

B. Tech. Sem - VIII (Mechanical Engg.) (2014 COURSE) (CBCS) :
SUMMER - 2019

SUBJECT: POWER PLANT ENGINEERING

Day: Thursday
Date: 23/05/2019

Time: 02.30 PM TO 05.30 PM
Max Marks: 60

S-2019-2916

N.B.:

- 1) Solve Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10 and Q.11 or Q. 12.
- 2) Figures to the right indicate **FULL** marks
- 3) Assume suitable **DATA** if necessary

- Q.1** a) With the help of a neat sketch, explain operation of a 'combined cycle power plant'. Also give its advantages over a conventional power plant. **(05)**
- b) What are the various issues in power generation in India? **(05)**

OR

- Q.2** a) With the help of a neat sketch, explain working of pumped storage power plant. Also state its advantages. **(05)**
- b) What is role of NTPC & NHPC in power development in India? **(05)**

- Q.3** A steam at 150 bar & 550°C enters a turbine and leaves to the condenser at 0.1 bar. During its passage to the expansion stages, some steam is bled from the turbine at 12 bar and used for feed water heating in an open feed heater. Find **(10)**
- i. Bleed steam per kg of steam supplied to the turbine
 - ii. Thermal efficiency of the plant.
- Assume that saturated liquid at 12 bar pressure comes out of the feed heater. Draw T-S and H-S diagram for the process.

OR

- Q.4** a) With the help of a neat sketch, explain general arrangement of an electrostatic precipitator. **(05)**
What are its advantages and disadvantages?
- b) Draw P-V and T-S diagrams for a gas turbine cycle with Regeneration, Inter-cooling & Reheating together. **(05)**
State different processes occurring during the cycle.

- Q.5** a) Steam expands in a set of nozzles from 9 bar at 300°C to 6 bar. Calculate **(05)**
- i. Exit velocity
 - ii. Exit area at 100% nozzle efficiency.
 - iii. Exit area at 85% nozzle efficiency
- Mass flow rate of steam is 1 kg/second.
- b) Name different types of cooling towers. State function of cooling towers. **(05)**
Explain induced draft cooling tower with the help of a neat sketch.

OR

P.T.O.

Q.6 a) What is Dalton's law of partial pressure for analysis of a condenser? (05)
What do you understand by vacuum efficiency and condenser efficiency?

b) A Steam turbine develops 3000 kW when a steam is supplied at 10 bar and 250°C. The vacuum in condenser is maintained at 65 cm of Hg. The barometer reads 75.2 cm of Hg. The rise in temperature of cooling water is limited to 15°C. The temperature of the condensate coming out of condenser is 35°C. Assuming expansion through turbine is isentropic, find specific steam consumption of the plant and cooling water supplied in tonnes per hour. (05)

Q.7 a) What is present status of wind power in India and across the globe? (05)

b) With the help of neat sketches, explain phenomenon of biomass combustion. (05)

OR

Q.8 What is need of hybrid power systems? (10)
What are different types of hybrid power systems available?
Explain any one type of such a system with the help of a neat sketch. State its advantages, disadvantages and give examples of any two commercial installations.

Q.9 a) What is load duration curve? (05)
What are its advantages?
Also define plant use factor.

b) What are different tariff methods for electrical energy? (05)

OR

Q.10 a) A 30 MW plant has an overall $\eta = 25\%$. The CV of fuel used is 25000 kJ/kg. Estimate the cost of coal per 24 hours if the load factor of plant is 0.4. One tonne of coal costs Rs. 650. (05)

b) A power plant supplies the loads having maximum demands of 40 MW, 50 MW and 30 MW respectively. The load factor of the plant on the basis of annual load curve is 60% and the diversity factor of the load is 1.2. Determine: (05)
i) The maximum load on the power plant.
ii) Annual energy supplied by the power plant

Q.11 a) Name different energy storage techniques available. (05)
Explain super conducting magnetic energy storage technique.

b) What are the safety measures to be taken in case of a nuclear power plant? (05)

OR

Q.12 a) What technological advancements have recently occurred in battery? (05)

b) What is importance of safety rules and maintenance schedules in case of power plants? (05)

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