ME505 Roll No _____

B.Tech
(SEM. V) THEORY EXAMINATION, 2015-16
I.C. Engine and Compressors

TIME: 3 HOURS **Max.MARKS: 100**

Note: ***1. Attempt all questions. Marks are indicated against each question.***
2. Assume any missing data suitably.

Q.1 Attempt any TWO parts of the following: 10x2=20

a) 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

b) With the help of P-V diagram, discuss the effect of dissociation on otto cycle. Show the effect of equivalence ratio on the power output and efficiency ratio of a constant volume fuel air cycle.

c) Answer the following.
   (i) Make comparison between CI and SI engine
   (ii) What do you understand by pumping losses. What will be the effect of throttling on pumping losses.

Q.2 Attempt any TWO parts of the following: 10x2=20

(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) Describe with suitable sketch the combustion phenomenon in SI engine. Discuss the effect of F/A ratio, compression ratio, engine load and engine speed on flame propagation.

c) Answer the following

(i) What are the objectives of super-charging. Draw and discuss the thermodynamic cycle of a super-changed I.C. engine and compare it with thermodynamic cycle of a naturally aspirated engine.

(ii) With the help of sketch, discuss the working principle of Crankcase scavenged two-stroke engines. Also draw the ideal indicator diagram for two stroke engine.

Q.3 Attempt any TWO parts of the following: 10x2=20

(a) Explain requirements of a C.I. engine fuel injection system. Draw layouts of common rail system and individual jerk pump system of injection and explain these systems.

(b) Explain the stages of combustion in CI engine with the help of P-θ diagram. It is desired for combustion to start at 15 btdc in a 4 stroke diesel engine running at 2000 rpm. If the ignition delay of fuel in milliseconds is 0.5 ms, find the crank angle at which fuel injection should start.

c) Answer the following

(i) state the requirements of good combustion chamber for CI engine.

(ii) Discuss the causes of HC emissions from SI engine.

Q4) Attempt any TWO parts of the following: 10x2=20

a) Define octane no. how it is found. An old car has a engine with a carburetor adjusted to supply stoichiometric air-fuel supply at normal condition using gasoline (C8H15) as fuel. Calculate the actual equivalence ratio the carburetor is supplying to the engine when it is supplied with the M20 (20% blend of methanol in petrol) fuel.

b) The power output of a six cylinder four stroke engine operating with diesel ($C_{16}H_{34}$))is absorbed by a dynamometer for which the law is W N/20000 where w is brake load in newton and N is RPM. 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 = 16 cm of Hg, C_d of orifice = 0.6

Engine bore = 100 mm, stroke = 110 mm, RPM = 2400, brake load = 560 N

Mechanical Efficiency= 90%

fuel density = 831 kg/m3, time taken for 50 ml fuel consumption = 10 sec,

Find isfc, equivalence ratio, volumetric efficiency and bmep.

c) Answer the following

i) Define fuel senstivity, cloud point and flash point.

ii) what are the major causes for the formation of HC emissions in the exhaust of SI Engine.

Q. 5 Attempt any TWO parts of the following 10x2=20

(a) A two stage reciprocating air compressor, compresses air from 16^0C and 1 bar to 60 bar. The air is cooled in intercooler to 30^0C and intermediate pressure is 7.3 bar. The stroke for both cylinders is 115 mm and low pressure cylinder has diameter of 100mm. Assuming index of compression 1.35 and that the volume of air at atmospheric conditions drawn in, per stroke is equal to low pressure cylinder swept volume, calculate (i) diameter of high pressure cylinder and (ii) power requirement of compressor when running at 250 rpm.

(b) Draw velocity vector diagram at the inlet and outlet of centrifugal compressor and drive Euler's equation for work done by impeller.

(c) Explain the phenomenon of surging and choking of centrifugal and axial flow compressors.