

**INTERNAL COMBUSTION ENGINES***Time: Three Hours**Maximum Marks: 100*

*Answer five questions, taking ANY TWO from Group A, any two from Group B and all from Group C.*

*All parts of a question (a, b, etc. ) should be answered at one place.*

*Answer should be brief and to-the-point and be supplemented with neat sketches.*

*Unnecessary long answer may result in loss of marks.*

*Any missing or wrong data may be assumed suitably giving proper justification.*

*Figures on the right-hand side margin indicate full marks.*

**Group A**

1. (a) Compare four stroke and two stroke engines based on construction, performance and advantages. 6
- (b) Explain assumption made in air standard cycle and working principle of air standard Otto cycle with P-V and T-s diagrams. 6
- (c) The temperature at the beginning of the compression process of an air-standard Otto cycle with a compression ratio of 8 is 300 K, the pressure is 1 bar, and the cylinder volume is 560 cm<sup>3</sup>. The maximum temperature during the cycle is 2000 K. Determine (i) the temperature and pressure at the end of each process of the cycle, (ii) the thermal efficiency, and (iii) the mean effective pressure, in atm. 8
  
2. (a) Discuss the characteristics of fuel for S.I. engine. Explain why is the volatility an important quality for SI engine fuels. 8
- (b) Explain briefly combustion phenomenon in SI engines. 6
- (c) Explain octane number and various fuels used in SI engine. 6
  
3. (a) Explain knocking in CI engines. Explain various factors influencing knocking in C.I. engine. 8
- (b) What do you mean by "Cetane number" of fuels? How is it determined? 6

- (c) Classify fuel injection system used in CI engines. Draw and explain any one type of fuel injection systems used in CI engines. 6
4. (a) Write short notes on (i) stoichiometric fuel air ratio and (ii) lean and rich mixture operation. 6
- (b) Explain the working of single jet carburettor with a neat sketch. 8
- (c) State the essential requirements of a good carburettor for automotive engines. 6

**Group B**

5. (a) Write important functions of lubricants. Explain splash lubrication with a neat sketch. 8
- (b) Explain with the help of a simple sketch, the working of a (i) wet sump lubrication system (ii) dry sump lubrication system. 6
- (c) Describe in brief the wet sump lubrication system. How is the lubrication of crank-pin bearing done? 6
6. (a) What is scavenging and scavenging efficiency. 6
- (b) What is scavenging in two stroke engine? Discuss loop scavenging and uniflow scavenging with neat sketches. 8
- (c) What is the purpose of supercharging? List various types of superchargers. What are its objectives? Advantages? Compare it with turbo-charging. 6
7. (a) Explain engine testing. Discuss various performance parameters of I.C. engine. Discuss the effect of load on indicated thermal efficiency. 8
- (b) Distinguish between speed characteristics and load characteristics of IC engines. To which type of engines they are applicable? 6
- (c) Explain working of eddy-current dynamometer. 6
8. (a) Draw a labelled figure of Wankel engine and show the function of various parts of the engine. (ii) What are the limitations of the Wankel engines? 8
- (b) Explain with a labelled sketch, the working principle of sterling engines. 6

- (c) Write advantages and disadvantages of biodiesel as alternative fuel for CI engine. 6

**Group C**

9. Answer the following in brief: 20
- (i) Volumetric efficiency of SI engine is comparatively
    - (a) lower than CI engine
    - (b) higher than CI engine
    - (c) same as CI engine
    - (d) None of the three above
  - (ii) What does the reversed ideal Stirling cycle consist of?
    - (a) Two reversible isothermal processes and two reversible adiabatic processes
    - (b) Two reversible isothermal processes and two reversible isochoric processes
    - (c) Two reversible isobaric processes and two reversible adiabatic processes
    - (d) Two reversible adiabatic processes and two reversible isochoric processes
  - (iii) For maximum specific output of a constant volume cycle (Otto cycle), the
    - (a) working fluid should be air
    - (b) speed should be high
    - (c) suction temperature should be high
    - (d) temperature of the working fluid at the end of compression and expansion should be equal.
  - (iv) Piston rings are usually made of
    - (a) cast iron
    - (b) aluminium
    - (c) phosphor bronze
    - (d) carbon steel
  - (v) During idling, a petrol engine requires
    - (a) lean mixture
    - (b) rich mixture

- (c) chemically correct
- (d) None of the three above
- (vi) Photochemical smog is mainly due to
  - (a) NO<sub>x</sub> and HO
  - (b) soot and particulate matter
  - (c) CO and CO<sub>2</sub>
  - (d) excess O<sub>2</sub>
- (vii) Concentration of NO<sub>x</sub> in the exhaust of a SI engine will be maximum when the fuel- air mixture is
  - (a) 10% lean
  - (b) stoichiometric
  - (c) 10% rich
  - (d) 20% rich
- (viii) Which one is the most viscous lubricating oil?
  - (a) SAE 30
  - (b) SAE 40
  - (c) SAE 50
  - (d) SAE 60
- (ix) The most popular dynamometer to measure brake power of an IC engine is
  - (a) rope brake dynamometer
  - (b) eddy current dynamometer
  - (c) electrical dynamometer
  - (d) hydraulic dynamometer
- (x) The stoichiometric air-fuel ratio for SI engine is of the order of
  - (a) 10:1
  - (b) 12:1
  - (c) 15:1
  - (d) 20:1

*(Refer our course material for answers)*