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GAYATRI VIDYA PARISHAD COLLEGE OF ENGINEERING FOR WOMEN
(AUTONOMOUS)

(Affiliated to Andhra University, Visakhapatnam)

I B.Tech. - II Semester Regular Examinations, June / July – 2025

THERMAL & HYDRO PRIME MOVERS

(EEE)

1. All questions carry equal marks
2. Must answer all parts of the question at one place

Time: 3Hrs.

Max Marks: 70

UNIT-I

1. a. What is meant by valve timing diagram? Mention the differences of actual four stroke single cylinder valve timing diagram to the ideal valve timing diagram. [7]
b. Why boiler accessories are installed. Explain the operation of economizer with the help of simple diagram. [7]

OR

2. a. A four cylinder four stroke, SI engine develops a maximum brake torque of 160 Nm at 3000 rpm. Calculate the engine displacement, bore and stroke. The brake mean effective pressure at the maximum engine torque point is 960 kPa. Assume bore is equal to stroke [7]
b. Compare and contrast Fire Tube boilers & water tube boilers. [7]

UNIT-II

3. a. Explain the working of a simple Rankine cycle and derive the expression for its thermal efficiency. [7]
b. A quantity of steam at 10 bar and 0.85 dryness occupies 0.15 m³. The steam is heated at constant pressure to raise its temperature up to 300°C. Determine:
i) The work done
ii) The change in internal energy
iii) The heat supplied [7]

OR

4. a. Draw the schematic for an ideal Rankine cycle. Draw P-V and h-s diagrams for this cycle. [7]
b. Discuss the thermodynamic variables that affect the efficiency and output of a Rankine cycle. [7]

UNIT-III

5. a. Discuss the effect of inter-cooling on the thermal efficiency of a gas turbine. [6]
b. A gas turbine consists of single stage compressor and a single stage turbine. If the plant works between the temperature limits of 300K and 1000K and 1 bar and 16 bar; find the net power of the plant per kg of air. Take specific heat at constant pressure as 1 kJ/kg K. [8]

OR

6. a. How gas turbines are classified? Explain with suitable sketches [5]
b. In a gas turbine plant, operating on Brayton cycle, air enters the compressor at 1 bar and 27°C. The pressure ratio in the cycle is 6. Calculate the maximum temperature in the cycle and the power developed by the turbine. Assume the turbine work as 2.5 times the compressor work. Take $\gamma=1.4$. [9]

UNIT-IV

7. a. A jet of water moving with a velocity of 20m/s impinges on a curved vane, which is moving with a velocity of 10m/s. The jet makes an angle of 20° with the direction of motion of vane at inlet and leaves at angle of 130° to the direction of motion of vane at outlet. Determine:
i) The angles of curved vane tips so that water enters and leaves without shock;
ii) The work done per N of water entering the vane. [8]
- b. Give the classification of hydraulic pumps and write the advantages of centrifugal pump over reciprocating pump. [6]

OR

8. a. A jet of water 50 mm in diameter issues with a velocity of 10m/sec and impinges normally on a stationary flat plate which moves in forward motion. Determine the force exerted by the jet on the plate and the work done. Consider the same data and calculate force exerted by the jet on the plate and the work done when the plate is moving with a velocity of 3 m/s in the same direction. [8]
- b. Explain the working of single-stage Centrifugal pump. [6]

UNIT-V

9. a. Draw a neat diagram of the operating characteristic curves of Pelton, Francis and Kaplan turbines. Discuss the practical importance of these curves. [6]
- b. The jet of water coming out of nozzle strikes the buckets of a Pelton wheel which when stationary would deflect the jet through 165° . The velocity of water at exit is 0.9 times at the inlet and the bucket speed is 0.45 times the jet speed. If the speed of the Pelton wheel is 300 rpm and the effective head is 150m, determine: i) Hydraulic efficiency and ii) Diameter of the Pelton wheel. Take coefficient of velocity, $C_v=0.98$. [8]
- OR
10. a. Make a neat sketch of a hydro power plant and clearly explain the various elements. [6]
- b. The following data pertain to a Kaplan turbine: shaft power= 13230 kW; speed= 75 rpm; head= 8m; diameter of boss of runner= 0.35 times the external diameter; speed ratio= 2; flow ratio= 0.6. Find the efficiency of the turbine. [8]