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Question Paper Code : 40932

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2025.

Third/Sixth/Seventh Semester

Mechanical Engineering

ME 8792 — POWER PLANT ENGINEERING

(Common to Electrical and Electronics Engineering/Safety and Fire Engineering)

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. How does regeneration in the Rankine cycle enhance its thermal efficiency?
2. Define steam rate and heat rate in power plants.
3. State the significance of cut-off ratio in the Diesel cycle
4. How waste heat from the gas turbine is utilized in a Combined Cycle Power Plant.
5. Compare nuclear fusion and Fission.
6. Why is heavy water used as a moderator in CANDU reactors?
7. List two main components of a wind turbine.
8. State the working principle of a fuel cell.
9. Define power tariff and list two types of tariffs.
10. Mention two environmental factors considered in site selection of a thermal power plant.

PART B — ($5 \times 13 = 65$ marks)

11. (a) (i) Describe the layout and working of a modern coal-fired thermal power plant (8)
- (ii) Highlight the role of the Rankine cycle and how its performance is enhanced using advanced cycles. (5)

Or

- (b) (i) Explain the draught system in a thermal power plant (5)
- (ii) Compare forced, induced, and balanced draught systems interning of their role in controlling air supply and flue gas discharge. (8)
12. (a) Air enters the compressor of a gas turbine plant operating on Brayton cycle at 1 bar and 23°C . The pressure ratio in the cycle is 6. If $WT = 2.5 WC$ where WT and WC are the turbine and compressor work respectively, Calculate the maximum temperature and cycle efficiency.

Or

- (b) Describe the environmental advantages of using Integrated Gasifier based Combined Cycle systems compared to conventional coal-fired power plants.
13. (a) (i) Describe the layout of a typical nuclear power plant with sketch. (7)
- (ii) Explain the role of each major subsystem such as the reactor core, coolant system, steam generator, and containment structure. (6)

Or

- (b) (i) Explain the operation of a Pressurized Water Reactor (PWR). (7)
- (ii) Discuss the role of high-pressure coolant in separating the primary and secondary circuits. (6)
14. (a) Analyze how water flow, head and turbine type influence the efficiency and power output of a hydroelectric power plant with a typical layout.

Or

- (b) (i) Analyze the energy conversion process in solar thermal power plants. (8)
- (ii) Compare various heat storage methods in terms of influence in continuous power supply. (5)

15. (a) The power station supplies the following load to the customers.

Time in hours	0-6	6-10	10-12	12-16	16-20	20-22	22-24
Load in MW	30	70	90	60	100	80	60

- (i) Draw the load curve and estimate the load factor of the plant. (5)
(ii) What is the load factor of a standby equipment of 30 MW capacity if it takes up all loads above 70 MW? What is the use factor. (8)

Or

- (b) (i) Analyze the pollution control technologies used in coal-fired power plants. (8)
(ii) Explain how they reduce particulate, SO_x, and NO_x emissions. (5)

PART C — (1 × 15 = 15 marks)

16. (a) Critically evaluate the role of Fluidized Bed Combustion (FBC) boilers in utilizing low-grade coal. Assess their contribution to improving fuel efficiency and minimizing environmental impact, highlighting both their advantages and limitations.

Or

- (b) Critically analyze the challenges associated with public perception and political resistance to nuclear power plants. How can safety, environmental, and technological advances be effectively communicated to address concerns?

