University of Mumbai
Examination 2021 under cluster 9 (Lead College: FAMT)
Examinations Commencing from 1st June 2021
Program: BE(Mechanical)
Curriculum Scheme: Rev/2016
Examination:SESemester IV
Course Code: MEC 401and Course Name: Applied Mathematics IV
Time: 2 hourMax. Marks: 80

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Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	Find the Eigen values of matrix A = $\begin{bmatrix} 3 & 10 & 5 \\ -2 & -3 & -4 \\ 3 & 5 & 7 \end{bmatrix}$
Option A:	3, -2 -2
Option B:	3, 4 1
Option C:	3 ,2,2
Option D:	-3,-4,1
2.	If matrix A $= \begin{bmatrix} -1 & 2 & 3 \\ 0 & 3 & 5 \\ 0 & 0 & -2 \end{bmatrix}$ find Eigen values of $A^3 + 5A + 8I$
Option A:	-1,3,-2
Option B:	2,-10, 50
Option C:	-2, 10 ,50
Option D:	-1, 27,-8
3.	If $A = \begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}$ find e^A
Option A:	$\begin{bmatrix} 0 & e \\ e^2 & 0 \end{bmatrix}$
Option B:	$\begin{bmatrix} 0 & -e \\ -e^2 & 0 \end{bmatrix}$
Option C:	$\begin{bmatrix} 0 & e^2 \\ e & 0 \end{bmatrix}$
Option D:	$\begin{bmatrix} e & 0 \\ 0 & e^2 \end{bmatrix}$
4.	Write down the matrix of quadratic form $x^2 - 2y^2 + 3z^2 - 4xy + xz -2yz$
Option A:	$\begin{bmatrix} 1 & -4 & 1 \\ -4 & 2 & -2 \\ 1 & -2 & 34 \end{bmatrix}$
Option B:	$\begin{bmatrix} 1 & -2 & 1/2 \\ -2 & -2 & -1 \\ 1/2 & -1 & 3 \end{bmatrix}$
Option C:	$\begin{bmatrix} 1 & -1 & -3 \\ -1 & -2 & 5 \\ -3 & 5 & 3 \end{bmatrix}$

Option D:	$\begin{bmatrix} 1 & -2 & 3 \\ -2 & 2 & -1 \\ 3 & -1 & 3 \end{bmatrix}$
5.	Find the directional derivative of $\emptyset(x,y,z) = xy^2 + yz^3$ at the points (2,-1,1) In the direction of the vector i + 2j +2k.
Option A:	$\dfrac{11}{3}$
Option B:	$-\dfrac{11}{3}$
Option C:	$\dfrac{22}{3}$
Option D:	$-\dfrac{22}{3}$
6.	A vector field $\bar{F} = ($ y sin z- sin x $)$ i $ + ($ x sin z + 2 y z$)$ j $ + ($ x y cos z + $y^2)$ k is irrotational what is value of curl $\bar{F}$
Option A:	1
Option B:	-1
Option C:	2
Option D:	0
7.	Evaluate by Green's Theorem $\bar{F} = x^2 i - xy j$ and c is the triangle Having vertices A (0,2) B (2, 0) , C (4,2) .
Option A:	$\dfrac{16}{3}$
Option B:	$\dfrac{32}{3}$
Option C:	$-\dfrac{32}{5}$
Option D:	$-\dfrac{16}{3}$
8.	Maximize z $= x_1 + 3x_2 + 3x_3$ Subject to $x_1 + 2x_2 + 3x_3 = 4$ $2 x_1 + 3x_2 + 5x_3 = 7$ find optimal basic feasible solution.
Option A:	(2,1,0)
Option B:	(1, 3,0)
Option C:	(1 ,0 4)
Option D:	(0 , 2 3)
9.	A continuous random variable X has probability density function f (x) $= k x^2 (1 - x^3) , 0 \le x \le 1$ find k .
Option A:	3
Option B:	4
Option C:	5
Option D:	6

10.	If X is Binomially distributed with E (X) = 2 and Var. (X) = 4/3 Find n
Option A:	4
Option B:	5
Option C:	2
Option D:	6
11.	A discrete random variable X has probability density function given below X : -2 -1 0 1 2 3 P(X = x) : 0.2 3/25 0.1 6/25 0.1 6/25 Find E (X)
Option A:	$\dfrac{3}{25}$
Option B:	$\dfrac{16}{25}$
Option C:	$\dfrac{3}{625}$
Option D:	$\dfrac{3}{325}$
12.	If a random variable X follows Poisson distribution such that p (X = 2) = 9 p (X = 4) + 90 p (X = 6) find mean .
Option A:	2
Option B:	3
Option C:	4
Option D:	1
13.	In small sample test what is sample size n.
Option A:	n > 30
Option B:	n > 40
Option C:	n< 30
Option D:	n < 60
14.	A random sample of 50 items gives the mean 6.2 and variance 10.24. Can it be regarded as drawn from population mean 5.4 find computed value of $[z]\|$ |
Option A:	1.77
Option B:	2.77
Option C:	1.27
Option D:	1.61
15.	The ki-square testx^2 is defined as
Option A:	$$\sum \left(\frac{(O + E)^2}{E} \right)$$
Option B:	$$\sum \left(\frac{(O - E)^2}{E} \right)$$
Option C:	$$\sum \left(\frac{(O - E)^2}{O} \right)$$
Option D:	$$\sum \left(\frac{(O - E)^2}{2E} \right)$$
16.	What is F- Test distribution?

Option A:	$\dfrac{n_1 s_1{}^2}{n_2 s_2{}^2}$
Option B:	$\dfrac{n_1 s_1{}^3}{n_2 s_2{}^3}$
Option C:	$\dfrac{n_1 s_1{}^2/(n_1-1)}{n_2 s_2{}^2/(n_2-1)}$
Option D:	$\dfrac{s_2^2}{s_1^2}$
17.	What is the type of the given matrix A=$\begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$
Option A:	Derogatory
Option B:	Non derogatory
Option C:	Non Diagonalisable
Option D:	Symmetric
18.	The means of two random samples of size 9 and 7 are 196.42 and 198.82 respectively. The sum of the squares of the deviations from the means are 26.94 and 18.73 respectively. Can the samples be considered to have been drawn from same population find $|t|$
Option A:	2.64
Option B:	1.64
Option C:	3.64
Option D:	4.64
19.	If $\bar{F}=$ (x + 3y) i + (y − 2z) j + (a z + x) k is Solenoidal , find the value of a .
Option A:	1
Option B:	2
Option C:	3
Option D:	-2
20.	If the product of two Eigen values of matrix A =$\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ is 16, Find the third Eigen value.
Option A:	1
Option B:	3
Option C:	2
Option D:	-1

Q2	Solve any Four out of Six. (5 marks each)
A	Show that the matrix A =$\begin{bmatrix} -9 & 4 & 4 \\ -8 & 3 & 4 \\ -16 & 8 & 7 \end{bmatrix}$ is Diagonalisable. Find the diagonal form D and the transforming matrix .
B	Solve the L.P.P by simplex method. Maximize $z = 3\,x_1 + 2\,x_2$ Subject to $3\,x_1 + 2\,x_2 \le 18$;

	$0 \leq x_1 \leq 4$; $0 \leq x_2 \leq \ 6$; $x_1, x_2 \geq 0$
C	The marks obtained by 1000 students in an examination are found to be normally Distributed with mean 70 and s. d. 5. Estimate the number of students whose marks will be (i) between 60 and 75 (ii) more than 75.
D	The standard deviation calculated from two random samples of sizes 9 and 13 are 1.99 and 1.9. Can the samples be regarded as drawn from the normal populations with the same standard deviations ?(given $F_{0.025} = 3.51$ with d.o.f. 8 and 12 and $F_{0.025} = 4.20$ with d.o.f.12 and 8
E	Ten individuals are chosen at random from a population and their heights are found to be 63, 63,64,65,66,69, 69, 70, 70, 71 inches. Discuss the suggestion that the mean height of the Universe is 65 inches.
F	Reduce the quadratic form $6 x^2 + 3y^2 + 3z^2 - 4 x y + 4 x z - 2 y z$ to canonical form through congruent transformations. Find its rank ,index, signature and class value

