PECMEL324 - Internal Combustion Engines and Gas Turbine

P. Pages : 2

Time : Three Hours

7667

GUG/W/23/14080

Max. Marks : 80

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Notes : 1. All questions carry equal 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. Solve Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.

1. a) Describe with neat sketch construction and operation of a distribution fuel injection pump. **8**

b) Enlist the various alternative fuel of the IC Engine? Explain briefly the various alternative fuel of IC engine. **8**

c) Explain Wet sump lubrication system with neat sketches. **4**

OR

2. a) What is a radiator? Explain its construction & working with sketches. **8**

b) Differentiate between four stroke and two stroke engine. **4**

c) Explain with neat sketch working value timing diagram for four stroke petrol engine. **4**

3. a) What are the various types of combustion chambers used in SI engines? Explain them briefly. **8**

b) Explain the stages of combustion in SI engines elaborating the flame front propagation. **8**

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 6) Net load on the brake wheel is 40 kg 7) Effective diameter of brake wheel is 1m, 8) Total gas used at NTP is 2.4m³, 9) Calorific value of gas at NTP is 19 MJ/m³, 10) Total air used is 36 m³, 11) Pressure of air is 720 mm Hg, 12) Temperature of air is 17ºC, 13) Density of air at NTP is 1.29 kg/m³, 14) Temperature of exhaust gas is 350ºC, 15) Room Temperature is 17ºC, 16) Specific heat of exhaust gas is 1 kJ/kg K, 17) Cooling water circulated is 80 kg, 18) Rise in temperature of cooling water is 30ºC.
Draw up heat balance sheet and estimate the mechanical and indicated thermal efficiency of the engine. Take R = 287 J/kg. K.

OR

6. a) A four-stroke petrol engine delivers a brake power of 36.8 kW with a mechanical efficiency of 80%. The Air-fuel ratio is 15:1 and the fuel consumption is 0.4068 kg/kWh. The heating value of the fuel is 42000 kJ/kg.   **10**
Calculate
   i)   Indicated power
   ii) Friction power
   iii) Brake thermal efficiency
   iv) Indicated thermal efficiency
   v)   Total fuel consumption
   vi) Air consumption /sec.

b) Explain briefly   **6**
   i)   Mean effective pressure
   ii) Specific output
   iii) Air fuel ratio
   iv) Specific fuel consumption.

7. Following data relate to a performance test of a single acting 14 cmx 10 cm reciprocating compressor: **16**
   1) Suction pressure = 1 bar.
   2) Suction temperature = 20°C.
   3) Discharge pressure = 6 bar.
   4) Discharge temperature = 180°C
   5) Speed of compressor = 1200 r.p.m.
   6) Shaft power = 6.25 kW
   7) Mass of air delivered = 1.7 kg/min
   Calculate the following
   a) The actual volumetric efficiency
   b) The indicated power
   c) The isothermal efficiency
   d) The mechanical efficiency
   e) The overall isothermal efficiency

<div align="center">OR</div>

8. a) Discuss with neat sketch screw compressor.   **5**

b) Describe the function of impeller and the diffuser in a centrifugal compressor.   **5**

c) Discuss the effect of impeller blade shape on performance of centrifugal compressor.   **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 kg/ s and CV is 42000 kJ/kg.   **10**

b) What do you understand by thrust augmentation? Explain different methods of thrust augmentation with the help of neat sketches.   **6**

<div align="center">OR</div>

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) State the principle of jet propulsion. Classify propulsion system & explain with neat sketch & T-S diagram of gas turbine plant for turbo jet.   **8**

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