

AIKTC/KRRC/SoET/ACKN/QUES/2021-22/

Date: 02/08/2022School: SoET-REV. C-SCHEME Branch: MECH. ENGG. SEM: IV

To,
Exam Controller,
AIKTC, New Panvel.

Dear Sir/Madam,

Received with thanks the following **Semester/Unit Test-I/Unit Test-II (Reg./ATKT)** question papers from your exam cell:

Sr. No.	Subject Name	Subject Code	Format		No. of Copies
			SC	HC	
1	Engineering Mathematics-IV	MEC401		✓	
2	Fluid Mechanics	MEC402		✓	
3	Kinematics of Machinery	MEC403		✓	
4	CAD/CAM	MEC404		✓	
5	Industrial Electronics	MEC405		✓	

Note: SC – Softcopy, HC - Hardcopy

(Shaheen Ansari)
Librarian, AIKTC

Sem - III, R. 19

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	What is the Laplace transform of $\int_0^t \sin 5u \, du$?
Option A:	$\frac{5}{s(s^2 + 25)}$
Option B:	$\frac{5}{s(s^2 - 25)}$
Option C:	$\frac{1}{s(s^2 - 25)}$
Option D:	$\frac{1}{s^2 + 25}$
2.	Find value of b_n in the Fourier expansion of function $f(x) = (2 - x^2)$ in the interval $(0, 2)$.
Option A:	$\frac{2}{n\pi} + \frac{2}{n^3\pi^3}$
Option B:	$\frac{2}{n\pi}$
Option C:	$\frac{4}{n\pi}$
Option D:	$\frac{4}{n^3\pi^3}$
3.	If $f(z) = e^z$ is an analytic function, then real part is given by
Option A:	$e^x \cos y$
Option B:	$\cos y$
Option C:	$-e^x \sin y$
Option D:	$\sin y$
4.	$L^{-1} [1/(S+2)^4]$
Option A:	$e^{-2t} \cdot t^3 / 3$
Option B:	$e^{-2t} \cdot t^4 / 6$
Option C:	$e^{-3t} \cdot t^3 / 6$
Option D:	$e^{-2t} \cdot t^3 / 6$
5.	If $f(x) = \cos x$ defined in $(-\pi, \pi)$ then the value Fourier coefficient b_n is
Option A:	0
Option B:	π
Option C:	$\frac{\pi}{(n^2 - 1)}$

Option D:	$\frac{2\pi}{(n^2 - 1)} [(-1)^n - 1]$
6.	A function $u(x, y)$ is harmonic if and only if,
Option A:	$u_{xx} + u_{yy} = 0$
Option B:	$u_x + u_y = 0$
Option C:	$u_{xy} + u_{yx} = 0$
Option D:	$u_x - u_y = 0$
7.	Find $L^{-1} \left[\frac{3s + 4}{s^2 + 16} \right]$
Option A:	$4 \sin 4t + \cos 4t$
Option B:	$\cos 4t + \sin 3t$
Option C:	$3 \cos 4t + \sin 4t$
Option D:	$\sin 3t + \cos 4t$
8.	If characteristic equation of matrix A of order 3×3 is $\lambda^3 - 3\lambda^2 + 3\lambda - 1 = 0$. Then by Cayley Hamilton theorem A^{-1} is equal to
Option A:	$A^3 - 3A^2 + 3A - I$
Option B:	$A^2 - 3A - 3I$
Option C:	$3A^2 - 3A - I$
Option D:	$A^2 - 3A + 3I$
9.	The Laplace Transform of $t.e^{at}$
Option A:	$\frac{1}{s}$
Option B:	$\frac{1}{(s-a)^2}$
Option C:	$\frac{1}{(s+a)^2}$
Option D:	$\frac{1}{s^2}$
10.	The equation of one dimensional heat flow is given by
Option A:	$\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$
Option B:	$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$
Option C:	$\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$
Option D:	$\frac{\partial u}{\partial t} = c^2 \left(\frac{\partial^2 u}{\partial x^2} - \frac{\partial^2 u}{\partial y^2} \right)$

