

B.E. / B.Tech. Mechanical Engineering (Model Curriculum) Semester-VI
PEC-MEL-324 / INTERNAL1 - Internal Combustion Engines and Gas Turbines

P. Pages : 3



Time : Three Hours

GUG/S/25/14080

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) Define 'Engine and Heat Engine'. How to classify IC Engine? What is the difference between 2-stroke and 4-stroke IC engine? **8**
- b) Clarify with neat sketch construction and operation of a down draught carter carburetor. **8**

OR

- 2.** a) Explain with neat sketch construction and working of four stroke engine. Explain with neat sketch working valve timing diagram for four stroke petrol engine. **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 neat sketch. **8**
- 3.** a) Explain the various factors that influence the flame speed. **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 in CI engines. **8**
- b) Explain with neat sketch the various types of combustion chambers used in CI engines. **8**
- 5.** A four stroke gas engine has a cylinder diameter of 25cm and stroke 45cm. The effective diameter of the brake is 1.6m. The observations made in a test of the engine were as follows- **16**
1. Duration of test = 40min.
 2. Total number of revolutions = 8080.
 3. Total number of explosions = 3230.
 4. Net load on the brake = 90kg.
 5. Mean effective pressure = 5.8 bar.
 6. Volume of gas used = 7.5m^3

7. Pressure of gas indicated in meter = 136mm 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 = 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 760mm of Hg.

OR

6. a) In a test of a 4-cylinder, 4-stroke engine 60mm bore and 95mm stroke, the following results were obtained at full throttle at a particular constraint speed and with fixed setting of fuel supply of 5.5 kg/h. 12
 BP with all cylinder working = 13.8kW
 BP with cylinder no. 1 cut-off = 9.82kW
 BP with cylinder no. 2 cut off = 9.72kW
 BP with cylinder no. 3 cut off = 8.67kW
 BP with cylinder no. 4 cut off = 8.55kW
 If the C.V. of the fuel is 84100kJ/kg and clearance volume = 0.0001m^3 , calculate;
 i) Mechanical efficiency
 ii) Indicated thermal efficiency
 iii) Air standard efficiency
- b) Discuss the following performance parameters of an I.C. Engines- 4
 i) Indicated power
 ii) Break power
 iii) Break power mean effective pressure
 iv) Specific fuel consumption

7. A centrifugal compressor running at 12000 rpm delivers $600\text{m}^3/\text{min}$ of free air. The air is compressed from 1 bar & 27°C to a pressure ratio of 4 with an isentropic efficiency of 85%. The blades are radial at impeller outlet & flow velocity of 60 m/s may be assumed throughout constant. The outer radius of the impeller is twice the inner one and slip factor is 0.9. 16

Calculate:

- a) Final temperature of air

- b) Power input of compressor
- c) Impeller diameter at inlet & outlet
- d) Width of impeller at inlet

OR

- | | | |
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| 8. | a) What is a rotary compressor? How are rotary compressors classified? | 8 |
| b) What is a centrifugal compressor? How does it differ from an axial flow compressor? | 8 | |
| 9. | a) Draw diagram of Ramjet engine and discuss its working. | 8 |
| b) Derive expression for optimum pressure ratio for maximum specific output in actual simple gas turbine cycle. | 8 | |

OR

- | | | |
|------------|---|-----------|
| 10. | A closed cycle gas turbine consists of two compressors and two turbines. All components are mounted on the same shaft. The pressure and temperature at the inlet of the first stage are 2 bar and 25°C. The maximum cycle pressure and temperature are limited to 8 bar and 850°C. Perfect cooler and perfect heater is used between two compressors and two turbines respectively. | 16 |
|------------|---|-----------|
- Assuming the compressor and turbine efficiencies as 83%. Find
- i) The cycle efficiency without regenerator
 - ii) With regenerator whose effectiveness is 0.65 and
 - iii) If the IP developed by the plant is 310 kW, find mass of fluid circulated. Air is used as working fluid $r = 1.4$ and $C_p = 1 \text{ kJ/kg K}$.
