Theory of Machines VTU CBCS Question Paper Set 2018

CBCS Scheme

USN | | | | | | | | | | |

15MR42

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Theory of Machines

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Explain Grubler's criterion for plane mechanisms. **(06 Marks)**

b. A slider crank mechanism is shown in Fig. Q1(b).The force applied to the piston is 1000N when the crank is at 60° from IDC, calculate the driving torque T_2. **(10 Marks)**

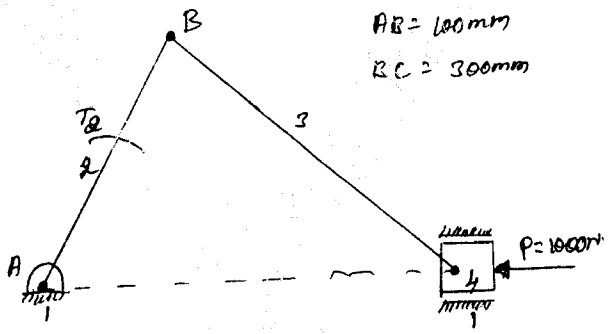

Fig. Q1 (b)

OR

2 a. What is the principle of virtual work? Explain. **(06 Marks)**

b. With a neat sketch, explain crank and slotted lever quick return motion mechanism. **(10 Marks)**

Module-2

3 a. Explain the inertia force and inertia torque. **(06 Marks)**

b. With a neat sketch explain inertia forces on a engine mechanism using slider crank mechanism. **(10 Marks)**

OR

4 a. Derive an expression for the ratio of belt tension. **(06 Marks)**

b. A flat belt required to transmit 35kW from a pulley of 1.5m diameter running at 300rpm. The angle of contact is spread over 11/24 of the circumference and the coefficient of friction between the belt and the pulley surface is 0.3. Determine taking centrifugal force into account width of belt required, it is given that the belt thickness is 9.5mm, density of material is 1.1 Mg/m^3 and the permissible working stress is 2.5 MPa. **(10 Marks)**

Module-3

5 a. Explain balancing of several masses rotating in the same plane. **(06 Marks)**

b. A, B, C and D are 4 masses carried by a rotating shaft at radius 100, 125, 200 and 150mm respectively. The planes in which the masses revolve are spaced 600mm apart and the masses B, C and D are 10, 5, 4kg respectively. Find required mass A and the relative angular positions of the 4 masses to keep the shaft in balance. **(10 Marks)**

OR

6 a. What do you mean by static balancing and dynamic balancing. **(06 Marks)**

b Explain the direct and reverse crank method of analysis of radial engines for primary and secondary forces. **(06 Marks)**

c. The following data are referred to a single cylinder engine. speed = 250 rpm stroke = 350mm mass of reciprocating parts = 60 kg, mass of revolving parts of 175mm radius is 40kg. If $2/3^{rd}$ of reciprocating parts and also the revolving parts are to be balanced find:

i) Balancing mass required at 400mm radius

ii) Residual unbalanced force when the crank has rotated, 60° from T.D.C (TOP dead centre) or inner dead centre (IDC) Data :

n = 250rpm

$r = \frac{\text{Stroke}}{2} = \frac{350}{2} = 175\text{mm} = 0.175\text{m}$

M = 60kg

M_1 = 40kg at 175mm radius

c = 2/3

b = 400mm = 0.4m

θ = 60°

(04 Marks)

Module-4

7 a. Define: i) Controlling Force ii) Governor power iii) Isochronous Governor. **(06 Marks)**

b. The arms of a porter governor are each 30cm long and are pivoted on the governor axis mass of each ball is 2kg. At mean speed of 150rpm, the arm makes 30° with the vertical. Determine the central load and the sensitivity of the governor of the sleeve movement is ±2.5cm. **(10 Marks)**

OR

8 a. Derive an expression for gyroscopic couple. **(06 Marks)**

b. Analyse the stability of a two wheel vehicle taking left turn. Derive the necessary equations. **(10 Marks)**

Module-5

9 Derive an expression for displacement velocity and acceleration of follower when the roller is in contact with straight flank. **(16 Marks)**

OR

10 A cam has straight working surface which are tangential to the base circle of cam. The follower is a roller follower with line of stroke passing through the axis of the cam. The particulars are following :

Base circle diameter = 100mm ; Roller diameter = 50mm. The angle between the tangential faces of the cam = 90°. The face are joined by a nose circle of radius = 10mm. The speed of rotation of cam = 180 rpm.

