able to

CO1: Select appropriate hydraulic and pneumatic control elements for specific industrial requirements

CO2: Develop hydraulic systems/ circuits to execute specific tasks

CO3: Develop logical and sequential pneumatic circuits for low power applications

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**L**	**H**	**H**	**-**	**-**	**-**	**L**	**-**	**M**	**M**	**L**
CO2	**L**	**H**	**L**	**-**	**L**	**-**	**L**	**-**	**L**	**-**	**L**
CO3	**L**	**H**	**L**	**-**	**L**	**-**	**M**	**-**	**L**	**-**	**L**

L – Low, M – Moderate (Medium), H- High

18SEOE01- VASTU SCIENCE FOR BUILDING CONSTRUCTION
(Common to All Branches)

Category: OE

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVE:
To impart basic knowledge of vastu science and its impact on human well being.

UNIT- I - INTRODUCTION (9)
Traditional definition - Meaning of Vastu and Vaastu -its classification -Relationship to earth - concept of existence and manifestation – planatory influence on earth.

UNIT- II - SPACE THEORY IN VASTU (9)
Features of good building site -good building shapes -macro, micro, enclosed and material spaces - relationship between built space, living organism and universe -impact of built space on human psyche. Flow of energy within built space and outside - zoning of functional areas -fitting of components in the building -significance of water bodies and energy -The cube as the basic structure.

UNIT- III - COSMOGRAM & SETTLEMENT CONCEPTS (9)
Orientation of building, site, layout and settlement -positive and negative energies - importance of cardinal and ordinal directions -The celestial grid or - mandala and its type. The Vaastu Purusha Mandala and its significance in creation of patterns, and lay-outs, extension of this to aural and visual fields -Types of Lay-Outs

UNIT- IV - INTERFACE OF TIME, VIBRATION AND RHYTHM (9)
Theory of vibration and energy transfer – equation of time and space – manifestation in living organism – human beings – measurement of the energy – Kirlian energy of various forms-documentation of objects – filaments and streamers.

UNIT- V - MEASUREMENTS & MATERIALS (9)
Units of measurement -Mana shastra -Ayadi techniques -Tala system and Hasta system of measures -Musical measurements compared to space measurements -resultant ambience in built space. Use of wood, stone, metal, brick and time- making technology, corbelling technology, jointing technology -foundations for heavy and light structures -Landscaping in and around buildings -Aesthetic in Indian Architecture.

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCE BOOKS:

*1. Dr.Prasanna Kumar Acharya-"**Manasara**" -Oxford1 University Press1927 -(English version)*
*2. K.S.Subramanya Sastri –"**Maya Matam**" -Thanjavur Maharaja Sarjoji saraswathil Mahal Library -Thanjavur-1966.*
*3. Stella Kramresh –"**The Hindu Temple"** Vol.1 & II Motital Banarsidass Publishers Pvt. Ltd., Delhi -1994.*

*4. Bruno Dagens –"**Mayamatam",** Vol.1 & IIIGNCA and Motilal Bamarsidars, .Publishers Pvt. Ltd-s Delhi -1994.*
*5. George Birdsall –"**Feng Shui: The Key Concepts**" -January 2011*

COURSE OUTCOMES:

The students are able to

CO 1: Obtain exposure on various concepts of vastu

CO 2: Understand the theories in Vastu.

CO 3: Familiarize with the Cosmogram and settlement concepts of vastu

CO 4: Understand the role of vasthu in energy flow manifestation in living beings.

CO 5: Plan a structure considering various vastu techniques.

COURSE ARTICULATION MATRIX:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	***H***										
CO2	***H***										
CO3	***H***										
CO4	***H***								***M***		
CO5	***M***				***M***						

L – Low, M – Moderate (Medium), H- High

18SEOE02 - PLANNING OF SMART CITIES
(Common to All Branches)

Category: OE

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVE:
To have an exposure on development of smart cities considering various fields related and their challenges.

UNIT- I SMART CITIES DEVELOPMENT POTENTIALS AND CHALLENGES (9)
Perspectives of Smart Cities: Introduction and Overview - Implementation Challenges - Methodological issues - Spatial distribution of start up cities – Re imagining post industrial cities - Implementation Challenges for Establishing Smart Urban Information and Knowledge Management System

UNIT- II ROLE OF ICT, REMOTE SENSING, AND GEOGRAPHICAL INFORMATION SYSTEM (9)
Optimising Green Spaces for Sustainable Urban Planning - 3D City Models for Extracting Urban Environmental Quality Indicators - Assessing the Rainwater Harvesting Potential - The Strategic Role of Green Spaces - Monitoring Urban Expansion

UNIT- III ENVIRONMENT, ENERGY, DISASTER MANAGEMENT AND SUSTAINABLE DEVELOPMENT (9)
Alternatives for Energy Stressed Cities - Social Acceptability of Energy-Efficient Lighting - Energy Management - Urban Dynamics and Resource Consumption - Issues and Challenges of Sustainable Tourism - Green Buildings: Eco-friendly Technique for Modern Cities

UNIT- IV MULTIFARIOUS MANAGEMENT FOR SMART CITIES (9)
An Assessment of Domestic Water Use Practices - An Issue of Governance in Urban Water Supply - Assessment of Water Consumption at Urban Household Level - Water Sustainability - Socio-economic Determinants and Reproductive Healthcare System - Problems and Development of Slums.

UNIT- V INTELLIGENT TRANSPORT SYSTEM (9)
Introduction to Intelligent Transportation Systems (ITS)- The Range of ITS Applications - Network Optimization-Sensing Traffic using Virtual Detectors- In-Vehicle Routing, and Personal route information-The Smart Car-Commercial Routing and Delivery-Electronic Toll Collection-The Smart Card-Dynamic Assignment- Traffic Enforcement. Urban Mobility and Economic Development

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCE BOOKS:

1. *Poonam Sharma, Swati Rajput, "**Sustainable Smart Cities in India_ Challenges and Future Perspectives Springe"r** 2017 Co.(P) Ltd. 2013*
2. *Ivan Nunes Da Silva, Rogerio Andrade Flauzino-**Smart Cities Technologies**-ExLi4EvA (2016)*

3. *Stan McClellan, Jesus A. Jimenez, George Koutitas (eds.)-**Smart Cities_ Applications, Technologies, Standards, and Driving Factors**-Springer International Publishing (2018)*
4. *Stan Geertman, Joseph Ferreira, Jr., Robert Goodspeed, John Stillwell, "**Planning Support Systems and Smart Cities**" , Springer, 2015*

COURSE OUTCOME:

CO 1: Identify the potential and challenges in smart city development.
CO 2: Apply the different tools for sustainable urban planning.
CO 3: Understand the concepts of environment, energy and disaster management.
CO 4: Identify the proper methods for water and waste water management.
CO 5: Familiarize with the intelligent transport systems.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1											
CO2											
CO3									***M***	***M***	
CO4						***M***					
CO5	***L***	***H***				***L***					

L – Low, M – Moderate (Medium), H- High

18SEOE03 - GREEN BUILDING

(Common to All Branches)

Category: OE

L	T	P	C
3	0	0	3

PRE-REQUISITES: NIL

COURSE OBJECTIVE:

- *To introduce the different concepts of sustainable design and green building techniques and how they may be synthesized to best fit a specific construction project.*

UNIT- I - INTRODUCTION (9)

Life Cycle impacts of materials and products – sustainable design concepts – strategies of Design for the Environment -The sun-earth relationship and the energy balance on the earth's surface, climate, wind – Solar radiation and solar temperature – Sun shading and solar radiation on surfaces – Energy impact on the shape and orientation of buildings – Thermal properties of building materials.

UNIT- II - ENERGY EFFICIENT BUILDINGS (9)

Passive cooling and day lighting – Active solar and photovoltaic- Building energy analysis methods- Building energy simulation- Building energy efficiency standards- Lighting system design- Lighting economics and aesthetics- Impacts of lighting efficiency – Energy audit and energy targeting- Technological options for energy management.

UNIT- III - INDOOR ENVIRONMENTAL QUALITY MANAGEMENT (9)

Psychrometry- Comfort conditions- Thermal comfort- Ventilation and air quality-Air conditioning requirement- Visual perception- Illumination requirement- Auditory requirement- Energy management options- -Air conditioning systems- Energy conservation in pumps- Fans and blowers- Refrigerating machines- Heat rejection equipment- Energy efficient motors- Insulation.

UNIT- IV - GREEN BUILDING CONCEPTS (9)

Green building concept- Green building rating tools- Leeds and IGBC codes. – Material selection Embodied energy- Operating energy- Façade systems- Ventilation systems- Transportation- Water treatment systems- Water efficiency- Building economics

UNIT- V - GREEN BUILDING DESIGN CASE STUDY (9)

Students to work through a controlled process of analysis and design to produce drawings and models of their own personal green building project. Topics include building form, orientation and site considerations; conservation measures; energy modeling; heating system and fuel choices; renewable energy systems; material choices; and construction budget-Case Study on green construction and design.

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCE BOOKS:

1. *Kibert, C. "**Sustainable Construction: Green Building Design and Delivery**", John Wiley & Sons, 2005*
2. *Edward G Pita, "**An Energy Approach- Air-conditioning Principles and Systems**", Pearson Education, 2003.*
3. *Colin Porteous, "**The New Eco-Architecture**", Spon Press, 2002.*
4. *Energy Conservation Building Codes: www.bee-india.nic.in*
5. *Lever More G J, "**Building Energy Management Systems**", E and FN Spon, London, 2000.*
6. *Ganesan T P, "**Energy Conservation in Buildings**", ISTE Professional Center, Chennai, 1999.*
7. *John Littler and Randall Thomas, "**Design with Energy: The Conservation and Use of Energy in Buildings**", Cambridge University Press, 1984.*

COURSE OUTCOMES:

The students are able to

CO 1: Describe the concepts of sustainable design
CO 2: Familiarize with green building techniques including energy efficiency management.
CO 3: Understand the indoor environmental quality management in green building.
CO 4: Perform the green building rating using various tools.
CO 5: Create drawings and models of their own personal green building project.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	***L***										
CO2					***M***	***M***					
CO3						***M***					
CO4						***M***					
CO5	***M***								***L***	***M***	***M***

L – Low, M – Moderate (Medium), H- High

18EEOE04 - ENVIRONMENT, HEALTH AND SAFETY IN INDUSTRIES
(Common to All Branches)

Category : OE

L	T	P	C
3	0	0	3

PREREQUISITES : NIL

COURSE OBJECTIVES:

On completion of this course the students are able to:

1. *Get knowledge about occupational health hazard and safety measures at work place*
2. *Learn about accident prevention and safety management*
3. *Learn about general safety measures in industries*

UNIT- I OCCUPATIONAL HEALTH AND HAZARDS (8)

Occupation, Health and Hazards - Safety Health and Management: Occupational Health Hazards - Ergonomics - Importance of Industrial Safety Radiation and Industrial Hazards : Types and effects - Vibration - Industrial Hygiene - Different air pollutants in industries and their effects Electrical, fire and Other Hazards - General causes, Machine Guards and its types, Automation.

UNIT- II SAFETY A WORKPLACE (10)

Safety at Workplace - Safe use of Machines and Tools: Safety in use of different types of unit operations - Ergonomics of Machine guarding - working in different workplaces - Operation, Inspection and maintenance Plant Design and Housekeeping, Industrial lighting, Vibration and Noise.

UNIT- III ACCIDENT PREVENTION (9)

Accident Prevention Techniques - Principles of accident prevention - Definitions, Theories, Principles - Hazard identification and analysis, Event tree analysis, Hazop studies, Job safety analysis - Theories and Principles of Accident causation - First Aid : Body structure and functions - Fracture and Dislocation, Injuries to various body parts.

UNIT- IV SAFETY MANAGEMENT (9)

Safety Management System and Law - Legislative measures in Industrial Safety: Various acts involved in Detail- Occupational safety, Health and Environment Management : Bureau of Indian Standards on Health and Safety, 14489, 15001 - OSHA, Process safety management (PSM) and its principles - EPA standards- Safety Management : Organisational & Safety Committee - its structure and functions.

UNIT- V GENERAL SAFETY MEASURES (9)

Plant Layout for Safety -design and location, distance between hazardous units, lighting, colour coding, pilot plant studies, Housekeeping - Accidents Related with Maintenance of Machines - Work Permit System : Significance of Documentation Directing Safety : Definition, Process, Principles and Techniques Leadership : Role, function and attribution of a leader Case studies - involving implementation of health and safety measures in Industries.

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total 45 Periods

REFERENCE BOOKS :

1. ***R.K. Jain and Sunil S. Rao, Industrial safety, Health and Environment Management, Khanna publishers, New Delhi (2006).***
2. ***Frank P. Lees - Loss of Prevention in Process Industries, Vol 1 and 2, Butterworth - Heinamann Ltd., London (1991)***
3. ***Industrial Safety - National Council of India***
4. ***Factories Act with Amendments 1987, Govt. of India Publications DGFASLI, Mumbai***

COURSE OUTCOMES:

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

CO1 : *Gain the knowledge about occupational health hazard and safety measures at work place*

CO2 : *Be Able to learn about accident prevention and safety management*

CO3 : *Understand occupational health hazards and general safety measures in industries*

CO4 : *Got to know various laws, standards and legislations.*

CO5 : *Able to learn about safety and proper management of industries*

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	L	M		H			L		H	H	L
CO2	H	H	M	H			L		M	H	H
CO3	H	H		M			L		L	M	M
CO4							L		L	L	L
CO5							L		L	L	L

L-Low, M-Moderate(Medium), H-High

18EEOE05 - CLIMATE CHANGE AND ADAPTATION

(Common to All Branches)

Category : OE

L	T	P	C
3	0	0	3

PREREQUISITES : NIL

COURSE OBJECTIVES:

On completion of this course the students are able to:

1. *Able get knowledge about Climate system and its changes and causes*
2. *Able to learn about impacts, adaptation and mitigation of climate change*
3. *Able to learn about clean technology and clean energy*

UNIT- I EARTH'S CLIMATE SYSTEM (09)

Introduction-Climate in the spotlight - The Earth's Climate Machine – Climate Classification - Global Wind Systems – Trade Winds and the Hadley Cell – The Westerlies - Cloud Formation and Monsoon Rains – Storms and Hurricanes - The Hydrological Cycle – Global Ocean Circulation – El Nino and its Effect - Solar Radiation – The Earth's Natural Green House Effect – Green House Gases and Global Warming – Carbon Cycle.