Q3	Solve any Four out of Six. (5 marks each)
A	If $A = \begin{bmatrix} 1 & 4 \\ 1 & 1 \end{bmatrix}$ find $A^7 + 31A^2 + I$.
B	Prove that $\bar{F} = (2 x y + z) i + (x^2 + 2 y Z^3) j + (3y^2 Z^2 + x) k$ is irrotational. Find the scalar potential $\bar{F}$ and work done in moving an object in this field from (1 , 2 ,0) to (2 , 2 , 1).
C	The average of marks scored by 32 boys is 72 with standard deviation 8 while that of 36 girls is 70 with standard deviation 6. Test at 1% level of significance whether the boys perform better than the girls.
D	Use the dual simplex method to solve the L.P.P. maximize $z = - 3 x_1 - 2 x_2$ Subject to $x_1 + x_2 \geq 1$; $x_1 + x_2 \leq 7$; $x_1 + 2 x_2 \geq 10$; $x_2 \leq 3$ $x_1, x_2 \geq 0$
E	Use Gauss Divergence Theorem to evaluate $\iint \bar{N}.\bar{F} \, ds$ where $\bar{F} = x^2 \, i + z \, j + y z \, k$ And s is the surface of the cube bounded by x = 0, x = 1, y = 0, y = 1, z = 0, z = 1 .
F	In an experiment on immunizations of cattle from Tuberculosis, the results were obtained Use ki- square test to determine the efficiency of vaccine in preventing tuberculosis.

	Affected	not affected	Total
Inoculated	290	110	400
Not inoculated	310	90	400
Total	600	200	800

University of Mumbai
Examination 2021 under cluster 9 (FAMT)
Examinations Commencing from 1ˢᵗ June 2021
Program: Mechanical Engineering
Curriculum Scheme: Rev 2016
Examination: SE Semester IV
Course Code: MEC402 and Course Name: Fluid Mechanics

Time: 2 hour   Max. Marks: 80

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Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	The vertical force on a submerged curved surface is equal to the
Option A:	force on the vertical projection of the curved surface
Option B:	force on the horizontal projection of the curved surface
Option C:	weight of the liquid vertically above the curved surface
Option D:	product of the pressure at the centroid and the area of the curved surface.
2.	The principle of floatation of bodies is based on
Option A:	Metacenter
Option B:	center of pressure
Option C:	center of gravity
Option D:	center of mass
3.	Decrease in temperature, in general, results in
Option A:	an increase in viscosities of both gases and liquid
Option B:	a decrease in the viscosities of both liquids and gases
Option C:	an increase in the viscosity of liquid and a decrease in that of gases
Option D:	a decrease in the viscosity of liquids and an increase in that of gases
4.	If the stream function given by $\Psi = 3xy$, then the velocity at a point (2, 3) will be
Option A:	7.21 unit
Option B:	10.82 unit
Option C:	18 unit
Option D:	54 unit.
5.	………… is defined as a scalar function of space and time such that its negative derivative with respect to any direction gives the fluid ……….. in that direction.
Option A:	Velocity potential function, velocity
Option B:	Stream function, pressure
Option C:	Circulation function, velocity
Option D:	Velocity potential function, pressure
6.	The quantity wQ/ g is called ……….. (where w = weight density, Q= discharge, g= gravitational constant)
Option A:	mass flux
Option B:	volume flux
Option C:	heat flux
Option D:	energy flux

7.	Bernoulli's theorem deals with the law of conservation of
Option A:	mass
Option B:	momentum
Option C:	Energy
Option D:	Heat
8.	In which of the following measuring devices Bernoulli's equation is not used:
Option A:	Venturimeter
Option B:	Orificemeter
Option C:	Pitot tube
Option D:	Manometer
9.	In Navier stokes equation consider following forces
Option A:	pressure and gravitational forces
Option B:	viscous, gravitational and pressure forces
Option C:	viscous, gravitational and surface tension forces
Option D:	pressure and viscous forces
10.	The total energy represented by the Bernoulli's equation has the unit
Option A:	Ns/m
Option B:	Nm/s
Option C:	N
Option D:	M
11.	What is fully developed flow?
Option A:	Where pressure is constant along flow direction
Option B:	Where velocity is constant along flow direction
Option C:	Where force is constant along flow direction
Option D:	Where temperature is constant along flow direction
12.	What is no slip boundary condition?
Option A:	Pressure at wall is minimum
Option B:	Velocity at wall is high
Option C:	Velocity at wall is zero
Option D:	Pressure at wall is zero
13.	When the pipes are connected in parallel, the total loss of head
Option A:	is equal to the sum of the loss of head in each pipe
Option B:	is same as in each pipe
Option C:	is equal to the reciprocal of the sum of loss of head in each pipe
Option D:	is equal to the difference of the losses of head in pipes
14.	Find Reynolds number if velocity is 2 m/s, density of fluid is 800 kg/m^3, and viscosity 0.1 N.s/m^2 is flowing through 0.25 m diameter pipe.
Option A:	4
Option B:	40
Option C:	400
Option D:	4000

15.	……….. thickness is the distance through which the total loss of momentum per second be equal to if it were passing a stationary plate.
Option A:	Displacement
Option B:	Momentum
Option C:	Energy
Option D:	Temperature
16.	The boundary layer exists in
Option A:	Flow of real fluids
Option B:	Flow of ideal fluids
Option C:	Flow over flat surfaces only
Option D:	Pipe-flow only
17.	The lift force that may act on an object is
Option A:	the component force due to the fluid displaced by the body
Option B:	the component of resultant fluid dynamic force in a direction normal to the general direction of flow
Option C:	the force due to shear stress that acts on the body surface
Option D:	the force due to viscosity that acts on the body surface
18.	In a normal shock in a gas, the
Option A:	upstream flow is supersonic
Option B:	upstream flow is subsonic
Option C:	downstream flow is sonic
Option D:	both downstream flow and upstream flow are supersonic.
19.	The sonic velocity in a fluid medium is directly proportional to
Option A:	mach number
Option B:	pressure
Option C:	square root of temperature
Option D:	viscosity
20.	A stagnation point is the point on the immersed body where the magnitude of velocity is
Option A:	small
Option B:	large
Option C:	zero
Option D:	negative

Q2. (20 Marks)	Solve any Four Questions out of Six (5 marks each).
A	A 400 mm diameter shaft is rotating at 200 r.p.m. in a bearing of length 120 mm. If the thickness of oil film is 1.5 mm and the dynamic viscosity of the oil is 0.7 N.s/m^2 , determine torque required to overcome friction in bearing. Assume a linear velocity profile.
B	Derive the continuity equation in cartesian coordinates
C	Explain Reynold's Transport theorem.
D	An oil of viscosity 0.02 poise and sp. gr. 0.8 is flowing through 50 mm diameter pipe of length 500 m at the rate of 0.19 lit./sec. Determine (i) Pressure gradient, (ii) Wall shear stress
E	Write short note on boundary layer separation.
F	Define Mach number, stagnation temperature and stagnation density.

