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

10ME/AU44

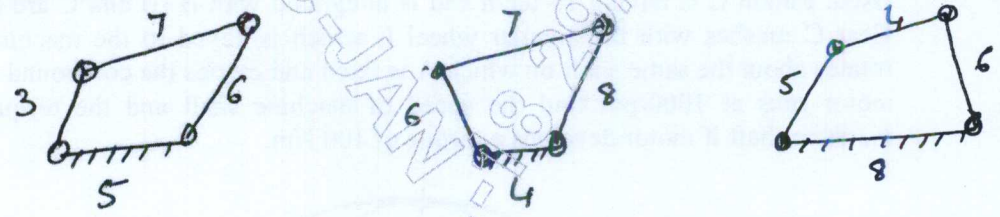
Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Kinematics of Machines

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Fig. Q1 shows four link mechanism is which the figure indicates the dimensions in standard units of length. Indicate the type of each mechanism whether crank rocker or double crank or double rocker. **(09 Marks)**



(i) (ii) (iii)

Fig Q1(a)

b. Differentiate between: i) Lower pair and higher pair ii) Closed pair and unclosed pair iii) Turning pair and rolling pair. **(06 Marks)**

c. What is meant by Inversion? Discuss any one inversion of a double slider crank chain. **(05 Marks)**

2 a. Sketch a Paucellier mechanism, show that it can be used to trace a straight line on the movement of links. **(10 Marks)**

b. With help of a neat diagram, discuss the working of Toggle mechanism. **(08 Marks)**

c. Differentiate between exact straight line and approximate straight line mechanism. **(02 Marks)**

3 A crank and rocker mechanism ABCD has the following dimensions :
AB = 0.75m, BC = 1.25m, CD = 1m, AD = 1.5m, BE = 437.5mm CE = 875mm. E is the point on coupler link BC, AD is fixed link, BEC is read clockwise, crank AB has an angular velocity of 20.94r/s counterclockwise and retardation of 280 r/s^2 at the instant $\angle DAB = 60°$, find :

i) The instantaneous velocity and acceleration of point C and E

ii) Angular velocity and acceleration of link BC. **(20 Marks)**

4 a. What is instantaneous centre of rotation of a body? Discuss different types of instantaneous centers. **(06 Marks)**

b. The lengths of the crank and connecting rod of a horizontal reciprocating engine are 100mm and 500mm respectively. The crank is rotating at 400rpm. Using Klein's construction, find : i) Velocity and acceleration of piston ii) angular velocity and angular acceleration of connecting rod when the crank has turned 30° from the inner deed centre. **(14 Marks)**

PART – B

5 In a four bar mechanism the dimensions of the links are as under AB = 50mm, BC = 66mm, CD = 56mm, AD = 100mm (fixed link).

At an instant when $D\hat{A}C = 60°$ the angular velocity of the input link AB is 10.5 rad/sec is the counterclockwise direction with an angular retardation of 26 rad/s^2. Determine analytically the angular displacement, angular velocity and angular acceleration of link DC and BC. **(20 Marks)**

6 a. What do you mean by the phenomenon, 'Interference' between two mating gears? **(02 Marks)**

b. Find the expression for the minimum number to teeth on the wheel if interference is to be avoided between two mating gears. **(12 Marks)**

c. A pinion and rack are is mesh. The rack is driven by a pinion of 125mm pitch circle diameter. The numbers of involute teeth on the pinion are 20. The addendum of both pinion and rack is 6.25mm. If interference is to be avoided, determine pressure angle. **(06 Marks)**

7 Fig Q7 shows epicyclic gear train pinion A has 15 teeth, and rigidly fixed to the motor shaft. The wheel B has 20 teeth and gears with A and also with the annular wheel D which is fixed. Pinion C is having 15 teeth and is integrated with B (B and C are compound wheel) Gear C meshes with the annular wheel E which is keyed to the machine shaft. The arm rotates about the same shaft on which A is fixed and carries the compound wheel B and C. If motor runs at 1000rpm find the speed of machine shaft and the torque exerted on the machine shaft if motor develops a torque of 100 Nm. **(20 Marks)**

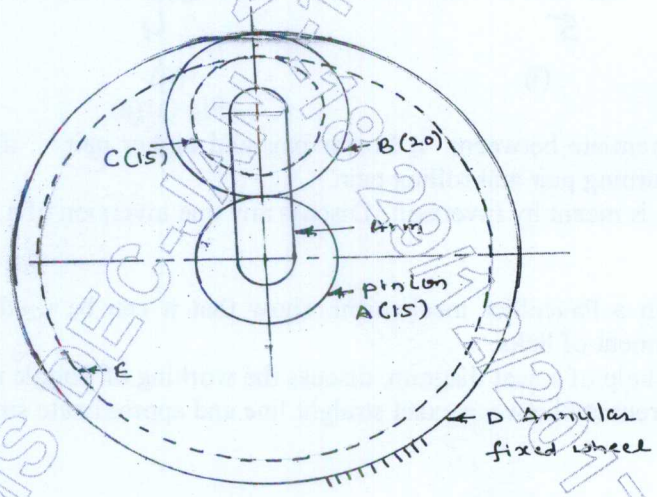


Fig Q7

8 a. Define and explain :
i) Cam profile ii) Base circle iii) Prime circle iv) Pitch curve. **(04 Marks)**

b. Draw the profile of cam to raise a valve with harmonic motion through 40mm is $\frac{1}{4}^{th}$ of revaluation, keep it fully raised through $\frac{1}{10}^{th}$ of the revolution and to lower with uniform acceleration and retardation motion is $\frac{1}{6}^{th}$ of revolution. The valve remains closed during rest of the revolution. The diameter of the roller is 20mm, minimum radius cam is 30mm. The axis of the valve rod passes through the axis of cam shaft. Assume that cam rotates is counterclockwise. **(16 Marks)**