UNIT- II OBSERVED CHANGES AND ITS CAUSES (09)

Observation of Climate Change – Changes in patterns of temperature, precipitation and sea level rise – Observed effects of Climate Changes – Patterns of Large Scale Variability – Drivers of Climate Change – Climate Sensitivity and Feedbacks – The Montreal Protocol – UNFCCC – IPCC – Evidences of Changes in Climate and Environment – on a Global Scale and in India – climate change modeling.

UNIT- III IMPACTS OF CLIMATE CHANGE (09)

Impacts of Climate Change on various sectors – Agriculture, Forestry and Ecosystem – Water Resources – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions – Uncertainties in the Projected Impacts of Climate Change – Risk of Irreversible Changes.

UNIT- IV CLIMATE CHANGE ADAPTATION AND MITIGATION MEASURES (09)

Adaptation Strategy/Options in various sectors – Water – Agriculture –- Infrastructure and Settlement including coastal zones – Human Health – Tourism – Transport – Energy – Key Mitigation Technologies and Practices – Energy Supply – Transport – Buildings – Industry – Agriculture – Forestry - Carbon sequestration – Carbon capture and storage (CCS) - Waste (MSW & Bio waste, Biomedical, Industrial waste – International and Regional cooperation.

UNIT- V CLEAN TECHNOLOGY AND ENERGY (09)

Clean Development Mechanism – Carbon Trading - examples of future Clean Technology – Biodiesel – Natural Compost – Eco- Friendly Plastic – Alternate Energy – Hydrogen – Bio-fuels – Solar Energy – Wind – Hydroelectric Power – Mitigation Efforts in India and Adaptation funding.

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total 45 Periods

REFERENCE BOOKS:

1. *Jan C. van Dam, **Impacts of Climate Change and Climate Variability on Hydrological Regimes**, Cambridge University Press, 2003.*
2. *IPCC fourth assessment report - The AR4 synthesis report, 2007*
3. *IPCC fourth assessment report –Working Group I Report, " **The physical Science Basis**", 2007*
4. *IPCC fourth assessment report - Working Group II Report, **" Impacts, Adaptation and Vulnerability**", 2007*
5. *IPCC fourth assessment report – Working Group III Report" **Mitigation of Climate change**", 2007*
6. *Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds., '**Climate Change and Water'**. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 2008.*
7. *Dash Sushil Kumar, "**Climate Change – An Indian Perspective**", Cambridge University Press India Pvt. Ltd, 2007.*

COURSE OUTCOMES:

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

CO1: *To understand the climatic system and the factors influencing the climatic changes*

CO2: *To assess the uncertainty and impact of climatic changes*

CO3 : *To develop strategies for adaptation and mitigation of climatic changes*

CO4 : *To identify clean technologies for sustainable growth*

CO5: *To identify clean technologies for sustainable growth*

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M			M			H		L	M	M
CO2	M			M			M		L	L	M
CO3	M			M			H		L	M	M
CO4	M	M	M	H	M	M	L	M	M	L	M
CO5	M			M			M		L	L	L

L-Low, M-Moderate(Medium), H-High

18EEOE06 - WASTE TO ENERGY

(Common to All Branches)

Category: OE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

On completion of this course the students are able to:

Able to get knowledge about the utilization of waste and its purpose.

UNIT- I INTRODUCTION (09)

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

UNIT- II BIOMASS PYROLYSIS (09)

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods -Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

UNIT- III BIOMASS GASIFICATION (09)

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- IV BIOMASS COMBUSTION (09)

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- V BIOGAS (09)

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 - 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

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total 45 Periods

REFERENCE BOOKS:

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, Tata McGraw 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.*

COURSE OUTCOMES:

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

CO1: *Understand solid waste management techniques*
CO2: *Know what is biomass*
CO3 : *Study Methods and factors considered for biomass gasification*
CO4 : *Know equipment meant for biomass combustion*
CO5 : *Understand about biogas and its development in India*

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M			M			H		L	L	L
CO2	M			M			H		L	L	L
CO3	M			M			H		L	L	L
CO4	M		M	M			H		L	L	L
CO5	M			M			H		L	L	L

L-Low, M-Moderate(Medium), H-High

18GEOE07 - ENERGY IN BUILT ENVIRONMENT
(Common to All Branches)

Category : OE

L	T	P	C
3	0	0	3

PREREQUISITES : NIL

COURSE OBJECTIVES:

On completion of this course students are able to:

1. *About energy use and its management*
2. *Understand constructional requirements of buildings*
3. *Know relationship of energy and environment*

UNIT- I INTRODUCTION (09)

Indoor activities and environmental control - Internal and external factors on energy use - Characteristics of energy use and its management -Macro aspect of energy use in dwellings and its implications - Thermal comfort - Ventilation and air quality - Air-conditioning requirement - Visual perception - Illumination requirement - Auditory requirement

UNIT- II LIGHTING REQUIREMENTS IN BUILDING (09)

The sun-earth relationship - Climate, wind, solar radiation and temperature - Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings – Lighting and daylighting: Characteristics and estimation, methods of day-lighting – Architectural considerations for day-lighting

UNIT- III ENERGY REQUIREMENTS IN BUILDING (09)

Steady and unsteady heat transfer through wall and glazed window - Standards for thermal performance of building envelope - Evaluation of the overall thermal transfer - Thermal gain and net heat gain - End-use energy requirements - Status of energy use in buildings - Estimation of energy use in a building

UNIT- IV ENERGY AUDIT (09)

Energy audit and energy targeting - Technological options for energy management - Natural and forced ventilation – Indoor environment and air quality - Airflow and air pressure on buildings - Flow due to stack effect

UNIT- V COOLING IN BUILT ENVIRONMENT (09)

Passive building architecture – Radiative cooling - Solar cooling techniques - Solar desiccant dehumidification for ventilation - Natural and active cooling with adaptive comfort –Evaporative cooling – Zero energy building concept.

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total 45 Periods

REFERENCE BOOKS:

1. *J. Krieder and A. Rabl (2000),* ***Heating and Cooling of Buildings: Design for Efficiency,****McGraw-Hill.*
2. *S. M. Guinnes and Reynolds (1989),* ***Mechanical and Electrical Equipment for Buildings****,Wiley.*
3. *A. Shaw (1991),* ***Energy Design for Architects****, AEE Energy Books.*
4. *ASHRAE (2001),* ***Handbook of Fundamentals****, ASHRAE, Atlanta, GA.*
5. *Reference Manuals of DOE-2 (1990), Orlando Lawrence-Berkeley Laboratory,University of California, and Blast, University of Illinois, USA.*

COURSE OUTCOMES:

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

CO1: *Understand energy and its usage*
CO2: *To know lighting to be given to a building*
CO3 : *To study energy requirements in a building*
CO4 : *Understand energy audit*
CO5 : *To study architectural specifications of a building.*

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M			M			M		L	L	L
CO2	M			M			M		L	L	L
CO3	M			M			M		L	L	L
CO4	M			M		M	M		L	L	L
CO5	M			M			M		L	L	L

L-Low, M-Moderate(Medium), H-High

18GEOE08 - EARTH AND ITS ENVIRONMENT
(Common to All Branches)

Category: OE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE

To know about the planet earth, the geosystems and the resources like ground water and air and to learn about the Environmental Assessment and sustainability.

UNIT- I -EVOLUTION OF EARTH (09)

Evolution of earth as habitable planet - Evolution of continents - oceans and landforms - evolution of life through geological times - Exploring the earth's interior - thermal and chemical structure - origin of gravitational and magnetic fields.

UNIT- II-GEOSYSTEMS (09)

Plate tectonics - working and shaping the earth - Internal Geosystems – earthquakes – volcanoes - climatic excursions through time - Basic Geological processes - igneous, sedimentation - metamorphic processes.

UNIT-III-GROUND WATER GEOLOGY (09)

Geology of groundwater occurrence - recharge process - Groundwater movement - Groundwater discharge and catchment hydrology - Groundwater as a resource - Natural groundwater quality and contamination - Modeling and managing groundwater systems.

UNIT-IV- ENVIRONMENTAL ASSESMENT AND SUSTAINABILITY (09)

Engineering and sustainable development - population and urbanization - toxic chemicals and finite resources - water scarcity and conflict - Environmental risk - risk assessment and characterization - hazard assessment - exposure assessment.

UNIT-V-AIR AND SOLID WASTE (09)

Air resources engineering - introduction to atmospheric composition – behaviour - atmospheric photochemistry - Solid waste management – characterization - management concepts.

Lecture: 45 periods Tutorial:0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCE BOOKS:

1. John *Grotzinger and Thomas H. Jordan,* ***Understanding Earth****, Sixth Edition, W. H. Freeman, 2010.*

2. Younger, P. L., ***Groundwater in the Environment: An introduction****, Blackwell Publishing, 2007.*

3. Mihelcic, J. R., Zimmerman, J. B., ***Environmental Engineering: Fundamentals, Sustainability and Design,*** *Wiley, NJ,* 2010.

COURSE OUTCOMES

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

CO1: Know about evolution of earth and the structure of the earth.

CO2: Understand the internal Geosystems like earthquakes and volcanoes and the various geological processes.

CO3:Understand the geological process of occurrence and movement of groundwater and the modeling systems.

CO4: Assess the Environmental risks and the sustainability developments.

CO5: Learn about the photochemistry of atmosphere and the solid waste management concepts.

COURSE ARTICULATION MATRIX:

	PO1	***PO2***	***PO3***	***PO4***	***PO5***	***PO6***	***PO7***	***PO8***	***PO9***	***PO10***	***PO11***
CO1	***L***			***M***	***M***			***H***	***H***		
CO2	***H***		***H***	***H***		***H***					
CO3	***M***						***H***			***M***	
CO4		***M***			***L***		***H***	***H***	***H***		***H***
CO5	***M***	***M***		***L***				***H***			

L-Low, M-Moderate(Medium), H-High

18GEOE09 - NATURAL HAZARDS AND MITIGATION
(Common to All Branches)

Category: OE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE

To get idea about the various natural hazards like Earthquakes, slope stability, floods, droughts and Tsunami and the mitigation measures.

UNIT- I -EARTHQUAKES (09)

Definitions and basic concepts - different kinds of hazards – causes - Geologic Hazards – Earthquakes - causes of earthquakes – effects - plate tectonics - seismic waves - measures of size of earthquakes - earthquake resistant design concepts.

UNIT- II- SLOPE STABILITY (09)

Slope stability and landslides - causes of landslides - principles of stability analysis - remedial and corrective measures for slope stabilization.

UNIT-III- FLOODS (09)

Climatic Hazards – Floods - causes of flooding - regional flood frequency analysis - flood control measures - flood routing - flood forecasting - warning systems.

UNIT- IV-DROUGHTS (09)

Droughts – causes - types of droughts - effects of drought - hazard assessment - decision making - Use of GIS in natural hazard assessment – mitigation - management.

UNIT-V-TSUNAMI (09)

Tsunami – causes – effects – undersea earthquakes – landslides – volcanic eruptions – impact of sea meteorite – remedial measures – precautions – case studies.

Lecture: 45 periods Tutorial:0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCE BOOKS:

1. *Donald Hyndman and David Hyndman, **Natural Hazards and Disasters**, Brooks/Cole Cengage Learning, 2008.*

*2. Edward Bryant, **Natural Hazards**, Cambridge University Press, 2005.*

*3. J Michael Duncan and Stephan G Wright, **Soil Strength and Slope Stability**, John Wiley & Sons, Inc, 2005.*

*4. Amr S Elnashai and Luigi Di Sarno, **Fundamentals of Earthquake Engineering,** John Wiley & Sons, Inc, 2008*

COURSE OUTCOMES

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

CO1: Understand the basic concepts of earthquakes and the design concepts of earthquake resistant buildings.

CO2: Acquire knowledge about the causes and remedial measures of slope stabilization.

CO3: Gain knowledge about the causes and control measures of flood.

CO4: Understand the types, causes and mitigation of droughts.

CO5: Know the causes, effects and precautionary measures of Tsunami.

COURSE ARTICULATION MATRIX:

	PO1	***PO2***	***PO3***	***PO4***	***PO5***	***PO6***	***PO7***	***PO8***	***PO9***	***PO10***	***PO11***
CO1	***H***	***M***	***H***			***H***		***M***		***H***	***M***
CO2	***H***			***H***	***H***		***L***		***M***	***H***	***M***
CO3	***H***		***H***				***M***			***H***	***M***
CO4	***H***		***M***		***L***					***H***	***M***
CO5	***H***				***L***		***M***			***H***	***M***

L-Low, M-Moderate(Medium), H-High

18EDOE10 - BUSINESS ANALYTICS
(Common to All Branches)

Category: OE

L	T	P	C
3	0	0	3

PREREQUISTES :NIL

COURSE OBJECTIVE:

- *Understand the role of business analytics within an organization.*
- *Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.*

UNIT- I BUSINESS ANALYTICS AND PROCESS (9)

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, 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 REGRESSION ANALYSIS (9)

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 STRUCTURE OF BUSINESS ANALYTICS (9)

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 (9)

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- VDECISION ANALYSIS AND RECENT TRENDS IN BUSINESS ANALYTICS (9)

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Recent Trends: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism

Lecture : 45 Periods Tutorial : 0 Periods Practical : 0 Periods Total : 45 Periods

Reference:

1. *Marc J. Schniederjans, Dara G.Schniederjans, Christopher M. Starkey***"Business analytics Principles, Concepts, and Applications"**, Pearson FT Press.

2. PurbaHalady Rao,2013"Business Analytics: An application focus", **PHI Learning Pvt. Ltd..**

3.***R.N.Prasad, Seema Acharya,2011"Fundamentals of Business Analytics ", Persons Education.***

4.*James Evans***"Business Analytics"**, Persons Education.

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: *Students will demonstrate knowledge of data analytics.*

CO2: *Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.*

CO3: *Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.*

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	L	L	L	L	M	L	-	L	M	-	L
CO2	-	H	L	L	L	L	-	-	L	-	-
CO3	L	L	-	-	L	-	L	M	L	-	L

L-Low, M-Moderate (Medium), H-High

18EDOE11-COST MANAGEMENT OF ENGINEERING PROJECTS
(Common to All Branches)

Category: OE

L	T	P	C
3	0	0	3

PREREQUISTES :NIL

COURSE OBJECTIVE :

- *To be familiar with cost management and project planning.*
- *To acquire knowledge of decision making, price strategies and total quality management tools.*

UNIT- I INTRODUCTION TO COST MANAGEMENT (9)

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 PLANNING ACTIVITIES (9)

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 ANALYSIS (9)

Cost Behavior 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.