Q3. (20 Marks)	Solve any Two Questions out of Three (10 marks each).
A	Starting from Navier stokes equation for incompressible laminar flows derive an equation for velocity profile of Couette flow. State the assumptions made.
B	Three pipes of diameters 300 mm, 200 mm and 400 mm and lengths 300 m, 170 m and 210 m respectively are connected in series. The difference in water surface levels in two tanks is 12 m. Determine the rate of flow if coefficients of frictions are 0·005, 0·0052 and 0·0048 respectively, considering Minor losses.
C	An aeroplane is flying at 1000 km/h through still air having a pressure of 78.5 kN/m^2 (abs.) and temperature – 8° C. Calculate on the stagnation point on the nose of the plane : (i) Stagnation pressure, (ii) Stagnation temperature, and (iii) Stagnation density. Take for air : R = 287 J/kg K and γ = 1.4

University of Mumbai
Examination 2021 under cluster 9 (FAMT)
Examinations Commencing from 1ˢᵗ June 2021
Program: Mechanical Engineering
Curriculum Scheme: Rev 2016
Examination: SE Semester IV
Course Code: MEC403 and Course Name: Industrial Electronics

Time: 2 hour   Max. Marks: 80

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Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	An SCR is made of silicon and not germanium because silicon
Option A:	is inexpensive
Option B:	has low leakage current
Option C:	is mechanically strong
Option D:	is tetravalent
2.	A monostable multivibrator has R = 120kΩ and the time delay T = 1000ms, calculate the value of C?
Option A:	0.9µF
Option B:	1.32µF
Option C:	7.5µF
Option D:	2.49µF
3.	In a microprocessor based system, the stack is always in
Option A:	Microprocessor
Option B:	ROM
Option C:	RAM
Option D:	EPROM
4.	A single phase induction motor which has the lowest speed is
Option A:	Universal
Option B:	Hysteresis
Option C:	Repulsion
Option D:	shaded poles
5.	A half controlled converter uses
Option A:	Diodes only
Option B:	Thyristors only
Option C:	Both diodes and thyristors
Option D:	MOSFETS only
6.	In a combinational circuit, each output depends entirely on the............... inputs to the circuit.
Option A:	Same
Option B:	Different
Option C:	Common
Option D:	Immediate

7.	Choose the correct statement
Option A:	MOSFET is a uncontrolled device
Option B:	Has low leakage current
Option C:	MOSFET is a current controlled device
Option D:	MOSFET is a temperature controlled device
8.	Which of the following is not an application of optical amplifier?
Option A:	Power amplifier
Option B:	In-line repeater amplifier
Option C:	Demodulator
Option D:	Preamplifier
9.	To avoid loading during read operation, the device used is
Option A:	Latch
Option B:	Flipflop
Option C:	Buffer
Option D:	Tristate buffer
10.	BLDC can be used instead of _____
Option A:	Synchronous motor
Option B:	Normal brushed DC motor
Option C:	Induction motor
Option D:	Air motor
11.	Three phase fully controlled bridge converter can be obtained by replacing six .... of an uncontrolled converter by six ....
Option A:	Thyristors; Diodes
Option B:	MOSFETs; Diodes
Option C:	Diodes; Thyristors
Option D:	Diodes; Transistors
12.	A......................circuit needs some type of memory to remember the past input values
Option A:	Logic circuit
Option B:	Sequential Circuit
Option C:	Parallel Circuit
Option D:	Comparator Circuit
13.	A diac is …………………. Switch
Option A:	An a.c.
Option B:	A d.c
Option C:	A mechanical
Option D:	both ac and dc
14.	555 TIMER pin 2 represent
Option A:	Discharge
Option B:	Trigger
Option C:	Threshold
Option D:	Reset

15.	The number of hardware interrupts present in 8085 microprocessor are
Option A:	5
Option B:	10
Option C:	8
Option D:	16
16.	No-load speed of which of the following dc motor will be highest?
Option A:	Shunt motor
Option B:	Series motor
Option C:	Cumulative compound motor
Option D:	Differentiate compound motor
17.	A three phase fully controlled converter can also operate in............mode.
Option A:	Counter
Option B:	Inverter
Option C:	Chopper
Option D:	Oscillator
18.	The NOR gate output will be high if the two inputs are _____
Option A:	00
Option B:	01
Option C:	10
Option D:	11
19.	Typical brushless motor doesn't have _____
Option A:	Commutator
Option B:	Permanent magnet
Option C:	Electronic controller
Option D:	Fixed armature
20.	What is the peak value of phase voltage in case of 3-phase VSI with 180° mode if the supply side consists of a constant dc voltage source of Vs.
Option A:	Vs
Option B:	3Vs/2
Option C:	2Vs/3
Option D:	3Vs

Q2. (20 Marks Each)	
A	**Solve any Two** **5 marks each**
i.	Compare DIAC and TRAIC.
ii.	Draw and explain second order low pars filter.
iii.	Explain different peripherals of MPS 430.
B	**Solve any One** **10 marks each**
i.	Explain use of rectifier-inverter pair for speed control of an induction motor.
ii.	Explain the block diagram of the MPS 430 microcontroller.

Q3. (20 Marks Each)	
A	**Solve any Two** **5 marks each**
i.	What is linear actuator motor? Give two applications.
ii.	Draw block diagram of closed loop control of a DC motor and explain the necessity of inner current control loop.
iii.	Explain Multiplexer and Demultiplexer with applications.
B	**Solve any One** **10 marks each**
i.	Write a short note on "Selection of motor and power rating for a pump".
ii.	With the help of connection diagram, derive the relation for voltage gain in Inverting mode of operation of OP-AMP and compare it with Non-inverting mode.

University of Mumbai
Examination 2021 under cluster 9 (FAMT)
Examinations Commencing from 1st June 2021
Program: Mechanical Engineering
Curriculum Scheme: Rev 2016
Examination: SE Semester IV
Course Code: MEC 404 and Course Name: Production Process-II

Time: 2 hour   Max. Marks: 80

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Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	Cutting conditions like Small chip thickness, high cutting speed & large rake angle are favorable for producing following types of chips.
Option A:	Continuous chips
Option B:	Discontinuous chips
Option C:	Continuous chips with built up edge
Option D:	Segmental chips
2.	The extra material from a rough sheared edge is trimmed by cutting is called as
Option A:	Slitting
Option B:	Shaving
Option C:	Blanking
Option D:	Piercing
3.	For machining of plastic material which of the following unconventional process can be used effectively?
Option A:	Ultrasonic machining
Option B:	Laser beam machining
Option C:	Electrochemical machining
Option D:	Electro discharge machining
4.	In this type of dynamometer, dial indicators are used to measure the force on cutting tool.
Option A:	Mechanical dynamometer
Option B:	Pneumatic dynamometer
Option C:	Electrical dynamometer
Option D:	Strain gauge type dynamometer
5.	The following type of jig is used for machining in more than one plane.
Option A:	Open type jig
Option B:	Box type jig
Option C:	Plate type jig
Option D:	Template jig
6.	The sheet metal is fed through a coil strip, and a different operation is performed at the same station with each stroke of a series of punches

Option A:	compound die
Option B:	Combination die
Option C:	Progressive die
Option D:	Simple die
7.	In a Merchant circle, this force acts in a direction perpendicular to the main cutting force.
Option A:	Shear force
Option B:	Normal compressive force
Option C:	Thrust force
Option D:	Cutting force
8.	How many pins are used in 3-2-1 principle of location for location of a component.
Option A:	Four
Option B:	Six
Option C:	Eight
Option D:	Ten
9.	In a Stereo lithography process, the liquid used in a Vat is called as
Option A:	Die-electric fluid
Option B:	Photopolymer Resin
Option C:	Kerosene
Option D:	Electrolyte
10.	As the cutting speed increases, the handling cost
Option A:	Remains same
Option B:	Increases
Option C:	Highly decreases
Option D:	Slightly decreases
11.	In which process, the material is removed from selected areas of the workpiece.
Option A:	Chemical Machining
Option B:	Water Jet Machining
Option C:	Electron beam machining
Option D:	Plasma arc machining
12.	This angle in single point cutting tool provides a clearance to the side flank of the tool to prevent rubbing of the workpiece.
Option A:	Back rake angle
Option B:	End relief angle
Option C:	End cutting edge angle
Option D:	Side relief angle
13.	Determine chip thickness ratio if uncut chip thickness is 0.2 mm and chip thickness is 0.4mm.
Option A:	0.5
Option B:	0.18
Option C:	0.28

