

## SEM 3@ENERGY ENGINEERING

Semester – III					
Paper Code	Paper Name	Credit Structure			
		L	T	P	C
	Introduction to Renewable Energy Resources	2	1	0	3
	Fluid Mechanics	3	1	0	4
	Steam Power System	3	1	0	4
	Electric Circuit Theory and Network	3	1	0	4
	Basics of Electronics	3	1	0	4
	Engineering Mathematics-III	2	1	0	3
	Disaster Management	2	1	0	3
	Fluid Mechanics Lab.	0	0	2	1
	Electric Circuit Theory and Network Lab.	0	0	2	1
	Basics of Electronics Lab.	0	0	2	1
Total Credits					28

MECHANICS OF SOLID LAB: 2(P)- 1(C)

WORKSHOP PRACTICE: 1(T) -3(P)-3(C)

### PAPER CODES:

**1.INTRODUCTION TO RENEWABLE ENERGY RESOURCCES: EEN211080**

**2.FLUID MECHANICS: WEM211010**

**3.STEAM POWER SYSTEM:EEN211020**

**4.ELECTRIC CIRCUIT THEORY AND NETWORK:EEN211090**

**5.BASICS OF ELECTRONICS:EEN211070**

**6.ENGINEERING MATHEMATICS III :EEN211100**

**7.DISASTER MANAGEMENT: .....**

**8.FLUID MECHANICS LAB: EEN212110**

## **9.ELECTRIC CIRCUIT THEORY AND NETWORK LAB:EEN212120**

## **10.BASICS OF ELECTRONICS LAB:EEN212130**

### **DETAILED SYLLABII/PREScribed TEXTS**

## **Introduction to Renewable Energy Resources (2 1 0 3)**

### **Unit –I: Introduction**

Challenges in the field of energy engineering, perception on energy technology, Dimensions of the energy problem, Historical perspective on energy technology and system development: Technology development for power generation (Wind mills to super-critical power plant), transportation (Bullock cart to future car concepts) and a few application sectors (candle kerosene lamp to solid state lighting). ..(9)

### **Unit-II: Energy Resources**

Conventional energy resources, Depletion of conventional energy sources and its exponential rise in consumption; Impact of Energy on Economy, Development and Environment, Energy for Sustainable Development, Energy and Environmental policies, Need for use of new and renewable energy sources. Resource assessment-Solar energy (Photovoltaic and Solar thermal), Wind energy, Biomass and Bioenergy, Geothermal energy and Ocean & Tidal energy, artificial photosynthesis. ..(9)

### **Unit – III: Energy Scenario**

Role of energy in economic development and social transformation: Energy & GDP, GNP and its dynamics. Conventional Energy Sources and Overall Energy demand and availability, Energy Consumption in various sectors and its changing pattern; Environmental impact of Fossil fuels, Renewable Sources Potential, Energy cycle of the earth, World Energy Scenario, Indian Energy Scenario, India's Solar Energy Mission, Jawaharlal Nehru National Solar Mission(JNNSM). ..(9)

### **Unit-IV: Energy Security**

Chemical and Nuclear: Non Proliferation, Energy Security, Energy Consumption and its impact on environmental climatic change. Role of renewables in energy security and climate change; International Energy Policies of G-8 Countries, G-20 Countries, OPEC Countries and EU. ..(8)

### **Text Books:**

1. J. M. Fowler, *Energy and the Environment*, McGraw Hill, 2nd Edn, New York, 1984.
2. T. B. Johansson, H. Kelly, A. K. N. Reddy and R. H. Williams (Ed), *Renewable Energy: sources for fuel and electricity*, Island Press, Washington DC, 1993.
3. A.Duffie and W.A.Beckmann, *Solar Engineering of Thermal Processes*-John Wiley (1980)
4. F.Kreith and J.F.Kreider, *Principles of Solar Engineering* , McGraw-Hill (1978)
5. T.N.Veziroglu, *Alternative Energy Sources*, Vol 5 and 6, McGraw-Hill (1978)

