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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belgaum)

Fourth Semester, B.E. - Industrial Production and Engineering

Semester End Examination; June/July - 2015

Theory of Machines

Time: 3 hrs

Max. Marks: 100

Note: i) Answer **FIVE** full questions, selecting **ONE** full question from each **Unit**.

ii) Assume suitable missing data if any.

UNIT - I

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|-------|---|----|
| 1. a. | Define with suitable examples: (i) Machine (ii) Mechanism (iii) Mobility (iv) Inversion | 8 |
| | b. Explain the sketches the inversions of single slider crank chain. | 12 |
| 2. a. | Explain with neat sketch the working principle of whit worth mechanism. | 10 |
| | b. Explain with a neat sketch the working principle of Achermann steering gear mechanism. | 10 |

UNIT - II

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|-------|--|----|
| 3. a. | Define arc of contact and derive an expression for the same. | 8 |
| | b. The following data refers to two mating involute gear of 20° pressure angle. Number of teeth on the pinion is 20. Gear ratio is 2. Speed of pinion is 250 rpm module is 12 mm. If the addendum on each wheel is such that the path of approach and path it recurs on each side are half of the maximum permissible length. Find the maximum velocity of sliding during approach and recurs and the length of arc of contact. | 12 |
| 4. a. | Derive an expression for holding torque in epicyclic gear train. | 3 |
| | b. A pinion A has 15 teeth and is rigidly fixed and the motor shaft. The wheel B has 20 teeth and gear with A and also with a fixed annular wheel D. Pinion G has 15 teeth and is fixed to the wheel B and gears with annular wheel E which is keyed to the machine shaft. B and G rotate together on a pin carried by an arm which rotates about the shaft which A is fixed. If the motor turn at 100 rpm. Find the speed of the machine shaft. | 17 |

UNIT - III

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|-------|---|----|
| 5. a. | Explain: | |
| | (i) Laws of dry friction | 10 |
| | (ii) co-efficient of friction | |
| | (iii) Different types of belt drives | 10 |
| | (iv) centrifugal tension. | |
| b. | A body weighs 10 KN is suspended freely from a belt which makes 2½ turns around a drum of 200 mm diameter revolving at 30 rpm. The other end of the belt is pulled by a man. The co-efficient of friction is 0.25. Determine; | 10 |
| | (i) Force required by the man | |
| | (ii) Power to lift the body. | |

6. a Derive an expression for ratio of belt tension in V-bolt drive. 8
- b. A belt which is embracing 165° of a pulley of effective diameter 1000 mm is transmitting 10 kW, the pulley is turning at 250 rpm. The co-efficient of friction is 0.3. Mass of the belt is 0.0012 gm/mm^3 , thickness of the belt is 10 mm. Safe working stress is 1.5 MPa. Find the necessary width of the belt and also the initial tension in the belt drive. 12

UNIT - IV

7. Draw the profile of a Cam for the following details.
 Minimum radius of Cam = 20 mm. Cam rotates at 1000 rpm CCW. Follower is 10 mm diameter roller lift if the followers is 20 mm outward stroke takes place with UARM during 120° of Cam rotation the follower remains at rest at the top most position during 60° at Cam rotation. Then the follower returns to its initial position during 120° of Cam rotation with SHM. Follower axis is 5mm to the right of the axis of the Cam. Calculate the maximum acceleration during return stroke. 20
8. A disk Cam to move a flut faced follower with the following motion. Outward with constant acceleration period for $\frac{\pi}{4}$ radians of Cam rotation, constant velocity period for $\frac{\pi}{2}$ radians of constant deceleration period for $\frac{\pi}{4}$ radians of Cam rotation. Dwell for $\frac{\pi}{4}$ radians then returns with SHM during $\frac{3}{4}\pi$ radians of Cam rotation. Total displacement of Cam is 40 mm. Minimum radius of curvature is 50 mm. Draw the Cam profile. 20

UNIT - V

- 9 a. Explain why two balance masses are required to balance a given revolving mass when balancing mass is to be placed in plane other than the plane where the given mass revolves. 5
- b. Four masses of magnitude 5, 6, 7 and M kg revolve in planes A, B, C, D respectively. The planes are spaced to A and B 0.8 m, A to C is 1.2 m, and A to D is 2 m. The masses are all at the same radius. Find the magnitude if mass M and the relative angular position for complete balance. 15
- 10 a. Derive an expression for the height of porter governor. 5
- b. In a porter governor all the arms are 15 cm long upper and lower arm are pivoted to the links 2 cm and 3 cm respectively from the axis. Central mass is 40 kg. Mass of each ball is 4 kg. Force of friction is 30 N and the extreme radii of rotation are 8 cm and 10 cm. Determine the range of the speed of the governor. 15