JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech in POWER PLANT ENGINEERING AND ENERGY MANAGEMENT
Effective from Academic Year 2017 - 18 admitted batch

COURSE STRUCTURE AND SYLLABUS

I Semester

Category	Course Title	Int. marks	Ext. marks	L	T	P	C
PC-1	Thermodynamics and Heat Transfer	25	75	4	0	0	4
PC-2	Energy Management and Energy Audit	25	75	4	0	0	4
PC-3	Thermal & Hydro Power Plants	25	75	4	0	0	4
PE-1	• Wind and Tidal Energy • Power Plant Erection • Material Handling Management	25	75	**3**	0	0	3
PE-2	• Solar Energy Technologies • Turbo machines and Propulsion Systems • Direct Energy Conversion	25	75	**3**	0	0	3
OE-1	***Open Elective - I**	25	75	3	0	0	3
Laboratory I	Power Plant Engineering Lab	25	75	0	0	3	2
Seminar I	Seminar-I	100	0	0	0	3	2
Total		**275**	**525**	**21**	**0**	**6**	**25**

II Semester

Category	Course Title	Int. marks	Ext. marks	L	T	P	C
PC-4	Power Plant Maintenance	25	75	4	0	1	4
PC-5	Cogeneration and Combined Cycle Power Plants	25	75	4	0	1	4
PC-6	Power Plant Instrumentation	25	75	4	0	1	4
PE-3	• Environment and Safety Engineering • Power Plant Performance monitoring and Testing • Power Plant Protection and Switch Gear	25	75	**3**	0	0	3
PE4	• Energy Storage Systems • Pollution Control and Environment • Power Distribution Systems	25	75	**3**	0	0	3
OE-2	***Open Elective - II**	25	75	3	0	0	3
Laboratory II	Power plant Simulation Lab	25	75	0	0	3	2
Seminar II	Seminar-II	100	0	0	0	3	2
Total		**275**	**525**	**21**	**0**	**6**	**25**

III Semester

Course Title	Int. marks	Ext. marks	L	T	P	C
Technical Paper Writing	100	0	0	3	0	2
Comprehensive Viva-Voce	0	100	0	0	0	4
Project work Review I	100	0	0	0	22	8
Total	**200**	**100**	0	**3**	22	**14**

IV Semester

Course Title	Int. marks	Ext. marks	L	T	P	C
Project work Review II	100	0	0	0	24	8
Project Evaluation (Viva-Voce)	0	200	0	0	0	16
Total	**100**	**200**	**0**	**0**	**24**	**24**

*** Open Elective subjects must be chosen from the list of open electives offered by various departments.**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (PPE & EM)

THERMODYNAMICS AND HEAT TRANSFER (Professional Core-I)

UNIT -I:

Review of Thermodynamic Laws and Corollaries: Transient flow analysis, Second law thermodynamics, Entropy, Availability and unavailability, Thermodynamic potential. Maxwell relations, Specific heat relations, Mayer's relation.

UNIT-II:

Ideal and Real gases: Equation of state. Real gas behavior, Vander Waal's equation, Generalization compressibility factor. Energy properties of real gases. Vapour pressure, Clausius, Clapeyro equation. Throttling, Joule. Thompson coefficient. Non reactive mixtures of perfect gases. Governing laws, Evaluation of properties, Real gas mixture.

UNIT-III:

Psychometric mixture properties and psychometric chart, Air conditioning processes, cooling towers.

Brief Introduction to Different Modes of Heat Transfer: Conduction: General heat Conduction equation-initial and boundary conditions. 1D steady state heat conduction – Composite systems – Systems with heat generation - Fins

UNIT-IV:

Transient heat conduction: Lumped system analysis-Heisler charts

Forced Convection: Equations of fluid flow-concepts of continuity, momentum equations-derivation of energy equation-: -dimensional analysis – Use of empirical correlations for determination of heat transfer coefficient for flow over flat plate and for fully developed flow inside a pipe

UNIT-V:

Free Convection: Introduction - .Development of Boundary Layer - Use of empirical correlations for determination of heat transfer coefficient for vertical plate and cylinder

Radiation Heat Transfer: Laws of Black body Radiation - Radiant heat exchange between black and grey surfaces.