## **Fluid Mechanics (3 1 0 4)**

### **Unit-I: Introduction**

Properties of fluids, Viscosity, Thermodynamic properties, surface tension and capillarity  
Pressure and its measurement: Pascal Law, pressure variation in fluid at rest, absolute, gauge, atmospheric, vacuum pressure, measurement of pressure, Bouyancy and flotation, meta-centre and meta-centric height ..(9)

### **Unit-II:**

Pressure - Kinetic & Datum Energy - Bernoulli's Theorem - Deduction of Bernoulli's Theorem - Eulers Equations for motion - Limitations of Bernoulli's Theorem - Practical Applications of Bernoulli's Theorem - Liquid jet & syphon - Momentum Equation - Forced and Free Vortex Reynold's Experiment - Laminar and Turbulent Flow - Reynold's Number - Navier Stoke's Equation of Motion - Laminar Flow between Parallel Plates - Waojuen - Poiseuille's Equation for Flow through Circular Pipes. ..(9)

Unit-III:

Boundary Layer - Displacement & Momentum Thickness - Laminar & Turbulent Boundary Layers in Flat Plates - Velocity Distribution in Turbulent Flows in Smooth and Rough Boundaries - Laminar Sub Layer Pressure Drop Characteristics - Friction Factor, Fluid - Fluid System Flow Patterns in Vertical and Horizontal Pipes. Major and minor losses, Hydraulic and total energy line, Pipes in series and parallel, Power transmission through pipes.

..(9)

Unit-IV:

**Turbine:** general layout of hydroelectric power plant, Impluse and reaction turbines, efficiency of turbines, classification based on discharge, head and specific speed, unit power, unit discharge

**Pumps:** Types of Centrifugal and Reciprocating Pumps - Comparision of Centrifugal and Reciprocating Pumps. Operation of centrifugal pump in series and parallel, Operation and working principle of pumps. ..(8)

**Text Books:**

1. F. M. White, *Fluid Mechanics, 5th Edition, McGraw-Hill, 2004.*
2. R. W. Fox, A. T. McDonald and P. J. Pritchard, *Introduction to Fluid Mechanics, 6th Edition, John Wiley and Sons, 2004.*
3. S. K. Som and C. Biswas, *Introduction to Fluid Mechanics and Fluid Machines, 2nd Edition, Tata McGraw-Hill, 2004.*
4. A. Bejan, *Advanced Engineering Thermodynamics , John Wiley, New York, 1988.*

## Steam Power System (3 1 0 4)

Unit – I: **Introduction**

Components of steam power systems, Rankine cycle and modified Rankine cycle on p-v, h-s & Ts diagrams. Use of steam table and chart. (3)

Unit – II: **Steam Generators:**

Introduction and classification, fire tube and water tube boilers, Mounting and accessories of boilers, different types of boilers, High pressure and modern boilers- constructional details and functioning, boiler draught its classification, chimney height, discharge through chimney, boiler performance- equivalent, boiler efficiency, heat balance. (11)

Unit – III: **Steam Engine**

Simple and compound steam engine, ideal and actual indicator diagrams, diagram factor, mep, ip, bp, mechanical efficiency, thermal efficiency. (4)

Unit – IV: **Steam Turbines**

Impulse and reaction turbine, velocity diagram, compounding of turbines, degree of reaction, height of reaction blading, state point locus for single stage and multistage turbines, condition curves, losses in steam turbines, governing of steam turbines. (12)

Unit – V: **Improved Turbines**

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Back- pressure and pass out turbines, Regenerative feed heating cycle, Binary vapour cycle. (5)

Unit – VI: **Steam Condensers**

Classification of condensers, sources of air in condenser, effects of air leakage in condenser,

vacuum efficiency, condenser efficiency, air pumps, cooling water calculations. (5)

#### Unit – VII: **Steam Nozzles**

Steam flow through nozzle-velocity of steam and discharge through nozzle and condition for maximum discharge, nozzle efficiency, supersaturated expansion of steam, general relationship between area, velocity and pressure in nozzle flow, steam injector. (5)

#### **Text Books:**

1. *The theory of practice of heat engine-* D.A. Rangham, Camb. Univ. Press.
2. *Elements of heat engine-* Pandey & Saha.
3. *Steam and gas turbine-* R. Yadav
4. *Thermal Engineering –* R. K. Rajput.

