

**JK Lakshmipat University Jaipur**  
**INSTITUTE OF ENGINEERING AND TECHNOLOGY**  
End Term Examination, November, 2018  
**Design of Machine Element-1**  
B. Tech. in Mechanical Engineering, Semester V

Roll No.....

Course Code : ME504

Time: **3 hours**

Max. Marks: 80

**Instructions to students:**

Do not write anything other than your roll number on question paper.

Assume suitable data wherever required and mention it clearly.

Writing appropriate units, nomenclature, and drawing neat sketches/schematics/ flow chart wherever, required are an integral part of the answer.

**Q.1A Objective type multiple choice questions (10 questions @ 1 mark) 10**

- i. A bolt of uniform strength can be developed by
  - a) keeping the core diameter of threads equal to the diameter of unthreaded portion of the bolt
  - b) keeping the core diameter smaller than the diameter of the unthreaded portion
  - c) keeping the nominal diameter of threads equal to the diameter of unthreaded portion of the bolt
  - d) none of the above
- ii. A taper key which fits half in the key way of the hub and half in the key way of shaft, is known as
  - a) sunk key
  - b) flat saddle key
  - c) hollow saddle key
  - d) tangent key
- iii. Clutch and coupling perform the same action.
  - a) Both being permanent joints
  - b) No they are different type of joints
  - c) Both being temporary joints
  - d) none of the above
- iv. In block brakes, the ratio of shoe width to wheel diameter is taken between
  - a) 0.1 and 0.25
  - b) 0.25 and 0.50
  - c) 0.50 and 0.75
  - d) 0.75 and 1
- v. The transverse fillet welds are designed on the basis of
  - a) tensile strength
  - b) shear strength
  - c) bending strength
  - d) compressive strength
- vi. Which of the following screw thread is used for power transmission in one direction only?
  - a) Acme threads
  - b) Square threads
  - c) Buttress threads
  - d) Multiple threads
- vii. The permissible stress in the fillet weld is  $100 \text{ N/mm}^2$ . The fillet weld has equal leg lengths of 15 mm each. The allowable shearing load on the weldment per cm length of the weld is
  - a) 7.5 kN
  - b) 10.6 kN
  - c) 15 kN
  - d) 22.5

- viii. Which of the following statement is wrong?
- A key is used as a temporary fastening
  - A key is subjected to tensile stresses
  - A key is always inserted parallel to the axis of the shaft
  - A key prevents relative motion between the shaft and boss of the pulley
- ix. A screw is said to be overhauling screw, if the
- friction angle is less than helix angle
  - friction angle is more than helix angle
  - friction angle is equal to helix angle
  - Deficiency of screw is 100%
- x. An automobile brake is only used to reduce the speed or bring the vehicle to halt.
- Yes
  - No, it also be used to hold the car
  - Brake acts only on moving vehicles
  - None of the mentioned

**Q.2 Short answer type questions (Answer any four)**

- A plate, 75 mm wide and 10 mm thick, is joined with another steel plate by means of single transverse and double parallel fillet welds. The joint is subjected to a maximum tensile force of 55 kN. The permissible tensile and shear stresses in the weld material are 70 and 50 N/mm<sup>2</sup> respectively. Determine the required length of each parallel fillet weld. 05
- What is 'self-locking' of power screw? What is the condition for self-locking? Why is the efficiency of self-locking square threaded screw less than 50%? 05
- The cross-section of a fl at key for a 40 mm diameter shaft is 22 × 14 mm. The power transmitted by the shaft to the hub is 25 kW at 300 rpm. The key is made of steel ( $S_{yc} = S_{yt} = 300 \text{ N/mm}^2$ ) and the factor of safety is 2.8. Determine the length of the key. Assume ( $S_{sy} = 0.577 S_{yt}$ ) 05
- What is a knuckle joint? Where do you use this type of joints? Draw free body diagram of each element in the joint mentioning their modes of failure. 05
- What are the two theories applied to friction plates? Explain with the help of cone clutch. 05

- Q.3A** A wall bracket is attached to the wall by means of four identical bolts, two at A and two at B as shown in Fig.1. Assuming that the bracket is held against the wall and prevented from tipping about point C by all four bolts and using an allowable tensile stress in the bolts as 40 N/mm<sup>2</sup>, determine the size of the bolts on the basis of maximum principal stress theory. 10

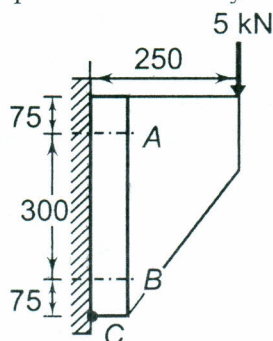


Figure 1

OR

- Q.3B A welded connection of steel plates is shown in Fig. 2. It is subjected to an eccentric force of 50 kN. Determine the size of the weld, if the permissible shear stress in the weld is not to exceed 70 N/mm<sup>2</sup>.