REFERENCES:

1. Thermodynamics/Holman/McGraw Hill.
2. Basic and Applied Thermodynamics/ P.K. Nag/ TMH
3. Thermodynamics/Sonnatag & Van Wylen / John Wiley & Sons
4. Principals of Heat Transfer/Frank Kreith/Cengage Learning
5. Heat Transfer / NecatiOzisik / TMH
6. Heat Transfer/ P.S. Ghosh dastidar/ Oxford Press
7. Heat Transfer/ P.K. Nag /TMH

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (PPE & EM)

ENERGY MANAGEMENT AND ENERGY AUDIT (Professional Core-II)

UNIT - I

Introduction: Principles of energy management. Managerial organization, Functional areas for i) manufacturing industry, ii) Process industry, iii) Commerce, iv) Government, Role of Energy manager in each of these organizations. Initiating, Organizing and managing energy management programs

UNIT - II

Economic Analysis: Scope, Characterization of an investment project. Types of depreciation, Time value of money. Budget considerations, Risk analysis.

UNIT - III

Methods of Evaluation Of Projects: Payback, Annualized costs, Investor's rate of return, Present worth, Internal rate of return, Pros and cons of the common method of analysis, Replacement analysis.

UNIT- IV

Alternative Energy Sources: Solar Energy: Types of devices for solar energy collections, Thermal storage system, Control systems. Wind Energy, Availability, Wind Devices, Wind Characteristics, performance of turbines and systems.

UNIT - V

Energy Audit: Definition and concepts. Types of energy audits, Basic energy concepts, Resources for plant energy studies. Data gathering, Analytical techniques. Energy Conservation: Technologies for energy conservation, Design for conservation of energy materials, Energy flow networks. Critical assessment of energy usage. Formulation of objectives and constrains, Synthesis of alternative options and technical analysis of options. Process integration.

REFERENCES:

1. Energy Management Hand Book / W.C. Turner (Ed)
2. Energy Management Principles / CB Smith/ Pergamon Press
3. Energy Management / W.R. Murthy and G. Mc. Kay / BS Publication
4. Management / H. Koontz and Cyrill Donnel / McGraw Hill
5. Financial Management / S.C. Kuchhal / Chaitanya Publishing House
6. Energy Engineering & Management – Amlan Chakrabarti - PHI

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (PPE&EM)

THERMAL AND HYDRO POWER PLANTS (Professional Core-III)

UNIT - I:

Introduction: Sources of energy, Type of Power plants. Direct energy conversion system, Energy sources in India, Recent developments in power generation, Combustion of coal, Volumetric analysis, Gravimetric analysis. Fuel gas analysis.

Steam power plant: Introduction. General layout of steam power plant, Modern coal. Fired Steam, Steam power plant. Power plant cycle, Fuel Handling, Combustion equipment, Ash handling, Dust collectors.

Steam Generators: Types, Accessories. Feed water heaters, Performance of boiling, Water treatment, cooling towers. Steam turbines. Compounding of turbines, Steam condensers, Jet and surface condensers.

UNIT- II:

Gas Turbine Power Plant: Cogeneration. Combined cycle power plant, Analysis, Waste heat recovery, IGCC power plant, Fluidized bed, Combustion, Advantages, Disadvantages

Nuclear Power Plant: Nuclear physics, Nuclear Reactor, Classification, Types of reactors, Site selection. Method of enriching uranium. Application of nuclear power plant. Nuclear Power Plant Safety: Bi-Product of nuclear power generation, Economics of nuclear power plant, Nuclear power plant in India, Future of nuclear power.

UNIT- III:

Overview of Hydro Power Systems-Review of World Resource Cost of Hydroelectric Power-Basic Factors in Economic Analysis of Hydro power Projects-Hydropower Plant Layout-Auxiliaries-Hydro Plant Construction-Under Ground Hydro plants-Safety measures-Hydrology.

UNIT-IV:

Advanced in Planning, Design and construction of Hydro electric Power Stations-Trends development of Generating Plant and Machinery-Plant equipment for Pumped Store Schemes- Governing of Water Turbines-Function of Turbine Governer-Condtion for Governing Stability-Surge Tank Oscillation and speed Regulative Problem of Turbine Governing Future.

