

**DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/  
MANAGEMENT/COMMERCIAL PRACTICE - NOVEMBER 2023**

**DESIGN OF MACHINE ELEMENTS**

(Maximum Marks:100)

(Time: 3 hours)

**PART - A**

( Maximum Mark : 10 )

**Marks**

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

1. Define factor of safety.
2. What is the purpose of a flexible coupling?
3. State the function of a governor.
4. What is the function of a bearing?
5. Define pitch point.

( 5 x 2 = 10 )

**PART - B**

( Maximum Mark: 30 )

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

1. What are the main classifications of machine design?
2. Explain (a) sunk key (b) saddle key (c) feather key
3. What is the minimum diameter of a shaft transmitting a torque of  $31.5 \times 10^4$  N-m without exceeding the maximum shear stress of 50 MPa.
4. List the useful purposes of couplings.
5. Explain bearing modulus with its significance.
6. Distinguish between simple gear train and compound gear train.
7. Sketch the cross section of a V belt and label its important parts.

( 5 x 6 = 30 )

*P.T.O*

**PART – C**

(Maximum Mark: 60 )

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

**UNIT - 1**

- III a) Two screws for a pipe hanger must hold a tensile load of 9 KN. Calculate the most suitable size of screw. Take the working stress in tension as 40MPa. (6)
- b) Explain the failures that occur in a rectangular sunk key. How length is found in a sunk key. (9)

**OR**

- IV (a) An engine cylinder is 300mm in diameter and the maximum steam pressure acting on the cylinder head is 1.2MPa. If the cylinder head is held by 12 studs find the size of the studs. Assume safe tensile stress for stud material as 28MPa. (6)
- (b) A screw jack has a square threaded screw of mean diameter 50mm and pitch 10mm. The coefficient of friction between screw and nut is 0.13. Neglecting collar friction, calculate the torque required to be applied on the screw for lifting a load of 25kN. (9)

**UNIT – II**

- V (a) Discuss with the help of sketch, the design procedure of Muff coupling. (6)
- (b) A solid circular shaft has to transmit a torque of 30kN-m. The maximum shear stress is not to exceed  $1^0$  per meter length. Take Modulus of Rigidity as 80 GPa. Design the diameter of shaft. (9)

**OR**

- VI (a) Derive an expression for design of a shaft of diameter  $d$  subjected to twisting moment only. (6)
- (b) Design a muff coupling for a shaft transmitting 40kW at 350 rpm. Design shaft and muff, if the permissible shear stress of shaft and muff are 30MPa and 15 MPa respectively. Assume maximum torque is 25% greater than mean torque. (9)

### UNIT – III

- VII (a) Briefly explain the classification of bearings. (6)
- (b) Draw the profile of a cam operating a knife edged follower from following data:
- 1) Follower to move outwards through 40 mm during  $60^\circ$  cam rotation.
  - 2) Follower to dwell for next  $45^\circ$ .
  - 3) Follower to return to its original position during next  $90^\circ$ .
  - 4) Follower to dwell for the rest of cam rotation.
- The displacement of follower is to take place with SHM during outward and return stroke. The least radius of the cam is 50mm. (9)

### OR

- VIII (a) Compare governors and flywheels. (6)
- (b) A journal bearing 60mm in diameter and 90 mm long runs at 450 rpm. The oil used for hydrodynamic lubrication has absolute viscosity 0.06 kg/m-s. If the diametral clearance is 0.1mm, find the safe load on the bearing. (  $S = 14.3 \times 10^6$  ) (9)

### UNIT – IV

- IX (a) Explain epicyclic gear train with the help of a neat sketch . (8)
- (b) Two pulleys 600mm and 400mm diameters are connected by a belt. Central distance between the pulley is 6 meters. Find the length of the belt required for (a) open belt drive ( b) cross belt drive. (7)

### OR

- X (a) Derive an expression for the velocity ratio of flat belt drive. (8)
- (b) A toothed wheel has 108 teeth. Its module is 1.25 mm. Find the circular pitch, pitch diameter and diametral pitch. (7)

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