Option D:	3.6
14.	In Rapid Prototyping process, the first step is
Option A:	Cleaning and Finishing
Option B:	CAD Model
Option C:	Part orientation
Option D:	Checking STL files
15.	Straight or helical grooves cut in the body of the drill to provide cutting edges, to allow chip removal, and to allow cutting fluid to reach the cutting edges is called as
Option A:	Margin
Option B:	Land
Option C:	Chisel edge
Option D:	Flutes
16.	The formation of depression at the tool-chip interface is called as
Option A:	Crater wear
Option B:	Flank wear
Option C:	Corrosive wear
Option D:	Adhesion wear
17.	Following element is used in the design of milling fixture.
Option A:	Toolpost
Option B:	Tailstock
Option C:	Chuck
Option D:	Setting block
18.	Following is an example of Solid based prototyping systems
Option A:	Fused Deposition Modelling
Option B:	Selective Laser Sintering
Option C:	3 D Printing
Option D:	Stereo lithography
19.	It is a multipoint tool whose teeth remove the whole machining allowance in a single stroke.
Option A:	Single point cutting tool
Option B:	Parting tool
Option C:	Broach
Option D:	Threading tool
20.	After the completion of cutting action, the blank is ejected by the following element out of cutting edge that may be jammed.
Option A:	stock stop
Option B:	knockout plate
Option C:	stock guide
Option D:	pilots

Q2	Solve any Four out of Six	5 marks each
A	Explain Mechanics of chip formation.	
B	Explain factors considered for selection of grinding wheel.	
C	Explain constructional features of Compound die.	
D	What are the basic steps in Rapid Prototyping.	
E	Give classification of Nontraditional machining.	
F	Explain Template jig and Plate jig.	

Q3.		
A	**Solve any Two**	**5 marks each**
i.	Explain in short: FDM process.	
ii.	What are the advantages and disadvantages of Laser beam machining process.	
iii.	Write note on: Scrap strip layout	
B	**Solve any One**	**10 marks each**
i.	A seamless tube of 50mm outside diameter is turned on a lathe with a cutting speed of 20 m/min. the tool rake angle is 15^0 and feed rate is 0.2mm/rev. the length of continuous chip in one revolution measures 80mm. Calculate i) Chip thickness ratio ii) Shear plane angle iii) Chip velocity iv) Shear strain v) Shear strain rate	
ii.	With the help of neat sketches, explain the methods of reducing cutting forces.	

University of Mumbai
Examination 2021 under cluster 9 (FAMT)
Examinations Commencing from 1st June 2021
Program: Mechanical Engineering
Curriculum Scheme: Rev 2016
Examination: SE Semester IV
Course Code: MEC405 and Course Name: Kinematics of Machinery
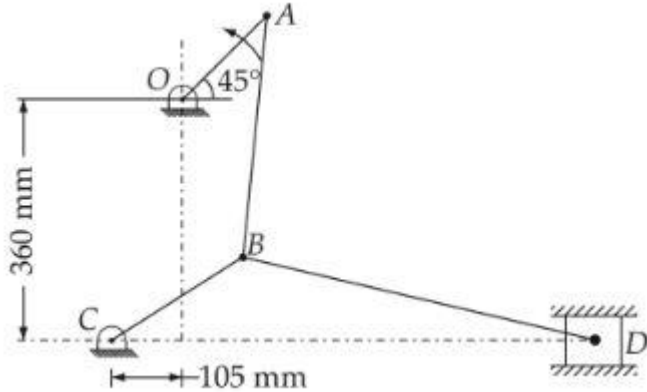
Time: 2 hour   Max. Marks: 80

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Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	When a body of mass moment of inertia I (about a given axis) is rotated about that axis with an angular velocity, then the kinetic energy of rotation is
Option A:	$0.5\ I.\omega$
Option B:	$I.\omega$
Option C:	$0.5\ I.\omega^2$
Option D:	$I.\omega^2$
2.	Which of the following factors are related by work energy principle?
Option A:	force, displacement and time
Option B:	force, velocity, time and mass
Option C:	force, velocity, displacement
Option D:	displacement, time and mass
3.	The two elements of a pair are said to form a _____ when they permit relative motion between them.
Option A:	open pair
Option B:	kinematic pair
Option C:	higher pair
Option D:	lower pair
4.	The Whitworth quick return motion mechanism is formed in a slider crank chain when the
Option A:	coupler link is fixed
Option B:	longest link is a fixed link
Option C:	slider is a fixed link
Option D:	smallest link is a fixed link
5.	Which of these is an approximate straight line motion mechanism?
Option A:	Scott Russell's mechanism
Option B:	Hart's mechanism
Option C:	Peaucellier mechanism
Option D:	Watt's mechanism
6.	_____mechanism is a crossed four bar chain mechanism in early steam engines to guide the piston rod in a cylinder to have an approximate straight line motion.
Option A:	Peaucellier's

Option B:	Chebychev's
Option C:	Grasshopper
Option D:	Watt's
7.	What is the purpose of double hooke's joint?
Option A:	Have constant linear velocity ratio of driver and driven shafts
Option B:	Have constant acceleration ratio of driver and driven shafts
Option C:	Have constant angular velocity ratio of driver and driven shafts
Option D:	Have constant angular acceleration ratio of driver and driven shafts
8.	The linear velocity of a point relative to another point on the same link is _____ to the line joining the points.
Option A:	Perpendicular
Option B:	Parallel
Option C:	at 45°
Option D:	at 60°
9.	According to Aronhold Kennedy's theorem, if three bodies move relatively to each other, their instantaneous centres will lie on a
Option A:	straight line
Option B:	parabolic curve
Option C:	Ellipse
Option D:	Hyperbola
10.	In a rotary engine the angular velocity of the cylinder center line is 25 rad/sec and the relative velocity of a point on the cylinder center line w.r.t. cylinder is 10 m/sec. Corioli's acceleration will be
Option A:	250 m/sec^2
Option B:	500 m/sec^2
Option C:	1000 m/sec^2
Option D:	2000 m/sec^2
11.	The linear velocity of a rotating body is given by the relation
Option A:	$v = r\omega$
Option B:	$v = r/\omega$
Option C:	$v = \omega/r$
Option D:	$v = 2\omega/r$
12.	Angle of ascent of cam is defined as the angle
Option A:	during which the follower returns to its initial position
Option B:	of rotation of the cam for a definite displacement of the follower
Option C:	through which the cam rotates during the period in which the follower remains in highest position
Option D:	moved by the cam from the instant the follower begins to rise, till it reaches its highest position
13.	In cycloidal motion of cam follower, the maximum acceleration of follower motion a_{max} at $\theta = \varphi/4$ is_____(where : h = Maximum follower displacement ω = Angular velocity of cam, φ=Angle for the maximum follower displacement for cam rotation

Option A:	$\dfrac{h\pi\omega^2}{2\varphi^2}$
Option B:	$\dfrac{3h\pi\omega^2}{2\varphi^2}$
Option C:	$\dfrac{2h\pi\omega^2}{\varphi^2}$
Option D:	$\dfrac{3h\pi\omega^2}{\varphi^2}$
14.	When two pulleys of different diameters are connected by means of an open belt drive, then the angle of contact taken into consideration should be of the
Option A:	Larger pulley
Option B:	Smaller pulley
Option C:	Average of two pulleys
Option D:	difference of two pulleys
15.	Centrifugal tension in belts is
Option A:	Useful because it maintains some tension even when no power is transmitted
Option B:	Not harmful because it does not take part in power transmission
Option C:	Harmful because it increases belt tension and reduces the power transmitted
Option D:	A hypothetical phenomenon and does not actually exist in belts
16.	The percentage improvement in power capacity of a flat belt drive, when the wrap angle at the driving pulley is increased from 150° to 210° by an idler arrangement for a friction coefficient of 0.3, is
Option A:	25.21
Option B:	33.92
Option C:	40.17
Option D:	67.85
17.	What shall be the centre distance between the axes of pinion and gear when a 20° full-depth involute profile pinion with 20 teeth meshes with a gear that has 50 teeth for a module of 6 mm?
Option A:	70 mm
Option B:	140 mm
Option C:	210 mm
Option D:	280 mm
18.	To have a velocity ratio of 50,the appropriate gears will be
Option A:	Spur gears
Option B:	Helical gears
Option C:	Worm and worm wheel
Option D:	Bevel gears
19.	A differential uses_____ gear train
Option A:	Simple
Option B:	Epicyclic
Option C:	Reverted
Option D:	Compound

