

MANIPAL INSTITUTE OF TECHNOLOGY

VI SEMESTER B.TECH. (AUTOMOBILE ENGINEERING) END SEMESTER EXAMINATIONS, APRIL/MAY 2017 SUBJECT: DESIGN OF IC ENGINES [AAE 4020] REVISED CREDIT SYSTEM

(29/04/2017)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

✤ Answer ALL the questions.

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- Missing data may be suitable assumed.
- **1A.** Write the functions of Liners and mention its types.(02)
- 1B. A four-stroke diesel engine working on diesel cycle has the following (08) specifications: compression ratio = 15:1, stroke volume = 100 cc, cut-off = 10% of the stroke volume, power = 5.0 kW, speed = 1500 rpm with a possibility of over speeding of 2000 rpm, cylinder material = cast iron. Determine a. the cylinder bore, b. cylinder length, c. wall thickness, d. thickness of cylinder head.
- 2A. Explain the significance of clearance between piston and cylinder walls. (03)
- **2B.** Design a cast iron piston for four-stroke single acting engine for the following **(07)** data:- bore = 100 mm, stroke = 120 mm, maximum explosion pressure = 5 N/mm², Brake mean effective pressure = 0.65 N/mm², fuel consumption = 0.227 kg/kWh, speed = 2200 rpm, σ t = 40 MPa for piston crown, p_w = 0.035 N/mm² and σ t = 80 N/mm² for piston ring. Permissible bearing pressure = 25 N/mm².
- **3A.** Mention the different forces and stresses experienced by Connecting rod. **(02)**
- **3B.** What are the indications of damaged crankshaft bearing? Mention its kinds. (03)

- 3C. A four-stroke single acting diesel engine has a connecting rod of Un- (05) symmetrical "I" beam cross-section having following details: web thickness is "t" and its height is "20t", top flange width of "16t" and thickness of "1.2t", bottom flange width of "24t" and thickness is same as top flange. Find the moment of inertial of section.
- **4A.** Draw a neat labelled sketch of the Side camshaft over-head valve actuating **(02)** mechanism.
- 4B. The conical valve of an IC engine is 60 mm in diameter and is subjected to a (03) maximum gas pressure of 4 N/mm². The safe stress in bending for the valve material is 46 MPa. The valve is made of steel for which k=0.42. the angle at which the valve disc seat is tapered is 30°. Determine thickness of the valve head, stem diameter and maximum lift of the valve.
- **4C.** Design a plane steel centre crankshaft for four-stroke single acting single (05) cylinder engine for the following specification: bore = 400 mm, stroke = 600 mm, mean effective pressure = 0.5 N/mm^2 , maximum gas pressure = 2.5 N/mm^2 , allowable crank pin bearing pressure = 10 N/mm^2 , allowable stress = 75 N/mm^2 , mean bearing pressure = 15 N/mm^2 , $\theta = 35^\circ$. The connecting rod is 5 times the crank pin. Calculate the forces on crank pin, diameter and length of crankpin, and diameter of crankshaft.

5A. List the different types of flywheel and mention its applications. **(02)**

5B. Design a cast iron flywheel used for four-stroke I.C engine developing 180 (08) kW at 240 rpm. The centrifugal stress developed in the flywheel is 5.2 MPa, the total fluctuation of speed is to be limited to 3% of the mean speed. The work done during the power stroke is 1/3 more than the average work done during the whole cycle. The maximum torque on the shaft is twice the mean torque. The density of cast iron is 7220 kg/m³.