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Question Paper Code : 11107

B.E./B.Tech. DEGREE EXAMINATION, MAY/JUNE 2014.

Sixth Semester

Automobile Engineering

080190022 — IC ENGINE DESIGN

(Regulation 2008)

Time : Three hours Maximum : 100 marks

(Design data and Heat and Mass Transfer hand book may be permitted)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the effect of stroke to bore ratio on the design of an IC engine

2. What is the importance of principle of similitude in the design of an IC Engine?

3. What are the functions of Trunk piston?

4. What is the effect angularity of connecting rod upon the side pressure of the piston on the cylinder liner?

5. What are the methods and materials used in manufacturing crankshafts.

6. Why do intake and exhaust valves have conical heads and seats?

7. Discuss the stresses acting in the engine flywheel?

8. Write the design requirement for MPFI engine.

9. What is the design requirement of water cooling system used in multi-cylinder engine?

10. Write the factors to be considered while designing lubrication system for multi-cylinder diesel engine.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Discuss various design consideration for an IC engine. (8)

(ii) List the requirements which the body of a motor vehicle should fulfil. (8)

Or

(b) (i) Discuss in detail about design of engine based on various engine operating conditions with necessary diagram. (8)

(ii) Discuss the design of piston for an internal combustion engine. (8)

12. (a) Design and sketch a cast iron piston for a single acting four stroke IC engine with 0.14 m cylinder bore, 0.19 m stroke and 0.375 m connecting rod length. The maximum gas pressure is 3.5 N/mm^2 and engine speed is 600 rev/min. It develops a brake mean effective pressure of 0.7 N/mm^2 and uses 4.65 kJ per kW per second. Check the piston for heat flow. (16)

Or

(b) Design the connecting rod of an internal combustion engine, for the following data:

Piston diameter	-	0.1525 m
Stroke	-	0.216 m
Length of the connecting rod, centre to centre	-	0.4595 m
Weight of reciprocating masses	-	27.5 N
Speed	-	2000 rpm
Compression ratio	-	5.1 MPa
Probable maximum explosion pressure	-	3.5 MPa

Assume suitable missing data.

13. (a) Design a crankshaft for 0.35 m × 0.35 m single acting four stroke single cylinder to operate at 250 rpm when crank is at dead centre. The mean effective pressure is 0.55 MPa and the maximum combustion pressure is 2.75 MPa. The ratio of the connecting rod length to crank radius is 5. The flywheel is used as pulley. The weight of the flywheel is 55 kN and the total belt pull is 6.5 kN. Assume suitable values for missing data. (16)

Or

(b) Design the rocker arm and push rod for the exhaust valve gear of a four stroke vertical, overhead valve, diesel engine with piston having a diameter of 0.14 m and a stroke of 0.18 m. The operating speed of the engine is 1200 rpm. The diameter of the exhaust valve is 54 mm and is to start to open 39° before crank reaches its bottom dead centre position and it close 8° after the crank has passes its top dead centre position. The gas pressure in cylinder when the valve starts to open is 0.49 N/mm^2 absolute and the pressure on top side of the valve may be taken as 0.105 N/mm^2 absolute. The weight of the valve is 2.5 N and lift is 10mm. (16)

14. (a) Design a flywheel for a four cylinder engine to develop 22.5 kW at 1200 rpm. Fluctuation of energy is 30% of that of one revolution; fluctuation of speed is 2%; radius of gyration 0.175 m. Calculate: (16)

(i) Energy to be absorbed/revolution

(ii) Weight of steel rim

(iii) Thickness of rim width

(iv) Inner and outer radius of rim

(v) Diameter of shaft, safe stress 35 MN/m²

(vi) Diameter of boss.

(vii) Size of the key.

Sketch with dimensions a sectional elevation and end view.

Or

(b) (i) Explain the actions of clutch during engagement and disengagement. (6)

(ii) A single plate clutch, both sides being effective is required connect a machine shaft to a driver shaft which runs at 500 rpm. The moment of inertia of the rotating parts of the engine is 1 kgm². The inner and outer radii of friction discs are 50mm and 100mm respectively. Assuming uniform pressure of 0.1 N/mm² and co efficient of friction of 0.25, determine the time taken for machine to reach full speed when the clutch is suddenly engaged. Also determine the power transmitted by the clutch, the energy dissipated during clutch slip and the energy supplied to the machine during engagement. (10)

15. (a) (i) Compare air cooling system and water cooling system. Explain its merits and demerits. (6)

(ii) Air at 25°C flow over a cross flow car radiator and cools water from 99°C to 60°C. Water flows at the rate of 4 kg/min through a number of separate passages within the heat exchanger. The mass flow rate of air is 14 kg/min. If overall heat transfer coefficient is 80 W/m² K. Determine the required heat transfer area and heat exchanger effectiveness. Assume clean and scale free heat transfer surfaces, constant specific heat of fluids over given temperatures ranges: $C_{p,water}$ = 4.187 kJ/ kg K, $C_{p,air}$ = 1.005 kJ/kg K, overall heat transfer coefficient is constant, Air is mixed fluid. Given that for cross flow heat exchanger.

$$E = (1/R)[1 - \exp\{-R(1 - \exp(-NTU))\}],\ R = C_{min}/C_{max}.$$ (10)

Or

(b) (i) State the effect of the flowing engine parameters on engine friction: Stroke to bore ratio, Cylinder size and number of cylinders, Piston rings, Compression ratio, Engine speed, Engine load. (12)

(ii) Where is dry sump lubrication is preferred and why? (4)