UNIT-V:

Economics of Power Generation: Factors affecting the economics, Loading factors, Utilization factor, Performance and operating characteristics of power plant, Point economic load sharing, Depreciation. Energy rate, Criteria for optimum loading. Specific economic energy problem

REFERENCES:

1. Power Plant Engineering / P.K. Nag / TMH
2. Power Plant Engineering / R.K. Rajput/ Lakshmi Publications.
3. Power Plant Engineering / P.C.Sharma/ Kotearia Publications.
4. Power Plant Technology / Wakil.
5. Micro Hydro Electric Power Station-Monition, L., M. Lenir and J. Roux.
6. Power Plant Elevation and Design-Tyler G. Hicks.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (PPE&EM)

WIND AND TIDAL ENERGY (Professional Elective-I)

UNIT – I:

Wind Energy Basis, wind Speeds and scales, Terrain, Roughness, Wind Mechanics, Power Content, Class of wind turbines, Atmospheric Boundary Layers, Turbulence. Instrumentation for wind measurements, Wind data analysis, tabulation, Wind resource estimation, Betz's Limit, Turbulence Analysis

UNIT - II:

Airfoil terminology-Blade element theory-Blade design-Rotor performance and dynamics-Balancing Technique (Rotor & Blade)- Types of loads; source of loads Vertical Axis Type- Horizontal Axis-Constant speed constant frequency- Variable speed Variable Frequency-Up wind- Down Wind- Stall Control-Pitch Control-Gear Coupled Generator type-Direct generator Drive /PMG/Rotor Excited sync Generator.

UNIT - III:

Details of Pitch Systems and Control Algorithms- Protection used and Safety Consideration in Wind turbines, Wind Turbine Monitoringwith error codes- SCADA & Databases: Remote Monitoring and Generation Reports- Operations and maintenance for Product Life cycle-Balancing technique (Rotor & Blade), FACTS control and LVRT and New trends for new Grid Codes.

UNIT- IV:

Energy from Oceans: Ocean thermal electric conversion (OTEC)- Claude & Anderson cycles, evaporators-Bio-fouling-Hybrid Cycle-Components of OTEC for Power generation.

Energy from Tides: Introduction- basic principle of Tidal power-components of tidal power plants-operation methods of utilization of Tidal Energy; Estimation of Energy and power from waves, wave energy conversion devices.

UNIT - V:

Tidal currents: Structure of the tidal currents, effects of intense turbulence generated by tides, Tidal power, Basic laws of tidal energy generation, Harnessing the power of tides for the generation of electricity, environmental impact of a tidal power, Impact of tides on climate, Tide-generating forces, Tidal forces, Analysis and prediction of tides and tidal currents.

REFERENCES:

1. Wind Energy Conversion Systems-Freries, L.L-Prentice Hall
2. Wind Energy Systems-Mario Garcia, Sanz, Constantine H. Houpis-CRC Press-2010
3. Non Conventional Energy Resources

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (PPE & EM)

POWER PLANT ERECTION (Professional Elective-I)

UNIT- I

Preparation of commissioning, trial run of various equipments, commissioning of valves, air and gas tightness test of boiler. Chemical cleaning boiler, preparation for boiler light up, thermal flow test of water walls and economizers, steam blowing.

UNIT- II

Safety valves setting, reliable run of boiler. Hydraulic test of boiler. Alkaline flushing and commissioning of regenerative system, acid cleaning of oil pipe lines, oil flushing procedure of lubricating oil and governing system.

Turbine Lubricating oil flow testing steam blowing, reheater safety valve, vacuum tightness test, ejector testing.

UNIT- III

Commissioning of governing system and ATRS & ATT, and TSE. Commissioning of generator and auxiliaries (Generator testing, rotor and stator cooling system, excitation system)Commissioning of electrical system (Circuit breakers, isolators, CT and PT, rectifiers, switchgear, DC System).C&I Commissioning activities (Minimum instrumentations required for major C&I commissioning, commissioning of control valve, tuning of control valves). Discussion/Appraisal.

UNIT- IV

Availability of electrical supply to the equipment (source feeder of each equipment, points of isolation of the equipment, locking during isolation, permit to work system). Boiler pre light up checks. (Meaning of light up, shut down, tripping, starting etc.,l No pending permits, local checks). Operation of service auxiliaries (cooling water pump, compressors, auxiliary steam, fuel oil pump). Operation of air-pre heater and ID fan)(Rechecks, flow path line up, permissives, interlocks).

UNIT- V

Operation of FD & PA Fans (pre checks, flow path line up permissives, interlocks). Mill operation (pre checks, flow path line up, permissives, interlocks). FSSS (Secondary air, burner tilt, fuel and air control).