UNIT- IV PRICING STRATEGIES AND BUDGETORY CONTROL (9)

Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing, Costing of service sector, Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

UNIT- V TQM AND OPERATIONS REASEARCH TOOLS (9)

Total Quality Management and Theory of constraints, Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

Lecture : 45 Periods Tutorial : 0 Periods Practical : 0 Periods Total : 45 Periods

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. Ashish K. Bhattacharya, **Principles & Practices of Cost Accounting** *A. H. Wheeler publisher.*

5. N.D. Vohra, **Quantitative Techniques in Management**, *Tata McGraw Hill Book Co. Ltd.*

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1:*Understanding methods concepts of cost management.*

CO2:*Developing the skills for project planning.*

CO3:*Evaluating the cost behavior and profit.*

COURSE ARTICULATION MATRIX

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	L	L	L	L	M	L	L	-	L
CO2	-	L	L	M	L	L	M	L	L	-	L
CO3	L	-	L	-	-	-	H	-	L	L	L

L-Low, M-Moderate (Medium), H-High

18EDOE12-INTRODUCTION TO INDUSTRIAL ENGINEERING
(Common to All Branches)

Category: OE

L	T	P	C
3	0	0	3

PREREQUISTES :NIL

COURSE OBJECTIVE :

- *The objective of this course is to provide foundation in Industrial Engineering in order to enable the students to make significant contributions for improvements in different organisations.*

UNIT- I INTRODUCTION (9)

Concepts of Industrial Engineering – History and development of Industrial Engineering – Roles of Industrial Engineer – Applications of Industrial Engineering – Production Management Vs Industrial Engineering – Operations Management – Production System – Input Output Model – Productivity – Factors affecting Productivity – Increasing Productivity of resources – Kinds of Productivity measures.

UNIT- II PLANT LOCATION AND LAYOUT (9)

Factors affecting Plant location – Objectives of Plant Layout – Principles of Plant Layout – Types of Plant Layout – Methods of Plant and Facility Layout – Storage Space requirements – Plant Layout procedure – Line Balancing methods.

UNIT- III WORK SYSTEM DESIGN (9)

Need – Objectives – Method Study procedure – Principles of Motion Economy – Work Measurement procedures – Work Measurement techniques.

UNIT- IV STATISTICAL QUALITY CONTROL (9)

Definition and Concepts – Fundamentals – Control Charts for variables – Control Charts for attributes – Sampling Inspection – Sampling Plans – Sampling Plans.

UNIT- V PRODUCTION PLANNING AND CONTROL (9)

Forecasting – Qualitative and Quantitative forecasting techniques – Types of production – Process planning – Economic Batch Quantity – Tool control – Loading – Scheduling and control of production – Dispatching–Progress control.

Lecture : 45 Periods Tutorial : 0 Periods Practical : 0 Periods Total : 45 Periods

References:

*1.O.P.Khanna, 2010**, Industrial Engineering and Management,** Dhanpat Rai Publications.*
*2.Ravi Shankar, 2009**, Industrial Engineering and Management,** Galgotia Publications & Private*
Limited.
*3. Martand Telsang,2006**, Industrial Engineering and Production Management,** S. Chand and Company.*
*4. M.I. Khan,2004**, Industrial Engineering and Production Management,** New Age International..*

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1:*Understanding thefunctioning of various kinds of Industries.*

CO2:*Developing the knowledge in plant location layout and work system design.*

CO3:*Evaluating the cost optimization in industries.*

COURSE ARTICULATION MATRIX

	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	-	-	L	L	L	L	L	L	M
CO2	L	L	L	L	L	L	-	-	L	H	M
CO3	L	L	-	-	-	-	H	-	-	L	-

L-Low, M-Moderate (Medium), H-High

18MFOE13 INDUSTRIAL SAFETY
(Common to All Branches)

Category: OE

PREREQUISITES: NIL

L	*T*	*P*	*C*
3	*0*	*0*	*3*

COURSE OBJECTIVES:

- *To be familiar with industrial safety equipments and techniques.*
- *To acquire practical knowledge of maintenance techniques available in industry.*

UNIT –I INDUSTRIAL SAFETY **(9)**

Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT –II FUNDAMENTALS OF MAINTENANCE ENGINEERING **(9)**

Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT –III WEAR AND CORROSION **(9)**

.Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT –IV FAULT TRACING **(9)**

Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, i. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT –V PERIODIC AND PREVENTIVE MAINTENANCE **(9)**

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance.

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

References:

*1. Higgins & Morrow **"Maintenance Engineering Handbook",** Da Information Services, 2008*

*2. H.P.Garg **"Maintenance Engineering"**, S. Chand and Company, 2010.*

*3. Audels **"Pump-hydraulic Compressors",** Mcgrew Hill Publication, 1943.*

*4. Winterkorn, Hans **"Foundation Engineering Handbook"**, Chapman & Hall London, 1975.*

COURSE OUTCOMES :

On completion of this course, students will be able to

***CO1:** Understand types of industrial safety equipments and techniques available.*

***CO2:** Acquire practical knowledge of maintenance techniques available in industry.*

***CO3:** Acquire knowledge on fault tracing techniques in industrial safety.*

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	M	L	L	L	-	L	L	-	M	M	L
CO 2	M	H	M	L	L	L	L	-	L	H	M
CO 3	H	H	H	L	-	L	M	-	M	L	-

L – Low, M – Moderate (Medium), H – High

18MFOE14 OPERATIONS RESEARCH
(Common to All Branches)

Category: OE

PREREQUISITES: NIL

L	*T*	*P*	*C*
3	*0*	*0*	*3*

COURSE OBJECTIVE :

- *To familiarize students with the basic concepts, models and statements of the operations research theory.*

UNIT- I INTRODUCTION **(9)**

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

UNIT- II LINEAR PROGRAMMING PROBLEM **(9)**

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

(9)

UNIT-III NON LINEAR PROGRAMMING PROBLEM

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

(9)

UNIT -IV SEQUENCING AND INVENTORY MODEL

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT -V GAME THEORY **(9)**

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

Contact Periods:

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

References:

*1. H.A. Taha **"Operations Research, An Introduction"**, PHI, 2008*

*2. H.M. Wagner **"Principles of Operations Research"**, PHI, Delhi, 1982.*

*3. J.C. Pant **"Introduction to Optimisation: Operations Research"**, Jain Brothers, Delhi, 2008*

*4. Hitler Libermann **"Operations Research"**, McGraw Hill Pub. 2009*

*5. Pannerselvam **"Operations Research"**, Prentice Hall of India 2010*

*6. Harvey M Wagner **"Principles of Operations Research"** Prentice Hall of India 2010*

COURSE OUTCOMES :

On completion of this course, students will be able to

CO1: *Apply basic theoretical principles in optimization and formulate the optimization models.*

CO2: *Develop mathematical skills to analyse and solve integer programming, network models arising from a wide range of industrial applications.*

CO3: *Implement optimization techniques in engineering problems.*

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	H	H	H	L	H	L	M	-	-	L	L
CO 2	H	H	H	L	-	L	L	-	-	L	-
CO 3	L	M	H	L	L	L	-	-	-	L	M

L – Low, M – Moderate (Medium), H – High

18MFOE15 COMPOSITE MATERIALS
(Common to All Branches)

Category: OE

PREREQUISITES: NIL

L	*T*	*P*	*C*
3	*0*	*0*	*3*

COURSE OBJECTIVES :

- *To be familiar with composite materials and their advantages, applications.*
- *To acquire knowledge of reinforcement, manufacturing and strength analysis of composites.*

UNIT- I INTRODUCTION **(9)**

Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT- II REINFORCEMENT **(9)**

Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT- III MANUFACTURING OF METAL MATRIX COMPOSITES **(9)**

Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT-IV MANUFACTURING OF POLYMER MATRIX COMPOSITE **(9)**

Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT-V STRENGTH ANALYSIS OF COMPOSITES **(9)**

Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

References:

1. ***Lubin****, George,* ***"Hand Book of Composite Materials",*** *Springer, 1982.*

*2. K.K.Chawla, "****Composite Materials"****, Springer, 2011*

3. Deborah D.L. Chung ***, "Composite Materials Science and Applications"*** *, Springer, 2010.*

*4. Danial Gay, Suong V. Hoa, and Stephen W.Tasi, "****Composite Materials Design and Applications"****, CRC Press,2002.*

*5. R.W.Cahn, "****Material Science and Technology – Vol 13– Composites",*** *VCH, West Germany, 1996.*

*6. WD Callister, Jr., Adapted by R. Balasubramaniam, "****Materials Science and Engineering, An introduction"****, John Wiley & Sons, NY, Indian edition, 2007.*

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1: *Understand the nature of composite materials and composite reinforcements.*

CO2: *Develop the skills for manufacturing of composites.*

CO3: *Evaluate the strength of composite materials.*

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	H	L	L	M	L	L	-	-	L	-	L
CO 2	L	M	H	L	L	L	-	-	L	L	L
CO 3	M	L	H	M	L	L	-	-	L	L	L

L – Low, M – Moderate (Medium), H – High

18TEOE16 – GLOBAL WARMING SCIENCE
(Common to All Branches)

Category : OE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- *To make the students to learn about the material consequences of climate change, sea level change due to increase in the emission of greenhouse gases and to examine the science behind mitigation and adaptation proposals.*

UNIT- I INTRODUCTION (9)

Terminology relating to atmospheric particles – Aerosols-types, characteristics, measurements – Particle mass spectrometry. Anthropogenic-sources, effects on humans.

UNIT- II CLIMATE MODELS (9)

General climate modeling- Atmospheric general circulation model, Oceanic general circulation model, Sea ice model, Land model concept, Paleo-climate, Weather prediction by Numerical process. Impacts of climate change, Climate Sensitivity, Forcings and feedbacks.

UNIT- III EARTH CARBON CYCLE AND FORECAST (9)

Carbon cycle-process, importance, advantages. Carbon on Earth, Global carbon reservoirs, Interactions between human activities and Carbon cycle. Geologic time scales, Fossil fuels and energy, Perturbed Carbon cycle.

UNIT- IV GREEN HOUSE GASES

Blackbody Radiation, Layer model, Earth's atmospheric composition and Green house gases effects on weather and climate. Radiative equilibrium. Earth's energy balance.

UNIT- V GEO ENGINEERING (9)

Solar mitigation, Strategies – Carbon dioxide removal, solar radiation management, Recent observed trends in global warming for sea level rise, drought, glacier extent.

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCE BOOKS:

1 *Archer, David.* ***GlobalWarming: Understanding the Forecast****, Wiley, 2011*

2 *Budyko,* ***Climate Changes, American Geophysical Society****, Washington, D.C.,244 pp.*

3 *Bodansky,* ***May we engineer the climate?****Clim. Change 33, 309-321.*

4 *Dickinson,* ***Climate Engineering-A review of aerosol approaches to changing the global energy*** *balance, Clim. Change 33, 279-290.*

5 *Climate Change 2007-****The Physical Science Basis: Working Group I Contribution to the Fourth Assessment Report of the IPCC****. Cambridge University Press,2007.*

COURSE OUTCOMES:

On completion of this course, the students will be able to:

CO1: *Understand the current warming in relation to climate changes throughout the Earth.*
CO2: *Assess the best predictions of current climate models.*
CO3: *Able to know about current issues, including impact from society, environment, economy as well as ecology related to greenhouse gases.*

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	M	L	L	L	L	M	H	M	L	M	L
CO 2	L	L	L	L	L	M	H	M	L	M	L
CO 3	L	L	L	L	L	H	M	M	L	L	L

L – Low, M – Moderate (Medium), H – High

18TEOE17 – INTRODUCTION TO NANO ELECTRONICS
(Common to All Branches)

Category : OE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- *To make the students to provide strong, essential, important methods and foundations of quantum mechanics and apply quantum mechanics on engineering fields.*

UNIT- I INTRODUCTION **L(9)**

Particles and Waves, Operators in quantum mechanics, The Postulates of Quantum Mechanics, The Schrodinger Equation Values and Wave Packet Solutions, Ehrenfest's Theorem.

UNIT- II ELECTRONIC STRUCTURE AND MOTION **(9)**

Atoms- The Hydrogen Atom, Many-Electron Atoms, Many-Electron Atoms.Pseudopotentials, Nuclear Structure, Molecules, Crystals. Translational motion – Penetration through barriers – Particle in a box. Two Terminal Quantum Dot Devices, Two Terminal Quantum Wire Devices.

UNIT- III SCATTERING THEORY **(9)**

The formulation of scattering events- scattering cross section, stationary scattering state. Partial wave stationary scattering events, Multi-channel scattering, Solution for Schrodinger Equation- radial and wave equation, Greens' function.

UNIT- IV CLASSICAL STATISTICS

Probabilities and microscopic behaviors, Kinetic theory and transport processes in gases, Magnetic properties of materials, The partition function.

UNIT- V QUANTUM STATISTICS

Statistical mechanics- Basic Concepts, Statistical models applied to metals and semiconductors. The thermal properties of solids- The electrical properties of materials. Black body radiation, Low temperatures and degenerate systems.

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCE BOOKS:

1. *Peter L. Hagelstein, Stephen D. Senturia, and Terry P. Orlando,* ***Introductory Applilied Quantum Statistical Mechanics****, Wiley (2004).*
2. *A. F. J. Levi,* ***Applied Quantum Mechanics*** *(2nd Edition), Cambridge (2006).*
3. *Walter A Harrison,* ***Applied Quantum Mechanics****, Stanfor University (2008).*
4. *Richard Liboff,* ***Introductory Quantum Mechanics****, 4th edition, Addison Wesley (2003).*
5. *P.W. Atkins and R.S. Friedman,* ***Molecular Quantum Mechanics*** *Oxford University Press, 3rd edition 1997.*

COURSE OUTCOMES:

On completion of this course, students will be able to:

CO1: *The student should be familiar with certain nanoelectronic systems and building blocks*

such as: low-dimensional semiconductors, hetero structures.

CO2: *The student should be able to set up and solve the Scfrödinger equation for different types*

of potentials in one dimension as well as in 2 or 3 dimensions for specific cases.

CO3: *Potentially be able to join a research group in nanoscience / nanotechnology as a student*

researcher.

