

12167

21314

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) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. a) Attempt any **THREE** of the following: **12**
- i) Write the design procedure of designing any machine element.
- ii) Define standardisation and state the four advantages of it.
- iii) Define factor of safety for ductile material and state the four factors consider while selecting factor of safety.
- iv) Show the thrust side and non thrust side of I. C. engine piston with a neat sketch.

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- b) Attempt any ONE of the following: 6
- i) What is stress concentration? What are the different causes of stress concentration and explain the remedies of it with neat sketches.
 - ii) A single plate with both sides effective has outer and inner diameter 300 mm and 200 mm respectively. The maximum intensity of pressure at any point in the contact surface is not to exceed 0.1 N/mm^2 . If the co-efficient of friction is 0.3 determine the power transmitted by a clutch at a speed of 2500 rpm.
2. Attempt any FOUR of the following: 16
- a) Write the design procedure of turn buckle.
 - b) Explain the two methods to make bolt of uniform strength.
 - c) Draw a neat sketch of knuckle joint and insert important dimensions in terms of 'd' diameter of knuckle pin. Calculate the diameter of rod to withstand a load of 400 kN permissible stresses are $\sigma^+ = 70 \text{ N/mm}^2$ and $\tau = 60 \text{ N/mm}^2$.
 - d) Draw the four speed gear box sliding type showing clearly input shaft, output shaft, lay shaft and various bearing locations.
 - e) Write the detail classification of bearing.
3. Attempt any FOUR of the following: 16
- a) Define the following:
 - i) Shaft
 - ii) Axle
 - iii) Spindle
 - iv) Key
 - b) What is lever? Explain the principle on which it works.
 - c) Write the design procedure for hand lever.

- d) A truck spring has 10 number of leaves. The supports are 1185 mm apart and the central (support) is 85 mm wide. The load on the spring is 20 kN and take permissible stresses of 300 N/mm^2 . Determine the thickness of the leaves if the width of springs is 85 mm.
- e) A multi disc clutch has 5 plates having 4 pairs of active friction surfaces, if the intensity of pressure is not to exceed 0.127 N/mm^2 find the power transmitted at 500 rpm. The outer and the inner radii of friction surfaces are 125 mm and 75 mm respectively. Assume uniform wear and take coefficient of friction = 0.3.

4. a) Attempt any **THREE** of the following: 12

- i) Draw the neat sketch of through bolt and tap bolt and give their applications.
- ii) Write two application of each of the following:
- 1) Socket and Spigot cotter joint
 - 2) Turn buckle
- iii) Design the turn buckle tie rod diameter to withstand a load of 2500 N, permissible stresses are $f_t = 70 \text{ N/mm}^2$ and $t_s = 60 \text{ N/mm}^2$.
- iv) Explain the effect of keyway on the shaft.

b) Attempt any **ONE** of the following: 6

- i) Design a muff coupling for a shaft which transmits 37.5 kW at 240 rpm. The allowable shear stress for shaft is 60 N/mm^2 and for cast iron muff is 10 N/mm^2 . The stresses for Ray are 60 N/mm^2 and 126 N/mm^2 in shear and bearing respectively.
- ii) Describe the procedure to design fulcrum pin of rocker arm.

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

- a) Draw the neat sketch of the fully floating axle. And design the diameter of rear axle shaft for fully floating type with the following data.

Engine power = 10 kW at 300 rpm.

Gear box ratios = 4 : 1, 2.4 : 1, 1.5 : 1, and 1 : 1

Differential reduction = 6 : 1

τ for the shaft = 70 N/mm².

- b) A four speed gear box is to be constructed for providing the ratios of 1.0, 1.46, 2.28 and 4 to 1 as nearly as possible. The dimensional pitch of each gear is 3.25 mm and the smallest pinion is to have at least 15 teeth. Determine the suitable number of teeth of any gear ratio. What is the distance between the main layout shaft?
- c) Describe the procedure to design valve seat and valve lift.

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

- a) Design the piston pin with following data:

i) Maximum pressure on the piston = 4 N/mm².

ii) Diameter of piston = 70 mm

Allowable stresses due to bearing, bending and shear are given 30 N/mm², 80 N/mm² and 60 N/mm² respectively.

- b) Describe the procedure to design an overhang crank-shaft of and I.C. engine.
- c) Design the connecting rod cross-section with the following data of petrol engine.

Maximum pressure inside the cylinder = 4.5 N/mm², Piston diameter = 70 mm, Stroke length = 80 mm, Effective length of connecting rod = 140 mm. Maximum allowable stress in the connecting rod in clipping is 100 N/mm². Take Rankine constant for steel $\frac{1}{6000}$. Explain why I section are used for connecting rod.
