00464

BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

Term-End Examination

June, 2010

BME-031 : ENERGY CONVERSION

Time : 3 hours *Maximum Marks : 70*

Note : *Answer **seven** questions. Suitable data may be assumed if required.*

1. (a) What do you understand by energy ? Describe forms of energy , their sources and state how they are used in practice. **6**

(b) A car is pulled up an inclined road by an electric motor driven hauling device upto the highest point which is 5 m above the level of the bottom of the inclined road. The efficiency of hauling gear is 90%. Calculate the power of electric motor if the car is hauled up in one minute. If the car were to be driven by its own engine it would have covered 100 m length of inclined road at a constant speed of 20 km/hr. The efficiency of transmission gearing of car from engine to wheel is 85%. Calculate the power developed by car engine. The car with engine weighs 12 kN. **4**

2. (a) What is an electric machine ? Distinguish between machines which receive mechanical energy and those which produce mechanical energy. Describe the construction of three types of generators. 5

(b) Differentiate between synchronous and asynchronous motors. Define slip speed in induction motor. Calculate the synchronous speed of a 6-pole induction motor when it is fed from a 60 Hz source. If the motor is running at 1180 rpm, what is % slip and what is the frequency of rotor current. 5

3. (a) What are the important elements of steam turbine ? Describe the types and function of one element. 5

(b) The velocity of steam exiting the nozzles of impulse stage of turbine is 400 m/s. The blades operate close to maximum blading efficiency. The nozzle angle is 20°. Neglect blade friction and assume equiangular blades over which 0.6 kg/s of steam flows. Construct velocity diagram taking relative velocities of steam at entry and exit as equal, calculate power and efficiency of turbine by the help of velocity diagram. 5

4. (a) Why do we need steam condenser in a steam power plant ? Describe a surface condenser. 6

(b) Steam enters a condenser with enthalpy 1810 kJ/kg and leaves it with enthalpy of 200 kJ/kg. The rate of cooling water flow is 200 kg/hr at a temperature of 25° C and water exits at a temperature of 87° C, find the amount of condensate. C_p for water 4.2 kJ/kg K. 4

5. (a) What is meant by regeneration in a steam power plant ? Describe a regenerative cycle with the help of Temp-entropy diagram and sketch of a steam power plant. 5

(b) With the help of a sketch describe a closed cycle gas turbine power plant. Mention fuels used in gas turbines. 5

6. (a) Mention non-conventional energy sources and describe use of wind for generating electricity. 6

(b) A propeller type wind turbine is operating at 40 rpm at maximum efficiency. Wind having density of 1.226 kg/m3 and velocity of 20 m/s exists. The turbine diameter is 100 m. Find 4

(i) total power density in wind
(ii) maximum obtainable power density
(iii) obtainable power density with efficiency = 50%
(iv) the total power

7. (a) What are manufactured solid fuels ? Describe their properties and applications. 5

(b) Determine the products of combustion and air fuel ratio by weight when fuel with chemical formula C_7H_{16} is burned with 20% excess air. 5

8. (a) Make a list of equipment for handling coal and ash in a power plant. Describe a pneumatic conveyor. 5

(b) Distinguish between 2-stroke and 4-stroke I. C. engines. What are the disadvantages of 2-stroke engine ? What is a hot bulb engine ? 5

9. (a) With schematic diagram describe the elements of hydro-electric power plant. What conditions are needed to be satisfied when site for such a plant is selected ? **6**

(b) In an ideal air standard gas turbine cycle, the minimum and maximum temperatures are respectively 310 K and 1100 K. Draw the cycle on a T-S diagram and calculate the optimal pressure ratio of cycle for maximum work output. Assume for air$(\gamma-1)/\gamma$ is 0.29 where γ is C_p/C_v. **4**

10. Write notes (7-10 lines) or just draw a labeled diagram on ***any five*** of the following. **2x5**

(i) Photovoltaic power generation

(ii) Geothermal power generation

(iii) Sketch of fluidized bed Boiler

(iv) Block diagrams showing Road and Rail Road Transportation systems

(v) Flameless Process of Combustion

(vi) Fly Ash and its characteristics

(vii) ESP

(viii) MHD