Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH (MECHANICAL/I&P ENGG.) END SEMESTER EXAMINATIONS, NOVEMBER 2018

SUBJECT: DESIGN OF MECHANICAL SYSTEMS [PE-VI] [MME 4002]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL the** questions.
- Missing data may be appropriately assumed.
- Assumptions made must be clearly mentioned.
- Use of Design Data Hand Book is allowed.

1. A four stroke petrol engine runs at 2000 rpm. Stroke length is 140 mm and length of connecting rod is 300 mm. Mean effective pressure is 1.2 MPa. The force corresponding to explosion pressure is 21442 N. Maximum explosion pressure is 2.5 MPa. Weight of reciprocating parts is 20 N. Connecting rod length is 300 mm. Determine the thickness of the end cap in connecting rod assembly if permissible tensile strength of end cap material is 100 MPa. **(05)**

2. For an IC engine crank speed is 300 rpm. The valve gear mechanism has a valve diameter of 72 mm. The lift of valve is 24 mm and weight of the valve is 4 N. Valve opens 30^0 before ODC and closes 2^0 after IDC. The valve opens and closes with uniform acceleration and deceleration for each half of the cycle. The peak pressure when the exhaust valve opens is 0.42 MPa. Stiffness of the spring used is 10 N/mm and spring index is 8. Determine the resultant load acting on the fulcrum pin. **(05)**

3. In a passenger lift the shaft mounted on the beams has a span of 300 mm. The pulley is centrally mounted on the shaft. The shaft assembly is mounted on the beam at a distance of 1.2 m from one end of beam. Each beam has a span of 2 m. The I section beam suggested is ISMB 150, having a depth of 150 mm, flange width of 80 mm, flange thickness of 7.5 mm, web thickness of 5 mm, section modulus of 97 cm^3, cross sectional area of 19 cm^2 and it weighs 15 kg/m. The pitch circle diameter of the pulley is 800 mm. The sum of the belt tensions is 15713 N. Design the RS Beams with suitable justifications. **(05)**

4. A screw jack is required to lift a load of 5000 kg through a maximum lift of 150 mm. The screw rod is made of steel having yield strength of 300 MPa in compression and yield shear strength of 180 MPa. Design the screw rod. **(05)**

5. An IC Engine piston made of aluminium alloy has a diameter of 80 mm. The thickness of the piston head is 10 mm. The stroke length is 150 mm. The maximum explosion pressure is 2.8 MPa. Determine dimensions of the piston head, piston rings and the piston skirt. Design the gudgeon pin based on bearing pressure. **(05)**

6. Design an overhung crankshaft for an IC Engine with the following details **(25)**

Piston diameter = 80 mm

Stroke length = 140 mm

Maximum explosion pressure = 3 MPa

Maximum Torque position is when the crank makes 30^0 with TDC.

Crank is made of forged steel having a permissible shear strength of 80 MPa and Ultimate tensile strength of 120 MPa. Draw the front view of the crankshaft.

OR

Design an automobile single plate clutch to transmit 35 kW at 2500 rpm. There are 3 toggle levers, actuating arm and clutch pedal for releasing the clutch. The cross section of lever is rectangular with width = 0.25 depth. There are 6 springs to engage the clutch. The spring index is 6.The Allowable shear stress for spring material is 360 MPa.The mechanical advantage required is 20. The maximum foot pressure on the pedal is 350 N. Take (D_m / b) = 4.5. Draw the sectional front view of clutch assembly.