20.	Tooth interference in an external involute spur gear pair can be reduced by
Option A:	decreasing center distance between gear pair
Option B:	decreasing module
Option C:	decreasing pressure angle
Option D:	increasing number of gear teeth

Q2. (20 Marks Each)	
A	**Solve any Two. (5 marks each)**
i.	Sketch and explain any two inversions of a double slider crank chain.
ii.	Explain Peaucellier's mechanism
iii.	State and prove Kennedy's theorem
B	**Solve any One** **10 marks each**
i.	In the toggle mechanism shown in Fig. the slider D is constrained to move on a horizontal path. The crank OA is rotating in the counterclockwise direction at a speed of 180 r.p.m. increasing at the rate of 50 rad/sec. The dimensions of the various links are as follows: OA = 180 mm; CB = 240 mm; AB = 360 mm and BD = 540 mm. For the configuration given, find acceleration of the slider D
ii.	Use following data of cam in which a knife edge follower is raised with uniform acceleration and deceleration and is lowered with simple harmonic motion: least radius of cam = 60 mm, Lift of follower = 45 mm, Angle of ascent = 60°, dwell between ascent and descent = 40°, Angle of descent = 70° If cam rotates at 180 rpm, determine maximum velocity and acceleration during ascent and descent

Q3. (20 Marks Each)	
A	**Solve any Two.(5 marks each)**
i.	With the help of neat sketch explain the terms base circle, prime circle and pitch circle with respect to cams
ii.	Explain self-locking and self-energizing brakes
iii.	With neat sketch explain interference in involute gears
B	**Solve any One** **10 marks each**
i.	In an epicyclic gear train an annular wheel A having 54 teeth meshes with a

		planet wheel B which gears with a sun wheel C, the wheel A and C being co-axial. The wheel B is carried on a pin fixed on one end of arm P which rotates at 100 rpm about the axis of the wheel A and C. If the wheel A makes 20 rpm in clockwise sense and the arm rotates at 100 rpm in anti clockwise direction and C has 24 teeth, Sketch the arrangement and determine rpm and sense of rotation of wheel C
	ii.	A v-belt having face width equal to 22 mm and nominal thickness equal to 14 mm is used to transmit power with 'V' groove angle 40°. If the mass of the belt is 0.4 kg/m and maximum allowable stress is 1.5 N/mm, determine the maximum power that can be transmitted. Angle of contact is 155° and co-efficient of friction is 0.2.

University of Mumbai
Examination 2021 under cluster 9 (FAMT)
Examinations Commencing from 1ˢᵗ June 2021
Program: **BE(MECHANICAL)**
Curriculum Scheme: Rev2019 'C' Scheme
Examination: SE Semester IV
Course Code: **MEC401** and Course Name:**Engineering Mathematics-4**

Time: 2 hour   Max. Marks: 80

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Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	Find the value of a if $\bar{F} = (x - 2z)i + (y - 5x)j + (az + 2x)k$ is solenoidal
Option A:	$a = 2$
Option B:	$a = -2$
Option C:	$a = -4$
Option D:	$a = 4$
2.	Vector field is Irrotational if
Option A:	$\nabla \times \vec{f} = 0$
Option B:	$\nabla . \vec{f} = 0$
Option C:	$\nabla \times \vec{f} \neq 0$
Option D:	$\nabla . \vec{f} = 1$
3.	The residue at the pole z =-1 of $f(z) = \frac{1}{(z+1)(z-2)^2}$ is
Option A:	1/3
Option B:	-1/3
Option C:	1/9
Option D:	-1/9
4.	The poles of $f(z) = \frac{3z-1}{(z+1)(z-2)}$ are
Option A:	1,-2
Option B:	-1,-2
Option C:	-1,2
Option D:	1,2
5.	Value of $\int_c \frac{sin2z \, dz}{(z + \pi/3)^4} dz$ is where C:$|z| = 2$
Option A:	$4\pi i/3$
Option B:	$\pi i/3$
Option C:	$2\pi i/3$
Option D:	$4\pi i$
6.	*The value of* $\int_0^{1+i} \bar{z} \, dz$ along straight line y=x is
Option A:	0
Option B:	2

Option C:	3
Option D:	1
7.	If the two regression coefficient are -8/15 and -5/6 then the correlation coefficient is
Option A:	0.667
Option B:	-0.507
Option C:	-0.667
Option D:	0.607
8.	Line of regression y on x is 8x-10y +66 =0. Line of regression x on y is 40x -18y -214 =0. The value of variance of y is 16. The standard deviation of x is
Option A:	3
Option B:	2
Option C:	6
Option D:	7
9.	$\sum xy = 2638, \bar{x} = 14, \bar{y} = 17$, n=10 then cov (x,y) is
Option A:	24.2
Option B:	25.8
Option C:	23.9
Option D:	20.5
10.	Least square fit for the straight line y= ax + b to the data

x	1	2	3
y	5	7	9

Option A:	y = 2x +4
Option B:	y = 2x -3
Option C:	y = 2x +3
Option D:	y = 3x -4
11.	A random variable X has the following probability distribution. The value of K is

x	2	3	4	5
P(x)	5/K	7/K	9/K	11/K

Option A:	16
Option B:	8
Option C:	48
Option D:	32
12.	In Poisson distribution if n = 100, p = 0.01, then the value of P(r = 0)
Option A:	1/e
Option B:	2/e
Option C:	3/e
Option D:	1/4e
13.	A continuous random variable X has pdf f(x) = kx; $0 \le x \le 1$ and k; $1 \le x \le 2$ .then the value of k
Option A:	2
Option B:	2/3

Option C:	3/2
Option D:	3
14.	If random variable X takes the values of x=1,2,3 with corresponding Probabilities 1/6, 2/3 1/6 then E(x) is
Option A:	1
Option B:	3
Option C:	4
Option D:	2
15.	Number of road accident on a highway during a month follows a Poisson distribution with mean 2. Probability that in certain month number of accidents in the highway will be equal to 2 is
Option A:	0.354
Option B:	0.2707
Option C:	0.435
Option D:	0.521
16.	In a normal distribution when mean is 1 and S.D =3 then for the intervals $-1.43 \leq x \leq 6.19$ (for z = -0.81, A= 0.2910, for z =1.73 ,A = 0.4582)
Option A:	0.7492
Option B:	0.4582
Option C:	0.2910
Option D:	0.1672
17.	X is normally distributed $\mu = 15,\ \sigma^2 = 9$. Given that for z=1, A=0.3413 $P(X \geq 18)$ is given by
Option A:	0.1587
Option B:	0.4231
Option C:	0.2231
Option D:	0.3413
18.	In normal distribution. The area under standard normal curve to the right of y axis is
Option A:	1
Option B:	0
Option C:	0.5
Option D:	0.6
19.	If observed frequencies are 5,10,15 and expected frequencies are each equal to 10 then chi square value is
Option A:	20
Option B:	10
Option C:	15
Option D:	5
20.	Among 64 offspring of a certain cross between guinea pig 34 were red,10 were black and 20 were white, According to genetic model these number should in the ratio 9:3:4. Expected frequencies in the order
Option A:	36,12,16
Option B:	12,36,16
Option C:	20,12,16

