

**Fifth Semester B.E. Degree Examination, Dec.2018/Jan.2019**  
**Dynamics of Machines**

Time: 3 hrs.

Max. Marks:100

**Note: Answer any FIVE full questions, selecting at least TWO questions from each part.**

**PART – A**

- 1 a. Explain the equilibrium of two force member, three force members and two force with torque. (06 Marks)
- b. A four link mechanism is acted upon by forces as shown in Fig.Q1(b). Determine the torque  $T_2$  to be applied on link 2 to keep the mechanism in equilibrium  $AD = 50\text{mm}$ ,  $AB = 40\text{mm}$ ,  $BC = 100\text{mm}$ ,  $DC = 75\text{mm}$ ,  $DE = 35\text{mm}$ . (14 Marks)

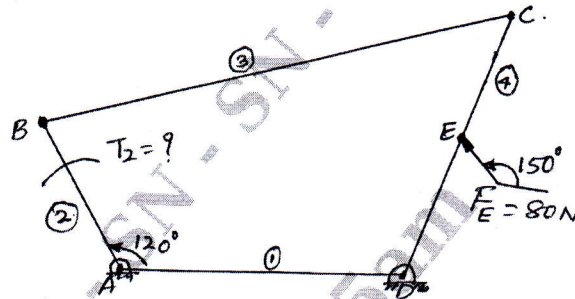


Fig.Q1(b)

- 2 a. State and explain D'Alembert's principle. (04 Marks)
- b. A single cylinder single acting four stroke gas engine develops 18.4kW at 300rpm with WD by the gases during the expansion stroke is 3times the WD on the gases during compression stroke. The WD during suction and exhaust being negligible and the total fluctuation is 2% of mean. The TMD during expansion is assumed to be triangular in shape. Find the moment of inertia of the fly wheel. (16 Marks)
- 3 a. Derive an expression of friction torque for a conical pivot subjected to uniform pressure. (06 Marks)
- b. A leather belt is required to transmit 7.5kW from a pulley 1.2 in diameter running at 250 rpm. The angle embraced is  $165^\circ$  and the co-efficient of friction between the belt and the pulley is 0.3. If the safe working stress for the leather belt is 1.5MPa, density of leather  $1000 \text{ kg/m}^3$  and thickness of belt 10mm. Determine the width of the belt taking centrifugal tension into account. (14 Marks)
- 4 a. Explain static and dynamic balancing. (06 Marks)
- b. A shaft carries four masses A, B, C and D of magnitude 200kg, 300kg, 400kg and 200kg respectively and revolving at radii 80mm, 70mm 600mm and 80mm in planes measured from A at 300mm, 400mm and 700mm. The angles between the crank measured anticlockwise are A to B  $45^\circ$ , B to C  $70^\circ$  and C and D  $120^\circ$ . The balancing masses are to be placed in planes X and Y. The distance between the planes A and X is 100mm, between X and Y is 400mm and between Y and D is 200mm. If the balancing masses revolve at a radius of 100mm find their magnitude and angular positions. (14 Marks)



## PART – B

- 5 a. Obtain an expression for primary forces for a V-engine having two identical cylinder lying in a plane. (08 Marks)
- b. In a four cylinder engine the two outer cranks are at  $120^\circ$  to each other and their reciprocating masses are each 100kg. The distance between the planes of rotation of adjacent cranks are 450mm, 750mm and 450mm, length of each crank is 300mm and length of each connecting rod is 1200mm, speed of engine is 240rpm. Find : The reciprocating masses and relative angular position for each of the inner crank. (12 Marks)
- 6 a. Define : i) sensitiveness ii) governor power iii) hunting iv) stability v) isochronous governor. (10 Marks)
- b. The arms of a porter governor are 300mm long. The upper arms are pivoted on the axis of rotation and the lower arms are attached to the sleeve at a distance of 35mm from the axis of rotation. The mass of the sleeve is 54kg and the mass of each ball is 7kg. Determine the equilibrium speed when the radius of rotation of the ball is 225mm. What will be the range of speed for this position if the frictional resistance to the motion of the sleeve is equivalent to a force of 30N at the sleeve? (10 Marks)
- 7 a. Derive an expression for gyroscopic couple produced by a rotating disc with neat diagram. (06 Marks)
- b. With neat sketch, explain the effect of gyroscopic couple on steering of aeroplane. When it takes right turn. The engine runs clockwise when viewed from rear? (06 Marks)
- c. A ship is pitching through a total angle of  $15^\circ$  the oscillations may be taken as SHM and the complete period has 32 seconds. The turbine rotor has a mass of 500kg and its radius of gyration is 450mm and it is rotating at 2000rpm calculate the maximum value of gyroscopic couple set-up, if the rotor is turning clockwise when seeing from the front(bow) how does the bow turn when falling. What is the maximum angular acceleration to which the ship is subjected while pitching. (08 Marks)
- 8 In a four stroke petrol engine the crank angle is  $4^\circ$  after TDC when the suction valve open and  $50^\circ$  after BDC. When the suction valve closes. The lift is 10mm the nose radius is 2.5mm and the least radius of the cam 20mm. The shaft rotates at 600rpm. 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. What is the minimum force exerted by the springs to overcome the inertia of moving parts weighing 250gm. (20 Marks)

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