B.E. Mechanical Engineering (Model Curriculum) Semester - VI

PECMEL324 - Internal Combustion Engines and Gas Turbine

P. Pages : 3 **GUG/S/23/14080**

Time : Three Hours * 2 8 1 7 * Max. Marks : 80

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 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) Clarify with neat sketch construction and operation of a down draught carter carburetor. **8**

b) 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. **8**

OR

2. a) With neat sketch explain thermostatic controlled water cooling system. **8**

b) Explain with neat sketch construction and operation of a fuel injection pump. **8**

3. a) What are homogeneous and heterogeneous mixtures? In which engines these mixtures are used? Explain. **4**

b) What are the various types of combustion chambers used in SI engines? Explain them briefly. **6**

c) Explain the effect of various engine variables on SI engine knock. **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. a) In a test of a 4-cylinder, 4-stroke engine 75 mm bore and 100 mm stroke, the following results were obtained at full throttle at a particular constraint speed and with fixed setting of fuel supply of 6.0 kg/h. **10**
BP with all cylinder working = 15.6 Kw
BP with cylinder no. 1 cut-off = 11.1 Kw
BP with cylinder no. 2 cut off = 11.03 Kw
BP with cylinder no. 3 cut off = 10.88 Kw
BP with cylinder no. 4 cut off = 10.66 kw
If the C. V. of the fuel is 83600 KJ/kg and clearance volume = $0.0001 m^3$, calculate;
i) Mechanical efficiency.
ii) Indicated thermal efficiency.
iii) Air standard efficiency.

b) Explain briefly **6**

i) Mean effective pressure

ii) Break power.

iii) Air fuel ratio

iv) Specific fuel consumption.

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 1.6m. The observations made in a test of the engine were as follow: **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 = $7.5m^3$

7) Pressure of gas indicated in meter = 136 mm water of gauge

8) Atmospheric temperature = 17°C.

9) Calorific value of gas = 19 MJ/m^3 at NTP

10) Rise in temperature of jacket cooling water = 45ºC.

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 m^2/s. The intake pressure and temperature of air are 0.1 MPa and 16ºC. 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 Cp = 1.005 kJ/kg K, R = 0.287 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 rotary compressor? How are rotary compressors classified? **6**

9. A pressure ratio of an open cycle constant pressure gas turbine plant is 6. The temperature range of plant is 15ºC and 800ºC. Using following data: **16**

Cpa = 1 kJ/kg K, Cpg – 1.075 kJ/ kgK,

γ = 1.4 for both air and gases,

C. V of fuel = 43000 kJ/kg.

ηc = 0.85 and ηc = 0.90

η comb (combustion chamber) = 0.95.

Find

i) The thermal efficiency of the plant

ii) I. P of the plant if circulation of air is 5 kg/sec.

iii) Specific fuel consumption.

Neglect the losses in the system.

OR

10. a) Derive expression for optimum pressure ratio for maximum specific output in actual simple gas turbine cycle. **8**

b) With the help of graph, explain the performance of turbo-jet engine and discuss the advantages and disadvantages of this propulsion system. **8**

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