No. of Printed Pages : 5

BME-031

B.Tech. MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

00120

Term-End Examination

June, 2016

BME-031 : ENERGY CONVERSION

Time : 3 hours *Maximum Marks : 70*

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

1. (a) Show the Rankine cycle on a PV diagram. Determine the work done. How is this cycle modified ? Explain.

(b) Show the pressure variation in a petrol engine cylinder, as the crank rotates. *5+5*

2. (a) How does a 2-stroke engine work ? Explain with sketches how suction, compression, power and exhaust processes take place. Why is fuel-air mixture first compressed in crank case ?

(b) What is the function of a condenser in a steam thermal power plant ? Explain with the help of Rankine cycle. Sketch a surface condenser. *5+5*

3. (a) What are the different types of coal ? Which of these coals contains maximum moisture and which contains maximum carbon ?

(b) Describe the proximate and ultimate analysis of coal. How do you find water content of coal ? Mention the liquid fuels that are used in a boiler. *5+5*

4. (a) Differentiate between Reheat and Regenerative cycles for power plants.

(b) Derive the expression for the efficiency of Otto cycle. *5+5*

5. (a) What is the function of spark plug in a petrol engine ? How does combustion occur in a diesel engine ? Give a simple sketch of a spark plug.

(b) Differentiate between boiler mountings and boiler accessories. Give two examples and sketch one boiler mounting. *5+5*

6. (a) In how many different forms is energy available on the Earth ? Classify them into two groups. Which form of energy is most widely used ?

(b) Explain the following laws of thermochemistry :

(i) Law of Lavoisier and Laplace

(ii) Hess's law of constant heat summation *5+5*

7. (a) How do you classify the internal combustion engines ? Mention the cycles on which these engines work. Why is it necessary to cool an I.C. engine ?

(b) With a neat sketch, explain the functioning of a 4-stroke petrol engine. What is the other type of engine and what advantages does it offer over a 4-stroke engine ? *5+5*

8. (a) With the help of neat sketches, explain the working principle of a nuclear power plant. State the functions of the following parts of a nuclear power plant :

* Nuclear reactor
* Moderator
* Control rod

(b) The equivalent of evaporation of a boiler is 10·4 kg/kg of fuel. The boiler produces 15 T/hr of steam at 2·00 MN/m^2. Feed water temperature is 40°C. Fuel consumption is 1650 kg/hr. Find the boiler efficiency and the condition of steam produced. Take calorific value of fuel = 29800 kJ/kg. *5+5*

9. (a) State the advantages and disadvantages of nuclear power plants over coal based power plants.

(b) A trial was conducted on a two-stroke cycle 4-cylinder gasoline engine having 10 cm bore and 12 cm stroke. The net dynamometer load was 310 N at a radius of 40 cm when the engine speed was 2050 rpm. At the same speed and throttle opening, the engine required 6 kW to motor it with the ignition switch off.

During the 3-minute run at this speed and power the engine consumed 0·52 kg of fuel with calorific value of 42100 kJ/kg and 24 kg of cooling water was circulated through the jacket. The temperature rise of cooling water was by 60°.

Determine :

(i) Mechanical efficiency

(ii) Indicated M.E.P.

(iii) Brake thermal efficiency *5+5*

10. (a) In a gas turbine plant, air compressor takes in air at a temperature of 15°C and compresses it to 4 times the initial pressure with an isentropic efficiency of 82%. The air is then passed through a regenerator before reaching the combustion chamber. The effectiveness of the regenerator is 78%. The maximum temperature of the cycle is 600°C and the isentropic efficiency of the turbine is 70%. Find the thermal efficiency of the plant. Take R = 0·287 kJ/kg K.

(b) A diesel fuel contains 70% C, 10% H_2, 5% O_2, 1% S and rest incombustible by weight. If air contains 23% oxygen by weight, find the amount of air required for complete combustion of 1 kg fuel. *5+5*