Proposed syllabus

NIRMA UNIVERSITY
School of Engineering, Institute of Technology
B.Tech. in Mechanical Engineering

Semester VII

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Course Code	2ME702
Course Title	Energy Systems II

Course Outcomes (CO):

After successful completion of the course, student will be able to –

1. analyze performance of vapour and gas power cycles,
2. explain the construction and working of various components of thermal and nuclear power plants,
3. evaluate the performance parameters of gas turbines and combined cycle power plants,
4. justify the necessity of alternative energy sources.

Syllabus **Teaching Hours: 45**

UNIT I **Vapour and Gas Power Cycles** **08**

Rankine cycle, superheating and reheating, regenerative feed water heating, Brayton cycle, means of improving performance, Brayton-Rankine combined cycle.

UNIT II **Thermal and Nuclear Power Plants** **16**

Overview and layout of thermal and nuclear power plants. Boilers: types of boilers, high pressure and supercritical boilers, mountings and accessories, packaged boiler. Waste heat recovery systems. Steam Nozzles: Types, continuity and SFE equations, concept of critical pressure, effect of variation of back pressure. Steam Turbines: Principle of operation, types, compounding, flow of steam through impulse blading, flow of steam through reaction blading. Condensers: principles of operation and construction, estimation of vacuum efficiency, air leakage, air and water handling capacity determination. Cooling towers. Boiler feed pump. Draught: estimation of height of chimney and condition of maximum discharge, induced, forced and balanced draught systems. Nuclear reactors: construction and working of fission and fusion reactors. Pollution issues related to power plant and its control.

UNIT III **Gas Turbine and Combined Cycle Power Plants** **06**

Gas turbine - types, performance parameters, constructional details. Use of gas turbines in jet propulsion. Combined cycle power plants - arrangements, parameters affecting the performance and analysis.

UNIT IV **Alternative Energy Sources** **15**

Need of alternative energy sources. Solar Energy: Solar radiation geometry, applications of solar energy, solar thermal and photovoltaic collectors, solar power plants. Wind Energy: Nature of wind, wind turbines, operative characteristics of wind turbines, wind

power plant. Biomass: Types of biomass and their basic properties, technologies for utilization of biomass. Energy storage systems. Fuel Cell Technology: Classification, construction and working of fuel cells, applications. Hybrid renewable energy systems.

Industrial visits to thermal power plant and energy installations will be arranged to support the classroom learning.

Self – Study The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Suggested Readings:

1. Yadav R., Steam and Gas Turbines and Power Plant Engineering, Central Publishing House.
2. S.M.Yahya, Turbines, Compressors and Fans. Tata McGraw-Hill.
3. El Wakil M.M., Power Plant Engineering, McGraw Hill.
4. Nag P.K., Power Plant Engineering, TMH Publication.
5. Arora S.C., Domkundwar S., Power Plant Engineering, Dhanpat Rai & Sons.
6. Nelson V., Starcher K., Introduction to Renewable Energy, CRC Press.
7. Sukhatme S.P., Nayak J.K., Solar Energy, McGraw Hill Education.
8. Sorenson B., Renewable Energy, Academic Press.
9. Viswanathan B., Scibioh M.A., Fuel Cells: Principles and Applications, Universities Press.

L=Lecture T= Tutorial P=Practical, C=Credit

w.e.f. academic year 2021-22 and onwards