COURSE ARTICULATION MATRIX:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO	M	M	L	M	L	M	L	L	L	L	L
CO	M	M	L	M	L	M	L	L	L	L	L
CO	M	M	L	M	L	H	L	L	L	L	L

L – Low, M – Moderate (Medium), H – High

18TEOE18 – GREEN SUPPLY CHAIN MANAGEMENT
(Common to All Branches)

Category : OE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

- *To make the students to learn and focus on the fundamental strategies, tools and techniques required to analyze and design environmentally sustainable supply chain systems.*

UNIT- I INTRODUCTION (9)

Logistics – aim, activities, importance, progress, current trends. Integrating logistics with an organization.

UNIT- II ESSENTIALS OF SUPPLY CHAIN MANAGEMENT (9)

Basic concepts of supply chain management, Supply chain operations – Planning and sourcing, Making and delivering. Supply chain coordination and use of Technology. Developing supply chain systems.

UNIT- III PLANNING THE SUPPLY CHAIN (9)

Types of decisions – strategic, tactical, operational. Logistics strategies, implementing the strategy. Planning resources – types, capacity, schedule, controlling material flow, measuring and improving performance.

UNIT- IV ACTIVITIES IN THE SUPPLY CHAIN

Procurement – cycle, types of purchase. Inventory management – EOQ, uncertain demand and safety stock, stock control. Material handling – purpose of warehouse and ownership, layout, packaging. Transport – mode, ownership, routing vehicles.

UNIT- V SUPPLY CHAIN MANAGEMENT STRATEGIES

Five key configuration components, Four criteria of a good supply chain strategies, Next generation strategies- New roles for end to end supply chain management. Evolution of supply chain organization.

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCE BOOKS:

1 *Rogers,Dale., and Ronald Tibben-Lembke."**An Examination of Reverse Logistics Practices."** Journal of Business Logistics 22, no. 2 (2001) : 129-48.*

2 *Guide, V., Kumar Neeraj, et al. "**cellular Telephone Reuse: The ReCellular Inc. Case."** Managing Closed-Loop Supply Chains. Case: Part 6, (2005): 151-156.*

3 *Mark, K. "**Whirlpool Corrporation: Reverse Logistics."** Richard Ivey School of Business. Case: 9B11D001, August 8, 2011.*

4 *Porter, Michael E., and Mark R. Kramer. "**Strategy and Society: The Link between Competitive Advantage and Corporate Social Responsibility."** Harvard Business Revies 84, no. 12 (2006): 78-92.*

5 *Shoshnah Cohen, Josep Roussel, "**Strategic Supply Chain Management",** the five disciplines for top performance, McGraw-Hill, (2005.)*

COURSE OUTCOMES:

On completion of this course, students will be able to:

***CO1:** Evaluate complex qualitative and quantitative data to support strategic and operational decisions.*

***CO2:** Develop self-leadership strategies to enhance personal and professional effectiveness.*

***CO3:** The importance of the design and redesign of a supply chain as key components of an organization's strategic plan.*

COURSE ARTICULATION MATRIX

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
CO 1	M	L	L	L	L	H	L	M	L	L	L
CO 2	M	L	L	L	L	H	L	M	L	L	L
CO 3	M	L	L	L	L	H	L	M	L	L	L

L – Low, M – Moderate (Medium), H – High

18PSOE19 **DISTRIBUTION AUTOMATION SYSTEM**
(Common to all Branches)

Category: OE

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE:

To study about the distributed automation and economic evaluation schemes of power network

UNIT-I INTRODUCTION (09)

Introduction to Distribution Automation (DA) - Control system interfaces- Control and data requirements- Centralized (vs) decentralized control- DA system-DA hardware-DAS software.

UNIT-II DISTRIBUTION AUTOMATION FUNCTIONS (09)

DA capabilities - Automation system computer facilities- Management processes- Information management- System reliability management- System efficiency management- Voltage management- Load management.

UNIT-III COMMUNICATION SYSTEMS (09)

Communication requirements - reliability- Cost effectiveness- Data requirements- Two way capability- Communication during outages and faults - Ease of operation and maintenance- Conforming to the architecture of flow. Distribution line carrier- Ripple control-Zero crossing technique- Telephone, cableTV, radio, AM broadcast, FM SCA,VHF radio, microwave satellite, fiber optics-Hybrid communication systems used in field tests.

UNIT-IV ECONOMIC EVALUATION METHODS (09)

Development and evaluation of alternate plans- select study area – Select study period- Project load growth-Develop alternatives- Calculate operating and maintenance costs-Evaluate alternatives.

UNIT-V ECONOMIC COMPARISON (09)

Economic comparison of alternate plans-Classification of expenses - capital expenditures-Comparison of revenue requirements of alternative plans-Book life and continuing plant analysis- Year by year revenue requirement analysis, Short term analysis- End of study adjustment-Break even analysis, sensitivity analysis - Computational aids.

CONTACT PERIODS:

Lecture: 45 Periods **Tutorial: 0 Periods** **Practical: 0 Periods** **Total: 45 Periods**

REFERENCE BOOKS:

1. *IEEE Tutorial course "**Distribution Automation**", IEEE Working Group on Distribution Automation, IEEE Power Engineering Society. Power Engineering Education Committee, IEEE Power Engineering Society. Transmission and Distribution Committee, Institute of Electrical and Electronics Engineers, 1988*
2. *Maurizio Di Paolo Emilio, "**Data Acquisition Systems: From Fundamentals to Applied Design**", Springer Science & Business Media, 21-Mar-2013*
3. *Taub, "**Principles Of Communication Systems**", Tata McGraw-Hill Education, 07-Sep-2008*
4. *M.K. Khedkar, G.M. Dhole, "**A Textbook of Electric Power Distribution Automation**", Laxmi Publications, Ltd., 2010.*

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

***CO1:** Analyse the requirements of distributed automation*
***CO2:** Know the functions of distributed automation*
***CO3:** Perform detailed analysis of communication systems for distributed automation.*
***CO4:** Study the economic evaluation method*
***CO5:** Understand the comparison of alternate plans*

COURSE ARTICULATION MATRIX:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	M	M	M	L	M	L	L	L	L	L
CO2	H	H	L	L	L	L	L	L	L	L	L
CO3	M	L	M	L	L	L	L	L	L	L	L
CO4	M	M	M	L	L	L	L	L	L	L	L
CO5	M	M	M	L	L	L	M	M	L	L	L

L – Low, M – Moderate (Medium), H- High

18PSOE20 POWER QUALITY ASSESSMENT AND MITIGATION Category : OE
(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE:

To identify, analyze and create solutions for the power quality problems in power system networks.

UNIT-I : INTRODUCTION (09)

Importance of power quality - Terms and definitions as per IEEE std.1159 for transients, short and long duration voltage variations, interruptions, short and long voltage fluctuations, imbalance, flickers - Symptoms of poor power quality- Definitions and terminology of grounding- Purpose of groundings- Good grounding practices - problems due to poor grounding.

UNIT-II : FLICKERS AND TRANSIENT VOLTAGES (09)

RMS voltage variations in power system, complex power, voltage regulation and per unit system - Basic power flow and voltage drop - Devices for voltage regulation and impact of reactive power management - Causes and effects of voltage flicker - Short term and long term flickers -Methods to reduce flickers- Transient over voltages, impulsive transients, switching transients - Effect of surge impedance and line termination - control of transient voltages.

UNIT-III : VOLTAGE INTERRUPTIONS (09)

Definitions -Voltage sags versus interruptions - Economic impact, Major causes and consequences -characteristics, assessment, Influence of fault location and fault level on voltage sag - Areas of vulnerability, Assessment of equipment sensitivity, Voltage sag limits for computer equipment- CBEMA, ITIC, SEMI F 42curves, Report of voltage sag analysis, Voltage sag indices, Mitigation measures for voltage sag- DSTATCOM, UPQC,UPS, DVR, SMEs, CVT, utility solutions and end user solutions.

UNIT-IV : WAVEFORM DISTORTION (09)

Definition of harmonics, inter-harmonics, sub-harmonics- Causes and effects - Voltage versus current distortion, Fourier analysis, Harmonic indices, A.C. quantities under non-sinusoidal conditions, Triplet harmonics, characteristic and non characteristic harmonics- Series and Parallel resonances- Consequence - Principles for controlling and Reducing harmonic currents in loads, K-rated transformer -Computer tools for harmonic analysis- Locating sources of harmonics, Harmonic filtering- Passive and active filters - Modifying the system frequency response- IEEE Harmonic standard 519-1992.

UNIT-V : ANALYSIS AND CONVENTIONAL MITIGATION METHODS (09)

Analysis of power outages, Analysis of unbalance condition: Symmetrical components in phasor quantities, Instantaneous symmetrical components, Instantaneous real and reactive powers - Analysis of distortion: On–line extraction of fundamental sequence components from measured samples – Harmonic indices – Analysis of voltage sag: Detorit Edison sag score, Voltage sag energy, Voltage Sag Lost Energy Index (VSLEI)- Analysis of voltage flicker, Reduced duration and customer impact of outages, Classical load balancing problem: Open loop balancing, Closed loop balancing, current balancing, Harmonic reduction, Voltage sag reduction.

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCE BOOKS:

1. M. H. J. Bollen, ***"Understanding Power Quality Problems, Voltage Sag and Interruptions",*** *IEEE Press, series on Power Engineering, 2000.*

2. Roger C. Dugan, Mark F. McGranaghan, Surya Santoso and Wayne Beaty H., ***"Electrical Power System Quality"****, Second Edition, McGraw Hill Publication Co., 2008.*

3. G.T.Heydt, ***"Electric Power Quality",*** *Stars in a Circle Publications, 1994(2nd edition).*

*4. Enrique Acha, Manuel Madrigal****, "Power System Harmonics: Computer Modeling and Analysis****", John Wiley and Sons, 2001.*

*5. Arrillaga J. and Watson N****."Power System Harmonics"****2nd edition on; John Willey&sons, 2003*

6. IEEE Std. 519-1992/ IEEE Std. 1159 IEEE recommended practices and requirements for harmonics control in electrical power system.

COURSE OUTCOMES:

CO1: *Acquire knowledge about the power quality issues and standards like IEEE,IEC on voltage, Frequency and harmonics.*

CO2: *Recognize the practical issues in the power system*

CO3: *Analyze the impact of power electronic devices and techniques in power system*

CO4: *Develop trouble shooting skills and innovative remedies for various power quality problems in power system*

COURSE ARTICULATION MATRIX:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	M	M	-	-	-	-	-	-	L
CO2	H	H	H	H	L	L	-	L	L	-	L
CO3	H	H	H	H	M	M	-	-	L	L	-
CO4	H	H	H	M	H	M	M	L	L	L	L

L – Low, M – Moderate (Medium), H- High

18PSOE21 **MODERN AUTOMOTIVE SYSTEMS** **Category : OE**
(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE:

To expose the students with theory and applications of Automotive Electrical and Electronic Systems.

UNIT-I : INTRODUCTION TO MODERN AUTOMOTIVE ELECTRONICS **(08)**

Introduction to modern automotive systems and need for electronics in automobiles- Role of electronics and microcontrollers- Sensors and actuators- Possibilities and challenges in automotive industry- Enabling technologies and industry trends.

UNIT-II : SENSORS AND ACTUATORS **(09)**

Introduction- basic sensor arrangement- Types of sensors- Oxygen sensor, engine crankshaft angular position sensor – Engine cooling water temperature sensor- Engine oil pressure sensor- Fuel metering- vehicle speed sensor and detonation sensor- Pressure Sensor- Linear and angle sensors- Flow sensor- Temperature and humidity sensors- Gas sensor- Speed and Acceleration sensors- Knock sensor- Torque sensor- Yaw rate sensor- Tyre Pressure sensor- Actuators - Stepper motors – Relays.

UNIT-III : POWER TRAIN CONTROL SYSTEMS IN AUTOMOBILE **(09)**

Electronic Transmission Control - Digital engine control system: Open loop and close loop control systems- Engine cooling and warm up control- Acceleration- Detonation and idle speed control - Exhaust emission control engineering- Onboard diagnostics- Future automotive power train systems.

UNIT-IV : SAFETY, COMFORT AND CONVENIENCE SYSTEMS **(10)**

Cruise Control- Anti-lock Braking Control- Traction and Stability control- Airbag control system- Suspension control- Steering control- HVAC Control.

UNIT-V : ELECTRONIC CONTROL UNITS (ECU) **(09)**

Need for ECUs- Advances in ECUs for automotives - Design complexities of ECUs- V-Model for Automotive ECU‘s- Architecture of an advanced microcontroller (XC166 Family, 32-bit Tricore) used in the design of automobile ECUs- On chip peripherals, protocol interfaces, analog and digital interfaces.

CONTACT PERIODS:

Lecture: 45 Periods Tutorial: 0 Periods Practical: 0 Periods Total: 45 Periods

REFERENCE BOOKS:

1. M. H. J. Bollen, ***"Understanding Power Quality Problems, Voltage Sag and Interruptions",*** *IEEE Press, series on Power Engineering, 2000.*

2. Roger C. Dugan, Mark F. McGranaghan, Surya Santoso and Wayne Beaty H., ***"Electrical Power SystemQuality"****, Second Edition, McGraw Hill Publication Co., 2008.*

3. G.T.Heydt, ***"Electric Power Quality",*** *Stars in a Circle Publications, 1994(2nd edition).*

*4. Enrique Acha, Manuel Madrigal****, "Power System Harmonics: Computer Modeling and Analysis****", John Wiley and Sons, 2001.*

*5. Arrillaga J. and Watson N.****"Power System Harmonics"****2nd edition on; John Willey&sons, 2003*

6. IEEE Std. 519-1992/ IEEE Std. 1159 IEEE recommended practices and requirements for harmonics control in electrical power system.

COURSE OUTCOMES:

CO1: *Acquire knowledge about the power quality issues and standards like IEEE,IEC on voltage, Frequency and harmonics.*

CO2: *Recognize the practical issues in the power system*

CO3: *Analyze the impact of power electronic devices and techniques in power system*

CO4: *Develop trouble shooting skills and innovative remedies for various power quality problems in power system*

COURSE ARTICULATION MATRIX:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	M	M	-	-	-	-	-	-	L
CO2	H	H	H	H	L	L	-	L	L	-	L
CO3	H	H	H	H	M	M	-	-	L	L	-
CO4	H	H	H	M	H	M	M	L	L	L	L

L – Low, M – Moderate (Medium), H- High

18PEOE22 **VIRTUAL INSTRUMENTATION** **Category:OE**
(Common to All Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE:

To comprehend the Virtual instrument action programming concepts towards measurements and control.

