

## MANIPAL INSTITUTE OF TECHNOLOGY

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

## END SEMESTER MAKE UP EXAMINATIONS, DEC 2016/JAN 2017

SUBJECT: DESIGN OFMACHINE ELEMEMNTS [MME 3112]

## REVISED CREDIT SYSTEM (27/12/2016)

Time: 3 Hours

MAX. MARKS: 50

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## Instructions to Candidates:

✤ Answer ALL the questions.

tion of Manipal University

- Missing data may be suitable assumed.
- ✤ Use of Design data hand book is permitted
- **1A.** Explain the procedure for design of machine elements with a flow chart
- 1B.

A flat bar shown in figure below is subjected to an axial load of 100kN. Assuming that the stress in the bar is limited to 200 N/mm<sup>2</sup>, determine the thickness of bar.



- **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  $180^{\circ}$  and coefficient of friction is 0.3. Find the diameter of the shaft. Assume  $C_m = 3.0$ ,  $C_t = 2.5$ ,  $\sigma_y = 190$  MPa and  $\sigma_u = 300$  MPa
- 2B. A rectangular sunk key, 14 mm wide, 10 mm thick & 75 mm long is required 3 to transmit 1200 N-m torque from a 50 mm diameter solid shaft. Determine whether the length is sufficient or not if the permissible shear stress = 56 MPa and crushing stress is 168 MPa

- **2C.** A steel connecting rod of rectangular cross section having side ratio as 2, is 3 subjected to a completely reversed axial load of 18 kN. The normal endurance stress for the material of connecting rod is 300 MPa and yield stress is 420 MPa. Determine suitable cross - sectional dimensions of the connecting rod. Taking factor of safety as 1.8, the size factor may be taken as 0.9, stress concentration factor is 1.5.
- **3A.** Explain the following (i) Surging of spring (ii) Solid length (iii) Free length (iv) Spring rate
- **3B.** What are the factors to be considered for selection of material for spring 5 wire? What are the important spring materials
- **4A.** Show that the efficiency of self-locking screw is less than 50 % 3
- **4B.** A pair of spur gears of minimum size with 20<sup>0</sup> stub involute profile is used to 5 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<sup>2</sup>. 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 2
- **4C.** Explain the following
  - (i) Notch sensitivity (ii) Stress concentration factor (ii)
- 5A. Derive an expression for torgue required to raise and lower the load on 5 square threaded screw
- **5B.** Derive the Soderberg's equation

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

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