Reg. No.										

Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

V SEMESTER B.TECH (I & P ENGG.)

END SEMESTER EXAMINATIONS, NOV/DEC 2015

SUBJECT: DESIGN OF MACHINE ELEMENTS (MME - 317)

REVISED CREDIT SYSTEM

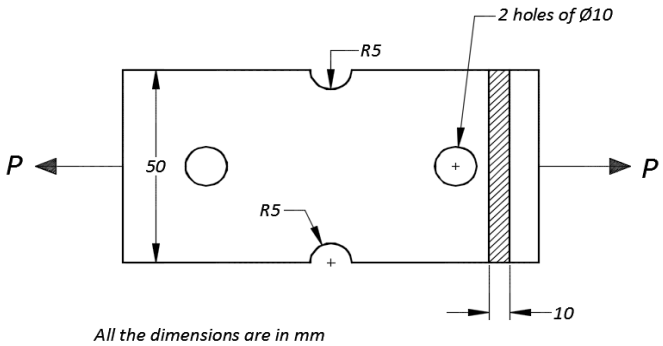
Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ANY FIVE FULL** the questions.
- Missing data may be suitable assumed.
- Use of design data hand book is permitted

1A. Explain the general procedure in design with a flow chart. **5**

1B. Determine the safe load that can be carried by a bar of rectangular cross-section in figure below limiting the maximum stress to 130 MPa and taking stress concentration into account. **5**



2A. A steel shaft is supported by two bearing placed 1100 mm apart. A pulley of diameter 620 mm is keyed at 400 mm to the right from left hand bearing and this pulley drives directly below it with a maximum tension of 2.75 KN. Another pulley of diameter 400 mm is placed 200 mm to the left of right hand bearing and is driven with a motor placed horizontally to the right when viewed from left bearing. The angle of contact of the pulley is 180^0 and coefficient of friction is 0.3. Find the diameter of the shaft. Assume C_m = 3.0, C_t = 2.5, σ_y = 190 MPa and σ_u = 300 MPa **5**

2B. Prove that Compressive stress induced in a square key due to the transmitted torque is twice of shear stress. **5**

3A. Explain the following **5**

(i) Surging of spring (ii) Solid length (iii) Free length (iv) Spring rate

3B. List any two advantages and disadvantages of power screws. **2**

3C. Explain the following **3**

(i) Notch sensitivity (ii) Stress concentration factor

4A. A pair of spur gears of minimum size with 20^0 stub involute profile is used to transmit 18 KW at 1200 revolutions per minute of pinion. The material used for both pinion and gear is chrome vanadium steel whose allowable static stress may be taken as 516.8 MN/m^2. Determine the module and face width for strength requirement only. The gears are subjected to 8 to 10 hours per day of service with medium shocks. Take velocity ratio as 3.5**:**1 **5**

4B. A loaded narrow gauge car weighing 20 KN moving with velocity of 1.2 m/sec is brought to rest by damper consisting of two helical springs. In bringing the car to rest the spring are to be compressed by 200 mm. Assuming a spring index of 6 and allowable shear stress of 360 N/mm^2, determine **5**

(i) Maximum load on each spring
(ii) Number of active coils
(iii) Diameter of wire and mean coil diameter

Take modulus of rigidity as 80 GPa

5A. A square threaded power screw has a nominal diameter of 30 mm and a pitch of 6 mm with double threads. The load on the screw is 6 KN and the mean diameter of the thrust collar is 40 mm. The co-efficient of friction for the screw is 0.1 and for the collar is 0.09 determine **5**

i) Torque required to raise the screw with the load
ii) Torque required to lower the screw with the load
iii) Overall efficiency

5B. Derive the Soderberg's equation **5**

$$\frac{1}{n} = \frac{\sigma_m}{\sigma_{yp}} + \frac{K_{tf}\sigma_a}{ABC\,\sigma_{en}}$$

Where A is surface finish factor, B is size factor and C is the load factor

6A. Derive Petroff's equation with usual notation. **5**

6B. Derive an expression for beam strength of a helical gear tooth with standard notations. **5**