FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **Bachelor of Technology (Mechanical Engineering)**

Semester: **V**

Course Code: **202050522**

Course Title: **Energy Systems**

Course Group: **Open Elective Course - I**

Course Objectives: The course will provide understanding of power generation technology using conventional and non-conventional energy sources which will be useful for understanding the operation and working of power plants.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Theory		J/V/P*		Total
Lecture	Tutorial	Practical		Internal	External	Internal	External	
3	0	0	3	50 / 18	50 / 17	NA	NA	100/35

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Energy Sources:** Energy and development, units and measurement, conventional and non-conventional sources of energy, fossil, non-fossil and renewable energy resources, Importance of electrical energy in modern industrial society, Usefulness, advantages and disadvantages of energy sources and need of alternative energy sources.	06
2	**Conventional Sources of Energy**: **Thermal Power Generation:** Steam Power station-Schematic Arrangement of steam power station-Choice of Site for steam Power stations- Equipment of Steam Power Station. **Hydro Power Generation:** Hydroelectric Power Station-Schematic Arrangement of Hydroelectric Power Station- Choice of Site selection for Hydroelectric Power Stations- Constituents of Hydroelectric Plant. **Nuclear Power Generation:** Nuclear Power Station- Schematic Arrangement of Nuclear Power Station-Selection of Site for Nuclear Power Station. **Gas Power Generation:** Gas Turbine Power Plant- Schematic Arrangement of Gas Turbine Power Plant- Equipment of Gas Power Station. **Comparison of all the Power Plants.**	14

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3	**Solar Energy:** ***Solar Photovoltaic:*** Solar Cell fundamentals, Technologies-Amorphous, monocrystalline, polycrystalline; V-I characteristics of a PV cell, PV module, array; Solar PV applications, Solar Water Pumps, Solar street lights. ***Solar Thermal Systems:*** *Solar* Collectors, Solar water heater, Solar Passive Heating and Cooling Systems, Solar Cookers, Solar Refrigeration and Air Conditioning, Solar thermal power generation technologies.	**10**
4	**Wind Energy:** The wind power plant – Introduction, wind turbine classes, Wind Turbine Components (Rotor, Nacelle, Tower, Electric Substation, Foundations) Wind Energy Conversion – Rotation principle, Forces on a rotor blade, Factors affecting performance of rotor (Aerodynamic efficiency, tip speed, tip speed ratio etc.), Thrust and torque on rotor, Power curve. Topologies and operation characteristics of SCIG based wind turbine power plant. Working Principle and operation characteristic of WRIG based wind turbine power plant.	**10**

List of Practicals / Tutorials:

1	NA

Reference Books:

1	Principles of Power System: V. K. Mehta, Rohit Mehta, S. Chand Publications
2	Wind Power Technology: Earnest Joshua, PHI Learning Pvt. Ltd.
3	Solar Energy: S. P. Sukhatme, McGraw Hill Education India Pvt. Ltd.
4	G.D Rai, "Non-conventional energy sources", Khanna Publishers.
5	Chetan Singh Solanki, "Solar Photovoltaic Technology and Systems:A Manual for Technicians,Trainers and Engineers", PHI Publisher, 2013.
6	Dr.R.K Singal, "Non-Conventional Energy Resources", S.K Kataria & Sons.
7	Thomas Ackermann, "Wind Power in Power System", John Willey &Sons, 2005.

Supplementary learning Material:	
1	https://electrical-engineering-portal.com/
2	https://www.coursera.org/learn/solar-energy-basics
3	www.nptel.ac.in
4	https://interestingengineering.com/electrical-engineering-salaries-worldwide

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment
- Interactive methods

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Internal Evaluation:

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks in %						**R**: Remembering; **U**: Understanding; **A**: Applying; **N**: Analyzing; **E**: Evaluating; **C**: Creating
R	**U**	**A**	**N**	**E**	**C**	
25%	30%	20%	15%	10%	0%	

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Compare various means of conventional electrical power generation and evaluate load curves, tariff structures and power factor and load power factor improvement.	**20**
CO-2	Power generation using solar and wind energy looking to current energy and environment scenario.	**30**
CO-3	Understand Energy generation and Problem using field case studies.	**15**
CO-4	Ability to solve the problems in different Renewable energy fields.	**20**
CO-5	Learn Applications and Understanding about the Design and analysis techniques.	**15**

Curriculum Revision:	
Version:	2
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	
Next Review on (Month-Year):	June-2025

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