Sub Code: RME071

Paper Id: 140722 Roll No: | | | | | | | | | | | | | |

B.TECH.
(SEM VII) THEORY EXAMINATION 2019-20
POWER PLANT ENGINEERING

Time: 3 Hours *Total Marks: 70*

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 7 = 14

a. Why thermal power plants are not suitable for supplying fluctuating loads.
b. What is a pulverized and why it is used?
c. Why are super heaters used in steam power plants?
d. Mention any two drawbacks of a stationary gas turbine power plant for generation of electricity.
e. Why is shielding of a Nuclear reactor necessary?
f. What are the advantages and limitations of geothermal power plant?
g. What is the significance of two part tariff and three part tariff?

SECTION B

2. Attempt any *three* of the following: 7 x 3 = 21

a. Determine the thermal efficiency of the basic cycle of a steam power plant (Rankine Cycle), the specific and hourly steam consumption for a 50 mW steam turbine operating at inlet conditions: pressure 90 bar and temperature 500°C. The condenser pressure is 0.40 bar.
b. Discuss the economics of plant selection in detail.
c. A 2-cylinder C.I. engine with a compression ratio 13:1 and cylinder dimensions of 200 mm × 250 mm works on two stroke cycle and consumes 14kg/h of fuel while running at 300 r.p.m. The relative and mechanical efficiencies of engine are 65% and 76% respectively. The fuel injection is effected up to 5% of stroke. If the calorific value of the fuel used is given as 41800 kJ/kg, calculate the mean effective pressure developed.
d. Explain the following terms:
(i) Fission of nuclear fuel
(ii) Distribution of fission energy
(iii) The chain reaction.
e. What is a circuit breaker? What are the different types of circuit breakers that are employed in typical power stations? Explain with neat diagrams.

SECTION C

3. Attempt any *one* part of the following: 7 x 1 = 7

(a) What is meant by load curve? How 'load duration curve' is obtained from 'load' curve?
(b) The maximum (peak) load on a thermal power plant of 60 mW capacity is 50 mW at an annual load factor of 50%. The loads having maximum demands of 25 mW, 20 mW, 8 mW and, 5 mW are connected to the power station.
Determine: (i) Average load on power station (ii) Energy generated per year (iii) Demand factor (iv) Diversity factor.

Sub Code: RME071

Paper Id: 140722 Roll No: | | | | | | | | | | | | | |

4. Attempt any *one* part of the following: 7 x 1 = 7

(a) Draw an explanatory line diagram of an ash handling system employed in steam power plants and also explain the difficulties encountered in the handling of ash in a thermal power station.

(b) In a simple steam Impulse turbine, steam leaves the nozzle with a velocity of 1000 m/s at an angle of 20° to the plane of rotation. The mean blade velocity is 60% of velocity of maximum efficiency. If diagram efficiency is 70% and axial thrust is 39.24 N/kg of steam/sec, estimate:
(i) Blade angles.
(ii) Blade velocity co-efficient.
(ii) Heat lost in kJ in friction per kg.

5. Attempt any *one* part of the following: 7 x 1 = 7

(a) Draw and explain the layout of an Integrated Gasifier based Combined Cycle Power Plant.

(b) In an open cycle regenerative gas turbine plant, the air enters the compressor at 1 bar abs 32°C and leaves at 6.9 bar abs. The temperature at the end of combustion chamber is 816°C. The isentropic efficiencies of compressor and turbine are respectively 0.84 and 0.85. Combustion efficiency is 90% and the regenerator effectiveness is 60 percent, determine:
(i) Thermal efficiency, (ii) Air rate, (iii) Work ratio.

6. Attempt any *one* part of the following: 7 x 1 = 7

(a) What are the desirable properties of a good moderator? Compare H_2O, D_2O and C as moderators.

(b) Explain the spring tides and neap tides. Discuss the different tidal power schemes and configurations with neat sketches.

7. Attempt any *one* part of the following: 7 x 1 = 7

(a) Describe the various methods of controlling the voltage at the consumer terminal used in power supply system.

(b) Two lamps are to be compared:
(i) Cost of first lamp is Re. 1 and it takes 100 watts.
(ii) Cost of second lamp is Rs. 4 and it takes 60 watts.
Both lamps are of equal candlepower and each has a useful life of 100 hours. Which lamp will prove economical if the energy is charged at Rs. 70 per kW of maximum demand per year plus 5 paise per kWh? At what load factor both the lamps will be equally advantageous?