CBCS SCHEME

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17AE/AS44

Fourth Semester B.E. Degree Examination, June/July 2019
Mechanism and Machine Theory

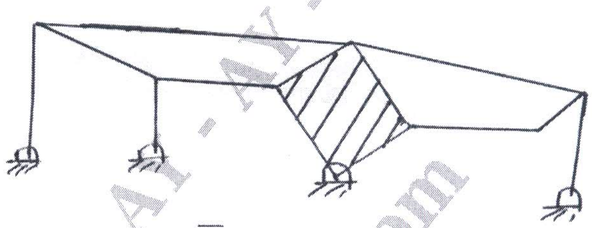
Time: 3 hrs. Max. Marks: 100

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

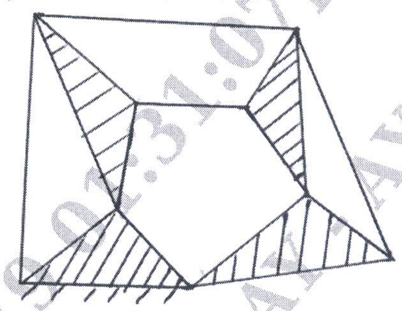
Module-1

1 a. Define : i) kinematic chain ii) machine iii) inversion iv) degree and freedom v) structure. **(05 Marks)**

b. Determine the number of degree of freedom for the mechanisms shown in FigQ1(b)(i),(ii). **(05 Marks)**



FigQ1(b)(i)



FigQ1(b)(ii)

c. Explain Whitworth quick return motion mechanism with a neat sketch. **(10 Marks)**

OR

2 a. Explain the working of an elliptical trammel. Prove that it traces an ellipse. **(08 Marks)**

b. Explain crank and slotted lever mechanism with a neat sketch. **(08 Marks)**

c. Discuss Ratchet and Pawl mechanism with a neat sketch. **(04 Marks)**

Module-2

3 A four bar mechanism ABCD is made up a four links, pin jointed at the ends. AD is a fixed link which is 180mm long. The links AB, BC and CD are 90mm, 120mm and 120mm long reactively. At certain instant, the link AB makes an angle a 60°(60 degrees) with the link AD. If the link AB rotates at a uniform speed of 100 rpm clockwise determine,

i) Angular velocity A the links BC and CD.

ii) Angular acceleration of the links CD and CB. **(20 Marks)**

OR

4 a. Determine the required input torque on the crank of a slider crank mechanism shown in Fig.Q4(a) for static equilibrium. **(12 Marks)**

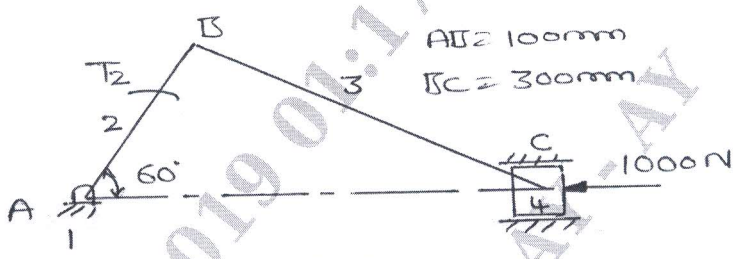


Fig.Q4(a)

b. Explain the condition for the equilibrium of the following system i) Two force member ii) Three force member iii) Member with two force and a torque iv) Four force member. **(08 Marks)**

Module-3

5 a. Derive an expression for length of path and contact for a pair of involutes gear in contact. **(10 Marks)**

b. Derive an expression data refer to a pair of 20° involutes gear in mesh module = 6mm, number of teeth on pinion = 17, number of teeth on gear = 49. Addendum on opinion and gear wheel = 1 module. Determine : i) the number of pair of teeth in contact ii) the angle turned through by the pinion and the gear wheel when one pair of teeth is in contact iii) the ratio of sliding to rolling motion when the tip of a tooth on the larger wheel.

