CBCS SCHEME

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

18MR42

Fourth Semester B.E. Degree Examination, Feb./Mar. 2022

Theory of Machines

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define: (i) Link (ii) Kinematic pair (iii) Degree of freedom (iv) Kinematic Chain **(10 Marks)**

b. What is kinematic pair? Classify the kinematic pairs and explain them. **(10 Marks)**

OR

2 a. With neat sketch, explain Whitworth mechanism and Oldham's coupling. **(10 Marks)**

b. Explain Ackerman steering mechanism with neat sketch. **(10 Marks)**

Module-2

3 a. Explain and analyze the inertia forces on a four bar mechanism. **(10 Marks)**

b. When a crank is 45° from the inner dead centre on the down stroke, the effective steam pressure on the piston of a vertical steam engine is 2.5 bar. The diameter of the cylinder = 0.75 m, stroke of the piston = 0.50 m and length of connecting rod = 1m. Determine the torque on the crank shaft, if the engine runs at 350 rpm and the mass of the reciprocating parts is 200 kg. **(10 Marks)**

OR

4 a. Derive an expression for the ratio of belt tensions. **(10 Marks)**

b. Belt of 100 mm width and 10 mm thick is transmitting power at 1000 m/min. The net driving tension is 1.8 times the tension on slack side. If the safe permissible stress is 2 MPa, calculate the maximum power that can be transmitted at this speed. Assume the density of leather as 1000 kg/m^3. Also

(i) Calculate the absolute maximum power that can be transmitted by this belt and the speed at which this can be transmitted.

(ii) Percentage increase in power. **(10 Marks)**

Module-3

5 a. Explain the balancing of several masses rotating in the same plane. **(10 Marks)**

b. A shaft carrier four masses A, B, C and D placed in parallel planes perpendicular to the shaft axis and in this order along the shaft. The masses B and C are 40 kg, 28 kg and both are at 160 mm radius. While the masses in planes A and D are at 200 mm radius. Angle between B and C is 100°, B and A is 190°, both angles being measured in the same sense. Planes A and B are 250 mm apart, B and C are 500 mm apart. If the shaft is to be in complete balance, determine:

(i) Masses in planes A and D

(ii) Distance between planes C and D

(iii) Angular position of mass D. **(10 Marks)**

OR

6 a. Explain balancing of reciprocating parts with neat sketch and expression. **(10 Marks)**

b. The piston's of a 4 cylinder vertical in line engine reach their upper most position at 90° interval in order of their axial position. Pitch of cylinder = 0.35 m, crank radius = 0.12 m, length of C.R = 0.42 m. The engine runs at 600 rpm. If the reciprocating parts of each engine has a mass of 2.5 kg. Find the unbalanced primary and secondary forces and couples. Take vertical plane of engine as reference plane. **(10 Marks)**

Module-4

7 a. Define: (i) Controlling force (ii) Governing power (iii) Isochronous governor **(10 Marks)**

b. Each arm of a porter governor is 300 mm long and is pivoted on the axis of the governor. 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 governor begins to lift and 250 mm when the speed is maximum. Determine the maximum and minimum speed and the range of speed of governor. **(10 Marks)**

OR

8 a. Explain gyroscopic effect on Aeroplane. **(10 Marks)**

b. The motor of a marine having a mass of 1000 kg and radius of gyration 300 mm rotates at 1550 rpm clockwise when looking from the bow. Determine the gyroscopic couple and its effect on the ship in the following cases.

(i) When the ship pitches with an angular velocity of 1 rad/sec when the bow (i) rising (ii) falling.

(ii) When the ship is speeding at 40 km/hr and takes a right turn in a circular path of 200 m radius.

(iii) When the ship rolls at certain instant, it has an angular velocity of 0.5 rad/sec when viewed from the stern. **(10 Marks)**

Module-5

9 Derive an expression for displacement velocity and acceleration of follower when the roller is in contact with straight flank. **(20 Marks)**

OR

10 Draw the full size profile of the cam which will give a lift of 38 mm to a follower carrying a roller of 25 mm diameter. The axis of the follower is off-set by 18 mm to the right of the axis of the cam. Ascent of the follower takes place with S.H.M in 0.05 second followed by a period of rest 0.0125 second. The follower by then descent with UARM during 0.125 second, the acceleration being 3/5 times retardation. The cam rotates in clockwise direction at a constant speed of 240 rpm and the base circle radius is 50 mm. **(20 Marks)**

* * * * *