Q2 (20 Marks)	Solve any Four out of Six5 marks each
A	Solve $\frac{\partial^2 u}{\partial x^2} - 2 \frac{\partial u}{\partial t} = 0$ by Bender-Schmidt method, given $u(0, t) = 0, u(5, t) = 0, u(x, 0) = x^2(25 - x^2)$ Assume $h=1$ & find the values of u up to $t=3$
B	Using convolution theorem find inverse Laplace transform of $\frac{1}{(s^2+1)(s^2+4)}$
C	Find the Laplace transform of $\cos t \cdot \cos 2t \cdot \cos 3t$
D	Using Cayley-Hamilton theorem, find the matrix represented by $A^8 - 5A^7 + 7A^6 - 3A^5 + A^4 - 5A^3 + 8A^2 - 2A + I$ where $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{bmatrix}$.
E	Find k such that $\frac{1}{2} \log(x^2 + y^2) + i \tan^{-1} \left(\frac{kx}{y} \right)$ is analytic.
F	Find Fourier expansion of $f(x) = x^2$ in the interval $(0, 2\pi)$.

Q3 (20 Marks)	Solve any Four out of Six5 marks each
A	Find $L^{-1} \left\{ \frac{s-2}{(s^2+4s+8)} \right\}$
B	Find Half-Range Cosine Series for $f(x)=x; 0 < x < 2$
C	Find the orthogonal trajectories of the curve is $e^x \cos y - xy = c$
D	Solve $\frac{\partial^2 u}{\partial x^2} - \frac{\partial u}{\partial t} = 0$, under the conditions $u(0, t) = 0; u(1, t) = t, u(x, 0) = 0$ $h = \frac{1}{4}$ (one-time step) using Crank Nicholson's method
E	Show that $\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ is diagonalizable. Determine transforming and diagonal matrix.
F	Find L.T. of the following functions:- (i) $te^{-4t} \sin 3t$ (ii) $\frac{1}{t} [\cos(2t) - \cos(3t)]$

Q4 (20 Marks)	Solve any Four out of Six5 marks each
A	Evaluate $\int_0^{\infty} e^t \sin 2t \cos 3t dt$
B	Find Fourier series of $f(x) = x^2$ in the interval $(-\pi, \pi)$. Hence prove that $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \dots = \frac{\pi^2}{6}$
C	An elastic string stretched between the fixed points $(0, 0)$ and $(1, 0)$ initially in the position $y = A \sin(\pi x)$ and released from rest. Find the displacement $y(x, t)$
D	If $A = \begin{bmatrix} 3 & 1 \\ 1 & 3 \end{bmatrix}$ Calculate e^A and 5^A
E	Find an analytic function $f(z)$ whose imaginary part is

	$e^{-x}(y \sin y + x \cos y)$
F	Find the inverse Laplace transform of $F(s) = \log\left(\frac{s^2 + a^2}{\sqrt{s+b}}\right)$.



20/5/2022

University of Mumbai
Examination summer 2022
 Program: Mechanical
 Curriculum Scheme: REV- 2019 'C' Scheme
 Examination: SE Semester: IV
 Course Code: 402 and Course Name: **Fluid Mechanics**

Time: 3 hour

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	The viscosity of liquids With increase in temperature.
Option A:	decreases
Option B:	increases
Option C:	first decreases and then increases
Option D:	first increases and then decreases
2.	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
3. is the square-root of the ratio of the inertia force to the pressure force.
Option A:	Reynolds number
Option B:	Mach's number
Option C:	Euler's number
Option D:	Froude's number
4.	The term $V^2/2g$ is known as
Option A:	Potential energy
Option B:	pressure energy
Option C:	kinetic energy per unit weight
Option D:	kinetic energy
5.	Which property of the fluid accounts for the major losses in pipes?
Option A:	Density
Option B:	Specific gravity
Option C:	Viscosity
Option D:	Compressibility
6.	If liquid has specific gravity 0.2, then what is weight density of the liquid?
Option A:	200 N/m^3
Option B:	2000 N/m^3
Option C:	1962 N/m^3
Option D:	1.962 N/m^3
7.	The Reynolds transport theorem establishes a relationship between _____ and _____
Option A:	Control mass system, Control volume system
Option B:	Differential equation, Integral equation
Option C:	Non-conservative equation, Conservative equation

