17525

15116

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

Marks

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

a) State stepwise procedure for component design.

b) Define system design, product design.

c) Define cyclic loading and describe any two types of cyclic stresses.

d) State all empirical relations required to design knuckle joint.

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

a) Define pitch circle diameter, diametral pitch, module and state relation between them.

b) State relations between load, effort and reaction at fulcrum when

I) Load and effort are parallel and acting opposite in direction.

II) Load and effort are inclined to each other.

III) Load and effort are right angled to each other and arms are inclined at an angle ' θ '.

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

a) Write stepwise procedure to design of piston pin.

b) Suggest suitable materials for propeller shaft and leaf spring with suitable justifications.

c) Explain procedure for design of cotter joint.

d) A bell crank lever is pivoted to a pin of diameter 20 mm, to raise a load of 5 kN at short arm end. The lengths of short arm and long arm are 100 mm and 450 mm resp. Determine shear stress and bearing pressure induced in fulcrum pin.

e) Two arms of rocker arm are equal and make included angle of 160°. It is used to operate exhaust valve, for which maximum force required is 5 kN. Determine length of fulcrum pin and induced shear stress in pin material if allowable bearing pressure in pin material is 7 N/mm^2.

P.T.O.

Marks

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

a) The tie rod is 40 mm in diameter. Determine dimensions of coupler and couplernut empirically.

b) In a sliding mesh gear box with three forward and one reverse speeds, clutch shaft pinion has 14 teeth, low gear main shaft has 32 teeth, the corresponding lay shaft pinions have 36 and 18 teeth. Determine centre distance between shafts if gears of 3.25 mm module are to be employed also determine gear ratio for second forward speed.

c) If radial width of piston ring is 8 mm and if two compression rings and one oil ring are to be employed on piston having crown thickness of 10 mm, compute length of piston above skirt.

d) For a cotter joint sustaining 50 kN load, spigot diameter is 46 mm. Determine outer diameter of socket and diameter of socket cotter, if mean width of cotter is 40 mm. Also determine induced bending stress in cotter.

e) State empirical relations used to design rectangular sunk key and prove that for a square key induced crushing stress is twice the shear stress.

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

a) State stepwise procedure to obtain length of leaf spring leaves.

b) State stepwise procedure to determine face width of frictional surface of a single plate clutch.

c) State any two applications of each of knuckle joint and turn buckle in an automobile.

d) Define whirling, critical speed and state effects of whirling on transmission shaft.

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

a) Describe importance of ergonomics and aesthetics in designing an automobile.

b) Design diameter of fully floating rear axle if engine power is 80 kW at 5000 rpm. Gearbox ratios are 4 : 1, 2.4 : 1, 1.5 : 1, 1 : 1. The differential reduction is 5 : 1. Allowable shear stress for shaft material is 65 N/mm^2 sketch the arrangement of the axle.

5. Attempt **any two**: **16**

a) I) A C.I. link, as shown in fig. transmits a load of 45 kN. Find the tensile stress induced in link material at Section A-A and B-B.

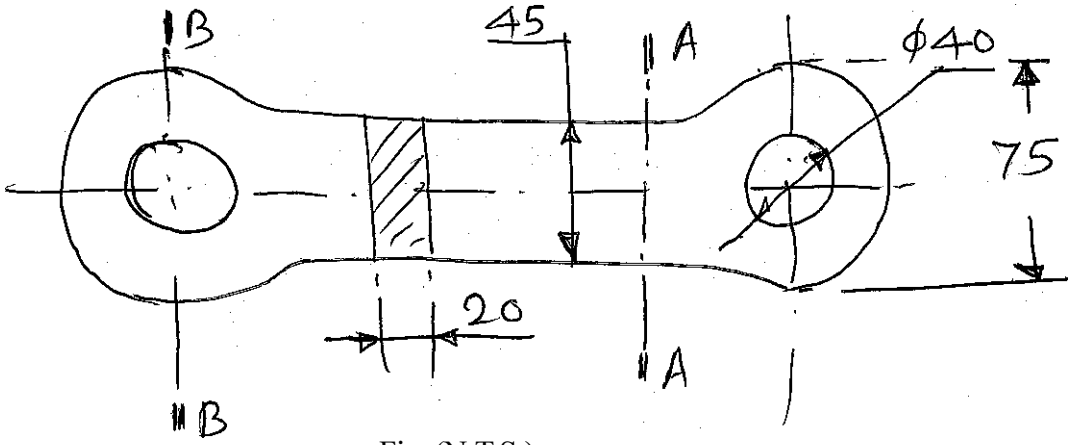

Fig. (N.T.S.)

Marks

II) Calculate force required to punch a circular hole of ϕ 60 mm in a plate of 5 mm thickness. If ultimate shear stress of plate material is 350 N/mm^2 and determine crushing stress experienced by punch.

b) Design and draw flange coupling for a shaft transmitting 90 kW at 250 rpm. The allowable shear stress for shaft material is 40 MPa and the angle of twist is not to exceed 10 in a length of twenty diameters. The allowable shear stress in coupling bolts is 30 MPa and i.e. for C.I. is 14 MPa. Assume key and shaft materials are same.

c) Design a piston pin for a piston having diameter 100 mm and sustaining max. gas pressure of 5 N/mm^2. The allowable stresses for pin material are 25 N/mm^2 in bearing, 70 N/mm^2 in shear and 140 N/mm^2 in bending. Draw a neat sketch of piston and locate piston pin centre on it. Assume max. bearing pressure on piston is limited to 0.45 N/mm^2.

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

a) Write stepwise design procedure for :

I) Cylinder bore

II) Cylinder head

III) Cylinder head bolts or studs.

b) A semi-elliptical leaf spring consists of two full length leaves and eight graduated leaves including master leaf. The effective length of the spring is 1m and max. force acting on it is 10 kN width of each leaf is 50 mm. The spring is initially preloaded so that stresses induced in each leaf are 350 N/mm^2. If modulus of elasticity of spring material is 207000 N/mm^2, determine thickness of each leaf, deflection of spring and initial nip. Sketch proportionate fig. of semi-elliptical leaf spring.

c) Determine dimensions of the cross-section of a connecting rod of an I.C. engine for following data :

Cylinder bore = 100 mm

Length of connecting rod = 350 mm

Max. gas pressure = 4 MPa

F.O.S. = 6

Rankines const. = 1/7500

Also find variations in height of cross-section and draw a neat proportionate sketch of connecting rod.