CBCS SCHEME

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

18MT45

Fourth Semester B.E. Degree Examination, July/August 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. Explain the classification of kinematic pairs. **(10 Marks)**

b. Determine the mobility of the mechanisms given below :

i) ii)

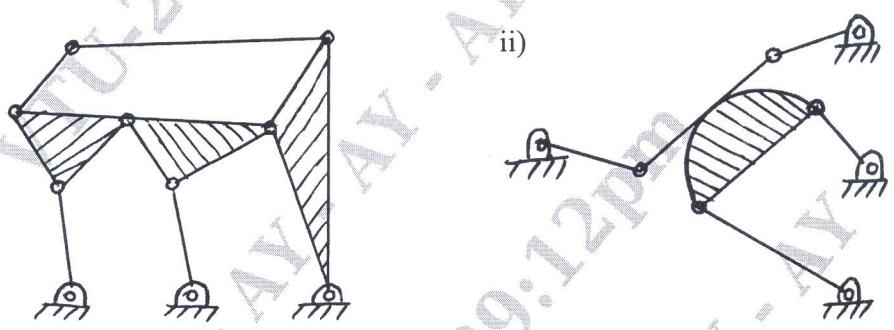

Fig.Q1(b) **(04 Marks)**

c. Sketch and explain the following mechanism :
i) Coupled wheel of a locomotive (Double Crank Mechanism)
ii) Beam engine (Crank and Lever Mechanism). **(06 Marks)**

OR

2 a. Explain Whitworth quick return motion mechanism. **(10 Marks)**

b. Explain the following mechanism with neat sketches :
i) Geneva Mechanism
ii) Ratchet and Pawl Mechanism. **(10 Marks)**

Module-2

3 a. A pair of gears 40 and 30 teeth respectively are of 25° involute form. Addendum = 5mm, Module = 2.5mm. If the smaller wheel is the driver and rotate at 1500 rpm, find the velocity of sliding at the point of engagement, at pitch point and at the point of dis-engagement. Also find the length of path of contact and length of arc of contact. **(10 Marks)**

b. Two 20° involute spur gears Mesh externally and give a velocity ratio of 3. Module is 3mm and the addendum is equal to 1.1 module. If the pinion rotates at 120rpm, determine :
i) Minimum number of teeth on each wheel to avoid interference
ii) Contact ratio. **(10 Marks)**

OR

4 a. In an epicyclic gear train as shown in Fig.Q4(a), the pitch circle diameter of the annular wheel A is 425mm and the module is 5mm. When the annular wheel is stationary, the spider which carries 3 planet gears P of equal size has to make one revolution for every 6 revolutions of the driving spindle carrying sun wheel S. Determine the number of teeth an all wheels.

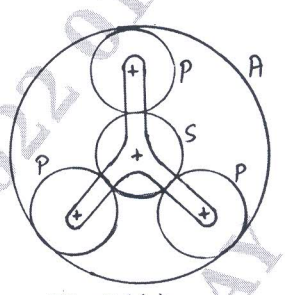

Fig.Q4(a) **(10 Marks)**

b. Explain the different types of gear trains with velocity ratio. Give examples for each. **(10 Marks)**

Module-3

5 Construct a can operating a knife – edged follower which has the following data :

i) Follower moves outwards through 40mm during 60° of can rotation
ii) Follower dwells for the next 45°
iii) Follower returns to its original position during next 90°
iv) Follower dwells for the rest of the rotation
v) The displacement of the follower is to tube place with SHM during both the outward and return strokes
vi) The least radius of the can is 50 mm
vii) The axis of the follower is offset 20mm towards right from the can axis. **(20 Marks)**

OR

6 A cam rotating clockwise at uniform speed of 300 rpm operates a reciprocating follower through a roller 1.5cm diameter. The follower motion is defined as below :

i) Out ward during 150° with UARM
ii) Dwell during next 30°
iii) Returns during next 120° with SHM
iv) Stroke of the follower is 3cm
v) Minimum radius of can is 3cm.

Draw the can profile when the follower axis passes through can axis. Also find the maximum velocity and acceleration during the raise and return of the follower. **(20 Marks)**

Module-4

7 a. A shaft carries four rotating masses A, B, C and D which are completely balanced. The masses B, C and D are 50kg, 80kg and 70 kg respectively. The masses C and D makes angles of 90° and 195° respectively with mass B in the same sense. The masses A, B, C and D are concentrated at radius 75mm, 100mm, 50mm and 90mm respectively. The plane of rotation of masses B and C are 250mm apart. Determine :

i) Mass A and its angular position
ii) Position of planes of A and D. **(14 Marks)**

b. Explain balancing of single revolting mass in two different planes for both the mass are on the same side. **(06 Marks)**

OR

8 a. A shaft routing at 200 rpm drives another shaft at 300rpm and transmits 6kW through a belt. The belt is 100mm side and 10mm thick. The diameter of smaller pulley is 0.5m. The distance between the shaft is 4m. Calculate the stress in the belt if it is,
i) An open belt drive
ii) A cross belt drive
Take $\mu = 0.3$. **(10 Marks)**

b. Derive an expression for ratio of driving tensions for flat belt drive. **(10 Marks)**

Module-5

9 a. Analyse the stability of a two wheel vehicle taking left turn derive the necessary equations. **(10 Marks)**

b. Explain the gyroscopic effect of steering of a ship moving in a heavy sea. **(10 Marks)**

OR

10 a. The arms of porter governor are 300mm long. The upper arms are pivoted on the axis of rotation. The lower arms are attached to a sleeve at a distance of 40mm from the axis of rotation. The mass of the load on sleeve is 70kg and the mass of each ball is 10kg. Determine the equilibrium speed when the radius of rotation of the balls is 200mm. If the friction is equivalent to a load of 20N at the sleeve, what will be the range of speed for this position. **(10 Marks)**

b. In a spacing loaded Hartnell type governor, the extreme radii of rotation of the balls are 80mm and 120mm. The ball arm and the sleeve arm of the bell crank lever are equal in length. The mass of each ball is 2kg. If the speeds at the two extreme positions are 400 and 420 rpm find,
i) The initial compression of the central spacing
ii) The spacing constant. **(10 Marks)**

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