Option D:	36,12,35

Q2	**Solve any Four out of Six** **5 marks each**
A	*Evaluate by Green's theorem for the field* $\vec{F} = x^2\hat{i} + xy\hat{j}$ *over the region R enclosed by* y=x² *and line* y=x
B	Evaluate $\int_c \frac{\sin \pi z^2 + \cos \pi z^2}{(z-1)(z-2)} dz$; c is $|z| = 3$
C	Determine the coefficient of correlation between X & Y from the following data <table><tr><td>X</td><td>51</td><td>54</td><td>56</td><td>59</td><td>65</td><td>60</td><td>70</td></tr><tr><td>Y</td><td>38</td><td>44</td><td>33</td><td>36</td><td>33</td><td>23</td><td>13</td></tr></table>
D	There is working women's hostel in a town where 75 % are from neighboring town, the rest all are from same town. 48% of women who hail from same town are graduates and 83 % of the women who have come from neighboring town are also graduates. Find the probability that a woman selected at a random is graduates from the same town.
E	In a certain examination test 2000 students appeared in a subject of statistics. Average marks obtained were 50% with standard deviation 5%. How many students do you expect to obtain more than 60% of marks, supposing that marks are distributed normally? (For z =2, A =0.4772)
F	The following table gives the number of accidents in a district during a week. Apply chi-square test to find whether the accidents are uniformly distributed over the week. <table><tr><td>Day</td><td>Sun</td><td>Mon</td><td>Tues</td><td>Wed</td><td>Thu</td><td>Fri</td><td>Sat</td></tr><tr><td>No.of accidents</td><td>13</td><td>12</td><td>11</td><td>9</td><td>15</td><td>10</td><td>14</td></tr></table> ($Table\ value\ of\ \chi^2 = 12.59, d.f = 6, level\ of\ significance = 5\%$)

Q3	Solve any Four out of Six	5 marks each
A	*Evaluate using Stokes theorem $\iint_s (\nabla \times \bar{f}).\hat{n}\,ds$ where s is curve surface of the paraboloid $x^2 + y^2 = 2z$ bounded by the plane z=2 where* $$\vec{f} = 3(x-y)\hat{i} + 2xz\hat{j} + xy\hat{k}$$	
B	Obtain Laurent's series expansions of f(x) = $\frac{z-1}{z^2-2z-3}$;$|z| > 3$	
C	Calculate the Spearman's rank correlation coefficient for the following data.	

x	32	55	49	60	43	37	43	49	10	20
y	40	30	70	20	30	50	72	60	45	25

D	A C.R.V X has the following pdf. $f(x) = k(x - x^2); 0 \leq x \leq 1$ Find K and mean	
E	Ten individuals are chosen at random from a population & their height are found to be (inches): 63,63,64,65,66,69,69,70,70 &71. In the light of the data, discuss the suggestion that the mean height in the population is 66 inches. (Table value of t_α=2.6, d.f =9, *level of significance* = 5%))	
F	Standard deviation of two samples of size 9 & 13 were found to be 12.15 & 11.85. Can it be concluded that the samples were drawn from the normal population with the same standard deviation? (Given $F_{0.025} = 3.51\ for\ d.o.f.\ 8\&\ 12\ \&F_{0.025} = 4.20\ for\ d.o.f.\ 12\&\ 8$)	

University of Mumbai
Examination 2021 under cluster 9 (FAMT)
Examinations Commencing from 1ˢᵗ June 2021
Program: Mechanical Engineering
Curriculum Scheme: Rev 2019
Examination: SE Semester IV
Course Code: MEC402 and Course Name: Fluid Mechanics

Time: 2 hour   Max. Marks: 80

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Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	If liquid has specific gravity 0.2, then what is weight density of the liquid?
Option A:	200 N/m³
Option B:	2000 N/m³
Option C:	1962 N/m³
Option D:	1.962 N/m³
2.	A fluid in which shear stress …….. than the yield value & shear stress is not proportional to the rate of shear strain is known a………
Option A:	more, Thyxotropic fluid
Option B:	less, Thyxotropic fluid
Option C:	more, Ideal plastic fluid
Option D:	less, Ideal plastic fluid
3.	The magnitude of the buoyant force can be determined by
Option A:	Archimedes' principle
Option B:	Newton's second law of motion
Option C:	Principle of moments
Option D:	Principle of energy
4.	In dimensional analysis the Buckingham's π–theorem is widely used and expresses the resulting equation in terms of
Option A:	the repeating variables
Option B:	geometric, kinematic and dynamic variables
Option C:	(n – m) dimensionless parameters
Option D:	n dimensionless parameters
5.	A ………… gives the path of one particular particle at successive instants of time, whereas……….. indicates the direction of a number of particles at the same instant
Option A:	path line, stream line
Option B:	path line, energy line
Option C:	stream line, Streak line
Option D:	path line, vertical line
6.	Find the velocity at a point (1, 1, 2) after 1 sec. for a 3D flow given by u = yz, v =

	$xz - t$, $w = xy + t$ m/s
Option A:	1
Option B:	2
Option C:	3
Option D:	0.5
7.	In ………. method equations of motion are very difficult to solve and the motion is hard to understand.
Option A:	Eulerian Method
Option B:	Langrangian Method
Option C:	viscous method
Option D:	pressure method
8.	………… is not a assumptions of Bernoulli's equation
Option A:	The liquid is ideal
Option B:	The flow is steady and continuous
Option C:	The liquid is incompressible
Option D:	Fluid is in static condition
9.	The term $V^2/2g$ is known as
Option A:	kinetic energy
Option B:	pressure energy
Option C:	kinetic energy per unit weight
Option D:	Potential energy
10.	In which of the following measuring devices Bernoulli's equation is not used:
Option A:	Venturimeter
Option B:	Orificemeter
Option C:	Pitot tube
Option D:	Manometer
11.	F.dt = d(mv) This equation is called as
Option A:	Euler momentum equation
Option B:	Navier stokes equation
Option C:	Impulse-momentum equation
Option D:	Energy equation
12.	The co-efficient of discharge of an Orificemeter is……… that of a Venturimeter.
Option A:	equal to
Option B:	smaller than
Option C:	much more than
Option D:	depend on working condition
13.	What is fully developed flow?
Option A:	Where pressure is constant along flow direction
Option B:	Where velocity is constant along flow direction
Option C:	Where force is constant along flow direction
Option D:	Where temperature is constant along flow direction

14.	Find Reynolds number if velocity of fluid is 2 m/s and density of fluid 800 kg/m^3 and Viscosity 0.2 N.s/m^2 is flowing through 0.25 m diameter pipe.
Option A:	2000
Option B:	200
Option C:	20
Option D:	2
15.	In Navier stokes equation consider following forces
Option A:	Pressure and gravitational forces
Option B:	Viscous, gravitational and pressure forces
Option C:	Viscous, gravitational and surface tension forces
Option D:	Pressure and viscous forces
16.	Potential, kinetic and pressure heads are considered for
Option A:	Energy gradient line
Option B:	Potential gradient line
Option C:	Hydraulic gradient line
Option D:	Pressure gradient line
17.	When the pipes are connected in parallel, the total loss of head
Option A:	is equal to the sum of the loss of head in each pipe
Option B:	is same as in each pipe
Option C:	is equal to the reciprocal of the sum of loss of head in each pipe
Option D:	is equal to the difference of the losses of head in pipes
18.	In a pipe flow the minor losses are those
Option A:	which depend on the length of the pipeline
Option B:	caused by friction and are thus also called friction losses.
Option C:	which have a large magnitude
Option D:	which are caused on account of total disturbance produced by such fittings as valves, bends, etc
19.	Which of following statements is correct for bluff bodies?
Option A:	The total drag is considerably larger as compared to that for streamlined bodies
Option B:	No friction drag act on the bodies
Option C:	The total drag is much less as compared to that for streamlined bodies
Option D:	Bodies are coincided with the stream line
20.	Boundary layer on a flat plate is called laminar boundary layer if
Option A:	Reynolds number is less than 2000
Option B:	Reynolds number is less than 4000
Option C:	Reynolds number is less than 5×10^5
Option D:	Reynolds number is more than 5×10^5

Q2. (20 Marks)	Solve any Four Questions out of Six (5 marks each).
A	Write short notes on types of fluids
B	Define stream function and velocity potential function.
C	A venturimeter with 150 mm diameter at inlet and 100 mm at throat is laid with its axis horizontal and is used for measuring the flow of oil of sp. gr. 1. The oil mercury differential manometer shows a gauge difference of 200 mm. Calculate the discharge. Assume the co-efficient of meter as 0.98.
D	An oil of viscosity 1 poise and relative density 0.9 is flowing through a circular pipe of diameter 50 mm and of length 300 m. The rate of flow of liquid is 0.0035 m^3 /s. Find the pressure drop in a length of 300 m and shear stress at the wall.
E	The main pipe divides into two parallel pipes which again form one pipe. The data is as follows : First parallel pipe; Length = 900 m; diameter = 0.7 m; Second parallel pipe : Length = 900 m; diameter = 0.5 m; Coefficient of friction for each parallel pipe = 0.0045. If the total rate of flow in the main is 1.8 m^3 /s find the rate of flow in each parallel pipe.
F	Write short note on boundary layer separation.

