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Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

VI SEMESTER B.TECH (MECHATRONICS ENGINEERING) END SEMESTER EXAMINATIONS, JUNE - 2017

SUBJECT: AUTOMOTIVE COMPONENT DESIGN [MTE 4002] REVISED CREDIT SYSTEM

Time: 3 Hours

MAX. MARKS: 50

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- Answer all the questions
- Data not provided may be assumed suitably
- Using data sheet is permitted
- **1a**) Design a cast iron piston for a four stroke engine with the following data:

Cylinder bore = 90 mm ; Stroke = 110 mm ; Maximum gas pressure = 4.8 N/mm2 ; Indicated mean effective pressure = 0.65 N/mm2 ; Mechanical efficiency = 90% ; Fuel consumption = 0.3 kg per brake power per hour ; Higher calorific value of fuel = 42×10^3 kJ/kg ; Speed = 1200 r.p.m. Permissible bending stress = 34 MPa, Heat absorbed by the piston = 0.05, Difference in temperature = 200 °C, Heat conductive = 46.6 W/m/°C, Number of rings = 3, Pressure of gas cylinder wall = 0.025 N/mm², Allowable bending stress for piston ring= 80 MPa, Bearing pressure = 0.35 N/mm² ,Bearing pressure at small end of the connecting rod = 20 N/mm² Bending stress of piston pin = 125 MPa.

Any other data required for the design may be assumed.

Calculate

- 1) Heat flowing through piston head.
- 2) Length of the piston.
- 3) Inside diameter of the piston pin.
- 1b) An engine with 80 percent mechanical efficiency develops a brake power of 30kW. Find its indicated power and frictional power. If frictional power is assumed to be constant, what will be the mechanical efficiency at half load?
- 1c) List and explain the properties of gasoline.
- **2a**) List the factors influencing the diesel knock.
- **2b**) With a neat sketch explain detonation.
- 2c) Calculate the radial thickness of piston ring for a piston of 100mm dia. Permissible wall 3 pressure is 0.03N/mm² and bending strength is 90 N/mm²
- **3a**) Illustrate the factors affecting the delay period in CI combustion chamber.
- 3b) A four stroke internal combustion engine has the following specifications:
 Brake power = 7.5 kW; Speed = 1000 r.p.m.; Indicated mean effective pressure = 0.35 N/mm²; Maximum gas pressure = 3.5 N/mm²; Mechanical efficiency = 80 %.

Determine:

- 1. The dimensions of the cylinder, if the length of stroke is 1.4 times the bore of the cylinder;
- 2. Wall thickness of the cylinder, if the hoop stress is 35 MPa;
- 3. Thickness of the cylinder head and the size of studs when the permissible stresses for the cylinder head and stud materials are 45 MPa and 65 MPa respectively.

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3c) Sketch and label the design terminologies for a connecting rod.

4a)	With a sketch explain the types of crankshaft based on crank position.	3
4b)	Derive an equation for energy stored in flywheel.	4
4c)	The conical value of an I.C. engine is 48 mm in diameter and is subjected to a maximum gas pressure of 5 N/mm ² . The safe stress in bending for the value material is 52 MPa. The value is made of steel for which $k = 0.42$. The angle at which the value disc seat is tapered is 28°. Determine: 1. Thickness of the value head 2. Stem diameter	3
	3. Maximum lift of the valve	
5a)	List the considerations in designing a friction clutch.	3

- 5b) Derive an expression for effective mean radius of single plate clutch with case (i) uniform 4 pressure intensity and (ii) uniform rate of wear.
- **5c**) Write a short note on types of gearboxes.