UNIT-I : INTRODUCTION (07)

Introduction - advantages - Block diagram and architecture of a virtual instrument - Conventional Instruments versus Traditional Instruments - Data-flow techniques, graphical programming in data flow, comparison with conventional programming.

UNIT-II : GRAPHICAL PROGRAMMING AND LabVIEW (09)

Concepts of graphical programming - LabVIEW software - Concept of VIs and sub VI - Display types - Digital - Analog - Chart and Graphs. Loops - structures - Arrays – Clusters- Local and global variables – String - Timers and dialog controls.

UNIT-III : VI MANAGING FILES & DESIGN PATTERNS (11)

High-level and low-level file I/O functions available in LabVIEW – Implementing File I/O functions to read and write data to files – Binary Files – TDMS – sequential programming – State machine programming – Communication between parallel loops –Race conditions – Notifiers & Queues – Producer Consumer design patterns

UNIT-IV : PC BASED DATA ACQUISITION (09)

Introduction to data acquisition on PC, Sampling fundamentals, ADCs, DACs, Calibration, Resolution, - analog inputs and outputs - Single-ended and differential inputs - Digital I/O, counters and timers, DMA, Data acquisition interface requirements - Issues involved in selection of Data acquisition cards - Use of timer-counter and analog outputs on the universal DAQ card.

UNIT-V : DATA ACQUISITION AND SIGNAL CONDITIONING (09)

Components of a DAQ system, Bus, Signal and accuracy consideration when choosing DAQ hardware – Measurement of analog signal with Finite and continuous buffered acquisition- analog output generation – Signal conditioning systems – Synchronizing measurements in single & multiple devices – Power quality analysis using Electrical Power Measurement tool kit.

LECTURE: 45 PERIODS TUTORIAL: 0 PERIODS PRACTICAL: 0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS:

*1. Jeffrey Travis, Jim Kring, **'LabVIEW for Everyone: Graphical Programming Made Easy and Fun (3rd Edition),** Prentice Hall, 2006.*

*2. Sanjeev Gupta, **'Virtual Instrumentation using LabVIEW'** TMH, 2004*

*3. Gary W. Johnson, Richard Jennings, **'Lab-view Graphical Programming'**, McGraw Hill Professional Publishing, 2001*

*4. Robert H. Bishop, **'Learning with Lab-view'**, Prentice Hall, 2003.*

*5. Kevin James, '**PC Interfacing and Data Acquisition: Techniques for Measurement**, Instrumentation and Control', Newness, 2000*

COURSE OUTCOMES:

CO1: *Gain Knowledge of graphical programming techniques using LabVIEW software.*

CO2: *Explore the basics of programming and interfacing using related hardware.*

CO3: *Outline the aspects and utilization of PC based data acquisition and Instrument interfaces.*

CO4: *Create programs and Select proper instrument interface for a specific application.*

COURSE ARTICULATION MATRIX

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	M	-	M	H	-	-	-	-	-	-
CO2	H	H	-	M	H	-	M	-	-	-	L
CO3			H	M	H						L
CO4	H	H	H	M	H	-	-	-	M	-	L

L – Low, M – Moderate (Medium), H- High

18PEOE23 **ENERGY AUDITING** **Category: OE**

(Common to All Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVE:

To Comprehend energy management schemes and perform economic analysis and load management in electrical systems.

UNIT-I : BASICS OF ENERGY MANAGEMENT **(09)**

Energy Scenario – Energy Sector Reforms – Impact on environment – Strategy for future and conservation – Basics of Energy and it forms (Thermal and Electrical). Energy Audit: Need – Types and Methodology - Audit Report – Energy Cost, Benchmarking and Energy performance – System Efficiency. Facility as an energy system – Methods for preparing process flow, Material and energy balance diagrams.

UNIT-II : ACTION PLANNING AND MONITORING **(09)**

Energy Management System – Performance assessment – Goal setting by Manager – Action plan implementation – Financial Management: Investment - Financial analysis techniques, ROI, Risk and sensitivity analysis, role of Energy Service Companies. Project management: Steps in detail. – Energy monitoring and interpretance of variances for remedial actions. Environmental concerns: UNFCC – Kyoto protocol – COP – CDM – PCF – Sustainable development.

UNIT-III : STUDY OF THERMAL UTILITIES **(09)**

Combustion of Oil, Coal and Gas – Performance Evaluation of Boilers – Boiler blow down – Boiler water treatment – Energy Conservation Opportunity – Cogeneration: Principal – Options - Classification – Influencing Factors and technical parameters. Waste heat recovery: Classification – application – benefits - Different heat recovery devices.

UNIT-IV : STUDY OF ELECTRICAL UTILITIES **(09)**

Electricity Billing – Electricity load management – Motor efficiency and tests – Energy efficient motors – Factors affecting motor efficiency and loss minimization – Motor load survey. Lighting System: Types and features – recommended luminance levels – Lighting system energy efficiency study – Energy Efficient Technologies: Maximum demand controllers – Intelligent PF controllers – Soft starters and VFDs – Variable torque load uses – Energy efficient transformers, Light controllers and Electronic ballasts.

UNIT-V : ENERGY ASSESSMENT IN UTILITY SYSTEMS **(09)**

Performing Financial analysis: Fixed and variable costs – Payback period – methods – factors affecting analysis – Waste Minimization Techniques: Classification – Methodology. Performance assessment of HVAC Systems: Measurements, Procedure – Evaluation. Assessment of Pumps: Measurements, Procedure – Evaluation.

LECTURE: 45 PERIODS TUTORIAL: 0 PERIODS PRACTICAL: 0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS:

1. *Murphy W.R. and G.Mckay Butter worth , "**Energy Management**", Heinemann Publications.*
2. *Paul o' Callaghan, **"Energy Management",** Mc-Graw Hill Book Company – 1st edition; 1998.*
3. *John.C.Andreas, **"Energy Efficient Electric Motors",** Marcel Dekker Inc Ltd – 2nd edition; 1995.*
4. *W.C.Turner, **"Energy Management Handbook",** John Wiley and Sons, Fifth edition, 2009.*
5. ***"Energy Management and Good Lighting Practice: fuel efficiency**" – booklet 12 – EEO.*
6. *www.em-ea.org/gbook1.asp*

COURSE OUTCOMES:

***CO1:** Possess knowledge on energy management.*

***CO2:** Analyze the feature of energy audit methodology and documentation of report.*

***CO3:** Able to plan energy management action and develop the understanding of implementation.*

***CO4:** Familiarize with thermal utilities.*

***CO5:** Familiarize with electrical utilities.*

***CO6:** Perform assessment of different systems.*

COURSE ARTICULATION MATRIX:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	-	M	L	L	-	M	M	L	-	M
CO2	-	-	M	L	L	-	M	M	L	-	M
CO3	-	-	M	L	-	-	M	M	L	-	M
CO4	-	-	M	-	-	-	M	-	L	-	M
CO5	-	-	M	-	-	-	M	-	L	-	M
CO6	-	-	M	-	-	-	M	-	L	-	M

L – Low, M – Moderate (Medium), H- High

18PEOE24 **ADVANCED ENERGY STORAGE TECHNOLOGY** **Category : OE**

(Common to All Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: NIL

COURSE OBJECTIVES:

To explore the fundamentals, technologies and applications of energy storage.

UNIT-I : ENERGY STORAGE: HISTORICAL PERSPECTIVE, INTRODUCTION AND CHANGES (09)

Storage Needs- Variations in Energy Demand- Variations in Energy Supply- Interruptions in Energy Supply- Transmission Congestion - Demand for Portable Energy-Demand and scale requirements - Environmental and sustainability issues.

UNIT-II : TECHNICAL METHODS OF STORAGE (09)

Introduction: Energy and Energy Transformations, Potential energy (pumped hydro, compressed air, springs)- Kinetic energy (mechanical flywheels)- Thermal energy without phase change passive (adobe) and active (water)-Thermal energy with phase change (ice, molten salts, steam)- Chemical energy (hydrogen, methane, gasoline, coal, oil)- Electrochemical energy (batteries, fuel cells)- Electrostatic energy (capacitors), Electromagnetic energy (superconducting magnets)- Different Types of Energy Storage Systems.

UNIT-III: PERFORMANCE FACTORS OF ENERGY STORAGE SYSTEMS (09)

Energy capture rate and efficiency- Discharge rate and efficiency- Dispatch ability and load flowing characteristics, scale flexibility, durability – Cycle lifetime, mass and safety – Risks of fire, explosion, toxicity- Ease of materials, recycling and recovery- Environmental consideration and recycling , Merits and demerits of different types of Storage.

UNIT-IV : APPLICATION CONSIDERATION (09)

Comparing Storage Technologies- Technology options- Performance factors and metrics- Efficiency of Energy Systems- Energy Recovery - Battery Storage System: Introduction with focus on Lead Acid and Lithium- Chemistry of Battery Operation, Power storage calculations, Reversible reactions, Charging patterns, Battery Management systems, System Performance, Areas of Application of Energy Storage: Waste heat recovery, Solar energy storage, Green house heating, Power plant applications, Drying and heating for process industries, energy storage in automotive applications in hybrid and electric vehicles.

UNIT-V : HYDROGEN FUEL CELLS AND FLOW BATTERIES (09)

Hydrogen Economy and Generation Techniques, Storage of Hydrogen, Energy generation - Super capacitors: properties, power calculations – Operation and Design methods - Hybrid Energy Storage: Managing peak and Continuous power needs, options - Level 1: (Hybrid Power generation) Bacitor "Battery + Capacitor" Combinations: need, operation and Merits; Level 2: (Hybrid Power Generation) Bacitor + Fuel Cell or Flow Battery operation-Applications: Storage for Hybrid Electric Vehicles, Regenerative Power, capturing methods.

LECTURE: 45 PERIODS TUTORIAL: 0 PERIODS PRACTICAL: 0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS:

1. *DetlefStolten,**"Hydrogen and Fuel Cells: Fundamentals, Technologies and Applications"**, Wiley,2010.*
2. *Jiujun Zhang, Lei Zhang,Hansan Liu, Andy Sun, Ru-Shi Liu**, "Electrochemical Technologies for Energy Storage and Conversion",** John Wiley and Sons, 2012.*
3. *Francois Beguin and ElzbietaFrackowiak ,**"Super capacitors"**, Wiley, 2013.*
4. *Doughty Liaw, Narayan and Srinivasan, **"Batteries for Renewable Energy Storage"**, The Electrochemical Society, New Jersy,2010.*

COURSE OUTCOMES:

***CO1:** Recollect the historical perspective and technical methods of energy storage.*

***CO2:** Learn the basics of different storage methods.*

***CO3:** Determine the performance factors of energy storage systems.*

***CO4:** Identify applications for renewable energy systems.*

***CO5:** Understand the basics of Hydrogen cell and flow batteries.*

COURSE ARTICULATION MATRIX:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	L	-	-	-	-	-	-	L	-	-
CO2	L	M	M	-	-	-	-	-	L	-	-
CO3	-	-	M	L	-	M	-	-	L	-	-
CO4	L	L	M	L	-	-	-	-	L	-	-
CO5	L	M	L	L	-	-	-	-	L	-	-

L – Low, M – Moderate (Medium), H- High

18AEOE25 DESIGN OF DIGITAL SYSTEMS **Category : OE**

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES*: Nil*

COURSE OBJECTIVES:

- *Design synchronous and asynchronous sequential circuits*
- *Develop VHDL code for digital circuits*
- *Implementation in PLDs*
- *Fault diagnosis*

UNIT- I SYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN **(9)**

Analysis of Clocked Synchronous Sequential Circuits - Modeling, state table reduction, state assignment, Design of Synchronous Sequential Networks, Design of iterative circuits - ASM chart - ASM realization.

UNIT- II ASYNCHRONOUS SEQUENTIAL CIRCUIT DESIGN **(9)**

Analysis of Asynchronous Sequential Circuits - Races in ASC – Primitive Flow Table - Flow Table Reduction Techniques, State Assignment Problem and the Transition Table – Design of ASC – Static and Dynamic Hazards – Essential Hazards – Data Synchronizers.

UNIT- III SYSTEM DESIGN USING PLDS **(9)**

Basic concepts – Programming Technologies - Programmable Logic Element (PLE) - Programmable Array Logic (PLA) - Programmable Array Logic (PAL) –Design of combinational and sequential circuits using PLDs – Complex PLDs (CPLDs)

UNIT- IV INTRODUCTION TO VHDL **(9)**

Design flow - Software tools – VHDL: Data Objects - Data types - Operators – Entities and Architectures – Components and Configurations – Signal Assignment –Concurrent and Sequential statements — Behavioral, Data flow and Structural modeling – Transport and Inertial delays – Delta delays - Attributes – Generics – Packages and Libraries

UNIT- V LOGIC CIRCUIT TESTING AND TESTABLE DESIGN **(9)**

Digital logic circuit testing - Fault models - Combinational logic circuit testing - Sequential logic circuit testing-Design for Testability - Built-in Self-test, Board and System Level Boundary Scan. Case Study: Traffic Light Controller

LECTURE: 45 PERIODS TUTORIAL: 0 PERIODS PRACTICAL: 0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS:

*1. Donald G. Givone, "**Digital principles and Design**", Tata McGraw Hill, 2002.*

*2. Nelson, V.P., Nagale, H.T., Carroll, B.D., and Irwin, J.D., "**Digital Logic Circuit Analysis and Design**", Prentice Hall International, Inc., New Jersey, 1995*

*3. Volnei A. Pedroni, "**Circuit Design with VHDL**", PHI Learning, 2011.*

*4. Parag K Lala, "**Digital Circuit Testing and Testability**", Academic Press, 1997*

*5. Charles H Roth, "**Digital Systems Design Using VHDL**," Cencage 2nd Edition 2012.*

*6. Nripendra N Biswas "**Logic Design Theory**" Prentice Hall of India,2001*

COURSE OUTCOMES:

Upon completion of the course the students will be able to:

CO1: Design synchronous and asynchronous sequential circuits based on specifications
CO2: Develop algorithm and VHDL code for design of digital circuits
CO3: Illustrate digital design implementation on PLDs .

