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BME-031

B.Tech. MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

00051

Term-End Examination

December, 2015

BME-031 : ENERGY CONVERSION

Time : 3 hours *Maximum Marks : 70*

Note : *Answer any* ***seven*** *questions. All questions carry equal marks. Use of steam table and scientific calculator is allowed.*

1. (a) Distinguish between a fire tube and a water tube boiler. In which case will the thickness of drum of water be less, if two types of same capacity are compared ? Which boiler will have less reserved energy and why ?

(b) Show the shapes of fixed and moving blades in impulse and reaction turbine working on steam. *5+5*

2. (a) In how many different ways can the solar energy be used for generating power ? Despite solar energy being free, use of solar energy for power is very less. Give reasons. Describe other applications of solar energy.

(b) What is biogas ? What are the sources of biogas ? How can we use biogas for power generation ? *5+5*

3. (a) Define indicated power and brake power of an engine. Also define mean effective pressure. Show how you would calculate IP.

(b) Describe how BP of an engine is measured in a laboratory. Why do you need to cool brake pulley ? *5+5*

4. In a steam power plant, the following are essential components :

Air preheater, economizer, superheater, feed pump and boiler. Show on sketch/block diagram how these components are arranged and indicate the direction of flow of water and steam. Also describe the functions of air preheater and economizer. *10*

5. What are the methods of removing particulate matter from flue gases ? Describe any one of them. What harmful effects are associated with particulate matter exhausting in atmosphere ? *10*

6. (a) Distinguish between two types of hydro-turbines. Where are they used? Sketch the hydro-power plant and mark various components. Name three turbines and state where they are used.

(b) What is wind energy ? Explain with a neat sketch the wind energy power plant. *5+5*

7. (a) Distinguish between throttling and adiabatic processes.

(b) In a gas turbine plant, the air pressure and temperature before compression are 1 bar and 28°C respectively. Pressure ratio = 3·5, and the temperature of gas before expansion is 700°C. If the isentropic efficiencies of the compressor and turbine are 80% and 85% respectively, calculate

(i) the efficiency of the cycle, and

(ii) the turbine exhaust temperature. *5+5*

8. (a) Write the expressions for work done for

(i) isentropic process,

(ii) constant volume and constant pressure processes, and

(iii) constant temperature process.

(b) A boiler generates 5000 kg/hr of steam at 16 bar and 300°C from feed water at 30°C. Coal used is 600 kg/hr of CV 30000 kJ/kg. Find the efficiency of the boiler. *5+5*

9. Sketch the Babcock and Wilcox boiler and show the position of superheater. Why are the tubes in this boiler inclined ? Show the path of hot gases. *10*

10. (a) How is the overall efficiency of a combined gas turbine power plant improved using reheat, regeneration and inter-cooling together ? Explain with p – V diagram.

(b) Calculate the volume of oxygen required for complete combustion of 1 m^3 of C_2H_2 and CO at constant pressure. *5+5*