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

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S.E. (Mechanical) (Second Semester) EXAMINATION, 2010

INTERNAL COMBUSTION ENGINES

(2008 COURSE)

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

N.B. :— (*i*) Answer *three* questions from Section I and *three* questions form Section II.

(*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 air standard efficiency of a Otto cycle with usual notations. Hence show that the efficiency of the Otto cycle is lower than that of a Carnot cycle. [8]

(*b*) An oil engine takes in air at 1.01 bar, 20°C and the maximum cycle pressure is 69 bar. The compression ratio is 18 : 1. Calculate the air standard efficiency and mean effective pressure based

P.T.O.

on dual combustion cycle. Assume that heat added at constant volume is equal to heat added at constant pressure. Take C_p = 1.005 kJ/kgK, C_v = 0.718 kJ/kgK and γ = 1.4 [10]

Or

2. (*a*) Explain in brief how chemical equilibrium affects the performance of the engine. [6]

(*b*) Draw theoretical and actual valve timing diagrams for four stroke diesel engine. Explain the reasons for the difference. [7]

(*c*) Explain pumping and friction losses and their effects on the power output of the engine. [5]

3. (*a*) What are the advantages and disadvantages of petrol injection system over conventional carburettor system ? [5]

(*b*) Discuss the effect of the following engine variables on flame propagation :

(*i*) Fuel-air ratio

(*ii*) Compression ratio. [5]

(*c*) Explain the factors which affect the tendency to detonate. [6]

Or

4. (*a*) Explain with neat sketches the following systems of a carburettor :

(*i*) Idling system

(*ii*) Choke. [7]

(*b*) Explain any *three* types of combustion chambers used in S.I. engines. [9]

5. (*a*) Explain phenomenon of diesel knock. Compare it with the phenomenon of detonation in S.I. engines. [8]

(*b*) Explain the following factors which affect the delay period : [8]

(*i*) Fuel

(*ii*) Injection pressure

(*iii*) Compression ratio

(*iv*) Speed.

Or

6. (*a*) Draw a schematic diagram of a Bosch type fuel pump and explain its construction and working : [8]

(*b*) Write short notes on the following :

(*i*) Supercharging

(*ii*) Turbocharging. [8]

SECTION II

7. (*a*) Explain battery ignition system with a neat sketch. [8]

(*b*) What are the different properties of lubricating oil ? [4]

(*c*) Write a short note on additives used in lubrication system. [4]

Or

8. (*a*) Define intake manifold and their function. State materials used. Discuss the requirement for design of intake manifolds. [8]

(*b*) Explain the valve mechanism for overhead valves in engine cylinder and list the materials for valves. [8]

9. (*a*) What is a dynamometer ? Name various types of dynamometers. Explain prony type of dynamometer with the help of a neat sketch. [8]

(*b*) A six cylinder gasoline engine operates on the four stroke cycle. The bore of each cylinder is 80 mm and stroke 100 mm. The clearance volume per cylinder is 70 CC. At a speed of 4000 r.p.m., the fuel consumption is 30 kg/hr. and the torque developed is 150 N.m. Calculate :

(*i*) The brake power

(*ii*) The brake mean effective pressure

(*iii*) The brake thermal efficiency.

Assume the calorific value of fuel as 43,000 kJ/kg. Also estimate relative efficiency when engine works on constant volume cycle with $\gamma = 1.4$ for air. [10]

Or

10. (*a*) The following observations were recorded during a trial on 4-stroke diesel engine :

Speed of the engine = 1700 r.p.m.

Brake Torque = 327.4 N.m

Friction power = 15 kW

Fuel used = 15 kg/hr

C.V. of fuel = 42,000 kJ/kg

Air supplied = 4.75 kg/min

Outlet temperature of cooling water = 65.8°C.

Cooling water circulated = 16 kg/min

Temperature of exhaust gas = 400°C

Room temperature = 20.8°C

Specific heat of exhaust gas = 1.25 kJ/kgK

Specific heat of water = 4.18 kJ/kgK

Estimate the following :

(*i*) BP

(*ii*) Mechanical efficiency

(*iii*) bsfc

(*iv*) Draw heat balance sheet on kW basis. [10]

(*b*) Write short notes on :

(*i*) Importance of heat balance sheet

(*ii*) Various factors affecting volumetric efficiency. [8]

11. (*a*) Discuss various types exhaust emissions from an automobile. Which of these are harmful ? [8]

(*b*) What is cracking ? What are the various methods of cracking employed to obtain various hydrocarbon compounds ? [8]

Or

12. (*a*) Enumerate the desirable properties of a fuel for I.C. engines. [8]

(*b*) What are Euro-III and Bharat norms ? List these norms for petrol engines. [8]