Drum level control, Super Heater, Re-Heater, temperature control and their interlocks. Operation of turbine lubricating system and barring gear. Operation of condensate and feed water system (BFP, Heaters CEP). HP/LP Bypass operation and turbine heating. Turbine rolling and synchronization. Operation of generator cooling system (stator and hydrogen cooling). Operation of Generator excitation system AVR. Operation of Turbine governing system. Integrated operation of unit (unit loading and shut down sequence) Operational difference between cold start up, warm start up and hot start up. Load dispatching and coordination with load dispatch center.

REFERENCES:

1. Power plant operation/ NPTI Publication
2. Power Plant Engineering/P.K. Nag/TMH
3. CEGB Manual on power Plant Operation

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (PPE & EM)

MATERIAL HANDLING MANAGEMENT (Professional Elective-I)

UNIT-I

Introduction to Integrated Materials Management - need, scope, functions, objectives and Importance of Materials Management, Purchasing function - Objectives and scope of purchasing - purchase budget and materials budget - purchase order cycle - Source selection and development - Negotiations In purchasing - public buying - Just in Time concept.

UNIT – II

Imports - Import trade control, foreign trade (Development and Regulations) Act and Rules -Import Procedures - Importation cycle, Inventory Management- Functions - Associated Coats - Classification – ABC VED - FSN analysis - Basic BOQ model.

UNIT -III

Inventory control systems - Periodic Review - P system and Continuous review systems – Q systems - Lead-time analysis - Reorder point level Calculations, MRP - Introduction - Terminology - Types of demand input to the MRP -Working Principle of MRP - Output of MRP - advantages and disadvantages.

UNIT-IV

Stores Management- Stores function - types of stores - storage procedures- stock Verification and stock accounting - stores records - Disposal of Surplus, scrap, reclamation and salvage of materials.

UNIT-V

Material Handling: layout, selection of equipment, principles of materials handling - Packaging, types of material handling equipment.

REFERENCES:

1. Purchasing and Materials Management/ P. Gopalakrisnan / TMH
2. Industrial Engineer in g and Management/ Ravi Shankar / Galgotia Publicatons / 2003
3. Production & Operations Management/ Chase / Mc Graw Hill
4. Purchasing and Materials Management/ Lamar Lee & Donald W. Dobler / McGraw Hill
5. Materials Management / Chitle A. K / PHI Learning

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (PPE & EM)

SOLAR ENERGY TECHNOLOGIES (Professional Elective-II)

UNIT- I

Solar Radiation and Collectors: Solar angles – Sun path diagrams – Radiation - extraterrestrial characteristics - measurement and estimation on horizontal and tilted surfaces - flat plate collector thermal analysis - testing methods evacuated tubular collectors - concentrator collectors – classification - design and performance parameters - tracking systems - compound parabolic concentrators - parabolic trough concentrators -concentrators with point focus - Heliostats – performance of the collectors.

UNIT – II

Solar Thermal Technologies: Principle of working, types, design and operation of - Solar heating and cooling systems - Thermal Energy storage systems – Solar Desalination – Solar cooker : domestic, community – Solar pond –Solar drying

UNIT - III

Solar PV Fundamentals: Semiconductor – properties - energy levels - basic equations of semiconductor devices physics. Solar cells - p-n junction: homo and hetro junctions - metal-semiconductor interface - dark and illumination
characteristics - figure of merits of solar cell - efficiency limits - variation of efficiency with band-gap and temperature - efficiency measurements - high efficiency cells – Solar thermo-photovoltaic's.

UNIT- IV

SPV System Design and Applications: Solar cell array system analysis and performance prediction- Shadow analysis: reliability - solar cell array design concepts - PV system design - design process and optimization - detailed array design -storage autonomy - voltage regulation - maximum tracking - centralized and decentralized SPV systems - stand alone - hybrid and grid connected system - System installation - operation and maintenances - field experience - PV market analysis and economics of SPV systems.

UNIT - V

SOLAR PASSIVE ARCHITECTURE: Thermal comfort - bioclimatic classification – passive heating concepts: direct heat gain - indirect heat gain - isolated gain and sunspaces - passive cooling concepts: evaporative cooling - Radiative cooling
- application of wind, water and earth for cooling; shading - paints and cavity walls for cooling - roof radiation traps - earth air-tunnel. – energy efficient landscape design - thermal comfort.

