

Total No. of Questions—12]

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S.E. (Mechanical) (II Sem.) EXAMINATION, 2010

IC ENGINES

(2008 COURSE)

Time : Three Hours

Maximum Marks : 100

N.B. :— (i) Answer *three* questions from Section I and *three* questions from 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) What are the assumptions made in analyzing the air standard cycle ? [6]

(b) Show that the compression ratio for the maximum work in an Otto cycle is given by :

$$r = \left(\frac{T_3}{T_1} \right)^{\frac{1}{2(r-1)}}$$

where T_1 and T_3 are the lower and upper limits of absolute temperature respectively.

P.T.O.

Also, prove that the intermediate temperatures for this condition are :

$$T_2 = T_4 = \sqrt{T_1 T_3} \quad [10]$$

Or

2. (a) A dual combustion cycle operates with a compression ratio of 12 and with a cut-off ratio of 1.615. The maximum pressure is 52.17 bar. Assuming indices of compression and expansion of 1.35, determine :
- (a) The temperature at cardinal points
 - (b) Air standard efficiency and
 - (c) The mean effective pressure of the cycle. [12]
- (b) Explain the phenomenon of dissociation and show its effect on the Otto cycle. [4]
3. (a) Explain Carter down draught carburettor with a neat sketch. [8]
- (b) A 4-stroke petrol engine has a swept volume of 2 litres and is running at 4000 rpm. The fuel-air ratio is 1 : 14 and the volumetric efficiency at this speed is 75%. The venturi throat diameter of the carburettor fitted to the engine is 3 cm. Determine the air velocity at the throat if the discharge coefficient for air is 0.9. The ambient pressure and temperature are 1 bar and 20°C respectively. Find the diameter of the fuel jet if the specific gravity of the fuel is 0.76. Assume, the coefficient for fuel flow is 0.6 and pressure drops to 0.96 bar at the throat. [8]

Or

4. (a) Explain Solex carburettor with a neat sketch : [8]
- (b) A 4-cylinder, 4-stroke SI engine has 100 mm cylinder diameter and 120 mm stroke, however volumetric efficiency is 80%. The engine runs at 4000 rpm and has its carburettor venturi diameter 30 mm. Determine the suction at the throat if the coefficient of air flow is 0.9. If the atmospheric pressure 1 bar, temperature 27°C and specific gravity of fuel is 0.78, then find the fuel jet diameter for given fuel-air ratio of 1 : 15. Assume, the coefficient of fuel flow is 0.7. [8]
5. (a) Describe the construction and working of a distributor fuel injection system in brief with the help of a diagram. [6]
- (b) Compare the knocking in SI and CI engines. [6]
- (c) What is direct-injection type combustion chamber for a CI engine ? What are the different types of this combustion chamber ? [6]
- Or
6. (a) Describe the different stages of combustion in a CI engine. [6]
- (b) Describe the phenomenon of knock in CI engine. [6]
- (c) What do we mean by supercharging ? Differentiate between supercharged and non-supercharged engines. [6]

SECTION II

7. (a) What are the requirements of an ignition system used in IC engines ? [4]
- (b) Explain with neat sketch, wet sump lubrication system used in IC engines. [6]
- (c) What are the various types of radiators used in cooling system ? Explain any *one* in detail. [6]

Or

8. (a) What is the purpose of exhaust system ? Give a sketch of exhaust system. [8]
- (b) Explain function of governing system used in IC engines. Explain working of hit and miss governing. [8]

9. (a) Explain in brief the following terms used in testing of IC engines :

(i) Indicated mean effective pressure

(ii) Indicated power. [4]

- (b) A single cylinder 4-stroke engine gave the following results while running on full load :

Area of indicator card = 300 mm²

Length of diagram = 40 mm

Spring constant = 1 bar/mm

Speed of the engine = 400 rpm

Load on the brake = 370 N

Spring balance reading	= 50 N
Diameter of brake drum	= 1.2 m
Fuel consumption	= 2.8 kg/h
Calorific value of fuel	= 41800 kJ/kg
Diameter of cylinder	= 160 mm
Stroke of piston	= 200 mm

Calculate :

- (i) Indicated mean effective pressure
- (ii) Brake power and brake mean effective pressure
- (iii) Brake specific fuel consumption
- (iv) Brake thermal efficiency
- (v) Indicated thermal efficiency. [12]

Or

10. (a) The following data were recorded in a test of one hour duration on a single cylinder oil engine working on 4-stroke cycle : [10]

Bore	= 300 mm
Stroke	= 450 mm
Fuel used	= 8.8 kg
Calorific value of fuel	= 41800 kJ/kg
Average speed	= 200 rpm
m.e.p.	= 5.8 bar
Brake friction load	= 1860 N

Quantity of cooling water = 650 kg

Temperature rise = 22°C.

Diameter of the brake wheel = 1.22 m

Calculate :

(i) Mechanical efficiency

(ii) Brake thermal efficiency.

Draw Heat Balance sheet.

(b) Discuss Morse test used during performance testing of IC engines. [6]

11. (a) Explain various important qualities of S.I. engine fuels. [6]

(b) What are the sources of HC formation in petrol engine? Explain various factors which affect the HC formation. [6]

(c) Discuss concept and working of hybrid vehicles. [6]

12. Write short notes on the following (any three) : [18]

(i) Refining process of petroleum

(ii) Alternate fuels for IC engines

(iii) Factor affecting formation of NO_x

(iv) Diesel engine emissions

(v) E.G.R