



17525

15162

4 Hours / 100 Marks

Seat No.

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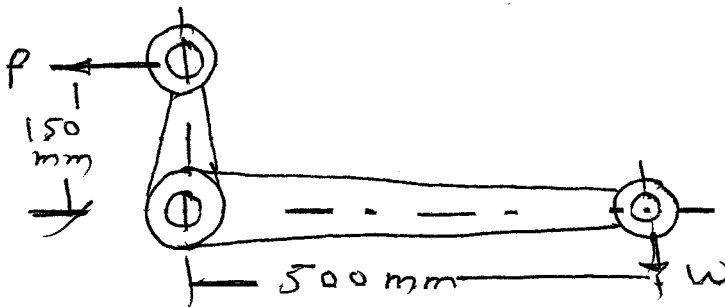
- Instructions :**
- (1) All questions are **compulsory**.
 - (2) Illustrate your answers with neat sketches **wherever** necessary.
 - (3) Figures to the **right** indicate **full** marks.
 - (4) Assume suitable data, if **necessary**.
 - (5) Use of Non-programmable Electronic Pocket Calculator is **permissible**.
 - (6) Mobile Phone, Pager and any other Electronic Communication devices are **not** permissible in Examination Hall.

Marks

(4×5=20)

1. Attempt **any five** :

- a) Describe fatigue and endurance limit.
- b) Describe the concept of “Bolts of uniform strength”.
- c) State strength equations to design spigot, spigot end, spigot collar.
- d) Design rectangular key for a shaft of 50 mm diameter. The allowable shear and crushing stresses for key material are 42 MPa and 70 MPa respectively.
- e) For a right angled bell crank lever, horizontal arm is 500 mm long and a load of 4.5 kN acts on it at its end. At the end of vertical arm, 150 mm in length a force ‘P’ acts as shown. Calculate force ‘P’, mechanical advantage and reaction at fulcrum.



- f) State the design procedure of single plate clutch using wear condition.
- g) State any four criterias for selection of “factor of safety”.

2. Attempt **any four** :

(4×4=16)

- a) Define :
 - 1) Strength
 - 2) Stiffness
 - 3) Creep
 - 4) Resilience
- b) Two rods of 52 mm diameter are joined by knuckle joint to transmit a load of 150 kN. Determine induced stresses in single eye and knuckle pin.
- c) State strength equations only, required to design turn buckle.
- d) Describe design procedure for full, floating rear axle.
- e) An automotive gear box given three forward and a reverse speed. Sketch neat layout and state all gear ratios in terms of number of teeth on each gear pair.
- f) Explain concept of nipping.

P.T.O.



3. Attempt any four :

- Describe spindle, axle and types of shaft with their appropriate example.
- Enlist types of failure and describe any three of them.
- Describe types of lever with their appropriate example.
- Draw neat sketch of leaf spring and show span of spring, ineffective length, central load, width of spring, total depth of spring.
- Define :
 - Indicated power
 - Brake power
 - Frictional power and state relation between them.
- State any four requirements of piston material.

4. Attempt any two :

(8×2=16)

- Design flange coupling to transmit 15 kW at 900 rpm. The service factor may be used as 1.35. Following permissible stresses may be assumed.
Shear stress for shaft, bolt and key material is 40 MPa. Crushing stress for bolt and key material is 80 MPa and shear stress for cast iron is 8 MPa.
- A multiplate clutch is to transmit 4.5 kW at 750 rpm. The inner and outer radii of contact surfaces are 40 and 70 mm respectively. The co-efficient of friction is 0.1. The average intensity of pressure is 0.35 N/mm². Find total no. of clutch plates, actual axial force required, actual average pressure and actual maximum pressure.
- A four stroke diesel engine has following specifications.
 - B.P. – 5 kW at 1200 rpm
 - Indicated mean effective pressure 0.35 N/mm²
 - Mechanical efficiency 80%
 Determine :
 - Bore and length of cylinder
 - Thickness of cylinder head
 - Size of studs for cylinder head if allowable tensile strength for stud material is 65 MPa.

5. Attempt any two :

(8×2=16)

- Design piston pin for following data piston diameter 70 mm, max. gas pressure inside cylinder 4.5 N/mm². Allowable stresses in bending, shear and bearing are 100 MPa, 70 MPa and 25 MPa respectively.
- I) Enlist applications of cotter joint and knuckle joint.
II) State the design procedure of rocker arm.
- Design bushed pins only for a flexible coupling to transmit 18 kW at 900 rpm. Diameter of shaft for coupling is 60 mm. Allowable shear and bending stresses in pin are 25 N/mm² and 50 N/mm² respectively. The allowable bearing pressure in rubber bush is 0.3 N/mm².

6. Attempt any two :

(8×2=16)

- Design connecting rod cross-section with following data.
 - Max. pressure inside cylinder 6.5 N/mm²
 - Piston diameter = 100 mm
 - Stroke length = 110 mm
 - Effective length of connecting rod = 220 mm
 - Max. allowable stress in crippling = 120 MPa
 - Rankin's constant $\frac{1}{6000}$

Also calculate height of cross-section at both the ends.

- State the design procedure for piston rings and skirt length.
- Describe service factor, overload factor, velocity factor and factor of safety.