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II/IV B.E. DEGREE EXAMINATION.

Second Semester

Electrical and Electronics Engineering

THERMAL PRIME MOVERS

(Common with Dual Degree Program in EEE)

(Effective from the admitted batch of 2006–2007)

Time : Three hours   Maximum : 70 marks

Question No. 1 is compulsory
Answer any FOUR from the remaining.
All questions carry equal marks.

1.   (a)   What is an adiabatic process?

     (b)   What is dryness fraction? What is its significance?

     (c)   What is a steam boiler? How they are classified?

     (d)   What is meant by thermal efficiency of I.C. Engine?

     (e)   Mention the function of nozzles used with steam turbines.

8. Write short notes on any THREE of the following :

    (a) Laws of thermodynamics

    (b) 2-stroke and 4-stroke engines

    (c) Super saturated steam flow in steam nozzles.

    (d) Methods of reduction of rotor speed

    (e) Methods to improve the thermal efficiency of gas turbines.

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(f) Give the main difference between impulse and reaction turbines.

(g) Give the methods to improve the thermal efficiency of gas turbine.

2. (a) Define thermodynamic process. Derive an expression for the work done during the adiabatic expansion of ideal gas.

(b) One kg of a gas expands reversibly and adiabatically. Its temperature during the process falls from 515 K to 390 K while the volume is doubled. The gas does 92 kJ of work in this process. Find the values of c_p and c_v.

3. (a) Derive an expression for the external work done during evaporation of superheated steam.

(b) One kg of steam at 18 bar and 280°C under a constant pressure process until the quality of steam becomes 0.5 dry. Find the work done, the heat transferred and the change in entropy.

4. (a) What is a steam boiler? How are they classified?

(b) Explain the construction and working of a Lancashire boiler with the help of suitable sketches.

5. (a) Differentiate between petrol and diesel engine.

   (b) A four cylinder engine running at 1200 r.p.m. gave 18.6 kW brake power. The average torque when one cylinder was cut out was 105 N-m. Determine the indicated thermal efficiency if the calorific value of the fuel is 42000 kJ/kg and the engine uses 0.34 kg of petrol per brake power hour.

6. (a) Discuss the function of the convergent portion, the threat and the divergent portion of a convergent - divergent nozzle with reference to flow of steam.

   (b) Steam enters a group of nozzles of a steam turbine at 12 bar and 220°C and leaves at 1.2 bar. The steam turbine develops 220 kW with a specific steam consumption of 13.5 kg/kWh. If the diameter of nozzles at throat is 7 mm, calculate number of nozzles.

7. (a) Explain the functions of the blading of a reaction turbine.

   (b) Discuss the method of velocity compounding of an impulse turbine for achieving rotor speed reduction.

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