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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/ MANAGEMENT/COMMERCIAL PRACTICE, NOVEMBER - 2025

DESIGN OF MACHINE ELEMENTS

[Maximum Marks: **100**] [Time: **3** Hours]

PART-A

[Maximum Marks: **10**]

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

1. Define factor of safety.
2. Name the different types of sunk keys.
3. What is meant by strength of shaft?
4. State the function of governor.
5. Name the different types of gear trains. (5 x 2 = 10)

PART-B

[Maximum Marks: **30**]

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

1. Differentiate pitch and lead of thread.
2. State torsion equation and explain each term.
3. Differentiate rigid coupling and flexible coupling. Give one example for each.
4. Draw the curve shows variation of coefficient of friction with bearing characteristic number and mark various points.
5. Compare the functions of flywheel with governor.
6. List out any six advantages of gear drive over belt and chain drive.
7. Explain module and circular pitch in respect of gears. (5 x 6 = 30)

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 30 KN is provided with a steel eye bolt for lifting it. If the ultimate tensile strength of steel is 500MPa and the factor of safety is 6, find the size of bolt. (9)

b. Draw a screw thread and mark important terms. (6)

OR

IV. a. A 150 mm diameter valve, against which a steam pressure of 2 MPa is acting, is enclosed by means of a square threaded screw 50mm external diameter with 6 mm pitch. If the coefficient of friction is 0.12, find the torque required to turn the handle. (9)

b. What is meant by a bolt of uniform strength? Briefly explain with neat sketch any two methods of manufacturing bolts with uniform strength. (6)

UNIT – II

V. a. Find the diameter of a solid steel shaft to transmit 20 kW at 200 rpm. The ultimate shear stress for steel may be taken as 360 MPa and factor of safety 8. If a hollow shaft is to be used in place of a solid shaft, find the inside and outside diameter when the ratio of inside to outside diameter is 0.5. (9)

b. Find the maximum shear stress induced in a solid circular shaft of diameter 160 mm when the shaft transmits 150 kW power at 180 rpm. (6)

OR

VI. a. Design a muff coupling to connect two shafts transmitting 100 kW at 200 rpm. The permissible shearing and crushing stresses for shaft and key material are 50 MPa and 100 MPa respectively. The material of muff is cast iron with permissible shear stress of 15 MPa. Assume that the maximum torque transmitted is equal to the mean torque. (9)

b. State the purpose of couplings. (6)

UNIT- III

VII. a. Draw the profile of a cam to give the following motion to a knife edged follower.

1. Out stroke during 60° of cam rotation
2. Dwell for the next 30° of cam rotation
3. Return stroke during next 60° of cam rotation
4. Dwell for the remaining rotation of the cam.

The stroke of the follower is 20 mm and the minimum radius of the cam is 50 mm. The axis of the follower is offset by 20 mm from the axis of the cam. The follower moves with uniform velocity during both the outstroke and return stroke. (9)

b. Name and sketch different types of cam followers used. (6)

OR

VIII. a. A foot step bearing supports a shaft of 150 mm diameter which is counter bored at the end with a hole diameter of 50 mm. If the bearing pressure is limited to 0.8 MPa and the speed is 100 rpm.

Find

(1) The load to be supported:

(2) The power lost in friction; and

(3) The heat generated.

Assume coefficient of friction as 0.015. (9)

b. Define the following terms as applied to governor.

i) Sensitiveness ii) Hunting iii) Equilibrium speed. (6)

UNIT - IV

IX. a. An engine shaft running at 120 rpm is required to drive a machine shaft by a belt. The pulley on the engine shaft is 2 m diameter and that of the machine shaft is 1m diameter. If the belt thickness is 5 mm, determine the speed of the machine shaft, when

(i) There is no slip; and

(ii) There is a total slip of 3%. (9)

b. State any five advantages of chain drive over belt drive. (6)

OR

X. a. A gear having 90 teeth meshes with a pinion having 20 teeth. Determine the distance between the centers of the gears if.

(i) The circular pitch is 12 mm, and

(ii) The module is 3 mm (9)

b. Show the nomenclature of a spur gear with the help of neat sketch. (6)

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