Sixth Semester Examination – 2008

IC ENGINES AND GAS TURBINES

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory
and any **five** from the rest.*

*The figures in the right-hand margin
indicate marks.*

1. Answer the following questions :   2 ×10

    (a) What do you mean by an *air standard cycle ?*

    (b) What is *firing order* in a multi cylinder engine ?

    (c) What is the function of the *radiator* in an automobile ?

    (d) What are the factors that can reduce knocking in SI engine ?

(e) How is the compression ratio of an SI engine fixed ?

(f) Draw the valve timing diagram of a four stroke petrol engine ?

(g) What do you mean by *self ignition temperature* of a fuel ?

(h) What is meant by *slip factor* in compressors ?

(i) When is *supercharging of IC engines* done ?

(j) Distinguish between *indicated power* and *brake power.*

2. (a) Calculate the percentage loss in the ideal efficiency of a diesel engine with compression ratio 14 if the fuel cut-off is delayed from 5% to 8%.   5

    (b) Explain how the flame-front travels in SI engine during normal combustion.   5

3. A four stroke diesel engine of 3000 cc capacity develops 14 kW/m^3 of free air induced per minute. When running at 3500 r.p.m. it has a volumetric efficiency of 80% referred to free

air conditions of 1.013 bar and 27 °C. It is proposed to boost the power of the engine by supercharging by a blower (driven mechanically from the engine) of pressure ratio 1.7 and isentropic efficiency of 75%. Assuming that at the end of induction, the cylinders contain a volume of charge equal to the swept volume at the pressure and temperature of the delivery from the blower, estimate the increase in brake power to be expected from the engine. Take the overall mechanical efficiency as 80%. 10

4. What are the different types of water cooling system used to cool the engine and the cylinder head ? Explain briefly the principal mechanism of heat transfer in each type of cooling system. Which modes of heat transfer is predominant in radiator ? 10

5. (a) Show that the air standard efficiency of the Otto cycle depends only on the compression ratio. 4

   (b) Explain the phenomenon of knocking in SI and CI engines. 6

6. (a) Describe with a neat sketch the different types of solid injection system. 5

   (b) Determine the quantity of fuel to be injected per cycle per cylinder for a 6-cylinder 4-stroke Diesel engine having brake specific fuel consumption of 245 gm / kW - hr and developing 89 kW at 2500 rpm. Take specific gravity of fuel as 0.84. 5

7. Draw the T-s diagram of an ideal regenerative gas turbine cycle. Find the thermal efficiency of the regenerative cycle based on pressure ratio r_p, maximum temperature (T_{max}) and inlet temperature of the gas to the compressor, T_I. 10

8. Write short notes on : (Any two) 5×2

   (a) engine emissions and their harmful effects

   (b) Effect of engine cooling on power output and efficiency

   (c) Simple carburetor and its drawbacks.

   ————