

(Please write your Enrolment No. immediately)

Enrolment No. ....

## MID TERM EXAMINATION

4<sup>th</sup> Semester, March, 2025

Paper Code: MEC-212

Time: 1<sup>1</sup>/<sub>2</sub> Hrs.

Subject: Machine Design -I

Max. Marks: 30

Note: Attempt Q.No. 1 which is compulsory and any two more questions from the remaining.

**Q1. Attempt any five:**

(5X2=10)

- (a) What are the manufacturing considerations in design of casting? (CO1)
- (b) What do you mean by factor of safety? (CO1)
- (c) What do you mean by stress concentration? (CO1)
- (d) Illustrate how the stress concentration in a component can be reduced. (CO1)
- (e) How are the keys classified? Draw neat sketches of different types of keys and state their applications. (CO2)
- (f) Explain what you understand by A.M. Wahl's factor and state its importance in the design of helical springs? (CO2)

**Q2. (a)** What is fatigue or Endurance limit of a material? Explain the mechanism of such failure. Draw the S-N curve. (CO1) (3)

**(b)** Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression. (CO1) (7)

**Q3.** Design a bushed-pin type of flexible coupling to connect a pump shaft to a motor shaft transmitting 32 kW at 960 r.p.m. The overall torque is 20 percent more than mean torque. The material properties are as follows: (a) The allowable shear and crushing stress for shaft and key material is 40 MPa and 80 MPa respectively. (b) The allowable shear stress for cast iron is 15 MPa. (c) The allowable bearing pressure for rubber bush is 0.8 N/mm<sup>2</sup>. (d) The material of the pin is same as that of shaft and key. Draw neat sketch of the coupling. (CO2) (10)

**Q4.** A helical spring is made from a wire of 6 mm diameter and has outside diameter of 75 mm. If the permissible shear stress is 350 MPa and modulus of rigidity 84 kN/mm<sup>2</sup>, find the axial load which the spring can carry and the deflection per active turn. (CO2) (10)

### SECOND MID TERM EXAMINATION

4<sup>th</sup> Semester, April, 2025

Paper Code: MEC-212

Subject: Machine Design -I

Time: 1<sup>1</sup>/<sub>2</sub>Hrs.

Max. Marks: 30

*Note: Attempt Q.No. 1 which is compulsory and any two more questions from the remaining.*

**Q1. Attempt any five:**

(5X2=10)

- (a) What do you understand by the term 'efficiency of a riveted joint'? According to I.B.R., what is the highest efficiency required of a riveted joint? (CO3)
- (b) What is the difference between caulking and fullering? Explain with the help of neat sketches. (CO3)
- (c) What is an eccentric loaded welded joint? Discuss the procedure for designing such a joint (CO3)
- (d) What is self-locking property of threads and where it is necessary? (CO4)
- (e) Show that the efficiency of self-locking screws is less than 50 percent. (CO4)
- (f) Write the expressions for static, limiting wear load and dynamic load for spur gears and explain the various terms used there in. (CO4)

**Q2. (a) Find the efficiency of the following riveted joints:**

- 1. Single riveted lap joint of 6 mm plates with 20 mm diameter rivets having a pitch of 50 mm.
- 2. Double riveted lap joint of 6 mm plates with 20 mm diameter rivets having a pitch of 65 mm.

Assume

Permissible tensile stress in plate = 120 MPa

Permissible shearing stress in rivets = 90 MPa

Permissible crushing stress in rivets = 180 MPa

(CO3) (7)

- (b) A 50 mm diameter solid shaft is welded to a flat plate by 10 mm fillet weld as shown in Fig.1. Find the maximum torque that the welded joint can sustain if the maximum shear stress intensity in the weld material is not to exceed 80 MPa. (CO3)

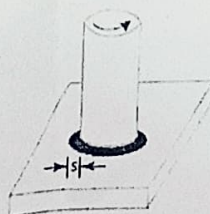


Fig.1

(3)

**Q3. (a) Derive expressions for efficiency and maximum efficiency of square threaded screw. (CO4) (5)**

- (b) An electric motor driven power screw moves a nut in a horizontal plane against a force of 75 kN at a speed of 300 mm / min. The screw has a single square thread of 6 mm pitch on a major diameter of 40 mm. The coefficient of friction at screw threads is 0.1. Estimate power of the motor. (CO4) (5)

**Q4. (a) Discuss the design procedure of spur gears. (CO4) (5)**

- (b) A bronze spur pinion rotating at 600 r.p.m. drives a cast iron spur gear at a transmission ratio of 4: 1. The allowable static stresses for the bronze pinion and cast iron gear are 84 MPa and 105 MPa respectively. The pinion has 16 standard 20° full depth involute teeth of module 8 mm. The face width of both the gears is 90 mm. Find the power that can be transmitted from the standpoint of strength. (CO4) (5)