21718

17525

4 Hours / 100 Marks Seat No. | | | | | | | | |

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**

a) Explain Ergonomic aspects of machine design.

b) List the stresses induced in cotter with the stress equation. Also write any two applications of the joint.

c) Describe the concept of "Bolts of uniform strength".

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.

B) Attempt **any one** : **6**

a) Draw a neat sketch of turn buckle joint. Design the turn buckle tie rod diameter only to withstand a load of 2000 N. Permissible stresses are $\in_t$ =70N/mm^2 , τ_s = 60 N/mm^2.

b) Write stepwise design procedure for the design of protective type flange coupling.

2. Attempt **any four** : **16**

a) Explain any eight design considerations in machine design.

b) Design a Knuckle joint for a tensile force of 40 kN. The safe stresses in the parts are 60 N/mm^2 in shear, 80 N/mm^2 in tensile and 50 N/mm^2 in crushing.

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

d) Design a propeller shaft to transmit 5 kW at 5000 rpm. with gear box reduction 16 : 1. Assume permissible shear stress for shaft material is 45 N/mm^2.

e) Explain the term standardisation. State any four advantages of it.

Marks

3. Attempt **any four** : **16**

a) Find the diameter of solid shaft to transmit 20 kW at 200 rpm. The ultimate shear stress for the shaft may be taken as 360 N/mm^2 and the F.O.S. as 8.

b) Describe nipping of leaf springs with neat sketch.

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

d) Explain - Max. principal stress theory.

e) Design the diameter of rear axle shaft for fully floating type with the following data :

Engine power = 10 kW at 300 rpm

Gear Box ratio = 4 : 1, 2.4 : 1, 1.5 : 1 and 1 : 1

Differential reduction = 6 : 1

Shear stress for shaft material = 70 N/mm^2.

4. A) Attempt **any three** : **12**

a) Define factor of safety. State the factors affecting its selection.

b) Give the application of following joints.

i) Knuckle Joint

ii) Turn Buckle

c) Define :

i) Indicated Power

ii) Brake Power

iii) Frictional Power and state relation between them.

d) Differentiate between hand lever and foot lever.

B) Attempt **any one** : **6**

a) Design bushed pin 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/mm^2 and 50 N/mm^2 respectively. The allowable bearing pressure in rubber bush is 0.3 N/mm^2.

b) A four stroke diesel engine has following specifications.

B.P. = 5 kW at 1200 rpm.

Indicated mean effective pressure = 0. 35 N/mm^2

Mechanical efficiency = 80%

Determine :

i) Bore and length of cylinder

ii) Thickness of cylinder head.

Marks

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 5.4 kN with a permissible stress of 280 N/mm^2. Determine thickness and width of the steel spring leaves. The ratio of total depth to the width of the spring is 3. Also determine the deflection of the spring.

b) Design piston pin with following data :

Max. gas pressure = 4 N/mm^2

Diameter of piston = 70 mm

Allowable stresses due to bearing, bending and shear are given 30 N/mm^2, 80 N/mm^2, 60 N/mm^2 respectively.

c) Draw a neat sketch of sliding mesh gear box and write the design procedure for teeth calculation.

6. Attempt **any two** : **16**

a) A multiple disc clutch has five plates having four 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 125 mm and 76 mm respectively. Assume uniform wear and take co-efficient of friction = 0.3.

b) Explain the design procedure used to design the piston rings and piston skirts.

c) Design the connecting rod cross-section with following data of petrol engine. Max. pressure inside the cylinder = 4.5 N/mm^2 piston diameter = 70 mm, stroke length = 80 mm, Effective length of connecting rod = 140 mm, max. allowable stress in the connecting rod in crippling is 100 N/mm^2. Take Rankine constant for steel is $\frac{1}{1600}$.