CBCS Scheme

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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)**

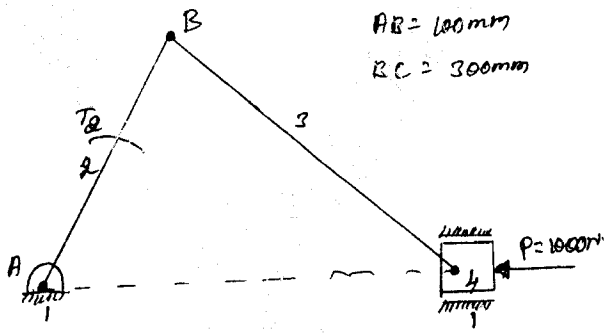

Fig. Q1 (b)

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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