Total No. of Questions—**12**] [Total No. of Printed Pages—**4+2**

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S.E. (Mech.) (Second Sem.) EXAMINATION, 2011

INTERNAL COMBUSTION ENGINES

(2008 PATTERN)

Time : Three Hours **Maximum Marks : 100**

N.B. :— (*i*) Answer any *three* questions from each Section.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Figures to the right indicate full marks.

(*v*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(*vi*) Assume suitable data, if necessary.

SECTION I

1. (*a*) Derive an expression for thermal efficiency of a Diesel cycle with usual notations. Hence show that the efficiency of the Diesel cycle is lower than that of Otto cycle for the same compression ratio. Comment why the higher efficiency of Otto cycle compared to Diesel cycle have no practical importance. [9]

P.T.O.

(*b*) The mean effective pressure of an ideal Diesel cycle is 8 bar. If the initial pressure is 1.03 bar and the compression ratio is 12, determine the cut-off ratio and the air-standard efficiency. Take $\frac{C_p}{C_v}$ for air as 1.4. [9]

Or

2. (*a*) How do the specific heats vary with temperature ? What is the physical explanation for this variation ? [5]

(*b*) Compare Air-standard cycle, fuel-air cycle and actual cycle of a gasolene engine. [5]

(*c*) Fuel supplied to an SI engine has a calorific value 42000 kJ/kg. The pressure in the cylinder at 30% and 70% of the compression stroke are 1.3 bar and 2.6 bar respectively. Assuming that the compression follows the law $pV^{1.3}$ = constant, find the compression ratio. If the relative efficiency of the engine compared with the air-standard efficiency is 50%, calculate the fuel consumption in kg/kW hr. [8]

3. (*a*) Describe with suitable sketches the following systems of a modern carburettor :

(*i*) Main metering system

(*ii*) Economiser system and

(*iii*) Choke. [9]

(*b*) A four-cylinder, four stroke square engine running at 40 rev/sec. has a carburettor venturi with 3 cm throat. Assuming the bore to be 10 cm, volumetric efficiency 75%, the density of air to be 1.15 kg/m^3 and coefficient of air flow to be 0.75. Calculate the suction at the throat. [7]

Or

4. (*a*) What action can be taken with regard to the following variables, in order to reduce the possibility of detonation in an S.I. engine ? Justify your answers by reasons :

(*i*) Mass of charge induced

(*ii*) Spark timing

(*iii*) Distance of flame travel and

(*iv*) Engine speed. [8]

(*b*) Explain the phenomenon of pre-ignition. How pre-ignition leads to detonation and vice-versa ? Explain how pre-ignition can be detected ? [8]

5. (*a*) Explain the stages of combustion in a CI engine. [6]

(*b*) What is the importance of delay period ? Should the delay period be zero ? [4]

(*c*) Explain the following : [6]

(*i*) Pre-combustion chamber

(*ii*) M combustion chamber.

Or

6. (*a*) How do the injection timing and the fuel quality affect the engine knock ? [4]

(*b*) Discuss the requirements of an ideal injection. [4]

(*c*) Describe the principle of a helix bypass pump and draw sketches for different types of plunger helix in use. [8]

SECTION II

7. (*a*) Explain any *one* type of Electronic Ignition System. [8]

(*b*) What do you mean by drive train mechanism ? Explain with sketches. [8]

Or

8. (*a*) What is governing of IC engines ? Explain Hit and Miss governing. [8]

(*b*) What do you mean by intake and exhaust system ? Explain with sketches various parts of intake and exhaust systems in brief. [8]

9. (*a*) What are the various methods for measuring friction power ? Describe the 'Motoring method' of measurement of friction power. [8]

(*b*) A 4-cylinder petrol engine with 80 mm bore and 110 mm stroke length working on 4-stroke principle develops torque 140 N-m at 4500 rpm. The clearance volume per cylinder is 0.065 litres. Fuel consumption is 16 kg/hr. Take C.V. of fuel as 42500 kJ/kg and was 1.4 for air.

Calculate :

(*i*) B.P.

(*ii*) bmep

(*iii*) Brake thermal efficiency and

(*iv*) Relative efficiency. [10]

Or

10. (*a*) Explain the limitations of Supercharging. [4]

(*b*) Describe with a sketch the principle of a hydraulic dynamometer. [8]

(*c*) A single cylinder engine running at 2000 rpm develops a torque of 10 N-m. The indicated power of the engine is 2.3 kW. Find the loss due to friction power as the percentage of brake power. [6]

11. (*a*) Enlist the specifications of an automotive engine. [8]

(*b*) Explain exhaust gas recirculation system to control oxides of nitrogen. [8]

Or

12. (*a*) Explain Hybrid Electric-vehicle (HEVs). [8]

(*b*) Explain :

(*i*) Compressed Natural Gas (CNG)

(*ii*) Liquefied Petroleum Gas (LPG). [8]