B. Tech. 5th Semester (Mechanical Engg.)
Examination, December–2012

INTERNAL COMBUSTION ENGINE
AND GAS TURBINES

Paper– ME-307-F

Time allowed : 3 hours]   _[Maximum marks : 100_

Note :   **_Question No. 1 is compulsory. Attempt any five_** _questions, selecting at least_ **one** _question from each part._

1. Attempt any 10 parts of **Q.1**.

  (a)   Define turbo charging.

  (b)   Explain grading of lubricating oil.

  (c)   What is Vapour-lock ?

  (d)   What is SAE-rating ?

  (e)   Define the working of catalytic converter.

  (f)   Explain methods of super charging.

  (g)   Explain the EURO-norms for pollution.

  (h)   Define engine oil Additives.

  (i)   Explain different methods of scavenging.

24260–7,850-P-4-Q-9-(12)   P.T.O.

(j)   What is Magneto Ignition System ?

(k)   Define the measurement of air consumption by I.C. Engine.

(l)   Explain the limitations of super charging.

$2 \times 10 = 20$

Part–A

2.   For an engine working on the Dual cycle, the compression ratio is 10 and the max. 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 the compression are 1 bar and 100°C respectively. Assume $C_p = 1.004$ KJ/kg.K and $C_v = 0.717$ KJ/kg.K of air.   20

3.   (a)   State the essential requirements of a diesel injection system.   10

(b)   Derive an expression for the calculation of air-fuel ratio for the carburettor.   10

Part–B

4.   (a)   Explain the phenomenon of knock in CI-Engine and compare it with SI engine knock.   10

(b) Name various theories of detonation. Explain the Pre-Ignition with neat sketch.   10

5. (a) Explain the following with neat sketches :

  (i) Evaporative cooling system.

  (ii) Pressure cooling system.   10

  (b) Explain the essential properties of an ideal lubricants and explain wet sump lubrication.   10

Part–C

6. A six cylinder, four stroke spark-Ignition of 10cm × 2cm (bore x stroke) with a compression ratio of 6 is tested at 4800 r.p.m. an a dynamometer of arm 55cm. During a 10 min. test, the dynamometer reads 45kg and the engine consumed 45kg of petrol of calorific value 45 MJ/Kg. The carburettor receives the air at 9°C and a bar at the rate of 10kg/min. Calculate :

(i) The brake power

(ii) The brake mean effective pressure

(iii) The brake specific fuel consumption

(iv) The brake specific air consumption

(v) The brake thermal efficiency

(vi) The air fuel ratio.   20

7. (a) Explain different categories of S.I. emissions. Also explain various factors affecting exhaust emission.   10

(b) Explain briefly various alternative fuels for I.C. Engines. 10

Part–D

8. (a) With a neat sketch, explain the inlet and exit velocity triangles for various types of blades. 10

(b) Define slip factor and derive an expression for same. 10

9. In an open cycle constant pressure gas turbine, air enters the compressor at 1 bar and 300K. The pressure of air after compression is 4 bar. The isentropic efficiencies of compression and turbine are 78% and 85% respectively. The air fuel ratio is 80 : 1. Calculate the power developed and thermal efficiency of the cycle if the flow rate of air is 2.5 kg/sec.

Take $C_p = 1.005$ KJ / Kg–K, $\gamma = 1.4$ for air

$C_p = 1.147$ KJ /Kg – K, $\gamma = 1.33$ for gases

$R = 0.287$ KJ / Kg–K

C.V. of fuel = 42,000 KJ /kg. 20