Q3. (20 Marks)	Solve any Two Questions out of Three (10 marks each).
A	Determine the total pressure and centre of pressure on a plane rectangular surface of 1 m wide and 3 m deep when its upper edge is horizontal and (a) coincides with water surface (b) 2 m below the free water surface.
B	Deive Eular's equation of motion in cartesian coordinate system.
C	A two-dimensional flow field is given by φ = 3xy, determine: (i) The stream function. (ii) The velocity at L(2, 6) and M (6,6) and the pressure difference between the points L and M.

University of Mumbai
Examination 2021 under cluster 9 (FAMT)
Examinations Commencing from 1st June 2021
Program: Mechanical Engineering
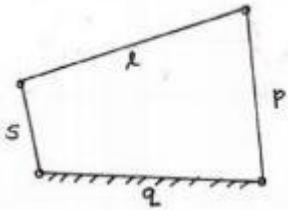Curriculum Scheme: Rev 2019
Examination: SE Semester IV
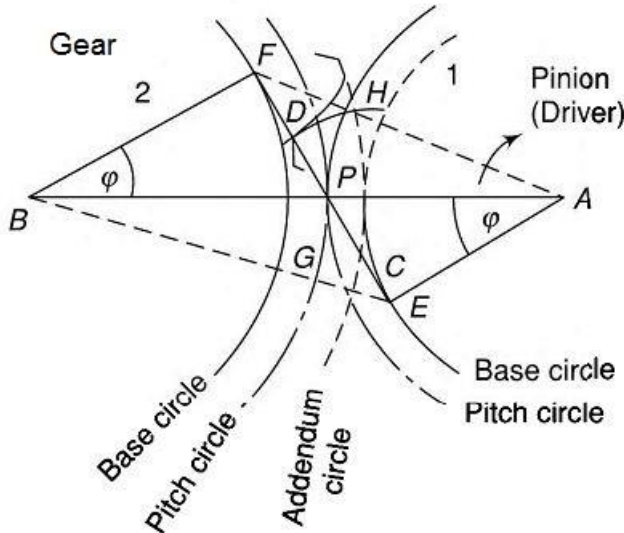Course Code: MEC403 and Course Name: Kinematics of Machinery

Time: 2 hour   Max. Marks: 80

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Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	According to work energy principle, a particle of mass m when subjected to unbalanced force system, the work done during displacement by all forces is equal to change in _____ during displacement.
Option A:	gravitational energy
Option B:	kinetic energy
Option C:	mechanical energy
Option D:	potential energy
2.	According to Grashoff's Law, which condition is true for given mechanism (where l and s are lengths of longest and shortest links, p and q are lengths of remaining two links)
Option A:	$(l+s) \geq (p+q)$
Option B:	$(l+s) = (p+q)$
Option C:	$(l+s) \leq (p+q)$
Option D:	$(l+p)=(s+q)$
3.	In constrained kinematic chain
Option A:	Definite relation between input and output
Option B:	No relation between input and output
Option C:	No relative motion between links
Option D:	Last link is not connected to first link
4.	Hart mechanism consists of _____ links
Option A:	4
Option B:	6
Option C:	8
Option D:	10
5.	Pantograph is not used to
Option A:	Copy the diagrams on enlarged scale
Option B:	Copy the diagrams on reduced scale

Option C:	Obtain exact straight-line motion
Option D:	Copy the diagram to 1:1 scale
6.	To Locate I_{26}, intersection of two lines passing through_____ and _____ is required (Refer below given Kennedy's Circle)

Option A:	I_{12}-I_{16} and I_{25}-I_{56}
Option B:	I_{12}-I_{16} and I_{24}-I_{46}
Option C:	I_{25}-I_{56} and I_{24}-I_{45}
Option D:	I_{12}-I_{15} and I_{24}-I_{25}
7.	A body in motion will be subjected to Corioli's acceleration when that body is
Option A:	in plane rotation with variable velocity
Option B:	in plane translation with variable velocity
Option C:	in plane motion which is a resultant of plane translation and rotation
Option D:	restrained to rotate while sliding over another body
8.	The magnitude of linear velocity of a point B on a link AB relative to point A is
Option A:	$\omega . AB$
Option B:	$\omega . (AB)^2$
Option C:	$\omega^2 . (AB)$
Option D:	$(\omega . AB)^2$
9.	The instantaneous centre of rotation of a rigid thin disc rolling on a plane rigid surface is located at
Option A:	the centre of the disc
Option B:	an infinite distance on the plane surface
Option C:	the point of contact
Option D:	the point on the circumference situated vertically opposite to the contact point
10.	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°
11.	A radial follower is one
Option A:	that reciprocates in the guides
Option B:	that oscillates
Option C:	in which the follower translates along an axis passing through the cam centre of rotation.
Option D:	moves in random direction

12.	Which of the following statements is false for SHM follower motion?
Option A:	SHM can be used only for moderate speed purpose
Option B:	The acceleration is zero at the beginning and the end of each stroke
Option C:	The jerk is maximum at the mid of each stroke
Option D:	Velocity of follower is maximum at the mid of each stroke
13.	Cam and follower is example of
Option A:	Higher pair
Option B:	Lower Pair
Option C:	Rolling Pair
Option D:	Sliding Pair
14.	The power transmitted by a belt is maximum when the maximum tension in the belt (T) is equal to
Option A:	T_C
Option B:	$2T_C$
Option C:	$3T_C$
Option D:	$4T_C$
15.	A shaft runs at 100 rpm and drives another shaft at 160 rpm through belt drive. The diameter of the driving pulley is 660 mm .Determine the diameter of the driven pulley by taking the belt thickness as 5 mm
Option A:	400.00 mm
Option B:	415.50 mm
Option C:	410.63 mm
Option D:	417.50 mm
16.	The following data relate to two meshing gears, velocity ratio=1/3, Module = 6 mm, pressure angle= 20^0, center distance = 360 mm, determine the number of teeth on the gear wheel.
Option A:	75
Option B:	100
Option C:	25
Option D:	90
17.	The path of contact in involute tooth profile is a
Option A:	Parabola
Option B:	Circle
Option C:	Straight line
Option D:	Curve
18.	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
19.	A fixed gear having 200 teeth is in mesh with another gear having 50 teeth. The two gears are connected by an arm. The number of turns made by the smaller gear for one revolution of arm about the centre of bigger gear is

Option A:	2
Option B:	4
Option C:	3
Option D:	6
20.	With reference to the following figure, in order to avoid interference of teeth, radius of addendum circle for gear cannot be greater than

Option A:	BE
Option B:	BG
Option C:	AF
Option D:	AH

Q2. (20 Marks Each)	
A	**Solve any Two. (5 marks each)**
i.	Explain successfully constrained motion with sketches of examples
ii.	Explain Hooke's Joint
iii.	What are centripetal and tangential components of acceleration? When do they occur? How are they determined?
B	**Solve any One** **10 marks each**
i.	The dimensions of a mechanism as shown in the figure are as follows: AB = 0.45 m, BD = 1.5 m, BC = CE =0.9 m. The crank AB turns uniformly at 180 rpm in the clockwise direction and the blocks at D and E are working in frictionless guides. Draw the velocity diagram for the mechanism and find the velocities of the sliders D and E in their guides using relative velocity method

ii.	A cam with a minimum radius of 25 mm is to be designed for a knife edge follower with the following data :— (i) to raise the follower through 35 mm during 60° rotation of the cam. (ii) dwell for the next 40° of the cam rotation. (iii) descending of the follower during the next 90° of the cam rotation. (iv) dwell during the rest of the cam rotation. if the ascending and descending of the cam is with SHM and UARM respectively. Calculate maximum values of velocity, acceleration, and jerk if the cam rotates at 150 rpm.