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	M	-	H	-	-	-	-	-	-	-
CO2	-	-	M	M	-	-	-	-	-	-	-
CO3	L	M	-	-	H	-	-	-	-	-	-

L-LOW M-MEDIUM H-HIGH

18AEOE26 ADVANCED PROCESSORS
(Common to all Branches)

Category : OE

L	T	P	C
3	0	0	3

PREREQUISITES*: Nil*

COURSE OBJECTIVES:

- *To introduce the basics of CISC and RISC*
- *Describe the architectural features of Pentium processors*
- *Describe ARM and Special processors*

UNIT- I MICROPROCESSOR ARCHITECTURE **(9)**

Instruction set – Data formats – Instruction formats – Addressing modes – Memory hierarchy – register file – Cache – Virtual memory and paging – Segmentation – Pipelining – The instruction pipeline – pipeline hazards – Instruction level parallelism – reduced instruction set – Computer principles – RISC versus CISC – RISC properties – RISC evaluation.

UNIT- II HIGH PERFORMANCE CISC ARCHITECTURE –PENTIUM **(9)**

The software model – functional description – CPU pin descriptions – Addressing modes – Processor flags – Instruction set – Bus operations – Super scalar architecture – Pipe lining – Branch prediction – The instruction and caches – Floating point unit– Programming the Pentium processor.

UNIT- III HIGH PERFORMANCE CISC ARCHITECTURE – PENTIUM INTERFACE **(9)**

Protected mode operation – Segmentation – paging – Protection – multitasking – Exception and interrupts - Input /Output – Virtual 8086 model – Interrupt processing.

UNIT- IV HIGH PERFORMANCE RISC ARCHITECTURE: ARM **(9)**

ARM architecture – ARM assembly language program – ARM organization and implementation – ARM instruction set - Thumb instruction set.

UNIT- V SPECIAL PURPOSE PROCESSORS **(9)**

Altera Cyclone Processor – Audio codec – Video codec design – Platforms – General purpose processor – Digital signal processor – Embedded processor – Media Processor – Video signal Processor – Custom Hardware – Co-Processor.

LECTURE: 45 PERIODS TUTORIAL: 0 PERIODS PRACTICAL: 0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS:

1. *Daniel Tabak, "**Advanced Microprocessors**", McGraw Hill. Inc., 2011.*
2. *James L. Antonakos, "**The Pentium Microprocessor**", Pearson Education, 1997.*
3. *Steve Furber, "**ARM System –On –Chip architecture**",Addison Wesley, 2009.*
4. *Gene .H. Miller, "**Micro Computer Engineering**", Pearson Education, 2003.*

*5. Barry. B. Brey, "**The Intel Microprocessors Architecture, Programming and Interfacing**",PHI, 2008.*

*6. Valvano, "**Embedded Microcomputer Systems**" Cencage Learing India Pvt Ltd, 2011.*

*7. Iain E.G.Richardson, "**Video codec design**", John Wiley & sons Ltd, U.K, 2002.*

COURSE OUTCOMES:

Upon completion of the course the students will be able to:

CO1: Distinguish between RISC and CISC generic architectures.

CO2: Describe the architectural features of Pentium processors

CO3: Develop simple applications using ARM processors

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**M**	**H**	**-**	**-**	**M**	**-**	**-**	**-**	**-**	**-**	**-**
CO2	**H**	**-**	**M**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CO3	**-**	**M**	**H**	**M**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

L-LOW M-MEDIUM H-HIGH

Category : OE

18AEOE27 PATTERN RECOGNITION	**L**	**T**	**P**	**C**
(Common to all Branches)	**3**	**0**	**0**	**3**

PREREQUISITES: Nil

***COURSE OBJECTIVES*:**

- *To get knowledge in pattern recognition in computer vision techniques*
- *To get knowledge in structural pattern methods*
- *To get knowledge on neural networks and fuzzy systems.*

UNIT- I PATTERN CLASSIFIER (9)

Overview of pattern recognition -Discriminant functions-Supervised learning –Parametric estimation- Maximum likelihood estimation –Bayesian parameter estimation- Perceptron algorithm-LMSE algorithm – Problems with Bayes approach –Pattern classification by distance functions-Minimum distance pattern classifier.

UNIT- II UNSUPERVISED CLASSIFICATION (9)

Clustering for unsupervised learning and classification - Clustering concept-C-means algorithm-Hierarchical clustering procedures- Graph theoretic approach to pattern clustering - Validity of clustering solutions.

UNIT- III STRUCTURAL PATTERN RECOGNITION (9)

Elements of formal grammars-String generation as pattern description - recognition of syntactic description- Parsing-Stochastic grammars and applications - Graph based structural representation.

UNIT- IV FEATURE EXTRACTION AND SELECTION (9)

Entropy minimization – Karhunen - Loeve transformation-feature selection through functions approximation- Binary feature selection.

UNIT- V NEURAL NETWORKS (9)

Neural network structures for Pattern Recognition –Neural network based Pattern associators-Unsupervised learning in neural Pattern Recognition-Self organizing networks-Fuzzy logic-Fuzzy classifiers-Pattern classification using Genetic Algorithms.

LECTURE: 45 PERIODS TUTORIAL: 0 PERIODS PRACTICAL: 0 PERIODS TOTAL: 45 PERIODS

REFERENCE BOOKS:

*1. R. O Duda, P.E Hart and Stork, "**Pattern Classification**", Wiley, 2012.*

*2. Robert J. Sehalkoff, "**Pattern Recognition: Statistical, Structural and Neural Approaches**", JohnWiley & Sons Inc., 2007.*

*3. Tou & Gonzales, "**Pattern Recognition Principles**", Wesley Publication Company, 2000.*

*4. Morton Nadier and P. Eric Smith, "**Pattern Recognition Engineering**", John Wiley & Sons, 2000.*

COURSE OUTCOMES:

Upon completion of the course, the students will have:

CO1: Apply parametric estimation and supervised learning techniques for pattern classification

CO2: Describe the structural pattern recognition methods

CO3: Apply neural networks, fuzzy systems and Genetic algorithms to pattern recognition and classification.

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	-	M	-	M	-	-	-	-	-	-	-
CO2	-	-	H	-	-	-	-	-	-	-	-
CO3	M	L	-	M	M	-	-	-	-	-	-

L-LOW M-MEDIUM H-HIGH

Category : OE

18VLOE28 VLSI DESIGN	**L**	**T**	**P**	**C**
(Common to all Branches)	**3**	**0**	**0**	**3**

PREREQUISITES*: Nil*

COURSE OBJECTIVES

- *To gain knowledge on MOS and CMOS Circuits with its characterization*
- *To design CMOS logic and sub-system*
- *To understand low power CMOS VLSI Design*

UNIT- I INTRODUCTION TO MOS CIRCUITS (9)

MOS Transistor Theory -Introduction MOS Device Design Equations -MOS Transistor as a Switches - Pass Transistor - CMOS Transmission Gate -Complementary CMOS Inverter - Static Load MOS Inverters - Inverters with NMOS loads - Differential Inverter - Tri State Inverter - BiCMOS Inverter.

UNIT- II CIRCUIT CHARACTERIZATION AND PERFORMANCE ESTIMATION (9)

Delay Estimation, Logical Effort and Transistor Sizing, Power Dissipation, Sizing Routing Conductors, Charge Sharing, Design Margin and Reliability.

UNIT- III CMOS CIRCUIT AND LOGIC DESIGN (9)

CMOS Logic Gate Design, Physical Design of CMOS Gate, Designing with Transmission Gates, CMOS Logic Structures, Clocking Strategies, I/O Structures.

UNIT- IV CMOS SUB SYSTEM DESIGN (9)

Data Path Operations - Addition/Subtraction, Parity Generators, Comparators, Zero/One Detectors, Binary Counters, ALUs, Multipliers, Shifters, Memory Elements, Control-FSM, Control Logic Implementation.

UNIT- V LOW POWER CMOS VLSI DESIGN (9)

Introduction to Low Power Design, Power Dissipation in FET Devices, Power Dissipation in CMOS, Low-Power Design through Voltage Scaling – VTCMOS Circuits, MTCMOS Circuits, Architectural Level Approach – Pipelining and Parallel Processing Approaches, Low Power Basics CMOS Gate and Adder Design.

LECTURE : 45 PERIODS TUTORIAL : 0 PERIODS PRACTICAL : 0 PERIODS TOTAL : 45 PERIODS

REFERENCE BOOKS:

1. *Sung Ms Kang, Yusuf Lablebici, "**CMOS Digital Integrated Circuits: Analysis & Design**", Tata Mc-Graw Hill, 2011.*
2. *N. Weste and K. Eshranghian, "**Principles of CMOS VLSI Design**", Addison Wesley, 1998.*
3. *Neil H.E. Weste, David Harris, Ayan Banerjee,"**CMOS VLSI Design:A Circuits and Systems Perspective** ", 2013, Pearson Education*
4. *Kiat-Seng Yeo, Kaushik Roy, "**Low-Voltage, Low-Power VLSI Subsystems**" – McGraw-Hill Professional, 2004.*
5. *Gary K. Yeap,"**Practical Low Power Digital VLSI Design**", Kluwer Academic Press, 2002.*
6. *Jan M. Rabaey,"**Digital Integrated Circuits: A Design Perspective**",Pearson Education, 2003.*

COURSE OUTCOMES:

After completing this course, the students will have:

- *CO1: Knowledge on MOS and CMOS Circuits with its characterization*
- *CO2: An ability to design CMOS logic and sub-system*
- *CO3: An understanding of low power CMOS VLSI Design*

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**H**	**L**	**M**	**-**	**L**	**-**	**-**	**-**	**M**	**-**	**-**
CO2	**H**	**L**	**M**	**-**	**L**	**-**	**-**	**-**	**M**	**-**	**-**
CO3	**H**	**L**	**M**	**-**	**L**	**-**	**-**	**-**	**M**	**-**	**-**

L-LOW M-MEDIUM H-HIGH

Category : OE

18VLOE29 ANALOG & MIXED MODE VLSI CIRCUITS
(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

- *To acquire knowledge on MOS circuit configuration and CMOS amplifier*
- *To analyze and design Operational amplifier*
- *To understand mixed signal circuits*

UNIT- I MOS CIRCUIT CONFIGURATION (9)

Basic CMOS Circuits - Basic Gain Stage - Gain Boosting Techniques - Super MOS Transistor - Primitive Analog Cells, Current Source, Sinks and References MOS Diode/Active resistor, Simple current sinks and mirror, Basic current mirrors, Advance current mirror, Current and Voltage references, Bandgap references.

UNIT- II CMOS AMPLIFIER (9)

CMOS Amplifier Performances matrices of amplifier circuits, Common source amplifier, Common gate amplifier, Cascode amplifier, Frequency response of amplifiers and stability of amplifier.

UNIT- III CMOS DIFFERENTIAL AMPLIFIER (9)

CMOS Differential Amplifier Differential signalling, source coupled pair, Current source load, Common mode rejection ratio, CMOS Differential amplifier with current mirror load, Differential to single ended conversion. Linear Voltage - Current Converters - CMOS, Bipolar and Low – Voltage BiCMOS Op - Amp Design - Instrumentation Amplifier Design.

UNIT- IV BICMOS CIRCUIT TECHNIQUES AND CURRENT-MODE SIGNAL PROCESSING (9)

Basic BiCMOS Circuit Techniques, Current - Mode Signal Processing: Continuous - Time Signal Processing – Sampled - Data Signal Processing – Switched - Current Data Converters.

UNIT- V ANALOG FILTERS AND A/D CONVERTERS (9)

Sampled - Data Analog Filters, Over Sampled A/D Converters and Analog Integrated Sensors: First - order and Second SC Circuits - Bilinear Transformation – Cascade Design – Switched - Capacitor Ladder Filter

LECTURE : 45 PERIODS TUTORIAL : 0 PERIODS PRACTICAL : 0 PERIODS TOTAL : 45 PERIODS

REFERENCE BOOKS:

1. *Behzad Razavi,* ***Design of Analog CMOS Integrated circuits****, Tata McGraw Hill Education, 2002.*
2. *Mohammed Ismail, Terri Fiez,* ***Analog VLSI signal and Information Processing****, McGraw- Hill International Editons, 1994.*
3. *R. Jacob Baker, Harry W. Li, and David E. Boyce, CMOS:* ***Circuit Design , Layout and Simulation****, Prentice Hall of India, 1997.*
4. *David A. Johns and Ken Martin,* ***Analog Integrated circuit Design****, John Wiley & Son, 2013*
5. *Greogorian and Tames,* ***Analog Integrated Circuit for Switched Capacitor Circuits****, John Wiley & Sons Inc., 4th Edition, 1986.*

COURSE OUTCOMES:

Upon completion of this course, the students will have:

CO1: Knowledge on MOS circuit configuration and CMOS amplifier

CO2: To analyze and design Operational amplifier

CO3: An understanding on mixed signal circuits

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**H**	**-**	**L**	**-**	**-**	**-**	**-**	**-**	**M**	**L**	**-**
CO2	**H**	**-**	**L**	**-**	**-**	**-**	**-**	**-**	**M**	**L**	**-**
CO3	**H**	**-**	**L**	**-**	**-**	**-**	**-**	**-**	**M**	**L**	**-**

L-LOW M-MEDIUM H-HIGH

Category : OE

18VLOE30 HARDWARE DESCRIPTION LANGUAGES

(Common to all Branches)

L	T	P	C
3	0	0	3

PREREQUISITES*: Nil*

COURSE OBJECTIVES

- *To gain knowledge on HDLs and Modeling styles*
- *To understand the VHDL and Verilog HDL.*
- *To design sub-systems USING VHDL/VERILOG*

UNIT- I BASIC CONCEPTS OF HARDWARE DESCRIPTION LANGUAGES (9)

VLSI Design flow, Features of VHDL, Capabilities, Hierarchy, Syntax and Semantics of VHDL; Basic Language Elements - Data objects - Variable signal, and constant, Data types, Operators and signal assignments, Design Suits - Entities, architecture declaration, configurations, Packages.

UNIT- II MODELING STYLES (VHDL) (9)

Behavioral Modeling - Process statement, Sequential assignment statements, Loops, wait statement, assertion statement, Delay Model – Inertial delay Model, Transport delay model; Gate Level Modeling – Component instantiation statements; Data flow Modeling - Concurrent assignment statement, Conditional assignment statements, Procedures, functions, Generics, attributes, Model simulation - Writing a test bench, Logic Synthesis.

UNIT- III INTRODUCTION TO VERILOG HARDWARE DESCRIPTION LANGUAGE (9)

Key features, Capabilities, Language Constructs and Conventions in Verilog, Syntax and Semantics of Verilog; Basic Language Elements: Operators, nets, registers, vectors, arrays, parameters, system tasks, complier directives, Module, port connection rules.