## **Electric Circuit Theory and Network (3 1 0 4)**

### Unit- 1: **Network Theorems**

Substitution Theorem, Tellegen's Theorem, Reciprocity Theorem. (3)

### Unit - 2: **Transient analysis**

Basic RL and RC circuits, Natural and Forced Response, THE RLC CIRCUIT: The Source-Free Parallel and Series RLC Circuit, The Overdamped Parallel and Series RLC Circuit, Critical Damping of Parallel and Series RLC Circuit, The Complete Response of the RLC Circuit. (5)

### Unit - 3: **Laplace Transform**

Definition of the Laplace Transform, Laplace Transforms of Simple Time Functions, Inverse Transform Techniques, Basic Theorems for the Laplace Transform. The Initial-Value and Final-Value Theorems. Graphical Convolution. Circuit Analysis Using Laplace Transform. (5)

### Unit 4: **Fourier Circuit Analysis**

Trigonometric Form of the Fourier Series, Complex Form of the Fourier Series, Definition of the Fourier Transform, Properties of the Fourier Transform, Fourier Transform Pairs for Some Simple Time Functions, The Fourier Transform of a General Periodic Time Function. (5)

### Unit - 5: **Network Topology**

Basic Definitions, Matrices and Graph, Generalized Element, Mutual Inductance. Formation of Network Equations (Node Equation, Mesh Equation, Cut-Set Equation, Loop Equation). (5)

### Unit - 6: **Two-Port Networks**

Admittance Parameters, Impedance Parameters, Impedance Parameters, Transmission Parameters, Inter relationship between various parameters. (5)

### Unit - 7: **Element of Network Synthesis and Approximation**

Positive Real Function, Reactance Function, RC & RL Network Function, Filter Specification, Butterworth and Chebyshev Approximation. (5)

#### **Text Books:**

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1. *Engineering cCircuit Analysis*, by William h. hayt, jr., jack e. kemmerly, steven m. durbin, published by mcgraw-hill.
2. *Network theory and filter design*, by Vasudev k aatre. new age international 2nd ed.

## **Basics of Electronics (3 1 0 4)**

### Unit - I: **Semiconductor Devices**

P-N Junction Diode, Characteristics and Parameters, The Diode Current Equation, Forward Bias Characteristic and Reverse Bias Characteristics, Temperature Dependence of V-I Characteristics, Full-Wave and Half wave Rectifier, Zener Diode, Voltage Regulators. ..(6)

### Unit – II: **Bipolar Transistor**

Formation of PNP / NPN junctions, energy band diagram; transistor mechanism and principle of

transistors, CE, CB, CC configuration, Ebers-Moll model of transistor; transistor characteristics: cut-off active and saturation mode, early effect. ..(6)

#### **Unit-III: Transistor Biasing Methods**

Biasing and Bias stability: calculation of stability factor with variation of  $I_{co}$ , Different operating modes; CE, CB, CC and their properties; small signal low frequency operation of transistors; equivalent circuits, h parameters as a two port network. ..(6)

#### **Unit-IV: Field Effect Transistor (FET)**

Construction and characteristics of JFET (N channel only), Transfer characteristics; construction and characteristics of MOSFET (N channel only), Depletion and enhancement type; CS, CG, CD configuration ..(6)

#### **Unit-V: Feed Back Amplifier & Electronic Instruments**

Concept (Block diagram), properties, positive and negative feedback, loop gain, open loop gain, feedback factors, effect of feedback on gain, bandwidth stability; effect of positive feedback, condition of oscillation, Barkhausen criteria, principle of operation and working of oscillators: Wein bridge and phase shift oscillator, cathode ray oscilloscope (CRO), electronic multimeters. ..(6)