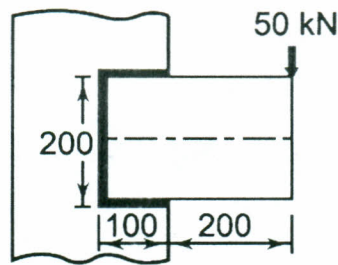


Figure 2

- Q.4A Two rods, made of plain carbon steel 30C8 ( $S_{yt} = 400 \text{ N/mm}^2$ ), are to be connected by means of a cotter joint. The diameter of each rod is 40 mm and the cotter is made from a steel plate of 15 mm thickness. Calculate the dimensions of the socket end making the following assumptions: 15
- (i) the yield strength in compression is twice of the tensile yield strength; and
  - (ii) the yield strength in shear is 55% of the tensile yield strength.
- The factor of safety is 6.

OR

- Q.4B The layout of a double-ply leather belt drive is shown in Fig. 3. The mass of the belt is 2 kg per metre length and the coefficient of friction is 0.35. Calculate (i) the tensions on the tight and loose sides, and (ii) the length of the belt. The belt is transmitting 35 kW of power.

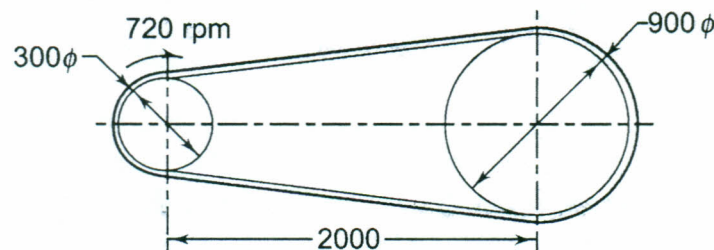


Figure 3

- Q.5 A double block brake is shown in Fig. 4. The brake drum rotates in a clockwise direction and the actuating force is 500 N. The coefficient of friction between the blocks and the drum is 0.35. Calculate the torque absorbing capacity of the brake. 15

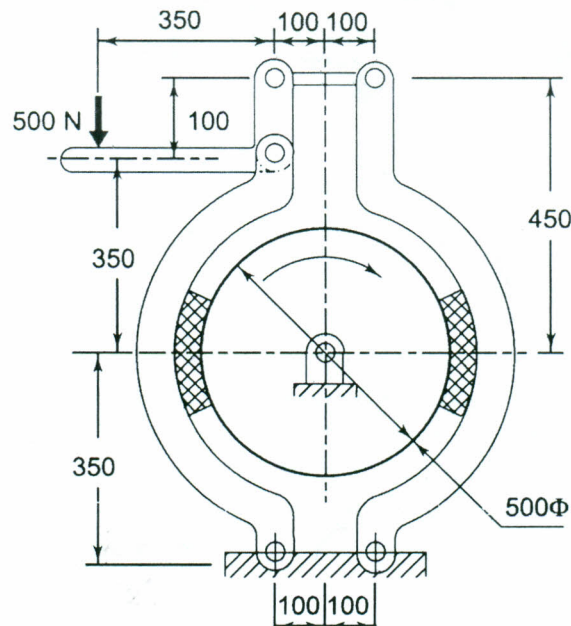


Figure 4

Q.6A A flywheel of 100 kg mass and 350 mm radius of gyration is rotating at 500 rpm. It is brought to rest by means of a brake. The mass of the brake drum assembly is 5 kg. The brake drum is made of cast-iron FG260( $c = 460 \text{ J/kg}^\circ\text{C}$ ). Assuming that the total heat generated is absorbed by the brake drum only, calculate the temperature rise. 05

05

Q.6B A machine is driven by a motor, which exerts a constant torque. The resisting torque of the machine increases uniformly from 500 N-m to 1500 N-m through a  $360^\circ$  rotation of the driving shaft and drops suddenly to 500 N-m again at the beginning of the next revolution. The mean angular velocity of the machine is 30 rad/s and the coefficient of speed fluctuations is 0.2. A solid circular steel disk, 25 mm thick, is used as flywheel. The mass density of steel is  $7800 \text{ kg/m}^3$  while Poisson's ratio is 0.3. Calculate the outer radius of the flywheel disk and the maximum stresses induced in it.