Reg. No.

MANIPAL INSTITUTE OF TECHNOLOGY A Constituent Institute of Manipal University, Manipal

VII SEMESTER B.TECH (MECHANICAL/IP ENGG.) END SEMESTER

EXAMINATIONS, NOV 2017

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.
- ✤ Additional data required may be appropriately assumed.
- ✤ Assumptions made must be clearly mentioned.
- Use of Design Data Hand Book is allowed.
- Design the left side flange of protected flange coupling transmitting 60 kW at (09) 400 rpm. Permissible tensile strength for steel & cast iron may be taken as 120 MPa & 100 MPa respectively. Consider an overload of 25 % and neglect the design of key.
- An automobile has a single plate clutch to transmit 33 kW at 2000 rpm. The (07) ratio of mean diameter to radial width of clutch plate is 4.5:1. Determine the diameters of the clutch plate.
- 3. 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° before ODC and closes 2° 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 load acting on the rocker arm fulcrum pin and design the fulcrum pin.
- 4. Design a screw jack to lift a load of 5 tonnes through a height of 150 mm. The (25) screw rod is made of steel having a yield strength of 300 MPa, in tension & compression and yield shear strength of 180 MPa. The nut is made of phosphor bronze having an allowable bearing pressure of 15 MPa. The cup and body are made of cast iron having an ultimate strength of 500 MPa in compression & 250 MPa in tension. Draw the front view of the screw jack.

OR

Design the pulley, beam, wire rope, shaft and bearing for a passenger lift. The number of passengers to be carried are 5 including the operator. Speed of cage is 1 m/s and acceleration / retardation is 1.5 m/s^2 . The shaft mounted on the beams has a span of 300 mm. 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 cm³, cross sectional area of 19 cm² and it weighs 15 kg/m. The pitch circle diameter of the pulley is 800 mm. The pulley has 6 arms of cross shaped section having web thickness of 12 mm. Assume the weight of pulley, shaft and bearing assembly as 14 % of the maximum load on the pulley. The pulley has a provision to carry 2 ropes which support the cage and balance weights. 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. Take the value of combined shock and fatigue factors to be equal to unity. Draw the **front view** of the assembly.