REFERENCES:

1. Goswami, D.Y., Kreider, J. F. and & Francis., Principles of Solar Engineering, Taylor and Francis,2000
2. Chetan Singh Solanki, Solar Photovoltatics – Fundamentals, Technologies and Applications, PHI Learning Private limited, 2011
3. Sukhatme S P, J K Nayak, Solar Energy – Principle of Thermal Storage and collection, McGraw Hill, 2008.
4. Solar Energy International, Photovoltaic – Design and Installation Manual – New Society Publishers, 2006
5. Roger Messenger and Jerry Vnetre, Photovoltaic Systems Engineering, CRC Press, 2010.

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M. Tech – I Year – I Sem. (PPE & EM)

TURBO MACHINES AND PROPULSION SYSTEMS (Professional Elective - II)

UNIT- I:

Fundamentals of Turbo Machines: Classifications, Applications, Thermodynamic analysis, Isentropic flow. Energy transfer. Efficiencies, Static and Stagnation conditions, Continuity equations, Euler's flow through variable cross sectional areas, unsteady flow in turbo machines

Gas Dynamics: Fundamental thermodynamic concepts, isentropic conditions, mach numbers and area, Velocity relations, Dynamic Pressure, Normal shock relation for perfect gas. Supersonic flow, oblique shock waves. Normal shock recoveries, detached shocks, Aerofoil theory.

UNIT - II:

Steam Nozzles: Convergent and Convergent-Divergent nozzles, Energy Balance, Effect of back pressure of analysis. Designs of nozzles.

Steam Turbines: Impulse turbines, Compounding, Work done and Velocity triangle, Efficiencies, Constant reactions, Blading, Design of blade passages, Angle and height, Secondary flow. Leakage losses, Thermodynamic analysis of steam turbines.

UNIT- III:

Centrifugal compressor: Types, Velocity triangles and efficiencies, Blade passage design, Diffuserand pressure recovery. Slip factor, Stanitz and Stodolas formula's, Effect of inlet mach numbers, Pre whirl, Performance

UNIT-IV:

Axial Flow Compressors: Flow Analysis, Work and velocity triangles, Efficiencies, Thermodynamic analysis. Stage pressure rise, Degree of reaction, Stage Loading, General design, Effect of velocity, Incidence, Performance

Cascade Analysis: Geometrical and terminology. Blade force, Efficiencies, Losses, Free end force, Vortex Blades.

UNIT-V:

Axial Flow Gas Turbines: Work done. Velocity triangle and efficiencies, Thermodynamic flow analysis, Degree of reaction, Zweifels relation, Design cascade analysis, Soderberg, Hawthrone, Ainley, Correlations, Secondary flow, Free vortex blade, Blade angles for variable degree of reaction. Actuator disc, Theory, Stress in blades, Blade assembling, Material and cooling of blades, Performances, Matching of compressors and turbines, Off design performance

Jet Propulsion-Classification-Thermodynamic analysis-Performance parameters-**Rocket Propulsion**-Classification-Propulsion systems.

REFERENCES:

1. Principles of Turbo Machines/DG Shepherd / Macmillan
2. Turbines, Pumps, Compressors/Yahya/TMH
3. Practice on Turbo Machines/ G. Gopal Krishnan & D. Prithviraj/ Sci Tech Publishers, Chennai
4. Gas Turbines/ Ganesan/TMH
5. Thermal Turbo machines - Singh-Wiley
6. Fundamentals of Turbo machinery/William W Perg/John Wiley & Sons
7. Principles of Jet Propulsion and Gas Turbine/NJ Zucrow/John Wiley & Sons/New York
8. Turbo machinery: Design & Theory-Rama S.R. Gorla, Aijaz A. Khan-CRC Press
9. Turbomachinery: Basic Theory & Applications-Earl Logar Jr-CRC Press

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (PPE & EM)

DIRECT ENERGY CONVERSION (Professional Elective-II)

UNIT-I:

Energy Balance of the earth: The Greenhouse effect – Physical Source of sunlight – Planck's black-body radiation distribution from different black body temperatures – The earth and Solar Constant – Spectral distribution of extra-terrestrial radiation – Basic earth-sun angles – Solar time and equation of time – attenuation of solar radiation by the atmosphere – Direct and diffuse radiation at the ground – Empirical equations for predicting the availability of solar radiation

UNIT -II:

Photovoltaics (PV): Semiconductor physics and Operating principle – Silicon as PV material - Direct and indirect band-gap material – Flow of Silicon material – Single crystal Silicon Solar cell – Structure – Important electrical parameters – Ideal and approximate equivalent circuits - Manufacturing processes (wafer and cell) of single crystal, multi-crystalline and Edge Defined Film Fed Growth Silicon - Temperature and Irradiation effects – Absorption coefficient and reflectance - Silicon film, Cadmium telluride (cdTe), Copper Indium Gallium Diselenide, amorphous silicon – Comparison of 'Thin film' and 'Bulk crystal' technology – manufacturing (module making) processes of amorphous silicon on glass, stainless steel and plastic substrates – Typical materials used - Concentrator technology and the importance of tracking – Comparison of efficiencies of various technologies – Recent trends in PV technology and manufacturing.

