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CS/B.Tech/ME/PE (NEW)/SEM-6/ME-601/2013
2013
IC ENGINE & GAS TURBINE

Time Allotted : 3 Hours   Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words
as far as practicable.

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : 10 × 1 = 10

    i)   During starting petrol engine requires

         a)   stoichiometric mixture

         b)   lean mixture

         c)   rich mixture

         d)   any A/F ratio is sufficient.

    ii) In turbochargers compressor is

         a)   electrically driven

         b)   exhaust GT driven

         c)   driven by the engine itself

         d)   none of these.

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iii) Supercharging of I.C. engine is essential for

    a) marine engine   b) aircraft engine

    c) stationary engine   d) none of these.

iv) The most perfect method of scavenging is

    a) cross-scavenging

    b) uniflow scavenging

    c) loop scavenging

    d) reverse flow scavenging.

v) Decrease in air-fuel ratio in SI engines results in

    a) increase of NO_X

    b) decrease of CO and UBHC

    c) increase of CO and UBHC

    d) both (a) and (c).

vi) Anti-knock property of C.I. engine fuel can be improved by adding

    a) tetraethyl lead

    b) trimethyl pentane

    c) amyl nitrate

    d) hexadecane.

vii) The principal surfaces requiring lubrication in an IC engine are

    a) cylinder head

    b) crank case

    c) inlet and exhaust manifold

    d) all of these.

viii) Advantage of fuel injection in SI engine is

    a) low maintenance cost

    b) low initial cost

    c) increased volumetric efficiency

    d) low pollution.

ix) The choke is closed when the engine is

    a) cruising

    b) hot

    c) idling

    d) cold.

x) For the same compression ratio and heat rejection

    a) $\eta_{otto} > \eta_{dual} > \eta_{diesel}$ b) $\eta_{otto} < \eta_{dual} < \eta_{diesel}$

    c) $\eta_{otto} > \eta_{diesel} > \eta_{dual}$ d) $\eta_{diesel} > \eta_{otto} > \eta_{dual}$.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. What are the effects of regeneration on Brayton cycle efficiency ? Define the effectiveness of a regenerator.   2 + 3

3. Explain the effect of pressure ratio on the net output and efficiency of a Brayton cycle.

4. Explain the method to reduce automobile pollution.

5. Explain with sketches the working of a Battery ignition system.

6. What is knocking in SI & CI engine ? Compare the knocking phenomenon of SI & CI engine.

7. What is supercharging ? What are the effects of supercharging in IC engine ?

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following.   3 × 15 = 45

8. a) A four stroke, four cylinder petrol engine is running at 3000 rpm. The bore of each cylinder is 60 mm, stroke is 90 mm. The clearance volume per cylinder is 60 c.c. Net brake load is 16 kg, torque arm is 350 mm. The fuel consumption per hour is 5 kg. Calculate the following calorific value of diesel :

   i) Brake power

   ii) Brake thermal efficiency if cylinder is 43000 kJ/kg

   iii) Indicated thermal efficiency if mechanical efficiency is 88%

   iv) Indicated mean effective pressure

   v) Relative efficiency

   vi) Brake specific fuel consumption.   9

b) Briefly explain the following :

   i) Time loss factor

   ii) Heat loss factor

   iii) Exhaust blow-down factor.   3 × 2

a) A simple jet carburetor is required to supply 5 kg of air and 0·5 kg fuel per minute. The fuel specific gravity is 0·75. The air is initially at 1 bar & 300 K. Calculate the throat diameter of the choke for a flow velocity of 100 m/sec. Velocity coefficient is 0·8. If the pressure drop across the fuel metering orifice is 0·80 of that of the choke, calculate the orifice diameter of fuel nozzle assuming C_{df} = 0·60, γ = 1·4.   8

b) Show with graphs the effect of fuel-air ratio on the efficiency and maximum power.   3

c) Explain cetane no. and octane no.   2 + 2

a) What are the advantages and limitations of supercharging in an I.C. engine ?   2

b) Explain briefly the stages of combustion in a C.I. engine.   3

c) A gas turbine plant operates on the Brayton cycle and the air at the inlet is at 27°C and 0·1 MPa. The pressure ratio is 6·25 and the maximum temperature is 800°C. The turbine and the compressor efficiencies are each 80%. Find the following :

i) The compressor work per kg of air

ii) The turbine work per kg of air

iii) The heat supplied per kg of air

iv) The cycle efficiency.

v) The turbine exhaust temperature. 1(

11. a) A 6 cylinder diesel engine operates on 4-stroke cycle The bore of each cylinder is 95 mm and stroke i: 120 mm. Speed of engine 2400 rpm. Orific(diameter = 30 mm. Coefficient of discharge, C_d = 0·62 Time of consume 100 c.c. diesel = 19·3 sec. Fue density = 0·831 gm/c.c. Density of air = 1·17 kg/m^3 Manometric water head = 197 mm. Brake drur dia. = 300 mm. Rope diameter = 20 mm. Brak load = 56 kg. Calculate the following :

i) Brake power

ii) Brake thermal efficiency if calorific value of diese is 43000 kJ/kg.

iii) Volumetric efficiency

iv) Brake mean effective pressure

v) Brake specific fuel consumption. 1

b) Explain the knocking phenomena in S.I. and C. engines and discuss the factors which reduce knocking.

a) Explain with figures various types of combustion chambers used in SI engines. 5

b) Explain with a neat sketch the battery ignition system. Why is spark advance required ? 6

c) What is scavenging process ? Explain with a suitable sketch, any one of the scavenging processes. 4

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