TED (15) – 5021

(REVISION — 2015)

Reg. No.....

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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/COMMERCIAL PRACTICE — OCTOBER, 2018

DESIGN OF MACHINE ELEMENTS

[*Time* : 3 hours

(Maximum marks : 100)

PART — A

(Maximum marks : 10)

Marks

I Answer *all* questions in one or two sentences. Each question carries 2 marks.

1. List any 4 Design factors.
2. Write the formula for finding the torque transmitted by a solid shaft.
3. Define the coefficient of fluctuation of speed of flywheel.
4. Define the slip in Belt drive.
5. Define the Circular pitch of gear. (5×2 = 10)

PART — B

(Maximum marks : 30)

II Answer any *five* of the following questions. Each question carries 6 marks.

1. Describe that the efficiency of screw jack is independent of load.
2. Explain (a) Sunk Key (b) Saddle Key and (c) Feather Key.
3. A solid shaft is required to transmit a torque of 20 kNm. Find the necessary diameter of shaft, if the allowable shear stress is 70 N/mm².
4. A muff coupling is used to connect two shafts for transmitting 1365 N-m. Find the diameters of shaft and muff. Assume that permissible shearstress of muff and shaft are 15 N/mm² and 30 N/mm² respectively.
5. Describe a detailed classification of bearings and explain.
6. Define the following :
   (a) Height of Governor (b) Isochronism of Governor and (c) Hunting of Governor
7. Describe the velocity ratios of (a) Simple gear train (b) Compound gear train (5×6 = 30)

Marks

PART — C

(Maximum marks : 60)

(Answer *one* full question from each unit. Each full question carries 15 marks.)

UNIT — I

III (a) A Machine weighing 25 kN is provided with a steel eye bolt for lifting it. If the ultimate tensile strength of steel is 480 N/mm² and the factor of safety is 6, find the size of bolt. 7

(b) A load of 2500 N is to be raised by a screw jack with a screw of 75 mm mean diameter and pitch of 12 mm. Find the efficiency of the screw jack, if the coefficient of friction of screw and nut is 0.075. 8

OR

IV (a) A 40 mm diameter shaft is subjected to a tangential force of 20 kN around it's circumference. Determine the size of key. The allowable shear stress in key is 60 N/mm². 7

(b) In a steam engine the maximum steam pressure is 1 N/mm² absolute and back pressure is 0.015 N/mm² absolute. The cylinder diameter is 300 mm. Determine the diameter of the screwed end of the piston rod, when the allowable stress is 45 N/mm² in tension. 8

UNIT — II

V (a) A solid circular shaft is to transmit 1.25 MW at 240 RPM. It is connected to another shaft with a flange coupling which has 6 bolts, equally spaced on a pitch circle having diameter of 1.5 times that of shaft diameter. The allowable shear stresses are 75 N/mm² for the shaft and 100 N/mm² for the bolts. Determine the diameter of shaft and diameter of bolts required. 7

(b) A solid circular shaft has to transmit a torque of 30 KN-m. The maximum shear stress is not to exceed 100 MPa and angle of twist is not to exceed 1° per meter length. Take the modulus of rigidity as 80 GPa. Design the diameter of shaft. 8

OR

VI (a) A flange coupling uses 8 equally spaced bolts on a pitch circle diameter of 120 mm. The maximum torque to be transmitted is 2500N-m. If the permissible shear stress of bolt material is 70 N/mm², estimate the minimum diameter of bolt required. 7

(b) A hollow shaft transmits 500 kW at 450 RPM. The maximum stress in shear is 60 N/mm². Find the outside and inside diameters of shaft, if the outside diameter is twice that of inside diameter, assuming that the maximum torque is 25% greater than the mean torque. 8

UNIT — III

VII (a) Explain the following terms of Flywheel.

(i) Maximum fluctuation of energy.

(ii) Coefficient of fluctuation of energy.

(iii) Energy stored in flywheel. 7

Marks

(b) A journal bearing whose diameter is 60 mm is subjected to a load of 4.5 kN while rotating at 180 RPM. If coefficient of friction is 0.02 and L/D ratio is 3, Find :

(i) Bearing pressure (ii) Power lost in friction (iii) Heat generated 8

OR

VIII (a) Explain Bearing characteristic number. Describe the relation between Coefficient of friction and Bearing characteristic number. 7

(b) Draw the profile of a cam operating a knife edge follower from the following data :

(i) Lifts the follower through 40 mm during 60 degree with SHM.

(ii) Dwell for next 45 Degrees.

(iii) Return stroke to it's original position during next 90° cam rotation with SHM.

(iv) Dwell for remaining period.

The least diameter of cam is 50 mm. 8

UNIT — IV

IX (a) A pulley 270 mm diameter is driven at 300 RPM by a belt 12 mm thick. The tensions in the tight and slack sides of the belt are 1560 and 490 N respectively. Find the power transmitted. 7

(b) With a sketch explain the Reverted gear train and describe it's velocity ratio. 8

OR

X (a) With a sketch explain the compound belt drive and describe it's velocity ratio. 7

(b) A set of spur gear wheels are arranged as follows :

Gear "A" drives Gear "B". Gears "B" and "C" is a compound wheel. Gear "C" drives Gear "D". If number of teeth on Gear A = 25, on B = 50, on C = 35 and on D = 70. If Gear A rotates at 300 RPM, find the RPM of wheel D. 8