Q3. (20 Marks Each)	
A	**Solve any Two. (5 marks each)**
i.	Why Cycloidal motion of follower is preferred for high speed applications? Explain with suitable sketch
ii.	Derive an expression for centrifugal tension in belt
iii.	Compare Cycloidal and involute tooth forms.
B	**Solve any One** **10 marks each**
i.	Two mating gears have 40 & 60 involute teeth of module 10 mm & 20^0 pressure angle. The addendum on each wheel is to be made of such a length that the line of contact on each side of the pitch point has half the maximum possible length. Determine the a) addendum height for each gear wheel, b) length of path of contact, & arc of contact & c) contact ratio.
ii.	2.5 kW of power is transmitted by an open-belt drive. The linear velocity of the belt is 2.5 m/s. The angle of lap on the smaller pulley is 165° .The coefficient of friction is 0.3. Determine the effect on power transmission in the following cases: i) Initial tension in the belt is increased by 10% ii) Initial tension in the belt is decreased by 10 % iii) Angle of lap is increased by 10% by the use of an idler pulley, for the same speed and the tension on the tight side

University of Mumbai
Examination 2021 under cluster 9 (FAMT)
Examinations Commencing from 1st June 2021
Program: Mechanical Engineering
Curriculum Scheme: Rev 2019
Examination: SE Semester IV
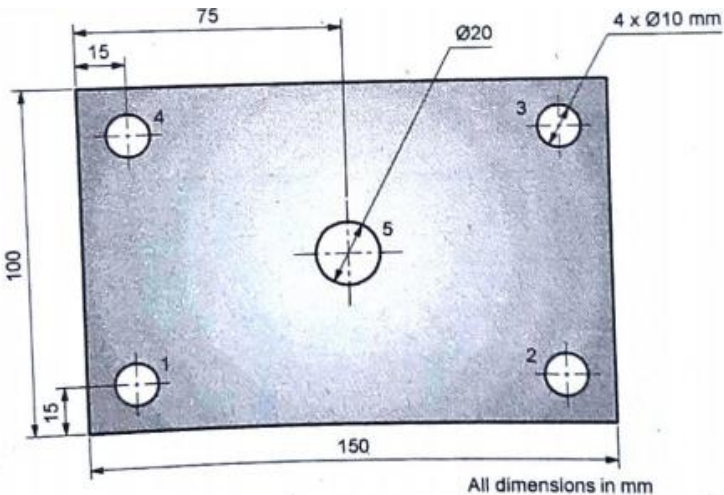Course Code: MEC404 and Course Name: CAD/CAM

Time: 2 hour   Max. Marks: 80

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Q1.	**Choose the correct option for following questions. All the Questions are compulsory and carry equal marks**
1.	Which gives calculation of properties like mass, volume etc.
Option A:	Wireframe modeling
Option B:	Solid modeling
Option C:	Sketching
Option D:	Drafting
2.	Which of the following modeling type includes Boolean operations?
Option A:	Surface modeling
Option B:	Wireframe modeling
Option C:	CSG Modeling
Option D:	Bezier curve plotting
3.	The coordinate of a point A(4,6) when reflected about Y axis will be
Option A:	(4,6)
Option B:	(-4, 6)
Option C:	(4, -6)
Option D:	(-4, -6)
4.	In Standard 3D transformation , a geometry is rotated about a
Option A:	Point
Option B:	Line
Option C:	Plane
Option D:	Solid
5.	Which of the technique is a contact type imaging technique to get internal data?
Option A:	Ultrasound
Option B:	CT
Option C:	CBCT
Option D:	MRI
6.	Which of the following is slicing software which can be used for printing BioCAD model?
Option A:	Cura
Option B:	3D Slicer
Option C:	Solidworks
Option D:	Blender
7.	Which of the following technique will provide an image with best visibility in

	terms of resolution?
Option A:	Ultrasound
Option B:	Radiography
Option C:	Fluoroscopy
Option D:	MRI
8.	Which of the following is a variable length binary format?
Option A:	.hrd
Option B:	.nii
Option C:	.mnc
Option D:	.dcm
9.	---------------------- miscellaneous function is used to turn the spindle as shown in figure
Option A:	M04
Option B:	M05
Option C:	M03
Option D:	M06
10.	Designation of main axes (X,Y,and Z) used in Turning Center is based on the Right Hand Rule, Assign the correct sequence of axis for the index finger, middle finger and thumb of the right hand.
Option A:	Z-Y-X
Option B:	Y-Z-X
Option C:	X-Y-Z
Option D:	Y-X-Z
11.	What purpose does support material serve in 3D printing?
Option A:	It increases the durability of the final product
Option B:	It allows easier assembly and post-processing
Option C:	It reduces waste
Option D:	It supports layers as they are printed, functioning as scaffolding
12.	Material in form of filament is used in
Option A:	SLA
Option B:	SLS
Option C:	LOM
Option D:	FDM
13.	Following …………is one of the type of additive manufacturing process
Option A:	Drilling
Option B:	Milling
Option C:	Forging
Option D:	Polyjet Modeling
14.	……….is the prepossessing of rapid prototyping technology.

Option A:	Part building
Option B:	Support generation
Option C:	Cleaning
Option D:	Finishing
15.	Which of the following process gives more dimensional accuracy in a product
Option A:	SLA
Option B:	FDM
Option C:	SLS
Option D:	LOM
16.	In STL, a valid model would be one whose one edge is shared by ....facets only.
Option A:	1
Option B:	2
Option C:	3
Option D:	4
17.	Process of converting STL file model in to layers is called……………..in RP.
Option A:	Chopping
Option B:	Slicing
Option C:	Cutting
Option D:	Trimming
18.	--------------------------- considered as a tool which offers visualization for Virtual Manufacturing.
Option A:	Magnifying Lens
Option B:	Virtual Reality
Option C:	Atomic Microscope
Option D:	Electronic Microscope
19.	Which statement best defines "Augmented Reality"
Option A:	Technology that overlays digital information on top of real world items
Option B:	Technology that turns physical objects into digital objects
Option C:	Technology that puts users in a new digital environment
Option D:	Technology that can achieve a human level understanding of images.
20.	The -------------------------------- leads the physical movements of the employees, labor and material resources in the organization has been reduced and converted to the digital movements.
Option A:	Subtractive Manufacturing
Option B:	Virtual Manufacturing
Option C:	Additive Manufacturing
Option D:	Conventional Manufacturing

Q2 (20 Marks)	Solve any Two Questions out of Three (10 marks each)
A	Determine the equation and degree of a Bezier Curve defined by a control polygon with vertices P_0 (2, 3), P_1 (3, 4), P_2 (3, 2), P_3 (4, 0). Generate at least five points on the curve.
B	A triangle ABC having vertices A (10, 5), B (20, 15) and C (25, 30) is reflected about a line y = -x. Determine the composite transformation matrix and the new coordinates of the triangle.
C	Write a manual part program to drill all the holes on component as shown in figure. The thickness of the component is 10 mm. Assume suitable data of speed and feed.

Q3 (20 Marks)	Solve any Four out of Six (5 marks each)
A	Explain 2D and 3D computer graphics representation.
B	State the matrices to align a 3D vector with Z axis.
C	Explain the difference between CT Scan and MRI imaging techniques.
D	State the comparison between CNC and DNC machines.
E	Explain post processing activities in rapid prototyping.
F	Explain the benefits of Virtual manufacturing to the Manufacturing Industries.