



12167

13141

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.

MARKS

1. A) Attempt **any three** of the following :

12

a) Explain design consideration in automobile design.

b) Explain types of induced stress.

c) What is factor of safety ? How and why it is selected ?

d) Why inlet port diameter is more than exhaust port diameter ?

B) Attempt **any one** of the following :

6

a) Mention types of bearing used in automobile at these places with justification :

1) Rear axle of truck

2) Big end bearing

3) King pin.

b) Explain design procedure for leaf spring.

P.T.O.



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

16

a) Design the knuckle joint is required to withstand a tensile load of 25000 N, if permissible stress are

$$\sigma_+ = 56 \text{ N/mm}^2 \quad \tau = 40 \text{ N/mm}^2$$

$$\sigma_c = 70 \text{ N/mm}^2$$

b) What is stress concentration and how it can be reduced ?

c) Draw a stress strain diagram for ductile material and state its importance.

d) Design the turn buckle, the rod diameter only to withstand a load of 1600 N, given permissible stresses are 70 N/mm^2 and 60 N/mm^2 in tension and shear respectively.

e) A multi disc clutch has three discs on driving shaft and two on the driven shaft. The outside diameter of the contact surface is 240 mm and inside diameter is 120 mm. Assuming uniform wear and $\mu = 0.3$. Find the maximum axial intensity of pressure between the discs for transmitting 25000 w at 1575 r.p.m.

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

16

a) Explain types of key and their application.

b) Explain design procedure for muff coupling.

c) Define a lever. Describe three basic types of lever.

d) Single plate dry clutch is to be designed to transmit 70000 W at 3000 r.p.m., the external to internal radius of friction surface ratio is 1.25.

Take $\mu = 0.3$ and maximum axial pressure as 0.1 N/mm^2 .

e) A four speed gear box is to be constructed for providing the ratios of 1.0, 1.46, 2.28 and 3.93 to 1 as nearly as possible. The diametral 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 the different gears.



MARKS

4. A) Attempt **any three** of the following : 12
- a) Explain role of ergonomics in automobile design.
 - b) Write two application of each of following :
 - 1) Socket and spigot
 - 2) Turn buckle.
 - c) Design a propeller shaft to transmit 5 kw at 5000 r.p.m. with a gear box reduction of 16 : 1. Assume shear stress = 45 N/mm².
 - d) Explain design procedure of knuckle joint.
- B) Attempt **any one** of the following : 6
- a) Design fully floating rear axle if
 - i) Engine power = 80 kw at 5000 r.p.m.
 - ii) Gear box ratio 4 : 1, 2.4 : 1, 1.5 : 1 and 1 : 1 differential reduction 5 : 1. Shear stress for shaft material 65 N/mm². Sketch the arrangement of axle.
 - b) Design fulcrum pin of rocker arm which carries a load of 5000 N and has equal lengths of load arm and effort arm. The length of arms are 250 mm. The angle between the arms is 160°. The allowable bearing pressure is 7 N/m²m.
5. Attempt **any two** of the following : 16
- a) Design a muff couplind for a shaft which transmits 37.5 kW at 240 r.p.m. The allowable shear stress for shaft is 60 N/mm² and for cast iron muff is 10 N/mm². The stresses for key are 60 N/mm² and 126 N/mm² is shear and bearing respectively.
 - b) A truck spring has 12 numbers of leaves, two of which are full length leaves. The spring supports are 1.05 m apart and the central band is 85 mm wide. The central load is to be 5.4 kN with a permissible stress of 280 N/mm². Determine the thickness and width of steel spring leaves. The ratio of the total depth of the width of the spring is 3. Also determine the deflection of the spring.
 - c) Design of piston pin with following data. Maximum gas pressure = 4 N/mm². Diameter of piston = 70 mm, allowable stresses due to bearing, bending and shear are given 30 N/mm², 80 N/mm², 60 N/mm² respectively.



6. Attempt **any two** of the following :

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

Brake power = 5 kW

Speed = 1200 r.p.m.

Indicated mean effective pressure = 0.35 N/mm^2

Mechanical efficiency = 80%.

Determine dimension of piston, thickness of cylinder, size of steel for cylinder head.

b) Design the connecting rod cross section with the following data of petrol engine $P_{\max} = 4.5 \text{ N/mm}^2$, 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/mm^2 .

Take Rankine constant for steel = $\frac{1}{6000}$.

c) The valve of an I.C. engine is 60 mm diameter and subjected to maximum gas pressure 4 N/mm^2 . The shape bending stress in valve material is 46 N/mm^2 .

Determine :

a) Thickness of valve head

b) Stem diameter

c) Maximum lift of valve assuming $\alpha = 30^\circ$.
