Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

V SEMESTER B. TECH (IP ENGG.) END SEMESTER EXAMINATIONS, NOVEMBER 2018

SUBJECT: DESIGN OF MACHINE ELEMENTS [MME 3112]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.
- Use of Design data hand book is permitted

1A. What is stress concentration? Explain briefly different methods to reduce stress centration. **4**

1B. A circular bar of 500 mm length is supported freely at its two ends. It is acted upon by a central concentrated cyclic load having a minimum value of 20 kN and a maximum value of 50 kN. Determine the diameter of bar according to Goodman's formula and according to Soderberg's formula by taking a factor of safety of 1.5, size effect of 0.85, surface finish factor of 0.9. The material properties of bar are given by: ultimate strength of 650 MPa, yield strength of 500 Mpa and endurance strength of 350 Mpa **6**

2A. Mention all types of key used in machine members **2**

2B. A shaft is supported on bearings A and B, 800 mm between centres. A 20° straight tooth spur gear having 600 mm pitch diameter, is located 200 mm to the right of the left hand bearing A, and a 700 mm diameter pulley is mounted 250 mm towards the left of bearing B. The gear is driven by a pinion with a downward tangential force while the pulley drives a horizontal belt having 180° angle of wrap. The pulley also serves as a flywheel and weighs 2000 N. The maximum belt tension is 3000 N and the tension ratio is 3: 1. Determine the maximum bending moment and the necessary shaft diameter if the allowable shear stress of the material is 40 MPa. Assuming nature of loading is gradually applied. **8**

3A. Derive an expression for stress and deflection of helical coil spring of circular wire cross section **3**

3B. A concentric spring for an aircraft engine valve is to exert a maximum force of 5000 **7**

N under an axial deflection of 40 mm. Both the springs have same free length, same solid length and are subjected to equal maximum shear stress of 850 MPa. If the spring index for both the springs is 6, find (a) the load shared by each spring, (b) the main dimensions of both the springs, and (c) the number of active coils in each spring. Assume G = 80 kN/mm^2 and diametric clearance to be equal to the difference between the wire

4A. Explain the following terms used in spur gear **4**

I. Pressure angle,
II. Module
III. Circular pitch
IV. Addendum depth

4B. A 15 kW and 1200 R.P.M. motor drives a compressor at 300 R.P.M. through a pair of spur gears having 20° stub teeth. The centre to centre distance between the shafts is 400 mm. The motor pinion is made of forged steel having an allowable static stress as 210 MPa, while the gear is made of cast steel having allowable static stress as 140 MPa. Assuming that the drive operates 8 to 10 hours per day under light shock conditions, find from the standpoint of strength ; (I) Module; (II) Face width and (III) Number of teeth and (IV) pitch circle diameter of each gear. **6**

5A. Define the following terms as applied to rolling contact bearings: **2**

I. Static load carrying capacity
II. Dynamic load carrying capacity

5B. Briefly explain bearing modulus **2**

5C A triple start square thread screw is used to raise a load of 50kN. The screw has a nominal diameter of 50 mm and pitch 8 mm. Height of the nut is 40 mm. the coefficient friction between the screw and nut is 0.12 and no collar friction. Find the maximum shear stress induced in the screw, transverse shear stress induced in the screw and nut threads and bearing pressure between screw and the nut. **6**