#### **Unit-VI: Operational Amplifier**

Introduction to integrated circuits, operational amplifier and its terminal properties, specification of M741. Application of operational amplifier: concept of virtual earth, inverting and non-inverting mode of operation, voltage summing, difference, constant gain multiplier, voltage follower, comparator, integrator, and differentiator. ..(5)

#### **Unit – VII: Basic digital circuit**

Boolean algebra: number system (Binary, Octal, Decimal, Hexadecimal), Arithmetic and logic operation. Logic gates, Karnaugh map reduction (Sum of products, Products of sum). Code: ASCII, EBCDIC, Gray. Combinational circuits: Adder, subtractor, encoder, decoder, comparator, multiplexer, de-multiplexer, etc. Sequential Circuits: Flip Flops, various types of Registers and counters and their design. ..(5)

#### **Unit - VIII: Communication Systems & Information Technology**

Introduction to modulation, amplitude modulation: generation of AM waves, demodulation of AM waves, Introduction to FM. Data Vs Information, digital modulation, modems, computer networking in block diagram. ..(5)

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#### **Text Books**

1. *Electronic devices and circuit theory: Robert. L. Boylestad, Louis Nashelsky, Pearson education, Prentice Hall.*
2. *Jimmie J Cathey, Sayed Nasar, Basic Electrical Engineering, TMH.*
3. *Digital Electronics: Floyd and Jain.*

#### **Reference Books**

1. *Electronics: Analog and digital, I.J.Nagrath , PHI Learning , 1st edition.*
2. *Electronic devices and circuits, I. J. Nagrath, PHI Learning.*
3. *Electronic devices and circuits, S. Salivahanan, N.Suresh Kumar,A.Vallaveraj TMH.*
4. *Foundation of Electronics, Rakshit & Chattopadhyay, New Age*
5. *Electronic devices and circuits: Malvino and Leech*

## **Engineering Mathematics-III (2 1 0 3)**

#### **Unit -I: Fourier series**

Euler's Formulae, Conditions for Fourier expansions, Fourier expansion of functions having points of discontinuity, change of interval, Odd & even functions, Half-range series. Typical Waveforms (Square, Saw-toothed, Triangular, Half Wave rectifier, Full Wave rectifier), Parseval's Identity (statement only). ..(7)

#### **Unit -II: Fourier Transforms**

Fourier Transform and its properties, Inverse Fourier Transform (statement only), Fourier

transform of derivative (statement only), Transformation of elementary functions, Convolution (statement only), Application of Fourier Transform in solving partial differential equations, Laplace's Equation (2D only), Heat Conduction Equation (1D only), Wave Equation (1D only).

..(7)

#### Unit -III: **Probability and Statistics**

Classification, Tabulation and Graphical representation of data, Mean, Median, Mode and Standard Deviation, Samples Space, Definition of Probability, Conditional Probability, Bayes' Theorem, Random Variable, Expectation, Variance, Probability mass function, Probability density function, Probability Distributions: Binomial, Poisson and Normal. Sampling theory: types of populations and types of sampling, method of drawing of random samples, expectation and standard error of sample mean and sample proportions, Statistical Inference: Point estimation, testing of hypothesis, Chi-square ( $\chi^2$ ) test, Correlation and Regression, Method of Least Squares; Linear Curve Fitting. ..(7)

#### Unit -IV: **Z – Transform & Difference Equations**

Z-transform, Elementary properties, Inverse Z-transform, Convolution theorem, Initial and Final value theorems, Formation of difference equation, Solution of difference equation using Ztransform.

..(7)

#### Unit -V: **Graph Theory**

Graphs, Digraphs, Isomorphism, Walk, Path, Circuit, Shortest Path: Dijkstra's Algorithm, Tree, Properties of Tree, Binary Tree, Fundamental Circuit, Minimal Spanning Tree: Kruskal's Algorithm, Prim's Algorithm. Cut Set, Fundamental Cut Set and Cut Vertices, Matrix Representation of Graphs (Adjacency and Incidence Matrices), Network, Flow Augmenting Path, Ford-Fulkerson Algorithm for Maximum Flow, Max Flow, Min Cut Theorem (statement only).

