



17525

11819

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**.*

Marks

1. A) Attempt **any three** : **12**
- i) State the eight considerations in machine design.
 - ii) Define standardisation and state the four advantages of it.
 - iii) Define (a) shaft (b) axle (c) spindle (d) key.
 - iv) List the important factors that influence the magnitude of F.O.S.
- B) Attempt **any one** : **6**
- i) The rear axle shaft connecting differential to side wheel is required to transmit 40 kW at 1600 rpm. If maximum torque is two times average torque and allowable shear stress is 80 N/mm² for axle shaft material, find out diameter of axle shaft if, (a) shaft is solid (b) shaft is hollow with outside diameter 1.6 times inside diameter.
 - ii) Draw a neat sketch of turn buckle joint. Also write the design procedure of it.
2. Attempt **any four** : **16**
- i) Define fatigue and endurance limit. Draw the S-N curve for cyclic loading.
 - ii) For a square key equally strong in shearing and crushing, show that the permissible crushing stress is twice the shear stress.
 - iii) Explain the two methods to make bolt of uniform strength.
 - iv) A knuckle joint is required to withstand a tensile load of 30 kN. Design the joint if the permissible stresses are 56 N/mm², in tension, 40 N/mm² in shear and 70 N/mm² in crushing respectively.
 - v) Draw thrust and non-thrust sides of I.C. engine piston.

P.T.O.

**3. Attempt any four :**

- i) Define Lever. Describe three basic types of Lever.
- ii) Design a propeller shaft to transmit 8 kW at 6500 rpm with gear box reduction of 16 : 1. Assume shear stress $f_s = 52 \text{ N/mm}^2$.
- iii) Design the piston crown thickness from the following data – diameter of piston = 90 mm, max. pressure on the piston = 4.6 N/mm^2 and allowable bending stress = 45 N/mm^2 .
- iv) Compare hand lever and foot lever on the basis of (a) effort required to operate (b) cross-section used (c) application (d) material.
- v) Explain aesthetic consideration in designing automobile components.

4. A) Attempt any three :

12

- i) Write the applications of cotter joint, knuckle joint and turn buckle.
- ii) 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 power transmitted at 500 rpm. The outer and inner radii of friction surfaces are 130 mm and 80 mm respectively. Assume uniform wear and take co-efficient of friction = 0.35.
- iii) Draw stress-strain diagram for ductile material and state its important.
- iv) Define indicated power and brake power of an engine cylinder.

B) Attempt any one :

6

- i) Design a rigid flange coupling to transmit a torque of 250 N-m. The shaft, key, bolt are made of alloy steel and flange are made of C.I. The allowable stresses for shaft material in shear –100 MPa, in crushing 250 MPa and allowable stresses for C.I. in shear –20 MPa.
- ii) Explain the design procedure of a Rocker arm for operating exhaust valve.

5. Attempt any two :

16

- i) A 4-stroke diesel engine has the following specifications :
Brake power = 6 kW, speed = 1200 rpm, Indicated mean effective pressure = 0.35 N/mm^2 , Mechanical efficiency = 80%. Determine,
 - a) Bore and length of cylinder
 - b) Thickness of cylinder head.
- ii) A truck spring has 12 numbers 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 steel spring leaves. The ratio of total depth to width of the spring is 3. Also determine the deflection of the spring.
- iii) Explain the design procedure of connecting rod.



[3]

17525

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16

6. Attempt any two :

- i) 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.

- ii) Determine the thickness of plain cylinder head for 0.4 m cylinder diameter. The maximum gas pressure is 3.2 N/mm^2 . Design the studs and cylinder cover. Take allowable tensile stress for cylinder cover and bolt equal to 42 N/mm^2 and 63 N/mm^2 respectively.
- iii) A single plate dry clutch transmits 8 kW at 940 rpm, the axial pressure is limited to 0.7 N/mm^2 . If the co-efficient of friction is 0.25, find;
- a) Mean radius and face width of friction lining assuming ratio of mean radius to face width as 4 and
- b) Outer and inner radii of the clutch plate.
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