

B.E. Mechanical Engineering (Model Curriculum) Sem-VI
PECMEL324 : Internal Combustion Engine and Gas Turbine

P. Pages : 2

Time : Three Hours



GUG/W/22/14080

Max. Marks : 80

- Notes :
1. All questions carry as indicated marks.
 2. Due credit will be given to neatness and adequate dimensions.
 3. Assume suitable data wherever necessary.
 4. Illustrate your answers wherever necessary with the help of neat sketches.
 5. Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.

1. a) Explain with neat sketch construction and operation of a fuel injection pump. **6**
- b) With neat sketch explain thermostatic controlled water cooling system. **5**
- c) Enlist the various components of the IC Engine? Explain briefly the various components of IC engine with the help of suitable diagram. **5**

OR

2. a) Give the importance of lubrication system in an IC Engine. List the various lubrication systems used in IC Engines? Explain dry sump lubrication system with neat sketch. **7**
- b) Explain with neat sketch construction and working of two stroke engine. **5**
- c) Explain with neat sketch working valve timing diagram for four stroke petrol engine. **4**
3. a) What is meant by abnormal combustion? Explain the phenomena of knock in SI engines. **4**
- b) What are the various types of combustion chambers used in SI engines? Explain them briefly. **6**
- c) Explain the stages of combustion in SI engines elaborating the flame front propagation. **6**

OR

4. a) Bring out clearly the process of combustion in CI engines and also explain the various stages of combustion. **8**
- b) Explain with neat sketch the various types of combustion chambers used in CI engines. **8**

5. The following observations were made during a trial of a single cylinder, four stroke cycle gas engine having cylinder diameter of 18 cm and stroke 24 cm. **16**
1) Duration of trial is 30 min. 2) Total number of revolution is 9000 3) Total number of explosion is 4450 4) Mean effective pressure is 5 bar 5) Net load on the brake wheel is 40 kg 6) Effective diameter of brake wheel is 1 m, 7) Total gas used at NTP is 2.4 m^3 , 8) Calorific value of gas at NTP is 19 MJ/m^3 , 9) Total air used is 36 m^3 , 10) Pressure of air is 720 mm Hg, 11) Temperature of air is 17°C , 12) Density of air at NTP is 1.29 kg/m^3 , 13) Temperature of exhaust gas is 350°C , 14) Room Temperature is 17°C , 15) Specific heat of exhaust gas is 1 kJ/kg K , 16) Cooling water circulated is 80 kg, 17) Rise in temperature of cooling water is 30°C .

Draw up heat balance sheet and estimate the mechanical and indicated thermal efficiency of the engine. Take $R = 287\text{ J/kg K}$.

OR

6. A four stroke gas engine has a cylinder diameter of 25 cm and stroke 45 cm. The effective diameter of the brake is 1.6 m. The observations made in a test of the engine were as follows: 16
1. Duration of test = 40 min.
 2. Total number of revolutions = 8080
 3. Total number of explosions = 3230.
 4. Net load on the brake = 90 kg.
 5. Mean effective pressure = 5.8 bar.
 6. Volume of gas used = 7.5 m^3
 7. Pressure of gas indicated in meter = 136 mm water of gauge.
 8. Atmospheric temperature = 17°C .
 9. Calorific value of gas = $19 \text{ MJ} / \text{m}^3$ at NTP.
 10. Rise in temperature of jacket cooling water = 45°C .
 11. Cooling water supplied = 180 kg.
- Draw up a heat balance sheet and estimate the indicated thermal efficiency and brake thermal efficiency. Assume atmospheric pressure as 760 mm of Hg.

7. A two stage single acting reciprocating compressor takes in air at the rate of $0.2 \text{ m}^3 / \text{s}$. The intake pressure and temperature of air are 0.1 Mpa and 16°C . The air is compressed to a final pressure of 0.7 Mpa. The intermediate pressure is ideal and inter-cooling is perfect. The compression index in both the stages is 1.25 and the compressor runs at 600 rpm. Neglecting clearance, determine: 16
- 1) The intermediate pressure
 - 2) The total volume of each cylinder
 - 3) The power required to drive the compressor, and
 - 4) The rate of heat rejection in the intercooler
- Take $C_p = 1.005 \text{ kJ/kg K}$, $R = 0.287 \text{ kJ/kg K}$.

OR

8. a) Discuss with neat sketch screw compressor. 5
- b) What is a centrifugal compressor? How does it differ from an axial flow compressor? 5
- c) What is a rotary compressor? How are rotary compressors classified? 6
9. a) A simple gas turbine works between absolute limits 295 k and 900 k the absolute pressure limit being 1 bar and 4 bar. The isentropic efficiency of compressor and turbine is 0.82 and 0.85 respectively. Estimate the actual thermal efficiency of a plant and power available for driving external load if the fuel consumption is $1 \text{ kg} / \text{s}$ and CV is 42000 kJ/kg . 10
- b) List the advantages and disadvantage of gas turbine plants over the I.C. engine plants. 6

OR

10. a) With the help of graph, explain the performance of turbo-jet engine and discuss the advantages and disadvantages of this propulsion system. 8
- b) What do you understand by thrust augmentation? Explain different methods of thrust augmentation with the help of neat sketches. 8
