Reg. No. | | | | | | | | | | |

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

V SEMESTER B. TECH (IP ENGG.) END SEMESTER EXAMINATIONS, MAKE-UP DECEMBER 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. Explain briefly the different factors affecting the fatigue strength — **4**

1B. A machined surface cold drawn steel cantilever member as shown in Figure 1 is subjected to an axial load that varies from 120 N compression to 480 N tension & a transverse load at its free end that varies from 50 N upwards and 150 N downwards. Determine the required diameter of the section using a factor of safety 2. The strength properties of the material are σ_u= 600 MPa, σ_y = 330 MPa & σ_{en} = 300 MPa. Neglect the column action and notch sensitivity factor. — **6**
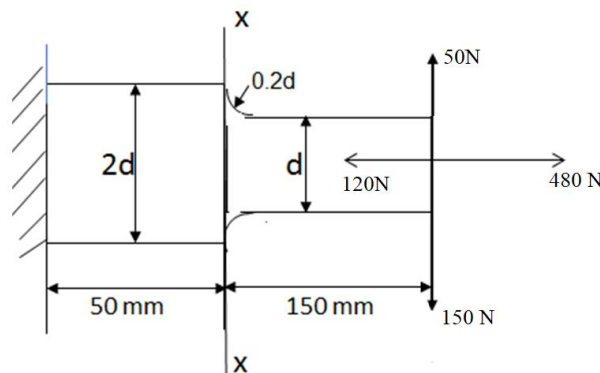

Figure 1

2 A Explain briefly about the ASME code for design of shaft — **2**

2 B A shaft is supported by two bearings placed 1 m apart. A 600 mm diameter pulley is mounted at a distance of 300 mm to the right of left hand bearing and this drives a pulley directly below it with the help of belt having maximum tension of 2.25 kN. Another pulley 400 mm diameter is placed 200 mm to the left of right hand bearing and is driven with the help of electric motor and belt, which is placed horizontally to — **8**

the right. The angle of contact for both the pulleys is 180° and μ = 0.24. Determine the suitable diameter for a solid shaft, allowing working stress of 63 MPa in tension and 42 MPa in shear for the material of shaft. Assume that the torque on one pulley is equal to that on the other pulley. Assume $C_m = C_t = 1$.

3A.	A rail wagon of mass 20 tonnes is moving with a velocity of 2 m/s. It is brought to rest by two buffers with springs of 300 mm mean coil diameter. The maximum deflection of springs is 250 mm. The allowable shear stress in the spring material is 600 MPa. Design the spring for the buffers. Assume the $G = 84 \times 10^3$ MPa.	**4**
3B.	A loaded narrow-gauge car of mass 1800 kg and moving at a velocity 72 m/min., is brought to rest by a bumper consisting of two helical steel springs of square section. The mean diameter of the coil is six times the side of the square section. In bringing the car to rest, the springs are to be compressed 200 mm. Assuming the allowable shear stress as 365 MPa and spring index of 6, find: 1. Maximum load on each spring, 2. Side of the square section of the wire, 3. Mean diameter of coils, and 4. Number of active coils. Take modulus of rigidity as 80 kN/mm^2	**6**
4A.	What is a herringbone gear? Define formative or virtual number of teeth on a helical gear.	**3**
4B.	A pair of helical gears with 30° helix angle is used to transmit 15 kW at 10 000 r.p.m. of the pinion. The velocity ratio is 4: 1. Both the gears are to be made of hardened steel of static strength 100 N/mm^2. The gears are 20° stub and the pinion is to have 24 teeth. The face width may be taken as 14 times the module. Find the module and face width from the standpoint of strength and check the gears for wear	**7**
5A.	Give a classification of bearings	**2**
5B.	A 25 mm nominal single start square threaded screw with pitch 5 mm is 400 mm long between the nut and collar. The axial load is 25 kN and the coefficient of friction between the screw and nut is 0.12, yield stress of the screw material is 350 Mpa. Determine the factor of safety.	**4**
5C	Select a suitable roller bearing for a shaft of 60 mm diameter at 960 rpm. It is used for 8 hr./day and fully utilized. Radial load on the bearing is 5kN.	**4**