Determine the acceleration of the roller centre

i) When the roller just leaves contact of the flank on its ascent.

ii) When the roller is at its outer end of its lift?

Data: d_1 = 100mm, r_1 = 50mm : d = 50mm, r = 25mm, $2\alpha = 90°$, $\alpha = 45°$, r_2 = 10mm, n = 180 rpm. **(16 Marks)**

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15MR42

Fourth Semester B.E. Degree Examination, June/July 2017
Theory of Machines

Time: 3 hrs. Max. Marks: 80

Note: ***Answer FIVE full questions, choosing one full question from each module.***

Module-1

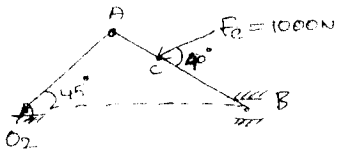
1 a. With a neat sketch, explain Whit-worth Quick return mechanism. State its application. **(08 Marks)**

b. State the conditions for a link to be in equilibrium.
(i) When two forces act.
(ii) When three forces act.
(iii) When two forces and a torque acts. **(06 Marks)**

c. What is free body diagram? **(02 Marks)**

OR

2 a. Determine the required input torque on the Crank of a slider mechanism as shown in Fig. Q2 (a) for static equilibrium. **(10 Marks)**



AC 40 mm
AB 80 mm
O_2A 40 mm

Fig. Q2 (a)

b. Distinguish between machine, mechanism and structure. **(06 Marks)**

Module-2

3 a. Briefly explain D-Alembert's principle on rectilinear motion and angular motion. **(06 Marks)**

b. State the laws of friction. **(05 Marks)**

c. Explain creep, slip and materials used in belts. **(05 Marks)**

OR

4 a. Derive an expression for total frictional torque for a pivot bearing subjected to uniform pressure. **(08 Marks)**

b. A pulley is driven by a flat belt 100 mm wide and 6 mm thick. The density of belt material is 1000 kg/m^3. The angle of lap is 120° and the co-efficient of friction is 0.3. The maximum stress in belt does not exceed 2 MPa. Find the maximum power that can be transmitted and the corresponding speed of the belt. **(08 Marks)**

Module-3

5 A shaft has three eccentrics of mass 1 kg each. The central plane of the eccentrics is 50 mm apart. The distances of the centres from axis of rotation are 20, 30 and 20 mm and their angular positions are 120° apart. If the shaft is balanced by adding two masses at a radius 70 mm and at a distance of 100 mm from central plane of middle eccentric. Find the amount of masses and their angular positions. **(16 Marks)**

OR

6 a. Discuss about static balancing and dynamic balancing. **(04 Marks)**

b. Prove that the resultant unbalanced force is minimum when half of the reciprocating masses are balanced by rotating masses i.e when C $\frac{1}{2}$. **(12 Marks)**

Module-4

7 a. With a neat sketch, explain effect of gyroscopic couple on steering of ship when rotor turns clockwise. **(08 Marks)**

b. Each arm of a porter governs is 300 mm long and is pivoted on the axis of the governer. Each ball has a mass of 6 kg and the mass of sleeve is 18 kg. The radius of rotation of ball is 200 mm when the governer begins to lift and 250 mm when the speed is maximum. Determine maximum and minimum speed and range of governer. **(08 Marks)**

OR

8 a. Define : (i) Sensitiveness (ii) Stability (iii) Hunting (iv) Effort of governor **(08 Marks)**

b. Derive an expression for angle of heel of a two wheeler, while taking a turn. **(08 Marks)**

Module-5

9 a. Derive expression for displacement velocity and acceleration of a roller follower making contact with straight flank of symmetrical tangent cam. **(10 Marks)**

b. Discuss the different types of follower displacement diagrams. **(06 Marks)**

OR

10 The following data relate to a cam profile in which the follower moves with uniform acceleration and deceleration during ascent and descent:
Minimum radius of cam = 25 mm
Roller diameter = 7.5 mm
Lift = 28 mm
Offset of follower axis = 12 mm towards right.
Angle of ascent = 60°
Angle of descent = 90°
Angle of dwell between ascent and descent = 45°
Draw the profile of cam. **(16 Marks)**

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