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DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/MANAGEMENT/
COMMERCIAL PRACTICE – APRIL -2020.

DESIGN OF MACHINE ELEMENTS

(Maximum Marks : 75)　　　　　　　　　　　　　　　　　[Time : 2.15 hours]

PART–A

Marks

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

1. Define design stress.

2. Define root of a screw thread.

3. List the classification of shafts.

4. Define dwell period of a follower.

5. State the effect of belt slip.　　　　　　　　　　　　　　(3x2=6)

PART - B

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

1. State the assumptions made on the design of cylinder cover bolts.

2. Explain overhauling and self locking of screw jack.

3. Define a coupling and list its uses.

4. Explain the design procedure of thrust bearing with shaft radius'r'

5. Compare a flywheel with a governor.

6. Explain creep of a belt and its effect. Also state its velocity ratio.

7. Find the module, pitch diameter and diametral pitch of a toothed wheel with 36 teeth
    and a circular pitch of 13 mm.

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PART - C

(Answer *any of the three units* from the following. Each full question carries 15 marks)

UNIT I

III　(a)　Two shafts are connected together by a flange coupling to transmit a toque

of 215 Nm. The flange of the coupling are fastened by four bolts at a radius

of 50mm. Find the size of the bolt if the allowable shear stress of bolt material

is 30 MPa. Assume the bolts are homogeneous material.　　　　　(7)

(b)   A shaft transmitting 15 kW at 200 rpm has a diameter of 50mm. The shaft uses
a square key with 12 mm side and 75 mm long. Find the induced shear and
compression stresses in the key.   (8)

OR

IV (a) An engine cylinder is 300 mm in diameter and the maximum steam pressure
acting on the cylinder head is 1.2 MPa. The cylinder head is held by 12 studs.
If the tensile stress for stud material is 28 MPa. Find the size of the studs.   (7)

(b) The outside diameter of a square threaded spindle of a screw jack is 40 mm and
pitch is 10 mm. If coefficient of friction between screw and nut is 0.15, neglecting
friction determine.

(i) Force required to raise a load of 20 kN

(ii) Efficiency of screw jack.

(iii) State whether the screw is self locking or overhauling and justify.   (8)

UNIT- II

V (a) A flange coupling has 8 equally spaced bolts on a pitch circle of diameter 120 mm.
The maximum torque to be transmitted is 2500 Nm. If the ultimate shear stress
of bolt material is 350 MPa and factor of safety is 5, find the minimum diameter of
bolts.   (7)

(b) A hollow shaft is to transmit 295 kW at 80 rpm. If the internal diameter is 0.6 of
the external diameter and shear stress is 50 MPa, find the internal diameter and
external diameter if the maximum torque is 1.4 times the mean.   (8)

OR

VI (a) A solid shaft is transmitting 1 MW at 240 rpm. Determine the diameter of the
shaft, if the maximum torque exceeds the mean torque by 20 percent. Assume
maximum shear stress as 60 MPa.   (7)

(b)   Design the hub, flange and key for a cast iron flange coupling to connect two
shafts of 100 mm diameter and runs at 250 rpm to transmit a torque of 5 kNm.
Permissible shear stress for key is 5 MPa and crushing stress is 100 MPa.
The allowable shear stress for flange is 8 MPa.   (8)

UNIT- III

VII (a) A foot step bearing supports a shaft of 120 mm diameter running at a speed of 100 rpm. The shaft is bored with a hole of 40 mm at the end. If the bearing Pressure is 0.75 MPa, find

    (i)The load to be supported   (ii) Power lost in friction

    (iii) Heat generated at the bearing, if coefficient of friction is 0.015.   (7)

  (b) Draw the profile of a plate cam operating a knife edged follower from the given data

    (i) It lifts the follower through 40 mm during 90^0 of cam rotation.

    (ii) The follower remains at rest for the next 30^0 of cam rotation.

    (iii) The follower descends to the original position during the next 120^0 of cam rotation.

    (iv) The follower remains at rest for the remaining part of cam rotation. The least radius of cam is 50 mm. Assume uniform acceleration and retardation for both upward and downward strokes and the follower axis passes through the axis of cam.   (8)

OR

VIII (a) Define the following terms applied to a governor.

    (i)Height of governor   (ii) Equilibrium speed

    (iii)Sensitiveness   (iv) Sleeve lift   (7)

  (b) Draw the profile of a cam to give the following motion to a roller follower.

    (i) Outstroke during 60^0 of cam rotation.

    (ii) Dwell for next 30^0 of cam rotation.

    (iii) Return stroke during next 60^0 of cam rotation.

    (iv) Dwell for the remaining part of cam rotation.

    The stroke of follower is 20 mm and the minimum radius of cam is 50 mm. The follower is radial and moves with simple harmonic motion and radius of roller is 15 mm.   (8)

UNIT – IV

IX (a) List seven advantages of gear drive. (7)

(b) An engine running at 150 rpm drives a line shaft by belt drive. The engine pulley is 750 mm diameter and the pulley of line shaft is 450 mm diameter. A 900 mm diameter pulley on the line shaft drives a 150 mm diameter pulley keyed to the dynamo shaft. Find the speed of dynamo shaft when (a) no slip (b) slip of 4%. (8)

OR

X (a) A gear having 90 teeth meshes with a pinion having 20 teeth. Determine the distance between the centers of the gears is if (a) circular pitch is 12 mm (b) module is 3 mm. (7)

(b) A belt is required to transmit 15 kW from a pulley of 1000 mm diameter running at 420 rpm. The angle of lap is 160^0 and coefficient of friction is 0.3. If the safe working stress of belt material is 1.2 MPa, find the width of the belt if its thickness is 10 mm. (8)

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