CBCS SCHEME

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

17AU43

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Kinematics 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 the following terms with sketches :
i) Link ii) Higher pair iii) Lower Pair iv) Kinematic chain. **(08 Marks)**

b. Illustrate inversion in Reciprocating Engine mechanism. **(06 Marks)**

c. Determine the mobility of the below mentioned mechanism. **(06 Marks)**

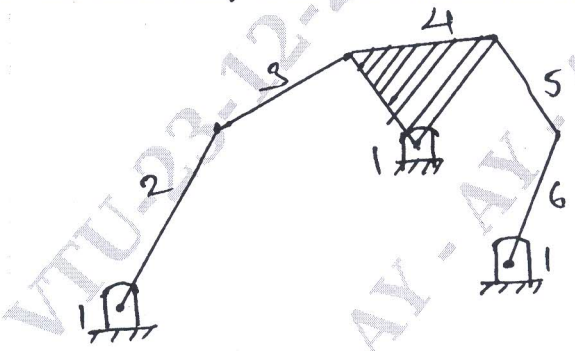

Fig Q1(a)

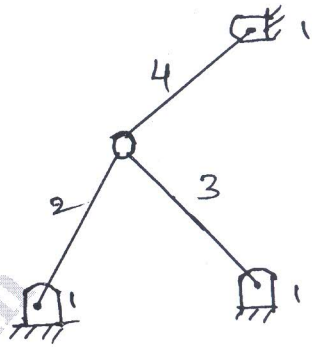

Fig Q1(a)

OR

2 a. Distinguish between a machine, mechanism and structure. **(06 Marks)**

b. Show how a pantograph mechanism can be used to draw enlarged (or) reduced size of a circle. **(08 Marks)**

c. Demonstrate straight line motion mechanism with the help of eaucellier mechanism. **(06 Marks)**

Module-2

3 a. In a Slider crank mechanism, the crank OB = 30mm and the connecting rod BC = 120mm. The crank rotates at a uniform speed of 300RPM clockwise. For the crank position shown in Fig Q3 (a), find
i) Velocity of piston 'C' and angular velocity of connecting rod 'BC'
ii) Acceleration of piston 'C' and angular acceleration of connecting rod 'BC'.

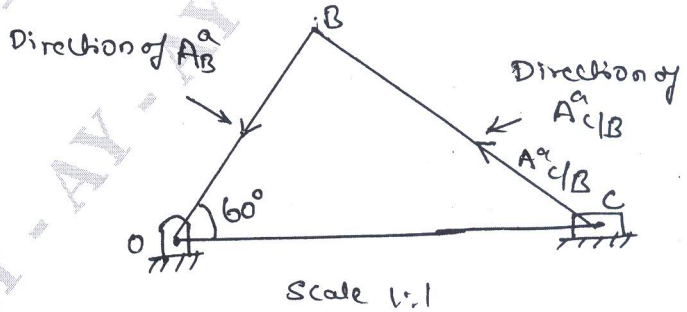

Fig Q3 (a)

(12 Marks)

b. Illustrate Arnold – Kennedy theorem. **(08 Marks)**

OR

4 a. In a slider crank mechanism shown in Fig Q4(a). The crank OA = 300mm and connecting rod AB = 1200mm. The crank OA is turned 30° from inner dead centre. Locate all the instantaneous centers. If the crank rotates as 15 rad/sec clockwise, find : i) Velocity of slider B and ii) Angular velocity of connecting rod AB.

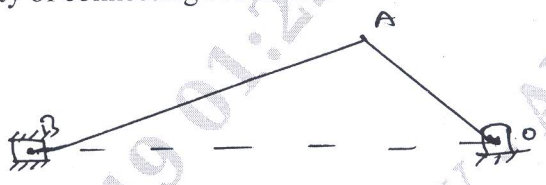

Fig Q4(a) **(12 Marks)**

b. Rephrase
   i) Linear Acceleration
   ii) Angular acceleration
   iii) Relative velocity
   iv) Relative acceleration **(08 Marks)**

Module-3

5 a. Using complex algebra derive expressions for velocity and acceleration of the piston, angular acceleration of connecting rod of a reciprocating engine mechanism. **(12 Marks)**

b. If the crank and connecting rod are 150mm and 600mm long respectively and crank rotates of a uniform speed of 100rpm clockwise, determine :
Angular velocity and angular acceleration of connecting rod
Velocity and acceleration of piston of using Ravenis approach. The angle which the crank makes with inner dead centre is 30°. **(08 Marks)**

OR

6 a. Illustrate use of Klein's construction for velocity diagram for slider crank mechanism. **(08 Marks)**

b. Determine the velocity and acceleration of the piston by Klein's construction to the following specification.
Stroke = 300mm ; Ratio of length of connecting rod to crank length = 4
Speed of engine = 300rpm: position of crank = 45° with inner dead centre. **(12 Marks)**

Module-4

7 a. Demonstrate law of Gearing (or) condition for correct Gearing. **(08 Marks)**

b. The number of teeth on a 20° full depth involute gear is 20. The module is 10mm and the addendum is one module. Determine :
   i) Pitch circle radius
   ii) Tooth thickness at pitch circle
   iii) Base circle radius
   iv) Tooth thickness at base circle
   v) Addendum circle radius
   vi) Pressure angle at addendum circle radius
   vii) Tooth thickness at addendum circle radius **(12 Marks)**

OR

8 a. An epicyclic gear train is composed of fixed annular wheel 'A' having 150 teeth. Meshing with 'A' is wheel 'B' which drives 'D' through an Idler wheel 'C'. 'D' being concentric with 'A' wheels 'B' and 'C' are carried on an arm which rotates clockwise at 100rpm about the axis of 'A' and 'D'. If the wheels B and D have 25 and 40 teeth respectively. Find using algebraic method. The number of teeth on 'C' and speed of rotation of 'C'. **(08 Marks)**

b. An epicycle gear train is constructed as follows. A fixed annular wheel 'A' and smaller concentric wheel 'B' are connected by a compound wheel $A_1 - B_1$. A_1 gearing with 'A". B_1 gearing with 'B'. The compound wheel revolves on a stud which is carried around on arm which revolves about the axis 'A' and 'B'. 'A' has 130 teeth, 'B' has 20 teeth, 'B_1' has 80 teeth, pitch of 'A' and A_1 being twice that of pitch of 'B' and B_1. Find out how many revolutions 'B' will make for one revolution of arm using tabular method. **(12 Marks)**

Module-5

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

i) Outward during 150° with UARM.
ii) Dwell for next 30°
iii) Return during next 120° with SHM
iv) Dwell for the remaining period

Stroke of follower is 3cm. minimum radius of the cam is 3cm. Draw the cam profile if the follower axis is offset by 1cm to the right of cam axis. **(20 Marks)**

OR

10 The exhaust valve of a diesel engine has a lift of 62.8mm. It is operated by a cam to give cycloidal motion during and closing periods each of which corresponds to 120° of cam rotation. The follower is provided with a roller of 20mm diameter and its line of stroke is radial. Minimum radius of the cam is 25mm. Draw the cam profile if the speed of cam is 300rpm clockwise. **(20 Marks)**

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