No. of Printed Pages : 4

BIMEE-029

DIPLOMA – VIEP – MECHANICAL ENGINEERING (DMEVI)

Term-End Examination

00586

June, 2015

BIMEE-029 : POWER PLANT ENGINEERING

Time : 2 hours *Maximum Marks : 70*

Note : *Answer any **five** questions. Use of Steam table, Mollier chart is permitted. Use of Scientific calculator is permitted.*

1. (a) What are the various types of coals ? Discuss the important properties of a good coal. 7

(b) The percentage composition of a sample of coal is C = 90, H_2 = 3·5, O_2 = 3·0, N_2 = 1·0, S = 0·5, the remainder being ash. Estimate the minimum weight of air required for the combustion of 1 kg of this fuel and the composition of the dry products of combustion, by volume, if 50% excess air is supplied. 7

2. (a) Draw the general layout of a modern thermal power plant. Explain the working of its major components. 7

(b) Steam at 20 bar, 360°C is expanded in a steam turbine to 0·08 bar. It then enters a condenser, where it is condensed to saturated liquid water. The pump feeds back the water into the boiler. Assuming ideal processes, find the net work done per kg of steam and the cycle efficiency. 7

3. (a) Discuss the special characteristics which enable water tube boilers to be best suited for modern thermal power plants. Describe the advantages gained by using economizers in a modern power plant. 7

(b) What is the function of a superheater in a power plant ? What are the different types of superheaters used in thermal power plants ? Explain their merits and demerits. 7

4. (a) Derive the equation for the discharge through a nozzle and the condition for its maximum value. 7

(b) Dry saturated steam at a pressure of 11 bar enters a convergent-divergent nozzle and leaves at a pressure of 2 bar. If the flow is adiabatic and frictionless, determine the exit velocity of the steam.

Assume the index of adiabatic expansion to be 1·135. 7

5. (a) What are the different types of condensers ? Discuss the relative advantages and disadvantages of a surface and a jet condenser. 7

(b) What are the different types of cooling towers ? Explain the working of a forced draft cooling tower with a neat sketch. 7

6. (a) In an impulse turbine, show that the maximum blade efficiency is given by

$$[(1 + K) / 2] \cos^2 \alpha$$

where α is the fixed nozzle angle, K is the blade velocity coefficient and the blade inlet and outlet angles are equal. 7

(b) In a stage of impulse turbine provided with single row wheel, the mean diameter of the blade is 1 m. It runs at 3000 rpm. The steam issues from the nozzle at a velocity of 350 m/s and the nozzle angle is 20°. The rotor blades are equiangular. The blade friction factor is 0·86. Determine the power developed, if the axial thrust on the end bearing of a rotor is 118 N. 7

7. (a) Draw the general layout of a hydroelectric power plant. Explain the working of its major components. 7

(b) What are the various types of nuclear reactors used in nuclear power plants ? Discuss the working of any one of them. 7

8. Write short notes on any ***four*** of the following :

$4 \times 3\frac{1}{2} = 14$

(a) Boiler draughts

(b) Choking of a nozzle

(c) Compounding of turbines

(d) Losses in turbines

(e) Diesel Power Plants

(f) Nuclear Waste Disposal