



17525

21415

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**.
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MARKS

1. A) Attempt **any three** : **12**
- a) List the important factors that influence the magnitude of factor of safety.
 - b) Define the following properties of a material :
 - i) Creep
 - ii) Ductility.
 - c) Mention the materials and application of the following joints :
 - i) Knuckle joint
 - ii) Spigot and socket joint.
 - d) Why propeller shaft are generally made hollow ?
- B) Attempt **any one** : **6**
- a) Design a hollow propeller shaft of a car with outside diameter 75 mm, transmits 22.5 kw at 1500 rpm to the wheels which are 90 cm in diameter. If the allowable shear stress is 60 N/mm^2 . Find out inner and outer diameter of shaft. Take gear box reduction as 5.
 - b) Draw a neat sketch of turn buckle joint. Design the turn buckle tie rod diameter only to withstand a load 2000 N. Permissible stresses are $f_t = 70 \text{ N/mm}^2$, $f_s = 60 \text{ N/mm}^2$.

P.T.O.

**MARKS**

2. Attempt **any four** : **16**
- a) What factors are to be considered while selection of the materials for design of machine element ?
 - b) Mention the methods of stress concentration with suitable examples.
 - c) Draw a neat and well labelled diagram of fully floating rear axle.
 - d) Draw a stress strain diagram for ductile material and state its importance.
 - e) Write the design procedure for single plate clutch according to uniform pressure theory.
3. Attempt **any four** : **16**
- a) What are the advantages of standardisation ?
 - b) Draw a neat and well labelled diagram of bushed pin flexible coupling.
 - c) Determine length, width and thickness of a mild steel rectangular sunk key required for 80 mm diameter shaft of mild steel to resist a torque of 5000 N-m.
Take – $f_s = 50 \text{ N/mm}^2$
 $f_c = 120 \text{ N/mm}^2$.
 - d) Why nipping is provided in leaf spring ?
 - e) What is the effect of key way cut into the shaft ?
4. A) Attempt **any three** : **12**
- a) What points are taken into consideration for design of the piston (any eight points) ?
 - b) State types of leaves used in engineering practice with their application.
 - c) What materials are used for clutch lining friction surfaces ?
 - d) Explain aesthetic consideration in designing automobile components.



MARKS

B) Attempt **any one** :

6

a) Explain the design procedure of a Rocker arm for operating exhaust valve.

b) Design a big end bolts of connecting rod with following data.

Maximum inertia force on the connecting rod 3000 N, at 4500 rpm.

Allowable stress for bolt = 65 N/mm^2 .

5. Attempt **any two** :

16

a) A truck spring has 12 number of leaves, two of which are full length leaves. The spring supports are 1.05 m apart and central band is 85 mm wide. The central load is to be 5.4 kN with a permissible stress of 280 N/mm^2 . Determine the thickness and width of the steel spring leaves. The ratio of the total depth to the width of the spring is 3. Also determine the deflection of the spring.

b) Draw a neat sketch of cotter joint. The joint has to withstand a load 60 kN.

Find :

I) The diameter of rod

II) Width of cotter.

Permissible stresses are = $f_t = 70 \text{ N/mm}^2$, $f_s = 60 \text{ N/mm}^2$, $f_b = 45 \text{ N/mm}^2$, $f_c = 2 \text{ ft}$.

c) Design the skirt length of the piston. With the given data of petrol engine. Maximum pressure inside the cylinder = 4.5 N/mm^2 . Piston diameter = 70 mm, side thrust is limited to 8% of maximum load on the piston. Allowable bearing pressure = 0.3 N/mm^2 , also draw a neat sketch of piston.



6. Attempt **any two** :

16

a) Draw a neat proportionate sketch of connecting rod. Why I-section is used as cross section of it ? What materials is selected for connecting rod ?

b) A four stroke diesel engine has the following specifications :

Brake power = 5 kw, speed = 1200 rpm. Indicated mean effective pressure = 0.35 N/mm^2 , Mechanical efficiency = 80%.

Determine :

I) Bore and length of the cylinder

II) Thickness of the cylinder head.

c) A four speed gear box is to be constructed for providing the ratio 1.0, 1.46, 2.28 and 3.93 to 1 as nearly as possible. The diametral pitch of gear is 3.25 mm and the smallest pinion is to have at least 15 teeth.

Determine the suitable number of teeth of the different gear. Also calculate the distance between main and layout shaft.