..(7)

#### **Text Books**

1. *Higher Engg. Mathematics: B.S. Grewal, Khanna Publishers.*

2. *Advanced Engg. Mathematics: E. Kreyzig*

3. *Probability and statistics for Engineer: Johnson. PHI*

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4. *Lipschutz S: Theory and Problems of Probability (Schaum's Outline Series) - McGraw Hill Book Co*

5. *West D.B.: Introduction to Graph Theory - Prentice Hall*

6. *Spiegel M R: Theory and Problems of Probability and Statistics (Schaum's Outline Series) - McGraw Hill Book Co.*

## **Disaster Management (2 1 0 3)**

#### Unit-I: **Introduction to Disasters**

Concepts, and definitions (Disaster, Hazard, Vulnerability, Resilience, Risks) (5)

#### Unit-II: **Disasters**

Classification, Causes, Impacts (including social, economic, political, environmental, health, psychosocial, etc. ) Differential impacts- in terms of caste, class, gender, age, location, disability Global trends in disasters!urban disasters, pandemics, complex emergencies, Climate change (6)

#### Unit-III: **Approaches to Disaster Risk reduction**

Disaster cycle - its analysis, Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural- nonstructural measures, roles and responsibilities of community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), states, Centre, and other stake-holders. (7)

#### Unit- IV. **Inter-relationship between Disasters and Development**

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc. Climate Change Adaptation. Relevance of indigenous knowledge, appropriate technology and local resources (6)



#### Unit-V: **Disaster Risk Management in India**

Hazard and Vulnerability profile of India Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, DM Act and Policy, Other related policies, plans, programmes and legislation) (6)

#### Unit- VI: **Project Work: (Field Work, Case Studies)**

The project /fieldwork is meant for students to understand vulnerabilities and to work on reducing disaster risks and to build a culture of safety. Projects must be conceived creatively based on the geographic location and hazard profile of the region where the college is located. A few ideas or suggestions are discussed below.

Several governmental initiatives require Urban Local Bodies (ULBs) and Panchayati Raj Institutions (PRIs) to be proactive in preparing DM Plans and community based disaster preparedness plans. Information on these would be available with the district Collector or Municipal Corporations. The scope for students to collaborate on these initiatives is immense. Teachers may explore possibilities. (5)

#### **Text /Reference Books:**

1. Alexander David, *Introduction in 'Confronting Catastrophe'*, Oxford University Press, 2000
2. Andharia J. *Vulnerability in Disaster Discourse*, JTCDM, Tata Institute of Social Sciences Working Paper no. 8, 2008
3. Blaikie, P, Cannon T, Davis I, Wisner B 1997. *At Risk Natural Hazards, Peoples' Vulnerability and Disasters*, Routledge.
4. Coppola P Damon, 2007. *Introduction to International Disaster Management*,
5. Carter, Nick 1991. *Disaster Management: A Disaster Manager's Handbook*. Asian Development Bank, Manila Philippines.
6. Govt. of India: *Disaster Management Act 2005*, Government of India, New Delhi.
7. Government of India, 2009. *National Disaster Management Policy*,
8. Gupta Anil K, Sreeja S. Nair. 2011 *Environmental Knowledge for Disaster Risk Management*, NIDM, New Delhi
9. *Indian Journal of Social Work* 2002. *Special Issue on Psychosocial Aspects of Disasters*, Volume 63, Issue 2, April.
10. Kapur, Anu & others, 2005: *Disasters in India Studies of grim reality*, Rawat Publishers, Jaipur.

### **Fluid Mechanics Lab. (0 0 2 1)**

### **Electric circuit theory and Network Lab. (0 0 2 1)**

### **Basics of Electronics Lab. (0 0 2 1)**

