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BME-052

DIPLOMA IN MECHANICAL ENGINEERING (DME) / ADVANCED LEVEL CERTIFICATE COURSE IN MECHANICAL ENGINEERING (DMEVI / ACMEVI)

Term-End Examination

December, 2014

BME-052 : BASICS OF THERMAL ENGINEERING

Time : 2 hours *Maximum Marks : 70*

Note : *Answer any* ***five*** *questions. Use of scientific calculator is permitted. Use of Steam table, Mollier diagram is permitted. Assume any missing data if required.*

1. (a) Explain thermodynamic properties and processes. 7

(b) Define thermal equilibrium. State and explain the Zeroth Law of Thermodynamics. 7

2. (a) Prove that 'Internal Energy' is a property of steam. 7

(b) Define thermodynamic reversibility. Under what conditions is a process said to be reversible ? 7

3. (a) Explain different types of calorimeters. 7

(b) Steam initially at 1·5 MPa and 300°C expands reversibly and adiabatically in a steam turbine to 40°C. Determine the 7

(i) condition of steam after expansion.

(ii) work done by the turbine per kg of steam.

4. (a) What is the difference between boiler mountings and accessories ? Give examples of some mountings and accessories. 7

(b) The equivalent evaporation from a boiler at 100°C is 10·4 kJ/kg of fuel. The calorific value of fuel is 29,800 kJ/kg. Determine efficiency of boiler. If the boiler produces 15,000 kg of steam per hour at 20 bar from a feed water at 40°C and the fuel used is 1,650 kg/hr, determine the condition of steam produced. 7

5. (a) How are the steam turbines classified ? Differentiate between pressure and velocity compounding. 7

(b) At a stage in a reaction turbine the mean blade ring diameter is 1 m and turbine runs at a speed of 50 rpm. The blades are designed for 50% reaction with exit angle of 30° and inlet angle of 50°. The turbine is supplied with steam at the rate of 6,00,000 kg/hr and an isentropic efficiency of 85%. Determine the 7

(i) power developed.

(ii) specific enthalpy drop per stage per kg.

(iii) percentage increase in relative velocity.

6. (a) What is steam condenser ? State its function. 7

(b) How does air come in to the condenser ? What are its effects on the performance of a condenser ? List the merit of air extraction. 7

7. (a) Explain the phenomenon of heat transfer by convection. State the Newton's law of cooling. 7

(b) Compare the renewable and non-renewable energy sources. List various engineering applications of solar energy. 7

8. Write short notes on the following : $4 \times 3\frac{1}{2} = 14$

(i) Stefan-Boltzmann's law

(ii) Nuclear energy

(iii) Economiser

(iv) Flow through nozzle