**DIPLOMA EXAMINATION IN ENGINEERING/TECHNOLOGY/
MANAGEMENT/COMMERCIAL PRACTICE, APRIL – 2020**

AUTOMOBILE DESIGN

[Maximum Marks: 75]   [Time: 2.15 Hours]

PART-A
(Answer *any three* questions in one or two sentences. Each question carries 2 marks)

I.   1. Define kinematic pair.

  2. Name any two inversions of a single slider crank chain.

  3. Define slip of a belt.

  4. Define velocity ratio of a gear train.

  5. Name two frictional materials of a clutch plate.   (3 x 2 = 6)

PART-B
(Answer any *four* of the following questions.   Each question carries *6* marks)

II 1. List the classification of bearings.

  2. A flat key is used to transmit a toque of 470 N-m form a shaft of 50mm diameter to a hub.
     Standard cross-section of the key is 16x10mm. Shearing and crushing stresses of the key
      material are 40 MPa and 76MPa respectively. Determine length of the key.

  3. List design considerations for an I.C. engine connecting rod.

  4. Give the types of shaft coupling.

  5. Write 6 terms used in a gear.

  6. Discuss the design considerations of a piston.

  7. What are the different types of followers in cam mechanism.   (4 x 6 = 24)

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

UNIT – I

III (a) Sketch and explain the kinematic arrangements of a beam engine.   (8)

  (b) Write the classification of a machine design.   (7)

OR

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IV (a) A solid circular shaft is subjected to a bending moment of 3000 N-m and a torque of 10000 N-m the shaft is made of 45 C 8 Steel having ultimate tensile stress of 700MPa and a ultimate shear stress of 500MPa. Assuming a factor of safety as 6, determine the diameter of the shaft. (8)

(b) Mention the names of any seven types of kinematic pairs. (7)

UNIT – II

V (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 100MPa respectively. The material of muff is cast iron with permissible shear stress of 15MPa. Assume that the maximum torque transmitted is equal to the mean torque. (8)

(b) Give the classification of types of keys. (7)

OR

VI (a) Describe the types of material used for belts. (8)

(b) A shaft runs at 400 rpm and drives another shaft at 600 rpm through belt drive. The diameter of the driving pulley is 600 mm. Determine the diameter of the driven pulley in the following cases.

    (i) Neglecting belt thickness;

    (ii) Taking belt thickness as 5 mm;

    (iii) Assuming for case (1) a total slip of 5%; and

    (iv) Assuming for case (2) a slip of 2.5% on each pulley. (7)

UNIT- III

VII (a) A single plate clutch, effective on both sides is required to transmit 25 KW at 3000 rpm. Determine the outer and inner diameters of friction surface if coefficient of friction is 0.255, ratio of diameters is 1.25 and the maximum pressure is not to exceed 0.1 N/mm^2. Also, determine the axial thrust to be provided by springs. Assume the theory of uniform wear. (8)

(b) Explain the design considerations of a friction clutch. (7)

OR

VIII (a) For an automobile engine calculate thickness of connecting rod and size of cap bolt, given Bore and stroke = 63x76mm, the diameter and length of crank pin are 41.27mm and 27.78mm respectively. The thickness of shell bearing = 1.65 mm, weight of revolving parts of connecting rod = 4.5N. Maximum engine speed 4500rpm. Maximum combustion force = 6750N. Permissible stress on cap material = $105 N/mm^2$ and permissible tensile stress in the bolt = $175/mm^2$. (8)

(b) Sketch and mark the parts of a single plate clutch. (7)

UNIT - IV

IX   Draw the profile of a cam operating flat face follower from the following data.

(a) Lift through 30mm during 90 degrees with SAM.

(b) The follower remains rest for next 60 degrees.

(c) The follower then falls to its original position during 90 degrees rotation of cam with S.H.M.

(d) The follower remains rest for remaining part of revolution.
Assume minimum radius of cam is 30mm. (15)

OR

X   Gear ratios for a small passenger car are as first gear 4.2:1, second gear 2.56:1, third gear 1.56:1 and top gear is 1:1. Inverse of the diametral pitch of each gear may be assumed as 3.25mm. The smallest pinion in the gear train must have at least 15 teeth, speed of the engine shaft is 1.52 times speed of lay shaft in gear box. Calculate

(a) Centre distance between shaft and lay shaft

(b) No. of teeth in each gear wheel

(c) Actual gear ratios on the basis of result of 2 above. (15)