Code : 102701

B.Tech 7th Semester Exam., 2021

(New Course)

INTERNAL COMBUSTION ENGINES

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

(ii) There are ***NINE*** *questions in this paper.*

(iii) Attempt ***FIVE*** *questions in all.*

(iv) Question No. 1 is compulsory.

1. Choose the correct answer of the following (any *seven*) : 2×7=14

(a) Main advantage of a two-stroke engine over four-stroke engine is

(i) more power output for the cylinder of same dimensions

(ii) absence of valves

(iii) more uniform torque on the crankshaft

(iv) All of the above

(b) If L is the stroke and N is the r p m, then mean piston speed of two stroke engine is

(i) LN

(ii) $LN/2$

(iii) $2LN$

(iv) None of the above

(c) An IC engine has a bore and stroke of 2 units each. The area to calculate heat loss can be taken as

(i) 4π

(ii) 5π

(iii) 6π

(iv) 8π

(d) The air-fuel ratio for idling speed of an automobile petrol engine is closer to

(i) 10 : 1

(ii) 15 : 1

(iii) 17 : 1

(iv) 21 : 1

(e) By higher octane number of SI fuel, it is meant that the fuel has

(i) higher heating value

(ii) higher flash point

(iii) lower volatility

(iv) longer ignition delay

(f) Where does mixing of fuel and air take place in case of diesel engine?

(i) Injection pump

(ii) Injector

(iii) Engine cylinder

(iv) Inlet manifold

(g) What is the purpose of employing supercharging for an engine?

(i) To provide forced cooling air

(ii) To raise exhaust pressure

(iii) To inject excess fuel for coping with higher load

(iv) To supply an intake of air at a density greater than the density of the surrounding atmosphere

(h) With increasing temperature of intake air, IC engine efficiency

(i) decreases

(ii) increases

(iii) remains same

(iv) depends on other factors

(i) The method of determination of indicated power of multi cylinder SI engine is by the use of

(i) Morse test

(ii) Prony brake test

(iii) Motorint test

(iv) Heat balance test

(j) An engine produces 10 kW brake power while working with a brake thermal efficiency of 30%. If the calorific value of the fuel used is 40000 kJ/kg, then what is the fuel consumption?

(i) 1·5 kg/hour

(ii) 3·0 kg/hour

(iii) 0·3 kg/hour

(iv) 1·0 kg/hour

2. (a) In what respect four-stroke cycle compression ignition engine differs from that of a four-stroke spark ignition engine? 7

(b) Describe, with a neat sketch, the working principle of a crankcase scavenged two-stroke engine. 7

3. *(a)* Draw p-V and T-s diagram of Otto cycle and derive an expression for the efficiency, and comment on the effect of compression ratio on the efficiency with respect of ratio of specific heats by means of a suitable graph. 10

(b) Determine the ideal efficiency of the diesel engine having a cylinder with bore 250 mm, stroke 375 mm and a clearance volume of 1500 cc, with fuel cut-off occurring at 5% of the stroke. Assume $\gamma = 1{\cdot}4$ for air. 4

4. *(a)* Compare the air-standard cycle and fuel-air cycle based on *(i)* character of the cycle, *(ii)* fuel-air ratio and *(iii)* chemical composition of the fuel. 7

(b) Find the percentage increase in the efficiency of a diesel cycle having a compression ratio of 16 and cut-off ratio by 10% of the swept volume, if C_v decreases by 2%. Take $C_v = 0{\cdot}717$ and $\gamma = 1{\cdot}4$. 7

5. *(a)* Explain various variables that affect the performance characteristics of SI engines. 6

(b) The following readings were taken during the test of a single-cylinder four stroke oil engine :

Cylinder diameter = 250 mm
Stroke length = 400 mm
Gross m.e.p. = 7 bar
Pumping m.e.p. = 0·5 bar
Engine speed = 250 r.p.m.
Net load on the brake = 1080 N
Effective diameter of the brake = 1·5 m
Fuel used per hour = 10 kg
Calorific value of fuel = 44300 kJ/kg

Calculate—

(i) indicated power;

(ii) brake power;

(iii) mechanical efficiency;

(iv) indicated thermal efficiency. 8

6. *(a)* What is meant by abnormal combustion? Explain the phenomena of knok in SI engines. 7

(b) Explain with the neat sketch the various stages of combustion in CI engine. 7

7. *(a)* Sketch the constructional layout of a battery ignition system and explain its working. 7

(b) Explain and compare the wet sump and dry sump lubrication systems. 7

8. (a) What are the various types of engine testing? Highlight its importance in relation to a new passenger vehicle. 7

(b) What is Morse test method? What are the various assumptions made in this test? On what vehicles this test can be performed? 7

9. (a) What are the main constituents of exhaust emissions from diesel engines? What is the effect of air-fuel ratio and surface-volume ratio on the exhaust emissions? 7

(b) What is the cause of formation of NO_X in petrol engine? What are the parameters that affect formation of NO_X? 7

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