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BME-020

B.Tech. MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING) / BTMEVI

01080

Term-End Examination

June, 2015

BME-020 : KINEMATICS & DYNAMICS OF MECHANISMS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any* ***five*** *questions. Use of scientific calculator is permitted.*

1. (a) Define the terms 'Element and Pair'. Slider crank mechanism is a special case of 4-bar mechanism. Justify the statement. 7

(b) Explain the various pairs and distinguish them. Find the degrees of freedom of the mechanism shown in Figure 1. 7

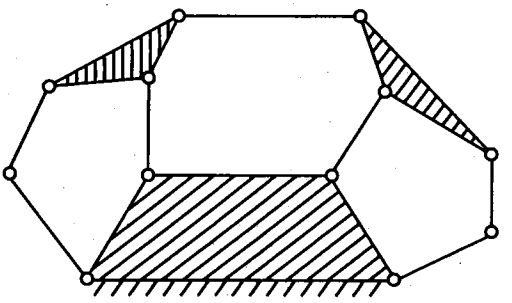

Figure 1

2. (a) In the slider crank mechanism shown in Figure 2, the crank OC makes 80 r.p.m. in clockwise sense. Determine the linear velocity of the slider and angular velocity of the connecting rod PC. Also find out the linear velocity of point Q on the connecting rod. Lengths of crank and connecting rod are 8 cm and 32 cm respectively. *10*

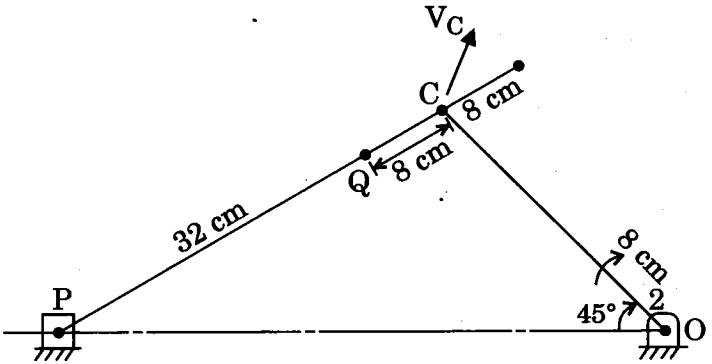

Figure 2

(b) Explain with suitable sketches 'Inversions of slider crank chain'. *4*

3. (a) Deduce the relation to obtain length of belt for open belt drive. *5*

(b) A flat belt runs on a pulley, 1 m in diameter, and transmits 7·5 kW at a speed of 200 r.p.m. Taking angle of lap as 170° and coefficient of friction as 0·2, find the necessary width of the belt, if pull is not to exceed 196 N/cm width of the belt. Neglect centrifugal tension. *9*

4. (a) Define pressure angle and pitch circle for a given cam profile. *4*

(b) Draw the profile of a cam when the roller follower moves with cycloidal motion during outstroke and return stroke, as detailed below :

(i) Outstroke with maximum displacement of 4 cm during 180° of cam rotation.

(ii) Return stroke for next 150° of cam rotation.

(iii) Dwell for the remaining 30° of cam rotation.

Minimum radius of the cam is 5 cm and the roller diameter of the follower is 1·0 cm. The axis of the follower is offset by 1 cm towards the right from the axis of cam shaft.

Also find out the maximum velocity and acceleration during the outstroke and return stroke, if the cam rotates uniformly at 500 r.p.m. *10*

5. A single cylinder horizontal oil engine has a crank radius 18·75 cm and a connecting rod 82·5 cm long. The revolving parts are equivalent to 55 kg at crank radius and the weight of the piston and gudgeon pin is 45 kg. The connecting rod has its weight equal to 57·5 kg and its mass centre is located at 26·25 cm from the crank pin centre. The revolving weights are fixed to the extensions of the crank webs at a radius of 21·25 cm to balance the revolving parts and half of the reciprocating parts. Neglecting the obliquity of the connecting rod, find the magnitude of the balance weight and the residual unbalanced force when the engine speed is 300 r.p.m. and the crank has rotated 60° from i.d.c. *14*

6. (a) Classify the various gear trains. Explain with the help of a neat sketch, the Epicyclic gear train. *4*

(b) A Hartnell governor has equal balls of weight 3 kg set initially at a radius of 20 cm. The arms of the bell-crank lever are 12 cm vertically and 15 cm horizontally. Find

(i) the initial compressive force on the spring, if the speed for an initial ball radius of 20 cm is 240 r.p.m, and

(ii) the stiffness of the spring required to permit a sleeve movement of 0·4 cm on a fluctuation of 7 percent in the engine speed. *10*

7. (a) Differentiate between Cycloidal tooth profile and Involute tooth profile. *5*

(b) Two mating spur gears with module pitch 6·5 mm have 19 and 47 teeth of 20° pressure angles and 6·5 mm addendum. Determine the number of pairs of teeth in contact and the angle turned through by the large wheel for one pair of teeth in contact. Also determine the ratio of the sliding velocity to the rolling velocity at the instant

(i) the engagement commences,

(ii) the engagement terminates, and

(iii) at the pitch point. *9*