

Exam.Code:0941  
Sub. Code: 7052

1129  
B.E. (Mechanical Engineering)  
Fifth Semester  
MEC-501: Design of Machine Elements - I

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Section.

x-x-x

1. a) What do you mean by Mechanical Engineering Design? What do you mean by the term "Stress Concentration"?
- b) Define a cotter. Differentiate between a Cotter and key.
- c) What is Power Screw? What do you understand by overhauling of screw?
- d) What is the function of the Coupling? How do you differentiate between a coupling and clutch?
- e) What are the advantages and disadvantages of the V-thread over the square thread? (5x2)

Section A

2. What do you mean by the term efficiency of a riveted joint? Also list down the assumptions taken in the design of riveted joints.  
Design a single riveted lap joint to connect two mild steel plates. 12.5 mm thick, the joint being designed for the maximum efficiency. The allowable stresses are Tensile stress,  $f_t = 35 \text{ N/mm}^2$ , Shearing stress,  $f_s = 28.5 \text{ N/mm}^2$  and Compressive Stress,  $f_c = 53 \text{ N/mm}^2$ . Also calculate the load this joint will carry per pitch length. (4, 6 marks)
3. Design and make a neat dimensioned sketch of a muff coupling which is used to connect two steel shafts transmitting 40 kW at 350 r.p.m. The material for the shafts and key is plain carbon steel for which allowable shear and crushing stresses may be taken as 40 MPa and 80 MPa respectively. The material for the muff is cast iron for which the allowable shear stress may be assumed as 15 MPa.
4. Design a cotter joint to connect piston rod to the crosshead of a double acting steam engine. The diameter of the cylinder is 300 mm and the steam pressure is  $1 \text{ N/mm}^2$ . The allowable stresses for the material of cotter and piston rod are as follows:  $\sigma_t = 50 \text{ MPa}$  ;  $\tau = 40 \text{ MPa}$  ; and  $\sigma_c = 84 \text{ MPa}$

Section – B

(2)

5. a) Explain the different types of levers with sketches
- b) A foot lever is **1 meter** from the centre of shaft to the point of application of load of **900 N**. Find the diameter of the shaft, if the permissible shear stress for the shaft material is **75 N/mm<sup>2</sup>**. Determine the dimensions of the key to secure lever to shaft, safe stress in shear for key material is **70 N/mm<sup>2</sup>**. Find the dimensions of rectangular arm of the foot lever at **100 mm** from the centre of shaft. Assume height of the lever near boss as **3 times** the thickness. Allowable stress is **70 N/mm<sup>2</sup>** (4, 6 marks)
6. A screw Jack is to lift a load of **80 kN** through a height of **40 cm**. The elastic strength of screw material in tension and compression is **200 MPa** and in shear **120 MPa**. The material for nut is phosphor-bronze for which the elastic limit may be taken as **100 MPa** in tension, **90 MPa** in compression and **80 MPa** in shear. The bearing pressure between the nut and the screw is not to exceed **18 N/mm<sup>2</sup>**. Design and draw the screw jack.
7. a) Show that the efficiency of self locking screws is less than 50 percent
- b) Design and draw an oval flanged pipe joint for a pipe having **50 mm** bore. It is subjected to an internal fluid pressure of **7 N/mm<sup>2</sup>**. The maximum tensile stress in the pipe material is not to exceed **20 MPa** and in the bolts **60 MPa**. Assuming the width of packing as **10 mm**. (3, 7 marks)

x-x-x