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B. Tech. 4th Semester (ME) F. Scheme
Examination, May–2014

STEAM AND POWER GENERATION

Paper–ME–210-F

Time allowed : 3 hours]   *[Maximum marks : 100*

Note : *Attempt any five questions in total, at least one question from each section. Q. No. 1 is compulsory. Each question carries equal marks. (20 marks).*

1. Explain the following –

   (a) Air pumps

   (b) Classification of fuels

   (c) Condenser efficiency

   (d) Impulse turbine

   (e) Degree of reaction

   (f) Actual indicator diagram

   (g) Mechanical efficiency of steam engine

   (h) Nozzle efficiency

   (i) Components of steam power system

   (j) Purpose of steam generator.   20

Section–A

2. (a) How does Rankine cycle differ from the Carnot cycle for a vapour ? 6

(b) Draw the layout of a steam power plant operating on Rankine cycle in which the boiler generates superheat steam. Depict the cycle on p-v and T-s and describe the working. 14

3. (a) Sketch and discuss the working of Lancashire boiler. Explain the flow path of the flue gases. 10

(b) Define draught and discuss the various types of draught used in boiler practice. Also discuss their relative merits and limitations. 10

Section–B

4. (a) What are effects of friction on performance of steam nozzle ? 6

(b) What do you understand by critical pressure ratio in flow through nozzles ? Derive an expression for critical condition and find the expression for mass flow rate for same condition. 14

5. (a) In a single cylinder double acting steam engine, steam is supplied at a pressure of 12 bar and exhaust takes place at 1.1 bar. The cut-off takes

place at 40% of stroke. If the stroke is equal to 1.25 times the cylinder bore and the engine develops an indicated power of 100 KW at 90 rpm, calculate the bore and stroke of the engine, assuming hyperbolic expansion and a diagram factor of 0.8. Also, determine the theoretical consumption in m³/min.   16

(b) State the advantages of compounding of steam engines.   4

Section–C

6. The velocity of steam leaving the nozzle of an impulse turbine is 900 m/s and nozzle angle is 20°. The blade velocity is 300 m/s and the blade friction factor is 0.7. Calculate for a mass flow rate of 1kg/s and symmetric blading :

(i)   the blade inlet angle

(ii) the axial thrust

(iii) the tangential force

(iv) the diagram power and efficiency.

7. (a) Why a Binary vapour cycle is used in power plants ? Discuss its working with the help of schematic and T-S diagrams.   14

(b) Explain the regenerative feed heating cycle and pass out turbines in detail.   6

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Section–D

8. (a) The absolute pressure in the condenser is 11.56 KPa when the barometer reads 1 bar. The temperature is 40°C. Determine the partial pressure of air, vacuum efficiency and the mass of air present in the condenser per kg of steam. 14

   (b) Differentiate between the surface and jet type of condenser. 6

9. (a) Enumerate various types of fuels with their fields of applications. 10

   (b) Discuss the methods of determining the calorific value of solid and liquid fuels. 10