Total No. of printed pages = 3

ME 181304

Roll No. of candidate | | | | | | | | | | |

B.E. 3rd Semester End-Term Examination

ME, IPE

THEORY OF MACHINES

(New Regulation & New Syllabus)

Full Marks – 70 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer question No. 1 and any *four* from the rest.

1. (a) Define lower pair and higher pair with one example.

   (b) What is gear train? What are its main types?

   (c) What are different modes of transmitting power from one shaft to another? Compare them.

   (d) What is meant by self locking and a self energised brake?

   (e) How does a Porter governor differ from that of a Watt governor? (5 × 2 = 10)

2. (a) Derive an expression for the length of an open belt?

   (b) An open belt 10 cm wide connects two pulleys mounted on parallel shafts with their centres 2.4 m apart. The diameter of the larger pulley is 45 cm and that of smaller pulley 30 cm. The co-efficient of friction between the belt and the pulley is 0.3 and the maximum stress in the belt is limited to 140 N/cm width. If the larger pulley rotates at 120 rpm, find the maximum power that can be transmitted. (5+10=15)

[Turn over

3. (a) Define Kinematic link, Kinematic pair and kinematic chain.

(b) In a slider crank mechanism shown in figure1, the length of the crank OA and connecting rod AB are 125 mm and 800 mm respectively. The centre of gravity E of the connecting rod is 450 mm from the slider B. The angular velocity of the crank is 20 rad/sec clockwise. When the crank has turned 60° from the IDC (inner dead centre) position, determine (i) Velocity of the slider b (ii) Velocity of the point E (iii) Angular velocities of the connecting rod AB. (5+10=15)

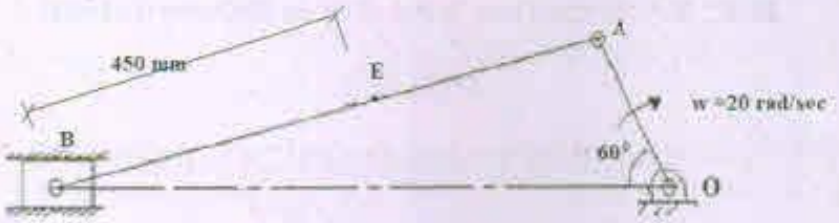

Figure – 1

4. (a) What are the main tooth profiles of gear teeth which fulfil the law of gearing? Compare them.

(b) An epicyclic gear train is shown in Figure 2. The wheel D is held stationary by the shaft A and the arm B is rotated at 200 RPM. The wheel E and F are fixed together and rotate freely on the pin carried by the arm. The wheel G is rigidly attached to the shaft C. Find the speed of C stating the direction of rotation relative to that of B. If the gearing transmits 7.5 KW, what will be the torque required to hold the shaft A stationary, neglecting all frictional losses.(T_E = 20, T_F = 40, T_G = 30). (5+10=15)

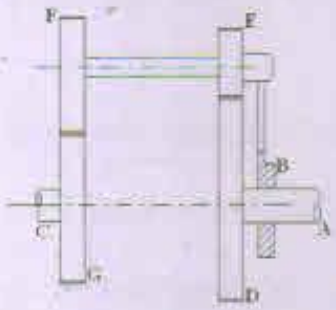

Figure – 2

5. (a) What do you understand by the terms cam ? Name the essential members of a cam mechanism.

(b) Draw the Cam profile for the following conditions:

Follower type = roller follower, in line; Roller Dia. = 5mm, roller rises by 25 mm with SHM in 180° of cam rotation, falls by half the distance instantaneously, and returns with uniform velocity in 180° of cam rotation . Take base circle radius = 20 mm. (5+10=15)

6. (a) What is Governor effort and power?

(b) In a Porter governor all the arms are equal and the upper and lower pair are fixed to the axis of rotation and the working range of the governor in terms of radius of rotation are 80mm and 120 mm respectively. The weight of the sleeve is 80 N and each ball weighs 20 N. Length of each arm of the governor is 400 mm. Draw the controlling force curve for the above governor and erect a speed scale corresponding to the radius of rotation of 150 mm. (5+10=15)

7. (a) What are various types of brakes used? What are the differences between the brakes and clutches?

(b) The single cylinder, single acting, four stroke gas engine develops 20 kW at 300 RPM. The work done by the gases during expansion stroke is three times the work done on the gases during the compression stroke, the work done during the suction and exhaust strokes being negligible. If the total fluctuation of speed is not to exceed ± 2 % of the mean speed and the turning moment diagram during compression and expansion is assumed to be triangular in shape. Find moment of Inertia of the flywheel. (5+10=15)