

TED (15) –5021
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**DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/MANAGEMENT/
COMMERCIAL PRACTICE – NOVEMBER – 2022**

DESIGN OF MACHINE ELEMENTS

(Maximum Marks : 100)

(Time : 3 hours)

PART – A
(Maximum Marks : 10)

Marks

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

1. List any four factors governing the design.
2. Write torsion equation and explain each term.
3. Explain the term sensitiveness of governor.
4. Define diametric pitch of gear.
5. List any four types of keys.

(5x2=10)

PART –B
(Maximum Marks : 30)

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

1. Explain the bolts of uniform strength.
2. A solid shaft transmits 560 kW power at 300 rpm. The maximum shear stress of the material is 60 N/mm^2 . Find the suitable diameter of the shaft.
3. Compare the functions of flywheel and governor.
4. Draw and mark the gear nomenclature.
5. With neat sketch explain reverted gear train.
6. Explain the bearing characteristic number and the significance of bearing modulus.
7. Define the general procedure for design.

(5x6=30)

PART – C

(Maximum Marks : 60)

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

UNIT – I

- III.** (a) An engine cylinder is 300 mm in diameter and the maximum steam pressure acting on the cylinder head is 1.2 Mpa. If the cylinder head is held by 12 studs find the size of studs. Assume safe tensile stress for stud material as 28 Mpa. (9)
- (b) An eye bolt carries a tensile load of 20kN. Find the size of the bolt, if tensile stress is not to exceed 100 Mpa. (6)

OR

- IV.** (a) In a steam engine maximum steam pressure is 1 Mpa absolute and the back pressure is 0.015 Mpa absolute. The cylinder diameter is 300 mm. Determine the diameter of the screwed end of the piston rod when the allowable stress is 45 Mpa in tension. (9)
- (b) A 40 mm diameter shaft is subjected to a tangential force of 20 kN around its circumference. Determine the sizes of the key. The allowable shear stresses in key is 60 Mpa. (6)

UNIT – II

- V.** (a) Design a muff coupling which is used to connect two shafts transmitting 40 kw at 350 rpm. Design shaft and muff, if the permissible shear stress of shaft and muff are 30 Mpa and 15 Mpa respectively. Assume maximum torque is 25% greater than the average torque. (9)
- (b) A solid circular shaft is used to transmit a torque of 9.6 Nm. The angle of twist over a length of 2m is 2 degree. Estimate the required diameter of the shaft and shear stress induced in the material. Take $G = 0.8 \times 10^5 \text{ N/mm}^2$ (6)

OR

- VI.** (a) Design a cast iron flange coupling to connect two shafts of 100 mm diameter. The shaft runs at 250 rpm and transmits a torque of 5 kN-m. Assume permissible shear stress for shaft, bolt and key as 50 Mpa. The permissible crushing stress for bolt and key material may be taken 100 Mpa. For cast iron flange, the allowable shear stress is 8 Mpa. (9)
- (b) A solid shaft is transmitting 1MW at 240rpm. Determine the diameter of the shaft if the maximum torque transmitted exceeds the mean torque by 20%. Take the maximum allowable shear stress as 60 Mpa. (6)

UNIT –III

- VII.** (a) Construct the profile of a cam operating a knife edged follower from the following data:
- (i) Follower to move the follower rough 40 mm during 60 degree of cam rotation.
 - (ii) Follower to dwell for next 45 degree.
 - (iii) Follower to Return to its original position during next 90 degree.
 - (iv) Follower to dwell for the rest of the cam rotation.
- The displacement of the follower is to take place with simple harmonic motion during both the outward and return stroke. The least radius of the cam is 50 mm. (9)
- (b) A journal bearing having a diameter of 65 mm is subjected to a load of 5 kN at a speed of 200 rpm. If the length to diameter ratio is 3, and coefficient of friction is 0.02. Find (i) Bearing Pressure (ii) Heat generated. (6)

OR

- VIII.** (a) A flat foot step bearing 180 mm diameter supports a load of 30 kN. If the coefficient of friction is 0.04 and the speed 120 rpm, calculate the power lost at the bearing in overcoming friction. (9)
- (b) With a neat sketch explain working of porter governor. (6)

UNIT – IV

- IX.** (a) Two pulley 600 mm and 400 mm diameters are connected by a belt. Central distance between the pulleys is 6 m. Find the length of belt required for (a) open belt drive and (b) cross belt drive. (9)
- (b) A 400 mm diameter pulley is driven at 750 rpm by a flat belt with a tight side tension of 300 N and slack side tension of 45.35 N. Determine the power transmitted by the belt. (6)

OR

- X.** (a) Find the power transmitted by a belt running over a pulley of 600 mm diameter at 200 rpm. The coefficient of friction between the belt and the pulley is 0.25, angle of lap 160 degree and the maximum tension in the belt is 2.5kN. (9)
- (b) Write three advantages and disadvantages of gear drive. (6)
