Paper Code: MTME023	Roll No.									

M. TECH.
FIRST SEMESTER THEORY EXAMINATION, 2016-2017
ADVANCED I C ENGINES

Time: 3Hours *Max. Mark: 70*

Note- Attempt all questions. All questions carry equal marks. Assume suitably missing data, if any:-

Q 1) Answer any two of the following. 7x2

a) Draw the typical valve timing diagrams for four stroke high speed and low speed SI engines. Compare SI and CI engines on the basis of volumetric efficiency, mechanical and thermal efficiency with proper explanation.
b) A diesel engine having compression ratio 16, operates on A/F ratio of 50:1. The temperature and pressure of air at the beginning of compression is 37 ºC and 1 bar. Find the efficiency and mean effective pressure of engine, assume engine works on air standard cycle, C.V. of fuel is 42 MJ/kg, $Cp_{,air}$ = 1.004 kJ/kg
c) Answer he following
   (i) Discuss the effect of dissociation on maximum temperature at different equivalence ratio.
   (ii) What do you understand by pumping losses (explain with the help of P-v diagram). What will be the effect of throttling and engine speed on pumping losses.

Q2) Answer any two of the following. 7x2

a) Define octane No., cetane no., and diesel index. How is the fuel Cetane no. measured?
b) An old car has a engine with a carburetor adjusted to supply stoichiometric air-fuel supply at normal condition using gasoline (C_8H_{15}) as fuel. Calculate the actual equivalence ratio the carburetor is supplying to the engine when it is supplied with the M30 (30% blend of methanol in petrol fuel).
c) Answer the following
   (i) Discuss the use of Hydrogen as a fuel for internal combustion engine.
   (ii) A direct injection diesel engine with CR=18 employs 4 hole nozzle. Fuel delivery is set at 12 mm3 /stroke per cylinder. If the air enters the engine at 27 C and 1 atm and injection is made near TDC, estimate the Saughter mean dia (SMD) of the fuel droplet. Given the fuel injection pressure 600 atm and
   SMD = 25 $(\Delta P)^{-0.135}$ $\rho_a^{0.121}$ $V_f^{0.131}$, micrometer
   Where ρ_a = air density, kg/m^3 , V_f =fuel delivery/stroke/nozzle orifice, mm^3

Q3) Answer any two of the following. 7x2

a) A single jet carburetor at petrol engine, has Venturi throat diameter of 22 mm. A/F ratio delivered by carburetor during driving is 14:1 by weight. Calculate the size of jet discharging the petrol. Assume following data.
Coefficient of discharge for air = 0.82, coefficient of discharge for petrol = 0.63, density of air = 1.2 Kg/m^3, density of petrol = 70 Kg/m^3. Assume petrol level in float chamber is at same level as jet and air behaves as incompressible fluid.

b) Discuss the effect of compression ratio, engine speed, spark timing and combustion chamber wall temperature on detonation in SI Engine.

c) State the requirements of fuel injection system of a CI Engine. Discuss common rail injection system.

Q4) Answer any two of the following. 7x2

(a) Discuss the EGR (Exhaust gas Recirculation) technique to Reduce NOx emissions. Compare the effect of EGR on NO reduction in SI and CI engine, explain the reasons for differences, if any.

(b) Answer the following.
(i) Discuss the heat release rate pattern for CI engine with the help of P-θ diagram.
(ii) Discuss with neat sketch the pattern of the burned mass fraction in a typical SI engine as a function of crank angle.

(c) Discuss the FID technique for measurement of HC emissions in engine exhaust.

Q5) Answer any two of the following. 7x2

a) Discuss the mechanism of HC pollutant formation in SI engine.

b) Discuss the working of three way catalytic converter. Discuss the reasons for catalytic converter becomes ineffective.

c) A six cylinder square four stroke 5 litre engine is tested at 2500 rpm on dynamometer which has 50 cm arm. The dynamometer scale reading was 500 N. The air consumption is measured by Air box method. The following readings were observed,
Ambient pressure and temperature = 1 bar and 27 ºC
Orifice dia = 30 mm, pressure drop across orifice = 14 cm of Hg, C_d of orifice = 0.6
For fuel, C/H ratio by mass = 83/17, density = 780 kg/m3,
time taken for 100 ml fuel consumption = 18 s,
Find bore of the engine, bsfc, equivalence ratio and volumetric efficiency.