

# 12241

**15116**

**4 Hours / 100 Marks**

Seat No.

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- Instructions* –
- (1) All Questions are *Compulsory*.
  - (2) Answer each next main Question on a new page.
  - (3) Illustrate your answers with neat sketches wherever necessary.
  - (4) Figures to the right indicate full marks.
  - (5) Assume suitable data, if necessary.
  - (6) Use of Non-programmable Electronic Pocket Calculator is permissible.
  - (7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.
  - (8) Use of design data book is not permitted.

**Marks**

**1. Attempt any FIVE of the following: 20**

- a) Write the various steps involved in general design procedure. Explain in brief.
- b) State the factors on which selection of ‘factor of safety’ depends.
- c) State various theories of elastic failures. Explain maximum principle stress theory.
- d) What is the effect of Key-way on the strength of the shaft?
- e) State the types of thread profile used for power transmission. Draw neat sketch of any two.

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- f) Explain with a neat sketch the 'Bolt of Uniform Strength'.
- g) State advantages of V-threads over Square threads.
- h) What are the contributions of 'Ergonomics' and 'Aesthetic' consideration in machine design.

**2. Attempt any FOUR of the following:**

**16**

- a) Distinguish between 'Fatigue failure' and 'Creep failure' of a machine component.
- b) What is stress-concentration'? State any two methods to reduce it with neat sketches.
- c) Write any four strength equations in the design of Knuckle joint with relevant sketches.
- d) Compare a hollow shaft and a solid shaft on the basis of strength and weight. Justify your answer by quantifying with suitable equations.
- e) State the meaning of the terms 'self-locking' and 'over hauling' of screw. Why efficiency of screw jack is less than 50%.
- f) Write the procedure for selection of bearings from the manufacture's catalogue.

**3. Attempt any TWO of the following:**

**16**

- a) Explain the design procedure of cotter joint with neat sketches and necessary equations.
- b) Explain with necessary sketches and equations how the screw spindle and nut of a screw jack is designed.
- c) Write the strength equations for designing a symmetrically loaded parallel and transverse weld along with neat sketches.

**4. Attempt any FOUR of the following:****16**

- a) Write Lewis-equation for the strength of gear tooth. Explain the meaning of each term.
- b) An electric motor driven power screw moves a nut in a horizontal plane against a force of 80 kN at a speed of 300 mm/min. Screw has a pitch 6 mm and a major diameter 40 mm. Coefficient of friction is 0.15. Estimate power of the motor.
- c) State the significance of Wahl's correction factor used in springs.
- d) Give examples where screwed joints are preferred over welded joints.
- e) Give the classification of bearings. How life of bearing is expressed?
- f) Design a Muff-coupling for connecting two shafts transmitting 50 kW at 500 rpm. The material for shaft and key is same for which allowable shearing and crushing stresses are 40 MPa and 80 MPa respectively.

**5. Attempt any TWO of the following:****16**

- a) Give the design procedure of hand-lever with neat sketch.
- b) Explain with neat sketch the design procedure for 'bushed-pin-type flexible coupling.
- c) A rail wagon of mass 20 tons is moving with a velocity of 10 kmph. It is brought to rest by using two buffer springs of 300 mm diameter. The maximum deflection of springs is 250 mm. An allowable shear stress for spring material is 800 MPa. Design the spring for buffers.

**6. Attempt any FOUR of the following:****16**

- a) Draw the stress-strain diagram for ductile and brittle materials. State all the points on it.
  - b) Write any four equations in the design of 'Turn buckle' with relevant sketches.
  - c) For a square key equally strong in shearing and crushing. Show that crushing stress is twice the shear stress.
  - d) A close coiled helical compression spring of 12 active coils has spring stiffness of 'K' N/m. It is cut into two springs having 4 and 8 turns respectively. Determine the spring stiffness of resultant springs.
  - e) State any four names of rolling contact bearings. State the applications of each.
  - f) State the importance of shape and colour in the design of aesthetics.
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