



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

(An Autonomous Institution affiliated to VTU, Belgaum)

Fifth Semester, B.E. - Automobile Engineering

Semester End Examination; Dec. - 2014

Theory of Machine - II

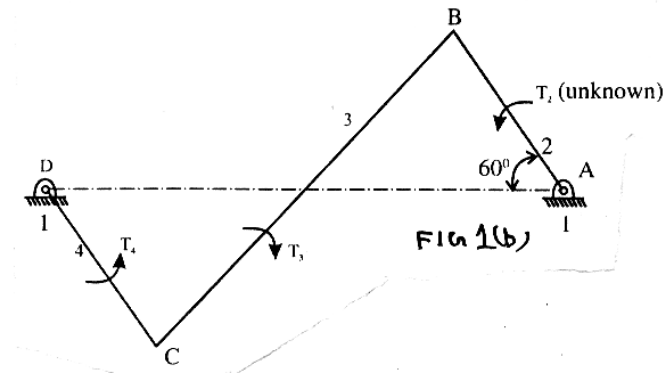
Time: 3 hrs

Max. Marks: 100

- Note:** i) Answer any **FIVE** full questions, selecting at least **TWO** full questions from each part.
 ii) Assume suitable missing data if any
 iii) A graphical solution must be done on drawing sheet.

PART - A

1. a. State the condition of equilibrium when a member subjected with two force and a couple. 3
- b. In a four bar mechanism shown in Fig. 1(b) torque T_3 and T_4 have magnitudes of 300 Nm and 2000 Nm respectively. Take $AD = 800$ mm, $AB = 300$ mm, $BC = 700$ mm and $CD = 400$ mm. For Static equilibrium find the required input on the crank 2 (T_2)



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- 2 a. What is correction couple? 3
- b. Explain line of Action of inertia force in a link. 5
- c. In a reciprocating engine, length of stroke is 30 cm and connecting rod is 60 cm long between centers. When the Piston has travelled 8 cm from the inner centre find:
- (i) The angular position of the crank 12
- (ii) Velocity and acceleration of the piston
- (iii) Angular velocity of the connecting rod if the engine speed is 240 rpm.
- 3 a. Derive a relationship for hoop stress in the fly wheel. 6
- b. TMD of multi cylinder engine with respect to mean energy line is given by -0.35, +4.1, -2.85, +3.25, -3.35, +2.6, -3.65, +2.85. -2.6 cm² each cm² represents 500 Nm of torque. The engine runs at 1000 rpm with limitation for fluctuation of speed at 2% mean speed. Find suitable dia 14 and C/S of rim if $\rho = 7200$ kg/m³ and safe stress 6 MPa. Take width of the C/S as twice the thickness.

Contd....2

- 4 a. Derive relationship for displacement, velocity and acceleration for tangent cam with roller follower when roller is in contact with straight flank 10
- b. In a four stroke petrol engine, The crank angle is 4° after TDC when the suction valve opens and 50° after BDC when the suction valve closes. The lift is 10 mm, the nose radius is 2.5 mm and the least radius of the cam is 20 mm. The shaft rotates at 600 rpm. The cam is of the circular type with a circular nose and flanks while the follower is flat faced. Determine the maximum velocity, maximum acceleration and retardation of the valve. 10

PART - B

5. A shaft carries four mass A, B, C and D 200, 300, 240 and 360 kg respectively, revolving at radii 90, 70, 100, 120 mm respectively. The distance from the plane A is 270 mm, 420 mm and 720 mm respectively. Angle between the crank A and B is 45° , B and C is 75° , C and D is 130° . Balance masses are placed 120 mm and 100 mm from D and A respectively. The distance between balancing masses is 500 mm. Find the balancing masses and their angular position if they are placed at a radius of 100 mm. 20
6. A six cylinder two stroke single acting diesel engine with cylinder centre lines are spaced at 650mm. In the end view crank angle are 60° apart and in order 1-4-5-2-3-6. The stroke of each piston is 400 mm and the crank to connecting rod ratio is 1:5. The mass of reciprocating parts is 250 kg per cylinder and that of rotating parts is 100 kg per crank. The engine rotates at 240 rpm. Investigate the engine for out of balance primary and secondary forces and couple. 20
7. a. Derive a relationship for the speed of the porter governor considering frictional force. 8
- b In a spring loaded governor of hartnell rotating masses are each 1.5 kg and rotate at a radius of 120 mm when the equilibrium speed is 550 rpm. At this speed the arms of bell crank lever are 100 mm and 75 mm respectively are vertical and horizontal. When the equilibrium speed is 575 rpm, the rotating masses at their maximum radius 145 mm. Determine spring stiffness and initial compression of the spring. 12
- 8 a. Explain the effect on stability of two wheeler when it takes a turn. 10
- b. An aero plane makes a complete half circle of 50 m radius towards left when flying at 200 km/hr. The mass of the rotary engine and propeller is 400 kg with radius of gyration 300 mm. The engine runs at 3000 rpm counter clockwise when viewed from the rear. Determine the gyroscopic couple and its effect on the air craft. 10

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