Code: 13A03402 **R13**

B.Tech II Year II Semester (R13) Supplementary Examinations December/January 2015/2016

THERMAL ENGINEERING – I

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) How heat engines are classified?
(b) Draw the ideal indicator diagram of a two stroke SI engine.
(c) What are the functional requirements of an injection system?
(d) Write the disadvantages of mist lubrication system.
(e) List out the factors affecting the delay period.
(f) Draw the sketch of a theoretical pressure crank angle diagram.
(g) What are the methods used to find the friction power to estimate the performance of the engine?
(h) List the factors to be considered in evaluating the performance of an engine.
(i) Write about clearance in compressors.
(j) List various advantages of centrifugal compressors over axial flow compressors.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Classify the Internal Combustion engines.
(b) Compare SI and CI Engines.

OR

3 (a) The cubic capacity of a four stroke over-square spark-ignition engine is 245 CC. The over-square ratio is 1.1. The clearance volume is 27.2 cc. Calculate the bore, stroke and compression ratio of the engine.
(b) Draw the sketch of a four stroke SI engine valve timing diagram and explain.

UNIT – II

4 (a) Explain the splash lubrication system with the help of a neat sketch.
(b) Draw the sketch of:
(i) Piston temperature distribution.
(ii) Cylinder temperature distribution.

OR

5 With a neat sketch explain the magneto ignition system.

UNIT – III

6 Explain the phenomenon of knock in SI engines with a neat sketch.

OR

7 Explain the stages of combustion in CI engines.

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UNIT – IV

8 The following observations were recorded during a trail of a four-stroke, single-cylinder oil engine:
Duration of trial is 30 min
Oil consumption is 4 liters
Calorific value of the oil is 43 MJ/kg
Specific gravity of the fuel = 0.8
Average area of the indicator diagram = 8.5 cm^2
Length of the 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 is 36^oC
Calculate: (i) Indicated power. (ii) Brake power. (iii) Mechanical efficiency. (iv) Brake specific fuel consumption in kg/kWh. (v) Indicated thermal efficiency.

OR

9 A test on a single-cylinder, four-stroke oil engine having a bore of 15 cm and stroke 30 cm gave the following results; speed 300 rpm; brake torque 200 Nm; indicated mean effective pressure 7 bar; fuel consumption 2.4 kg/h; cooling water flow 5 kg/min; cooling water temperature rise 35^oC; air-fuel ratio 22; exhaust gas temperature 410^oC; barometer pressure 1 bar; room temperature 20^oC. The fuel has a calorific value of 42 MJ/kg and contains 15% by weight of hydrogen. Take latent heat of vaporization as 2250 kJ/kg. Determine: (i) The indicated thermal efficiency. (ii) The volumetric efficiency based on atmospheric conditions. Draw up a heat balance in terms of kJ/min. Take C_P for dry exhaust gas = 1 kJ/kgK and super heated steam C_P = 2.1 kJ/kgK; R = 0.287 kJ/kgK.

UNIT – V

10 (a) List out the methods employed to increase isothermal efficiency for high speed compressors and explain in brief.

(b) A 4-cylinder double-acting compressor is required to compress 30 m^3/min of air at 1 bar and 27^0C to a pressure of 16 bar. Determine the size of motor required and cylinder dimensions if the following data is given:

Speed of the compressor = 320 r.p.m
Clearance volume = 4%
Stroke to bore ratio = 1.2
Mechanical efficiency = 82%
Value of index = 1.32

Assume no pressure change in suction values and the air gets heated by 12^0C during suction stroke.

OR

11 With help of a neat sketch explain the construction and working of an axial flow compressor.

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