UNIT- IV MODELING STYLES (VERILOG) (9)

Gate Level Modeling - Gate types, Gate delays; Dataflow Modeling – continuous assignment, Behavioral Modeling - Initial & Always Construct, Assignments with Delays, wait construct, Multiple always blocks, If and if - else, assign, Loop Construct, Sequential and Parallel blocks, Switch level modeling - MOS switches, CMOS switches.

UNIT- V DESIGN SUB-SYSTEMS USING VHDL/VERILOG (9)

Combinational logics – Adder, Subtractor, Decoders, Encoders, Multiplexer, code Converter; Flip flop, state machines – Mealy type FSM, Moore type FSM, Counters and Shift register. Synthesis of digital logic circuits.

LECTURE : 45 PERIODS TUTORIAL : 0 PERIODS PRACTICAL : 0 PERIODS TOTAL : 45 PERIODS

REFERENCE BOOKS:

1. *J. Bhaskar, "**A VHDL Primer"**, 3rd Edition, Pearson Education, 2015.*
2. *Douglas Perry, "**VHDL**", McGraw Hill International, New York, 1998.*
3. *S. Brown & Z. Vransesic, "**Fundamental of digital Logic with Verilog design**", Tata McGraw Hill, 2002.*
4. *S. Palnitkar, "**Verilog HDL: A Guide to Digital Design and Synthesis**", Prentice Hall (NJ, USA), 2003.*
5. *Frank Vahid, "**Digital Design**", Wiley, 2006.*
6. *Peter J Ashenden, "**The Designer's Guide to VHDL**", Morgan Kaufmann Publishers, 2008.*
7. *Navabi, "**VHDL Analysis & Modeling of digital systems**", McGraw Hill, 1998.*

COURSE OUTCOMES:

After completing this course, the students will have:

- *CO1: Knowledge on HDLs and Modeling styles*
- *CO2: To write the VHDL and Verilog HDL codes*
- *CO3: To design sub-systems USING VHDL/VERILOG*

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**H**	**L**	**H**	**L**	**M**	**-**	**-**	**-**	**M**	**-**	**-**
CO2	**H**	**L**	**H**	**-**	**M**	**-**	**-**	**-**	**M**	**-**	**-**
CO3	**H**	**L**	**H**	**-**	**M**	**-**	**-**	**-**	**M**	**-**	**-**

L-LOW M-MEDIUM H-HIGH

18CSOE31 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING
(Common to All Branches)

Category : OE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with:

- *Artificial Intelligence and intelligent agents, history of Artificial Intelligence*
- *Building intelligent agents (search, games, constraint satisfaction problems)*
- *Machine Learning algorithms*
- *Applications of AI (Natural Language Processing, Robotics/Vision)*
- *Solving real AI problems through programming with Python, Tensor Flow and Keras library.*

UNIT- I FOUNDATIONS OF AI L(9)

Introduction - History of Artificial Intelligence - Intelligent Agents - Uninformed Search Strategies - Informed (Heuristic) Search Strategies - Adversarial Search - Constraint Satisfaction Problems.

UNIT- II SUPERVISED AND UNSUPERVISED LEARNING L(9)

Maximum likelihood estimation -Regression -Linear, Multiple, Logistic - bias-variance, Bayes rule, maximum a posteriori inference- Classification techniques - k-NN, naïve Bayes - Decision Trees - Clustering - k-means, hierarchical, high-dimensional- Expectation Maximization.

UNIT-III ENSEMBLE TECHNIQUES AND REINFORCEMENT LEARNING L(9)

Graphical Models - Directed and Undirected Models - Inference - Learning- maximum margin, support vector machines - Boosting and Bagging - Random Forests - PCA and variations - Markov models, hidden Markov models -Reinforcement Learning- introduction - Markov Decision Processes - Value-based methods - Q-learning- Policy-based methods

UNIT- IV DEEP LEARNING L(9)

Neural Network Basics - Deep Neural Networks - Recurrent Neural Networks (RNN) - Deep Learning applied to Images using CNN - Tensor Flow for Neural Networks & Deep Learning

UNIT- V AI APPLICATIONS L(9)

Applications in Computer Vision : Object Detection- Face Recognition - Action and Activity Recognition -Human Pose Estimation.

Natural Language Processing - Statistical NLP and text similarity - Syntax and Parsing techniques - Text Summarization Techniques - Semantics and Generation - Application in NLP - Text Classification -speech Recognition - Machine Translation - Document Summarization - Question Answering

Applications in Robotics : Imitation Learning - Self-Supervised Learning -Assistive and Medical Technologies - Multi-Agent Learning

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. *Peter Norvig and Stuart J. Russell, "**Artificial Intelligence: A Modern Approach**", Third edition*
2. *Tom Mitchell, **"Machine Learning"**, McGraw-Hill, 1997*
3. *Ian Goodfellow, Yoshua Bengio, and Aaron Courvillem, "**Deep Learning**", MIT press, 2016.*
4. *Michael Nielson , **"Neural Networks and Deep Learning"***
5. *Christopher Bishop, **"Pattern Recognition and Machine Learning",** Springer, 2006*
6. *Richard Sutton and Andrew Barto, **Reinforcement Learning: An introduction",** MIT Press,1998*
7. *Kevin P. Murphy, **"Machine Learning: A Probabilistic Perspective"**, MIT Press, 2012.*
8. *Trevor Hastie, Robert Tibshirani, Jerome Friedman, **"The Elements of Statistical Learning"**, Second Edition ,Springer, 2011*

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

CO1: *Develop expertise in popular AI & ML technologies and problem-solving methodologies.* ***[Familiarity]***

CO2: *Use fundamental machine learning techniques, such as regression, clustering, knearest neighbor methods, etc.* ***[Usage]***

CO3: *Distinguish between supervised and unsupervised machine learning methods.* ***[Usage]***

CO4: *Gain knowledge of the different modalities of Deep learning currently used.* ***[Familiarity]***

CO5: *Use popular AI & ML technologies like Python, Tensorflow and Keras todevelop Applications.* ***[Usage]***

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**H**	**H**	**H**	**M**	**H**	**H**			**L**		**M**
CO2	**H**	**M**	**M**	**M**	**M**	**M**			**L**		**M**
CO3	**H**	**H**	**H**	**M**	**H**	**M**			**L**		**L**
CO4	**H**	**H**	**M**	**H**	**M**	**H**			**L**		**L**
CO5	**H**	**H**	**H**	**M**	**H**	**M**			**L**		**L**

L-LOW M-MEDIUM H-HIGH

18CSOE32 COMPUTER NETWORK ENGINEERING
(Common to All Branches)

Category : OE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with:

- *The hardware and software architecture of Computer Networks*
- *The concepts of internetworking*
- *Issues in resource allocation*
- *End-to-end protocols and data transmission*
- *Network management models*

UNIT- I FOUNDATION L(9)

Applications – Requirements – Network Architecture – Implementing Network software – Performance – Perspectives on connecting – Encoding – Framing – Error detection – Reliable transmission – Ethernet and Multiple Access Networks – Wireless.

UNIT- II INTERNETWORKING L(9)

Switching and bridging – IP – Routing – Implementation and Performance – Advanced Internetworking – The Global Internet – Multicast – Multiprotocol and Label Switching – Routing among Mobile devices.

UNIT- III CONGESTION CONTROL AND RESOURCE ALLOCATION L(9)

Issues in Resource allocation – Queuing disciplines – Congestion Control – Congestion avoidance mechanism – Quality of Service.

UNIT- IV END-TO-END PROTCOLS AND DATA L(9)

Simple Demultiplexer – Reliable Byte Stream –Remote Procedure Call – RTP – Presentation formatting - Multimedia data.

UNIT- V NETWORK MANAGEMENT L(9)

SNMPv1 and v2 Organization and information model - Communication model – Functional model - SNMP proxy server- Remote monitoring- RMON1 andRMON2.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. *Larry L. Peterson, Bruce S. Davie, **"Computer Networks a Systems approach"**, Fifth edition, Elsevier, 2011.*
2. *Priscilla Oppenheimer, **"Top-down Network Design: A Systems Analysis Approach to Enterprise Network Design"**, 3rd Edition, Cisco Press, 2010.*
3. *James D. McCabe, Morgan Kaufmann, **"Network Analysis, Architecture, and Design"**, Third Edition, Elsevier, 2007.*
4. *William Stallings, **"SNMP, SNMPv2, SNMPv3, and RMON 1 and 2,"** Third Edition, Pearson Education, 2012*

5 *Mani Subramanian,* ***"Network Management Principles and practice"****, Pearson Education, 2010.*

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

CO1: *Explain the architecture and applications of Computer Networks.* ***[Familiarity]***

CO2: *Analyze the performance of MAC protocols.* ***[Assessment]***

CO3: *Configure switches and Routers.* ***[Assessment]***

CO4: *Design algorithms to ensure congestion control and QOS.* ***[Usage]***

CO5: *Appreciate the performance of End-to-End protocols and data transmission techniques.* ***[Assessment]***

CO6: *Use SNMP and RMON.* ***[Usage]***

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**H**	**M**	**M**	**M**	**M**	**M**			**M**		**M**
CO2	**H**	**H**	**M**	**H**	**M**	**H**			**M**		**M**
CO3	**H**	**H**	**M**	**H**	**M**	**H**			**M**		**M**
CO4	**H**	**H**	**H**	**M**	**H**	**M**			**M**		**M**
CO5	**H**	**H**	**M**	**H**	**M**	**H**	**L**		**M**		**M**
CO6	**H**	**H**	**H**	**M**	**H**	**M**	**L**		**M**		**M**

L-LOW M-MEDIUM H-HIGH

18CSOE33 BIG DATA ANALYTICS
(Common to All Branches)

Category : OE

L	T	P	C
3	0	0	3

PREREQUISITES: Nil

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with:

- *Statistical methods*
- *Bayesian, Support Vector and Kernel Methods*
- *Time Series Analysis and Rule Induction*
- *Neural networks and Fuzzy Logic*
- *Visualization Techniques*

UNIT- I STATISTICAL CONCEPTS AND METHODS L(9)

Statistical Concepts: Probability, Sampling and Sampling Distributions, Statistical Inference, Prediction and Prediction Errors–Resampling- Statistical Method: Linear Models, Regression Modeling, Multivariate Analysis.

UNIT- II BAYESIAN METHODS AND SUPPORT VECTOR AND KERNEL METHODS L(9)

Bayesian Methods: Bayesian Paradigm, modeling, inference and networks – Support Vector and Kernel Methods: Kernel Perceptron, Overfitting and Generalization Bounds, Support Vector Machines, Kernel PCA and CCA.

UNIT- III TIME SERIES ANALYSIS AND RULE INDUCTION L(9)

Analysis of time series: linear systems analysis, nonlinear dynamics, Delay Coordinate Embedding - Rule induction: Propositional Rule Learning, Rule Learning as search, Evaluating quality of rules, Propositional rule induction, First order rules-ILP systems.

UNIT- IV NEURAL NETWORKS AND FUZZY LOGIC L(9)

Neural networks: learning and generalization, competitive learning, principal component analysis and neural networks; Fuzzy logic: extracting fuzzy models from data, fuzzy decision trees.

UNIT- V STOCHASTIC SEARCH METHODS AND VISUALIZATION L(9)

Stochastic Search Methods: Stochastic Search by Simulated Annealing, Adaptive Search by Evolution- Evolution Strategies- Genetic Algorithms & Programming- Visualization : Classification of Visual Data Analysis Techniques, Data Type to be Visualized, Visualization Techniques, Interaction Techniques and Specific Visual Data Analysis Techniques.

Lecture: 45 Periods Tutorial : 0 Periods Practical: 0 Periods Total: 45 Periods

Reference Books

1. *Michael Berthold, David J. Hand,* ***"Intelligent Data Analysis-An Introduction"****, Second Edition, Springer, 2007.*
2. *Bill Franks,* ***"Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with advanced analystics"****, John Wiley & sons, 2012.*
3. *Jimmy Lin and Chris Dyer,* ***"Data Intensive Text Processing using Map Reduce"****, Morgan and Claypool Publishers, 2010.*
4. *Tom White,* ***"Hadoop: The Definitive Guide"****, O`Reilly Publishers, 2012*
5. *David Loshin, "****Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph****", Morgan Kaufmann, 2013.*
6. *Paul Zikopoulos, Chris Eaton, "****Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data****", McGraw-Hill Education, 2011.*

COURSE OUTCOMES:

Upon completion of this course, the students will be able to:

CO1: *Explain the statistical concepts and methods.* ***[Familiarity]***

CO2: *Use Bayesian, support vector and kernel Methods.* ***[Usage]***

CO3: *Perform Time series analysis.* ***[Usage]***

CO4: *Use Rule induction.* ***[Usage]***

CO5: *Apply Neural network and Fuzzy logic.* ***[Usage]***

CO6: *Use Stochastic search methods.* ***[Usage]***

CO7: *Explain Visualization Techniques.* ***[Familiarity]***

COURSE ARTICULATION MATRIX:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	M	M	M	M	M			M		M
CO2	H	H	H	M	H	M			M		M
CO3	H	H	H	M	H	M	L		M	L	M
CO4	H	H	H	M	H	M			M		M
CO5	H	H	H	M	H	M			M		M
CO6	H	H	H	M	H	M	L		M		M
CO7	H	M	M	M	M	M			M	L	M

L-LOW M-MEDIUM H-HIGH

18EDACZ1 - ENGLISH FOR RESEARCH PAPER WRITING
(Common to all Branches)

Category : AC

L	T	P	C
2	0	0	0

PREREQUISITES: Nil

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with:

- *Writing quality research papers in English*

UNIT- I **L(6)**

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT- II **L(6)**

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism

UNIT- III **L(6)**

Sections of a Paper, Abstracts, Introduction, Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

UNIT- IV **L(6)**

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

UNIT- V **L(6)**

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions, useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

LECTURE: 30 PERIODS TUTORIAL: 0 PERIODS PRACTICAL: 0 PERIODS TOTAL: 30 PERIODS

REFERENCE BOOKS:

1 ***Goldbort R (2006) Writing for Science, Yale University Press*** *(available on GoogleBooks).*

2 ***Day R (2006) How to Write and Publish a Scientific Paper****, Cambridge University Press.*

3 ***Highman N (1998), Handbook of Writing for the Mathematical Sciences****, SIAM. Highman's book .*

4 ***Adrian Wallwork , English for Writing Research Papers****, Springer New York Dordrecht Heidelberg London, 2011.*

COURSE OUTCOMES:

Upon completion of this course the students will be able to,

CO1: *Utilize writing skills to write best quality research paper and provide better readability.*

CO2: *Describe each section of a paper with clarity.*

CO3: *Review the papers efficiently.*

CO4: *Utilize the key skills to write title, abstract, introduction and literature review of the paper.*

CO5: *Write the methods, results, Discussion and Conclusion using the required skills and useful phrases.*

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	H	L	L	M			H			
CO2	H	H	L	L	M			H			
CO3	H	H	L	L	M			H			
CO4	H	H	L	L	M			H			
CO5	H	H	L	L	M			H			

L-Low, M-Moderate (Medium), H-High

18EDACZ2 - DISASTER MANAGEMENT
(Common to all Branches)

Category : AC

L	T	P	C
2	0	0	0

PREREQUISITES: Nil

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with:

- *Key concepts in disaster risk reduction.*
- *Types of disasters and hazards.*
- *Disaster prone areas in India.*
- *Strengths and weaknesses of disaster management approaches.*
- *Risk assessment methods.*

UNIT- I INTRODUCTION L(6)

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 L(6)

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 DISASTER PRONE AREAS IN INDIA L(6)

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 AND MANAGEMENT L(6)

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 RISK ASSESSMENT L(6)

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.

