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

10AU54

Fifth Semester B.E. Degree Examination, July/August 2021
Dynamics of Machines

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. With neat sketch discuss the equilibrium of the following system :
   i) Three force members
   ii) Member with two forces and a torque. **(05 Marks)**

b. A slider crank mechanism is shown in Fig.Q1(b). The force applied to the piston is 1000 N when the crank is at 60° from IDC. Calculate the driving torque, T_2. AB = 100 mm, BC = 300 mm. **(15 Marks)**

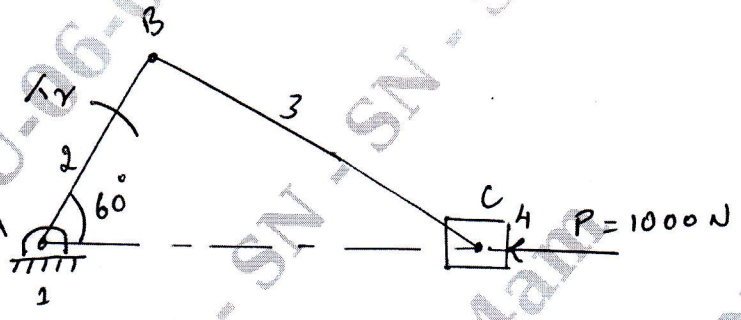

Fig. Q1 (b)

2 a. Explain with a neat sketch inertia of the connecting rod. **(06 Marks)**

b. The lengths of crank rod and connecting rod of a vertical reciprocating engine 400 mm and 2m respectively. The crank is rotating clock wise at a speed of 400rpm. The mass of he connecting rod is 250 kg and distance of its centre of gravity from the cross-head pin centre is 1.2m. Find the torque exerted on the crankshaft due to the inertia of moving parts analytically when crank has turned through 40° from top dead centre and piston is moving down wards. The radius of gyration of connecting rod about an axis passing through its centre of gravity is 900mm. **(14 Marks)**

3 a. Derive the expression for maximum fluctuation of energy and find the relationship between K_e and K_S. **(10 Marks)**

b. A gas engine working on otto cycle is provided with 2 flywheels. Each of mass 140 bgs and radius of gyration 0.7m. The cylinder is 0.24m diameter, stroke is 0.27m and mean speed is 250 rpm. The mean pressure during the cycles are :
   i) Suction stoke = Atmospheric pressure
   ii) Comp. stroke pressure = 10.6 N/cm^2
   iii) Firing stroke pressure = 62N/cm^2
   iv) exhaust stroke pressure = 5 N/cm^2

   If the resistance is to be constant. Find the percentage variation of speed of engine. **(10 Marks)**

4 a. Derive the expression for displacement, velocity and acceleration when roller follower has contact on flank. **(10 Marks)**

b. A cam has a straight working surfaces which are tangential to the base circle of the cam. The follower is roller follower with line of stroke passing through the axis of the cam. The particulars are the following : Base circle diameter = 100mm, Roller diameter = 50 mm. The angle between tangential faces of cam = 90°. The faces are joined by nose circle of radius = 10mm. The speed of rotation of the cam = 180 rpm. Determine acceleration of the roller centre. i) When roller just leaves contact of the flank on its ascent ii) when roller is at its outer end of its lift. **(10 Marks)**

5 a. Explain static balance and dynamic balance as applied to revolving masses in different planes. **(06 Marks)**

b. Three masses 10kg, 12kg and 8kg are revolving at radii 6cm, 7cm and 8cm in three parallel planes A, B and C respectively of the shaft. Plane B and C are at distance of 0.5m from A on either side of A(B is on left side). The three masses are placed in such a way that they are statically balanced. Find the unbalanced couple in a plane mid-way between A and B if the shaft revolves at 1000 rpm . **(14 Marks)**

6 a. What are inline engines and state how they are balanced? **(06 Marks)**

b. The piston of a 4 cylinder vertical inline engine reach their upper most position at 98 interval in order of their axial position. Pitch of cylinder = 0.35m. crank radius = 0.12m, length of C.R = 0.42m. The engine runs at 600rpm. If the reciprocating parts of each engine has a mass of 2.5kg. Find the unbalanced primary and secondary forces and couples. Take central plane of engine as reference plane. Solve by graphical method. **(14 Marks)**

7 a. Define the following:
i) Sensitiveness
ii) Stability
iii) Isochronous Governor
iv) Controlling force **(08 Marks)**

b. In a porter governor all the arms are 15 cm long. Upper and lower arms are pivoted to the links 2 cm and 3 cm respectively from the axis. Central mass is 40 kg mass of each ball is 4 kg. Force of friction is 30 N and the extreme radii of rotation are 8 cm and 10 cm. Determine the range of speed of governor. **(12 Marks)**

8 a. Explain Gyroscopic couple with equation. **(08 Marks)**

b. An aeroplane 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. **(12 Marks)**

* * * * *