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BME-020

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

Term-End Examination

01360

June, 2016

BME-020 : KINEMATICS & DYNAMICS OF MECHANISMS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. Use of scientific calculator is allowed. Make suitable assumptions wherever necessary.*

1. (a) Describe inversions of two slider four bar kinematic chain. 7

(b) Some four bar linkages are shown in Figure 1. The numbers indicate the respective link length in cm. Identify the nature of each mechanism, whether it is double crank, crank rocker, double rocker, etc. 7

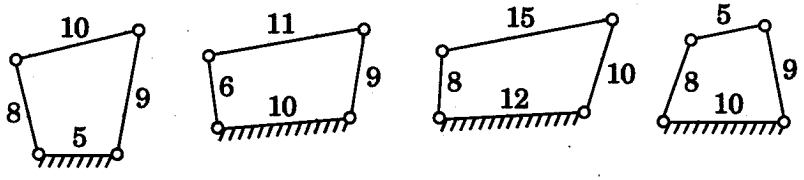

Figure 1

2. In a reciprocating engine, the crank is 10 cm long and the connecting rod length is 30 cm. The crank rotates at 75 r/s (CCW) and has angular acceleration 1200 r/s^2 (CCW). Determine the angular velocity and angular acceleration of the connecting rod when the crank makes 120° with idc. Also determine the velocity and acceleration of a point which is 10 cm away from the big end centre on the connecting rod towards the small end. *14*

3. (a) Determine the condition of maximum power transmission in an open belt drive. *4*

(b) In an open belt drive, the smaller pulley is 400 mm in diameter. The angle of lap on this pulley is 160° and the coefficient of friction is 0·25. Which of the following alternatives can be more suitable for increasing the power transmitted ? *10*

(i) Increase in initial tension by 10%

(ii) Increase in coefficient of friction by 10%

4. A cam has 30 mm minimum diameter and rotates clockwise at 1200 rpm. It operates a roller follower of 10 mm diameter.

(a) Follower has outstroke of 25 mm in 120° with uniform and equal acceleration and retardation.

(b) Follower has to return to its initial position during 90° of cam rotation after dwelling for 60° with S.H.M.

(c) Follower dwells for remaining period.

Draw the cam profile if the follower is radial. Determine maximum velocity and acceleration during outstroke and return stroke. *14*

5. (a) Explain the law of gearing and derive expression for velocity of sliding. *6*

(b) Calculate

(i) the length of path of contact, and

(ii) contact ratio when a pinion having 17 teeth drives a gear having 49 teeth. The gear teeth have involute profile of pressure angle 20° and module is 6 mm with addenda on both being 1 module. *8*

6. (a) Classify gear trains and explain them. *4*

(b) An epicyclic gear train consists of a sun wheel S, a stationary internal gear E and three identical planet wheels P carried on star shaped planet carrier C. The speed of the planet carrier C is one-fifth of the sun wheel S. The minimum number of teeth on any wheel is 16. The driving torque on the sun wheel is 100 Nm. Determine the number of teeth on different wheels and required holding torque on stationary internal gear. *10*

7. (a) Explain the effect of friction at the sleeve on the range of speed of the governor. *4*

(b) In a Hartnell governor, the vertical and horizontal arms of the bell crank levers are 15 cm and 10 cm, respectively. The mass of each ball and sleeve are 2 kg and 5 kg, respectively. The stiffness of the spring is 250 N/cm. At the minimum speed of 300 rpm, the radius of rotation of the balls is 8 cm. Determine

(i) the speed after sleeve lift of 6 cm, and

(ii) the initial tension of the spring. *10*

8. (a) Explain how single plane and two plane balancing is performed and which balancing is required where. *7*

(b) How is a single cylinder engine balanced ? Determine the residual unbalance which may remain. *7*