LECTURE: 30 PERIODS TUTORIAL: 0 PERIODS PRACTICAL: 0 PERIODS TOTAL: 30 PERIODS

REFERENCE BOOKS:

1. *R. Nishith, Singh AK, "**Disaster Management in India: Perspectives, issues and strategies**" New Royal book Company.*
2. *Sahni, Pardeep Et.Al. (Eds.)," **Disaster Mitigation Experiences And Reflections**", Prentice Hall Of India, New Delhi.*
3. *Goel S. L. , "**Disaster Administration And Management Text And Case Studies**" ,Deep & Deep Publication Pvt. Ltd., New Delhi.*
4. *Jagbir Singh, **"Disaster Management: Future Challenges and Opportunities",** I.K. International Publishing House Pvt. Ltd. , New Delhi, 2007.*

COURSE OUTCOMES:

Upon completion of this course the students will be able to,

CO1: *Differentiate hazard and disaster and types of disasters.*

CO2: *Identify the causes and types of manmade and natural disaster.*

CO3: *Describe the disaster prone areas in India.*

CO4: *To predict and, where possible, prevent disasters, mitigate their impact on vulnerable populations, and respond to and effectively cope with their consequences*

CO5: *Provide survival strategies based on risk assessment.*

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M		M	M	L		H		M		M
CO2	M		M	M	L		H		M		M
CO3	M		M	H	L		H		M		M
CO4	M		M	M	L		H		M		M
CO5	M		M	H	L		H		M		M

L-Low, M-Moderate (Medium), H-High

18EDACZ3 - VALUE EDUCATION
(Common to all Branches)

Category : AC

L	T	P	C
2	0	0	0

PREREQUISITES: Nil

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with:

- *Value of education and self- development*
- *Requirements of good values in students*
- *Importance of character*

UNIT- I - ETHICS AND SELF-DEVELOPMENT **L(6)**

Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non-moral valuation. Standards and principles. Value judgements.

UNIT- II - PERSONALITY AND BEHAVIOR DEVELOPMENT **L(6)**

Soul and Scientific attitude .Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness. Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance.

UNIT- III - VALUES IN HUMAN LIFE **L(6)**

Importance of cultivation of values, Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature ,Discipline

UNIT- IV - VALUES IN SOCIETY **L(6)**

True friendship. Happiness Vs suffering, love for truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature

UNIT- V - POSITIVE VALUES **L(6)**

Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

LECTURE: 30 PERIODS TUTORIAL: 0 PERIODS PRACTICAL: 0 PERIODS TOTAL: 30 PERIODS

REFERENCE BOOKS:

1. *Chakroborty, S.K. "**Values and Ethics for organizations Theory and practice**", Oxford University Press, New Delhi*
2. *Dr. Yogesh Kumar Singh, "**Value Education**", A.P.H Publishing Corporation,New Delhi*
3. *R.P Shukla, "**Value Education and Human Rights**", Sarup and Sons, NewDelhi.*
4. ***https://nptel.ac.in/courses/109104068/36***

COURSE OUTCOMES

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

CO1: Understand the values and work ethics

CO2: Enhance personality and behaviour development

CO3: Apply the values in human life.

CO4: Gain Knowledge of values in society.

CO5. Learn the importance of positive values in human life.

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	**H**	**M**	**M**	**H**		**H**				**H**	
CO2	**H**	**M**	**M**	**H**		**H**				**M**	
CO3	**H**	**M**	**M**	**H**		**H**				**M**	
CO4	**H**	**M**	**M**	**H**		**H**				**M**	
CO5	**H**	**M**	**M**	**H**		**H**				**M**	

L-Low, M-Moderate (Medium), H-High

18EDACZ4 - CONSTITUTION OF INDIA
(Common to all Branches)

Category : AC

L	T	P	C
2	0	0	0

PREREQUISITES: Nil

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with:

- *Indian constitution*
- *Constitutional rights & duties*
- *Organs of governance*
- *Local administration*
- *Roles and functions of Election commission*

UNIT- I - INDIAN CONSTITUTION **L(6)**

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

UNIT- II - CONSTITUTIONAL RIGHTS & DUTIES **L(6)**

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 **L(6)**

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 **L(6)**

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: 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 **L(6)**

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.

LECTURE: 30 PERIODS TUTORIAL: 0 PERIODS PRACTICAL: 0 PERIODS TOTAL: 30 PERIODS

REFERENCE BOOKS:

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.*

COURSE OUTCOMES

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

CO1: *Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.*

CO2: *Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.*

CO3: *Understand the various organs of Indian governance.*

CO4: *Familiarize with the various levels of local administration.*

CO5: *Gain knowledge on election commission of India.*

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1				**H**		**L**	**H**			**H**	**M**
CO2				**H**		**L**	**H**			**H**	**M**
CO3				**H**		**L**	**H**			**H**	**M**
CO4				**H**		**L**	**H**			**H**	**M**
CO5				**H**		**L**	**H**			**H**	**M**

L-Low, M-Moderate (Medium), H-High

18EDACZ5 - PEDAGOGY STUDIES
(Common to all Branches)

Category : AC

L	T	P	C
2	0	0	0

PREREQUISITES: Nil

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with:

- *Understanding of various theories of learning, prevailing pedagogical practices and design of curriculum in engineering studies.*
- *Application of knowledge in modification of curriculum, its assessment and introduction of innovation in teaching methodology.*

UNIT- I - INTRODUCTION L(6)

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 - PEDAGOGICAL PRACTICES L(6)

Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education. Evidence on the effectiveness of pedagogical practices Methodology for the in depth stage: quality assessment of included studies.

UNIT- III - PEDAGOGICAL APPROACHES L(6)

How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teacher's attitudes and beliefs and Pedagogic strategies.

UNIT- IV - PROFESSIONAL DEVELOPMENT L(6)

Professional development: alignment with classroom practices and follow-up support. Peer Support from the head teacher and the community. Curriculum and assessment Barriers to learning: limited resources and large class sizes.

UNIT- V - CURRICULUM AND ASSESSMENT L(6)

Research gaps and future directions Research design Contexts Pedagogy Teacher education Curriculum and assessment Dissemination and research impact.

LECTURE: 30 PERIODS TUTORIAL: 0 PERIODS PRACTICAL: 0 PERIODS TOTAL: 30 PERIODS

REFERENCE BOOKS:

1 *Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools,Compare, 31 (2): 245-261.*

2 *Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.*

3 *Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.*

4 *Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.*

5 *Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.*

6 *Chavan M (2003) Read India: A mass scale, rapid, '**learning to read'** campaign.*

7 ***www.pratham.org/images/resource%20working%20paper%202.pdf.***

COURSE OUTCOMES:

Upon completion of this course the students will be able to,

CO1: Explain the concept of curriculum, formal and informal education systems and teacher education.

CO2: Explain the present pedagogical practices and the changes occurring in pedagogical approaches.

CO3: Understand the relation between teacher and community, support from various levels of teachers to students and limitation in resources and size of the class.

CO4: Perform research in design a problem in pedagogy and curriculum development.

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1				**H**		**H**	**M**			**H**	**L**
CO2				**H**		**H**	**M**			**H**	**M**
CO3				**H**		**H**	**M**			**H**	**M**
CO4				**H**		**H**	**H**			**H**	**M**

L-Low, M-Moderate (Medium), H-High

18EDACZ6 - STRESS MANAGEMENT BY YOGA
(Common to all Branches)

Category : AC

L	T	P	C
2	0	0	0

PREREQUISITES: Nil

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with:

- *Eight parts of yoga*
- *Techniques to achieve overall health of body and mind*
- *Breathing techniques and its effects*

UNIT- I **L(6)**

Definitions of Eight parts of yog. (Ashtanga).

UNIT- II **L(6)**

Yam and Niyam.-Do`s and Don't's in life.

UNIT- III **L(6)**

Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.

UNIT-IV **L(6)**

Asan and Pranayam : Various yog poses and their benefits for mind & body.

UNIT- V **L(6)**

Regularization of breathing techniques and its effects-Types of pranayam.

LECTURE: 30 PERIODS TUTORIAL: 0 PERIODS PRACTICAL: 0 PERIODS TOTAL: 30 PERIODS

REFERENCE BOOKS:

1 ***'Yogic Asanas for Group Tarining-Part-I"*** *:Janardan Swami Yogabhyasi Mandal, Nagpur*

2 *"**Rajayoga or conquering the Internal Nature**" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata*

3 *Pandit Shambu Nath, "**Speaking of Stress Management Through Yoga and Meditation**",New Dawn Press,New Delhi.*

4 *K.N Udupa,"Stress and its management by Yoga", Motilal Banarsidass Publ,New Delhi.*

***COURSE OUTCOMES**:*

Upon completion of this course, the students will be able to:

CO1: *Understand the basics of Yoga.*

CO2: *Identify Do's and Dont's in life.*

CO3: *Follow ethical and moral guidelines given by Yamas and Niyamas in life.*

CO4: *Develop healthy mind in a healthy body thus improving social health by Asan and Pranayam*

CO5: *Use breathing techniques to live a stress free life*

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1				**H**		**M**	**H**			**H**	
CO2				**H**		**M**	**H**			**H**	**L**
CO3				**H**		**M**	**H**			**H**	
CO4				**H**		**M**	**H**			**H**	
CO5				**H**		**M**	**H**			**H**	

L-Low, M-Moderate (Medium), H-High

18EDACZ7 - PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS
(Common to all Branches)

Category : AC

L	T	P	C
2	0	0	0

PREREQUISITES: Nil

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with:

- *Techniques to achieve the highest goal happily*
- *How to become a person with stable mind, pleasing personality and determination*
- *Awakening wisdom in students*

UNIT- I **L(6)**

Neetisatakam-Holistic development of personality-Verses- 19,20,21,22 (wisdom)-Verses- 29,31,32 (pride & heroism)-Verses- 26,28,63,65 (virtue)

UNIT- II **L(6)**

Verses- 52,53,59 (dont's)-Verses- 71,73,75,78 (do's). - Approach to day to day work and duties.- Shrimad Bhagwad Geeta - Chapter 2-Verses 41, 47,48,

UNIT- III **L(6)**

Shrimad Bhagwad Geeta -Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,-Chapter 18-Verses 45, 46, 48.

UNIT- IV **L(6)**

Statements of basic knowledge.-Shrimad Bhagwad Geeta: -Chapter2-Verses 56, 62, 68 -Chapter 12 -Verses 13, 14, 15, 16,17, 18-Personality of Role model.

UNIT- V **L(6)**

Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, Chapter 4-Verses 18, 38,39-Chapter18 – Verses 37,38,63

LECTURE: 30 PERIODS TUTORIAL: 0 PERIODS PRACTICAL: 0 PERIODS TOTAL: 30 PERIODS

REFERENCE BOOKS:

1. *"**Srimad Bhagavad Gita**" by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata*
2. *Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.*
3. *"**Bhagavad Gita: The Song of God**", Swami Mukundananda, Jagadguru Kripaluji Yog, USA*
4. *"**Bhagavad-Gita As It Is**", A.C. Bhaktivedanta Swami Prabhupada,, Bhaktivedanta Book Trust Publications*

COURSE OUTCOMES :

On completion of this course, students will be able to

CO1: *Understand the Holistic development*

CO2: *Understand the day to day to day work and duties*

CO3: *Understand mankind to peace and prosperity*

CO4: *Become versatile personality.*

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1							**H**	**M**	**L**		**H**
CO2							**H**		**M**		**H**
CO3							**H**		**M**		**H**
CO4							**H**	**M**	**M**		**H**

L-Low, M-Moderate (Medium), H-High

18EDACZ8 - SANSKRIT FOR TECHNICAL KNOWLEDGE
(Common to all Branches)

Category : AC

L	T	P	C
2	0	0	0

PREREQUISITES: Nil

COURSE OBJECTIVES:

Upon completion of this course, the students will be familiar with:

- *Alphabets and tense of the language.*
- *Sentence formation*
- *The Technical information in Sanskrit Literature*

UNIT- I **L(6)**

Alphabets in Sanskrit, Past/Present/Future Tense

UNIT- II **L(6)**

Simple Sentences - Order, Introduction of roots

UNIT- III **L(6)**

Technical information about Sanskrit Literature

UNIT- IV **L(6)**

Technical concepts of Engineering-Electrical, Mechanical

UNIT- V **L(6)**

Technical concepts of Engineering-Architecture, Mathematics

LECTURE: 30 PERIODS TUTORIAL: 0 PERIODS PRACTICAL: 0 PERIODS TOTAL: 30 PERIODS

REFERENCE BOOKS:

1. ***"Abhyaspustakam"*** *– Dr.Vishwas, Samskrita-Bharti Publication, New Delhi*
2. ***"Teach Yourself Sanskrit"*** *Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication*
3. ***"India's Glorious Scientific Tradition"*** *Suresh Soni, Ocean books (P) Ltd., New Delhi.*

COURSE OUTCOMES:

Upon completion of this course the students will be able to,

CO1: Read and write sentences

CO2: Explore the huge knowledge from ancient literature

CO3: Use technical concepts to develop logic in mathematics and engineering.

COURSE ARTICULATION MATRIX

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1								M	L		H
CO2	L								M		H
CO3		L	H	H					H	M	H

L-Low, M-Moderate (Medium), H-High