Internal Combustion Engines
(DE/ME-1.1, Dec05)

Note: Section A is compulsory. Attempt any four questions from Section B and any two from Section C.

Section-A

1. a) With the help of P-V diagram state for which cycle i.e. otto or diesel, the cycle efficiency will be greater for same peak pressure, temperature and heat rejection?
   b) Define octane number.
   c) Explain why rich mixture is required for idling?
   d) Differentiate between Air-injection and solid injection.
   e) Discuss briefly the effect of fuel-air ratio and compression ratio on flame speed.
   f) List few effects of super charging.
   g) State briefly the limitations experienced in the evaluation of friction power using Wilian's line method.
   h) List the parameters by which performance of an engine is evaluated?
   i) List the factors which limit the brake power and brake mean effective pressure of a CI engine.
   j) Explain briefly the significance of compensating devices in carburetor.

Section-B

2. Explain briefly the stages of combustion in spark ignition engines elaborating the flame front propagation.
3. Discuss the important qualities of spark ignition fuel.
4. For an engine working on ideal cycle, the compression ratio is 10 and the maximum pressure is limited to 70 bar. If the heat supplied is 1680 KJ/kg, find the pressures and temperatures at the various salient points of the cycle and the cycle efficiency. The pressure and temperature of air at the commencement of compression are 1 bar and 100°C, respectively. Assume C_P = 1.004 kj/ kg-K of air.
5. The following observations were recorded during a trail of a four stroke, single cylinder oil engine. Duration is trial is 30 minutes; oil consumption is 4 litres; calorific value of oil is 43 MJ/kg; Specific gravity of fuel=0.8; average area of indicator diagram = 8.5 cm^2, length of indicator diagram = 8.5 cm; spring constant = 5.5 bar/cm; brake load = 150 kg; spring balance reading = 20 kg; effective brake wheel diameter = 1.5 m; speed = 200 rpm; cylinder diameter = 30 cm; stroke = 45 cm; jacket cooling water = 10 kg/min; temperature rise = 36°C, Calculate
   (i) Indicated power
   (ii) Brake power
   (iii) Mechanical efficiency
   (iv) Brake specific fuel consumption in kg/k Wh and
   (v) Indicated thermal efficiency
6. With the help of sketch explain the working of a simple carburetor.

Section-C

7. Explain the effect of various engine variables on spark ignition engine knock.
8. (a) Find the percentage change in the efficiency of an otto cycle having a compression ratio of 10, if C_V decreases by 2%.
   (b) Explain by means of suitable graphs the effect of dissociation on maximum temperature and brake power.
9. (a) With the help of sketch explain the working of any one type supercharger.
   (b) A simple jet carburetor is required to supply 5 kg of air and 0.5 kg of fuel per minutes. The fuel specific gravity is 0.75. The air is initially at bar and 300 K. Calculate the throat diameter of the choke for a flow velocity of 100 m/s. Velocity coefficient is 0.80. If pressure drop across the fuel metering orifice is 0.80 of that of the choke, calculate orifice diameter assuming C_{df} = 0.60 and v = 1.4