i) Is just making contact
ii) Is just leaving contact with its mating tooth
iii) Is at pitch point. **(10 Marks)**

OR

6 a. In an epicyclic gear train shown in Fig.Q6(a). The internal wheels A and B and the compound wheel C and D rotate independently about axis 0. The wheel E and F rotate on pins fixed to arm G. E gear with A and C, and F gear with B and D. All the wheels have the same module and the number of teeth are $T_C = 28$, $T_D = 26$, $T_E = T_F = 18$.

i) Find the number of teeth on A and B
ii) If the arm G makes 100 rpm clockwise and A is fixed, find the speed of B.
iii) If the arm G makes 100rpm clockwise and wheel A makes 10pm counter clockwise, find the speed of wheel B.

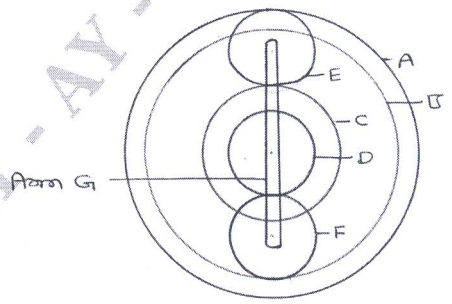


Fig.Q6(a) **(14 Marks)**

b. Explain compound gear train and reverted gear train with neat sketch. **(06 Marks)**

Module-4

7 a. A shaft carries four masses A, B, C and D of magnitude 200kg, 300kg, 400kg and 200kg respectively and revolving at radii 80mm, 70mm, 60mm and 80mm in planes measured from A at 300mm, 400mm and 700mm. The angle between the cranks measured anticlockwise are A to B 45°, B to C 70° and C to D 120°. 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. **(16 Marks)**

b. Explain briefly static and dynamic balancing. **(04 Marks)**

OR

8 a. The following data are referred to a single cylinder engine. Speed = 250rpm, stroke = 350mm. Mass of reciprocating part = 60kg, mass of revolving parts at 175mm radius is 40kg. If $2/3^{rd}$ of reciprocating parts and all the revolving parts are to be balanced find : i) balancing mass required a 400mm radius ii) residual unbalanced force when the crank has rotated 60° from top dead center. **(08 Marks)**

b. In a four cylinder engine the two outer cranks are at 120° to each other and their reciprocating masses are each 100kg. The distance between the planes of rotation of adjacent crank are 450mm, 750mm and 450mm. Length of each crank is 300mm and the length of each connecting rod is 1200mm. Speed of engine is 240rpm. Find i) the reciprocating masses and relative angular position for each of the inner crank. **(12 Marks)**

Module-5

9 a. Derive an expression for the height and speed of porter governor. **(10 Marks)**

b. The arm of a porter governor are 250mm long. The upper arm are pivoted on the axis of revolution, but the lower arms are attached to a sleeve at a distance of 50mm from the axis of rotation. The weight on the sleeve is 600N and the weight of each ball is 80N. Determine the equilibrium speed when the radius of rotation of the balls is 150mm. If the friction is equivalent to a load of 25N at the sleeve, determine the range of speed for this position. **(10 Marks)**

OR

10 a. Explain the effect of gyroscopic couple on an airplane when propeller turn clockwise when viewed from the rear end aeroplane takes i) left turn ii) right turn. **(10 Marks)**

b. A Hartnell governor having a central sleeve spring and two right angled bell crank lever operator at 290rpm and 310rpm for a sleeve lift of 15mm. The sleeve arm and ball arm are 80mm and 120mm respectively. The levers are pivoted at 120mm. From the governor axis and the mass of each ball is 2.5 kg. The ball arms are parallel to the governor axis at the lowest equilibrium speed. Determine i) loads on the spring of the lower and highest equilibrium speed. ii) stiffener a the spring. **(10 Marks)**

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