

B.E. (Mechanical Engineering) Model Curriculum Semester-VI
PECMEL324 - Internal Combustion Engines and Gas Turbines

P. Pages : 2

Time : Three Hours



GUG/W/24/14080

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) 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 Wet sump lubrication system with neat sketches. **8**

OR

2. a) Enlist the different types of cooling systems employed in automobiles. What is a radiator? Explain its construction & working with sketches. **8**
- b) Describe with neat sketch construction and operation of a distribution fuel injection pump. **8**
3. a) Explain the effect of various engine variables on SI engine knock. **8**
- b) What are the various types of combustion chambers used in SI engines? Explain them briefly. **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. a) The following observations were recorded during a trial of a four stroke single cylinder oil engine. Duration of trial is 30 minutes, oil consumption is 4 liters, calorific value of the oil is 43 MJ/kg, specific gravity of the fuel is 0.8, average area of the indicator diagram is 8.5 cm^2 , length of the indicator diagram is 8.5 cm, spring constant is 5.5 bar/cm, brake load is 150 kg, spring balance reading is 20 kg, effective brake wheel diameter is 1.5 m, speed is 200 rpm, cylinder diameter is 30 cm, stroke is 45 cm, jacket cooling water is 10 kg/min, temperature rise is 36°C . **12**
- Calculate:
- | | |
|----------------------------------|---|
| i) indicated power | ii) brake power |
| iii) mechanical efficiency | iv) brake specific fuel consumption in kg/kWh and |
| v) indicated thermal efficiency. | |
- b) Explain briefly **4**
- | | |
|----------------------------|-------------------------------|
| i) Mean effective pressure | ii) Break power |
| iii) Air fuel ratio | iv) Specific fuel consumption |

OR

- 6.** 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 $R = 287 \text{ J/kg K}$.

- 7.** Air at a temperature of 17°C flows into the centrifugal compressor running at 20000 rpm. **16**
- Using the following given data. Slip factor = 0.80, work input factor = 1, isentropic efficiency = 70%, Outer diameter of blade tip = 50 cm, Assuming the absolute velocity of air entering and leaving the compressor are same, Find:
- a) Temperature rise of air pressing through compressor and
 - b) The static pressure ratio

OR

- 8.**
- a) Discuss the effect of impeller blade shape on performance of centrifugal compressor. **4**
 - b) Draw velocity diagram at the outlet of centrifugal compressor and name various components. **8**
 - c) What is a rotary compressor? How are rotary compressors classified? **4**
- 9.** 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 $\gamma=1.4$ and $C_p = 1 \text{ kJ/kg K}$.

OR

- 10.**
- a) What do you understand by thrust augmentation? Explain different methods of thrust augmentation with the help of neat sketches. **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**
