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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 and Production Engineering
Semester End Examination; June - 2016
Theory of Machines

Time: 3 hrs   *Max. Marks: 100*

Note: *i) Answer **FIVE** full questions, selecting **ONE** full question from each unit.*
ii) Assume missing data suitably.

UNIT - I

1 a. Explain the classification of kinematics pairs with suitable sketches.   10

b. With neat sketches explain any two inversions of double slider crank chain.   10

2 a. What is quick return motion? Explain the working of crank and slotted lever mechanism.   10

b. Draw the neat sketch of Geneva wheel mechanism and explain its working.   10

UNIT - II

3 a. State and prove law of Gearing.   8

b. The number of teeth in the wheels are 20 and 31 with pressure angle 20º, module = 2.5 mm
Addendum = module, calculate ;

i) Lengths of paths of contacts

ii) Angle turned through by pinion and gear wheel when any one pair is in contact.   12

4 a. With neat sketches explain different types of gear trains.   6

b. An epicyclic gear train is constructed as follows. A fixed annular wheel 'A' and a small
concentric wheel 'B' are connected by a compound wheel A_1 - B_1. A_1 gearing with A and B_1
gearing with B. The compound wheel revolves on a stud which is carried around an arm
which revolves about axis 'A' and 'B'. Wheel 'A' has 130 teeth, B has 20 teeth and B_1 has
80 teeth. Pitch of A and A_1 being twice that of pitch of B and B_1. How many revolutions 'b'
will make for one revolution of arm?   14

UNIT - III

5 a. Derive an expression for centrifugal tension and define centrifugal tension.   6

b. A belt which is embracing 165º of a pulley which is 1000 mm diameter is transmitting
10 kW. The pulley is running at 250 rpm. The coefficient of friction is 0.3 mass density of
belt material is 0.0012 grams/mm^3. Thickness of belt is 10 mm. Considering centrifugal
tension. Find width of belt. Safe working stress is 1.5 MPa, Also determine the initial tension
in the belt drive.   14

6 a. Explain the different types of friction and laws of friction.   8

b. A compressor requiring 80 kW is to run at 200 rpm, the drive is by V - belt from an electric
motor running at 750 rpm. The diameter of the pulley on the compressor shaft is 1 m, while
the center distance between the pulley is limited to 2 m. The belt speed should not exceed
1200 m/min.   12

Determine the number of V - belts required to transmit the power if each belt has a cross sectional area of 375 mm^2 and density of 1000 kgs/m^3 and has an allowable stress of 2.5 MPa. The groove angle of the pulley is 40º and the coefficient of friction between belt and pulley is 0.25.

UNIT - IV

7 a. With neat sketches explain different types of cams and followers. 8

b. Explain with an example displacement velocity and acceleration diagrams when the follower moves with simple Harmonic motion. 12

8. A cam rotating clockwise at uniform speed of 300 rpm operates a reciprocating follower through a roller of 15 mm diameter. The follower motion is defined as below,

i) Outward during 150º with UARM

ii) Dwell for next 30º

iii) Return during next 120º with SHM 20

iv) Dwell for the remaining period

Stroke of the follower is 30 mm, minimum radius of the cam is 30 mm. Draw the cam profile. When the follower axis is offset to right by 10 mm.

UNIT - V

9 a. What is balancing of rotating masses? Why is it necessary? Explain the conditions for static and dynamic balancing. 6

b. A shaft carries four masses A, B, C and D 200 kg, 300 kg, 240 kg and 360 kg respectively revolving at radii 90, 70, 100 and 120 mm respectively. The distance from the plane 'A' are 270 mm, 420 mm and 720 mm respectively. Angle between the crank 'A' and 'B' is 45º, 'B' and 'C' is 75º, C and D is 130º, Balancing masses are placed 120 mm and 100 mm from 'D' and 'A' respectively. Plane of the first balancing mass is to be left of 'D' and plane of the second balancing mass is to be the right of 'A'. the distance between them being 500 mm. Find the balancing masses and their angular position if they are placed at a radius of 100 mm. 14

10 a. Define the following with respect to governor :

i) Controlling force

ii) Stability 6

iii) Sensitiveness.

b. In a porter governor all the arms are 150 mm long. Upper and lower arms are pivoted to the links 20 mm and 30 mm respectively from the axis. Central mass is 40 kg and mass of each ball is 4 kg. Force of friction of rotation is 30 N and the extreme radii of rotation are 80 mm and 100 mm. Determine the range of speed of governor. 14

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