UNIT-III:

PV modules and Arrays: Design requirements of PV modules – Rating of PV modules – Standard Test Conditions (STC), Normal Operating Cell Temperature (NOCT) and Standard Operating Conditions (SOC) – Output curves ('Current-Voltage' or 'I-V' and 'Power-Voltage' or 'P-V') under various irradiance and temperature conditions – Mounting structure for PV modules/arrays – Orientation and array layout – Effects of shading - Other balance of systems (BOS) and protective devices: blocking and bypass diodes, movistors – Roof mounted arrays – Building integrated PV (BIPV) – Typical faults and diagnosis – Hot Spot problem in a PV module and safe operating area - Performance measurement of typical parameters of cells/modules under natural and simulated light – Indoor sun simulators - Outdoor PV array testers – ASTM and IEEE standards for Class A and Class B simulators – Pulsed, steady state and single flash types – Determination of temperature coefficients, series and shunt resistances, curve correction factor - Computation of efficiency and fill factor – Translation of parameters actually measured to STC – Reliability Testing: Qualification tests, IEC Standards 61215 & 61646 – Reliability test – Field stress testing.

UNIT-IV:

PV Systems: Stand alone and grid connected – Load estimation – Daily load demand – Solar radiation/irradiance table for a particular location - Sizing of the PV array, battery, inverter and other BOS – Maximizing efficiency of sub-systems – Balance of systems – Single axis and two axis tracking at optimum inclination of the PV array – Power conditioning and control – Maximum Power Point Trackers, Charge controllers/regulators, AC/DC Converters, DC/AC inverters – Alarms, indicators and monitoring equipment – Energy Storage: Batteries, Deep cycle lead acid type, Battery Design and construction, Other types of batteries, Battery Selection criteria, Safety issues – Typical applications of PV – Hybrid systems: PV-Wind, PV-Diesel engine, PV-Mains - System Sizing examples: Domestic loads, Water pumping, Lighting (using CFLs, White LEDs) - hybrid systems, village power packs – Installation practices – Trouble shooting – Economic analysis: Life Cycle Cost analysis – Environment impacts of PV – Green buildings – Potential for GHG emission reduction of installed PV systems

UNIT-V:

The Hydrogen EconomyAdvantages of hydrogen as an energy carrier – Components of the hydrogen economy - Generation of hydrogen - Transport and storage of hydrogen: physical and chemical - Fuel Cells – Classification of fuel cells based on (a) Type of electrolyte (b) Type of the fuel and oxidant (c) operating temperature (d) application and (e) chemical nature of electrolyte

REFERENCES:

1. Solar Electricity /Edited by Tomas Markvart/John Wiley and Sons
2. Solar Cells – Operating Principles, Technology and System Applications /Martin A. Green/Prentice Hall Inc
3. Modelling Photovoltaic Systems using P Spice/Luis Castaner and Santiago Silvestre/John Wiley and Sons
4. Solar Energy – Fundamentals and Applications/H. P. Garg and J. Prakash/Tata McGraw-Hill
5. Generating Electricity from the Sun/Edited by Fred C. Treble/Pergamon Press
6. Amorphous Silicon Solar Cells/K. Takahashi and M. Konagai/North Oxford Academic
7. Photovoltaic Systems Engineering/Roger Messenger/CRC Press
8. Fuel Cells/Livin Oniciu/Abacus Press 1976

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech – I Year – I Sem. (PPE & EM)

POWER PLANT ENGINEERING LAB - I

1. Performance Evaluation of Fuel Cell
2. PCM Based Energy Storage System.
3. Condition Monitoring of Wind Turbine
4. Evaluation of Calorific Value of Solid, Liquid, and Gaseous Fuels
5. Performance Evaluation of Steam Generator
6. Performance and Evaluation of Surface Condenser
7. Study and Analysis of Impulse and Reaction Turbines
8. Proximate and Ultimate analysis of India Coal
9. Performance and Testing of Bio mass Gasifier
10. Power Plant Instrumentation Trainer