Reg.No.										

MANIPAL INSTITUTE OF TECHNOLOGY

A Constituent Institute of Manipal University, Manipal

V SEMESTER B. TECH (IP) END SEMESTER EXAMINATIONS, NOV 2017

SUBJECT: DESIGN OF MACHINE ELEMENTS [MME 3112]

REVISED CREDIT SYSTEM

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer All the questions & Assume suitable missing data
- Machine design data hand book permitted to use

1A Determine the principal stresses and maximum shear stress at point A & B for the component shown in Figure 1. **4**

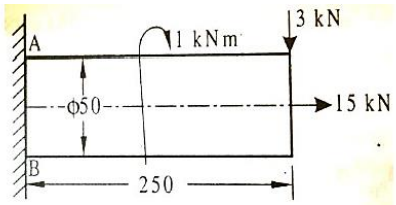

Figure 1.

1B A machined surface cold drawn steel cantilever member as shown in Figure 2 is subjected to an axial load that varies from 500 N compression to 1000 N tension & a transverse load at its free end that varies from 100 N upwards and 200 N downwards. Determine the required diameter of the section using a factor of safety 2. The strength properties of the materials are σ_u= 550 MPa, σ_y = 480 MPa & σ_{en} = 270 MPa. Neglect the column action and notch sensitivity factor. **6**

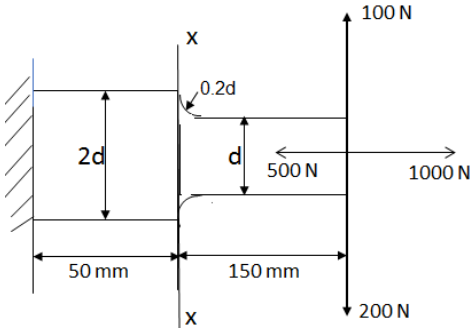

Figure 2

2A Design a 14.5° full depth involute spur gear to transmit 20 kW of power at 1200 rpm of the pinon. The gear ratio is 3:1, center-to-center distance close to 400 mm. The pinion is made C-30 heat treated steel and gear is made of 0.3% carbon heat treated forged steel. The drive must be safe for continuous operation with medium shock. Also check for wear and dynamic load. What is your recommendation for a safe design? **6**

2B Two helical springs nested one inside the other supports a load of 500 N. Both the springs are of same material and modulus of rigidity is 82.7 GPa. The dimension of each spring are as follows. **4**

Particular	**Outer spring**	**Inner spring**
Mean coil diameter	40 mm	28 mm
Wire diameter	5 mm	4 mm
Active number of turns	10	8
Free length	90 mm	78 mm

Determine the following

I. Deflection of each spring

II. Load shared by each spring

III. Stress induced in each spring

3A A counter shaft supported between bearing carries two pulleys as shown in Figure 3. Pulley B receives power from a motor placed vertically below it. The ratio of belt tensions on pulley B is 2. Pulley C delivers power to a machine placed vertically above it. The machine causes a tension of 3 kN in the tight side of the belt and 1 kN in the slack side. Determine the diameter of the shaft if the allowable shear stress in the shaft material is limited to 60 MPa. Assume the loads are steady and neglect the weight of the pulley. **6**

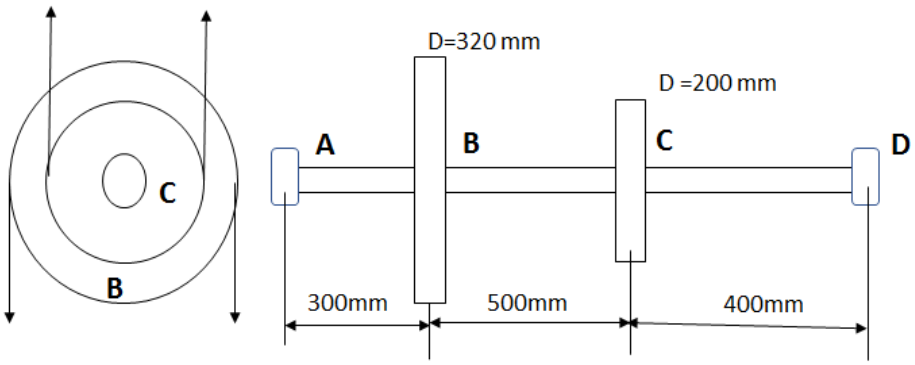

Figure 3

3B	Derive Lewis equation for tangential load on spur gear tooth with suitable assumption.	**4**
4A	A journal bearing for a centrifugal pump with the following specifications. Diameter of the journal = 75 mm, speed of the journal = 1440 rpm, load on the journal = 1150 N, working temperature of Oil = 70°C. Atmospheric temperature = 25°C. Select a suitable lubricant and state weather artificial cooling is required.	**7**
4B	Prove that square key is equally strong in crushing and in shear	**3**
5A	A cylinder head of steam engine is subjected to steam pressure of 0.8 MPa. It is held in position by means of 12 bolts. A soft copper gasket is used to make the joint leak proof. The bore diameter of the cylinder is 250 mm. Find the size of bolts so that the stress in bolts is not to exceed 110 MPa.	**4**
5B	Briefly explain the following a) ASME code for design of shafts b) S-N diagram c) Comparison between journal bearing and antifriction bearing	**6**