University of Mumbai

Examinations Summer 2022

23/5/2022

Program: Mechanical Engineering

Examination: SE Semester IV

Course Code: 41223 and Course Name: Kinematics of Machinery

1T01434 / / S.E.(Mechanical) Engineering)(SEM-IV)(Choice Base Credit Grading System) ((R- 19) (C Scheme)

Time: 2 hour 30 minutes

Max. Marks: 80

Q1. (20 Marks)	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks** **02 Marks each**
1.	A Crank and slotted lever mechanism used in a shaper has a center distance of 300 mm between the center of oscillation of the slotted lever and the center of rotation of the crank. The radius of the crank is 120 mm. Find ratio of the time of cutting to the time of return stroke.
Option A:	1.5
Option B:	17.2
Option C:	1.72
Option D:	1.9
2.	Cam and follower is example of
Option A:	Higher pair
Option B:	Lower Pair
Option C:	Rolling Pair
Option D:	Sliding Pair
3.	The Coriolis acceleration component
Option A:	lags the sliding velocity by 90°
Option B:	leads the sliding velocity by 90°
Option C:	lags the sliding velocity by 180°
Option D:	leads the sliding velocity by 180°
4.	In simple gear train, if there is odd number of idlers , the direction of rotation of the driver and the driven gears will be
Option A:	Opposite
Option B:	Same
Option C:	Depends upon number of teeth of the gears
Option D:	Contact ratio
5.	The total number of instantaneous centres for a mechanism consisting of n links are
Option A:	n
Option B:	n/2
Option C:	n(n-1)/2
Option D:	n(n+1)/2
6.	On which of the following factor does the moment of inertia of an object not depend upon
Option A:	Axis of rotation
Option B:	Angular velocity

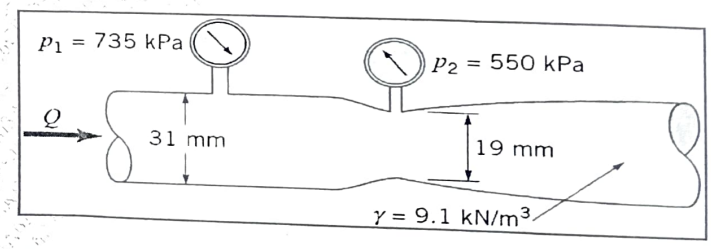
Option C:	Distribution of mass
Option D:	Mass of an object
7.	The power transmitted by a belt is maximum when the maximum tension in the belt (T) is equal to
Option A:	$3T_c$
Option B:	$2T_c$
Option C:	(1/3) T_C
Option D:	$4T_c$
8.	In a Davis steering mechanism the distance between pivot of front axle (b) 120cm, and the length of wheel base is (l) 260cm. When the vehicle moving straight path the angle of (α) inclination of track arm to the vertical is ---------- degree.
Option A:	21.99
Option B:	32.81
Option C:	12.99
Option D:	19.33
9.	Chordal action in chain
Option A:	Changes the velocity ratio
Option B:	Increases overall length of chain
Option C:	Decreases overall length of chain
Option D:	Changes the center distance between sprockets
10.	A gear wheel turning at 20 radians per second is in mesh with pinion turning at double the speed of wheel. If the length of path of approach is 10 mm, what will be the sliding velocity at pitch point?
Option A:	600 mm/s
Option B:	60 mm/s
Option C:	6 mm/s
Option D:	0

Q2.	**Solve any Four out of Six** **5 marks each**
A	Explain elliptical trammel
B	Compare Cycloidal and involute tooth forms.
C	Derive the expression for open belt drive
D	Describe the procedure to draw velocity and acceleration diagrams of a four-link mechanism.
E	Explain double block or shoe brake with a neat sketch.
F	Classify various types of CAM and follower
Q3	**Solve any Two Questions out of Three** **10 marks each**
A	The following data relate to knife edge follower. Minimum radius of CAM 45 mm Lift of follower 40 mm Angle of ascent 60^0 angle of descent 120^o angle of dwell for the follower in the highest position 90^0. Plot the displacement, velocity acceleration plot if the ascent and descent motion of the CAM is Simple Harmonic Motion.
B	An open belt running over two pulleys 240 mm & 600 mm diameter connects two parallel shafts 3 m apart & transmits 5 kW from the smaller pulley that rotates at 400 rpm coefficient of friction is 0.3 & the safe working tension is 10 N per mm width, Determine-i) Min width of the belt, ii) Initial belt tension, iii) Length of the belt required.

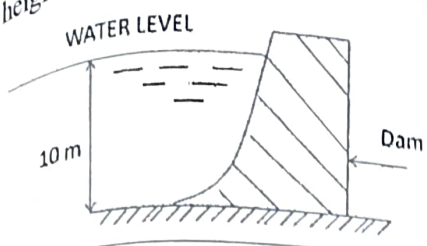
Option D:	Substantial derivative, Local derivative
8.	The coefficient of discharge of Venturimeter lies within the limits:
Option A:	0.95 to 0.99
Option B:	0.8 to 0.85
Option C:	0.7 to 0.8
Option D:	0.6 to 0.7
9.	The maximum velocity in a circular pipe when flow is laminar occurs at
Option A:	the top of the pipe
Option B:	the bottom of the pipe
Option C:	the centre of the pipe
Option D:	not necessarily at the centre
10.	**What is the graph that is represented in the airfoil section?**
Option A:	Lift-moment ratio
Option B:	Coefficient of lift-coefficient of drag ratio
Option C:	Angle of attack-drag ratio
Option D:	Lift–angle of attack ratio

Q2.	
A	**Solve any Two** **5 marks each**
i.	What is Pascal law and Archimedes Principle?.
ii.	How do you determination of head loss in pipes due to friction
iii.	Write short notes on types of fluids.
B	**Solve any One** **10 marks each**
i.	A 1 m wide and 1.5 m deep rectangular plane surface lies in water in such a way that its plane makes an angle of 30° with the free water surface. Determine the total pressure and position of centre of pressure when the upper edge is 0.75 m below the free water surface.
ii.	In a two-dimensional incompressible flow, the fluid velocity components are given by $u = x - 4y$ and $v = -y - 4x$. Show that velocity potential exists and determine its form as well as stream function.

Q3.	
A	**Solve any Two** **5 marks each**
i.	What are the properties of Newtonian and non-Newtonian fluids?
ii.	With neat sketch explain working and construction of venturimeter
iii.	Write a short note on Buckingham's π theorem.
B	**Solve any One** **10 marks each**
i.	Determine the flow rate through the Venturimeter shown in figure ($\gamma=\rho g$)



ii. Find the magnitude and direction of the resultant water pressure acting on a curved face of a dam which is shaped according to the relation $y = (x^2/8)$ as shown in fig. The height of the water retained by the dam is 10 m. Consider the width of the dam as unity.



Q4.

A **Solve any Two** **5 marks each**

i. What is Reynolds transport theorem? What purpose does it serve?

ii. Define stream function and velocity potential function.

iii. Write short note on boundary layer separation and methods to control it

B **Solve any One** **10 marks each**

i. An oil of viscosity 9 poise and specific gravity 0.9 is flowing through a horizontal pipe of 60 mm diameter. If the pressure drop in 100 m length of the pipe is 1800 kN/m^2 determine the rate of flow of oil.

ii. Water (ρ= 999.7 kg/m3 and μ=1.307 x10-3 kg/m.s) is flowing in a 0.20-cm-diameter 15-m-long pipe steadily at an average velocity of 1.2 m/s.

Determine

(a) the pressure drop and

(b) The pumping power requirement to overcome this pressure drop