

Roll No.

24173

B. Tech. 4th Semester (ME)

Examination – May, 2017

STEAM AND POWER GENERATION

Paper : ME-210-F

Time : Three Hours]

[Maximum Marks : 100

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

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

1. Explain the following :

2 × 10 = 20

(i) Air pumps

(ii) Condenser efficiency

- (iii) Mechanical efficiency of steam engine
- (iv) Nozzle efficiency
- (v) Components of steam power system
- (vi) Purpose of steam generator
- (vii) Boiler Accessories
- (viii) Stoichiometric air fuel ratio
- (ix) Mechanical Draught
- (x) Mollier diagram

SECTION – A

2. (a) Explain the Carnot cycle in detail with sketch. 6
- (b) Explain the Rankine Cycle and modified Rankine cycle on p-v, h-s, and T-s diagrams in detail. 14
3. (a) Sketch and discuss the working of Babcock Wilcox boiler in detail. 10
- (b) Discuss the various types of draught used in boiler practice. Also discuss their relative merits and limitations. 10

SECTION – B

4. (a) Explain the concept of super saturated^{*} flow in nozzles. 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 two cylinder compound steam engine develops 112 KW of indicated power at 112 rpm. Steam is supplied at 8 bar, exhaust at 0.23 bar and the stroke of each cylinder is 1.1 times the diameter of LP cylinder. Diagram factor is 0.7. Assuming expansion to be hyperbolic and neglecting the clearance compression and the engine is without receiver, find the cylinder dimensions if each cylinder develop equal power. The ratio of expansion for the engine is 8. 20

SECTION - C

6. The blade speed of a single ring impulse blading is 250m/s and nozzle angle is 20° . The heat drop is 550KJ/kg and the nozzle efficiency is 0.85. The blade discharge angle is 30° and the machine develops 30KW, when consuming 360kg of steam per hour. Draw the velocity diagram and calculate : 20
- (a) Axial thrust on the blading
- (b) The heat equivalent per kg of steam friction of the blading

7. (a) Why a Binary vapour cycle is used in power plants? 6
- (b) Is it possible to increase the efficiency of regenerative feed heating cycle to become equal to Carnot efficiency? If so, what are the drawbacks of such an arrangement? Explain the regenerative feed heating cycle and pass out turbines in detail. 14

SECTION - D

8. (a) Estimate the condenser cooling water flow rates for a 400MW power plant if the water undergoes 10° temperature rise. Assume overall plant efficiency 40% and boiler efficiency 80%. 14
- (b) Explain the effect of air leakage in 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