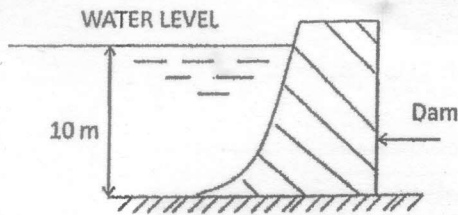
Option D:	Substantial derivative, Local derivative
8.	The coefficient of discharge of Venturimeter lies within the limits
Option A:	0.95 to 0.99
Option B:	0.8 to 0.85
Option C:	0.7 to 0.8
Option D:	0.6 to 0.7
9.	The maximum velocity in a circular pipe when flow is laminar occurs at
Option A:	the top 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 $u = x^2 - 4y$ and $v = y^2 - 4x$. Show that velocity potential exists and determine its form as well as stream function.

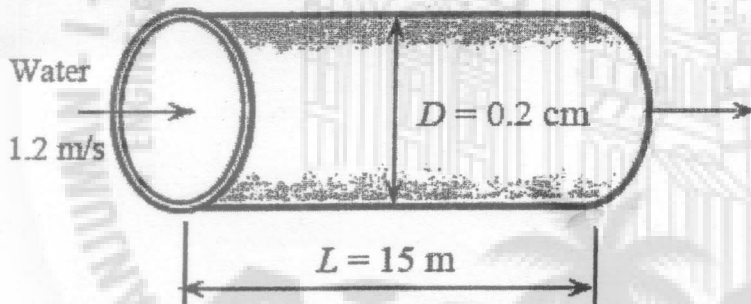
Q3.	
A	Solve any Two 5 marks each
i.	What are the properties of Newtonian and non-Newtonian fluids?
ii.	With neat sketch explain working and construction of venturimeter
iii.	Write a short note on Buckingham's π theorem.
B	Solve any One 10 marks each
i.	Determine the flow rate through the Venturimeter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

$\gamma = 9.1 \text{ kN/m}^3$

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.
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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 ($\rho = 999.7 \text{ kg/m}^3$ and $\mu = 1.307 \times 10^{-3} \text{ kg/m.s}$) 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



23/05/2022

University of Mumbai

Examinations Summer 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)

Q.R Code 93619

Time: 2 hour 30 minutes

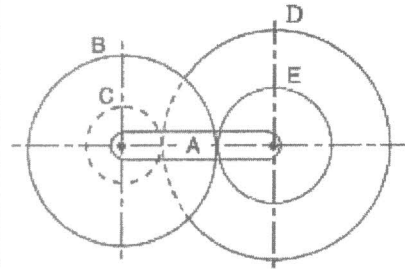
Max Marks: 80

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

	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° angle of descent 120° angle of dwell for the follower in the highest position 90° . 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.	

In a reverted epicyclic gear train, the arm A carries two gears B and C and a compound gear D - E. The gear B meshes with gear E and the gear C meshes with gear D. The number of teeth on gears B, C and D are 75, 30 and 90 respectively. Find the speed and direction of gear C when gear B is fixed and the arm A makes 100 r.p.m. clockwise.



Q4. (20 Marks)	Solve any Two	5 marks each
A	What are centripetal and tangential components of acceleration? When do they occur? How are they determined?	
B	Derive the equation for centrifugal tension	
C	Explain successfully constrained motion with sketches of examples.	
	Solve any any One	10 Marks each
A	Two mating gears have 40 & 60 involute teeth of module 10 mm & 20° 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.	
B	The dimensions of a mechanism as shown in the figure are as follows: $AB = 0.45 \text{ m}$, $BD = 1.5 \text{ m}$, $BC = CE = 0.9 \text{ m}$. 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.	

26/05/2022

D.P. code: 93960

Time: _____ hour

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	In shearing along X axis, the image coordinate X' is , (Shx-Shearing factor along X direction, object coordinates are (X,Y))
Option A:	X'=0
Option B:	X'=1
Option C:	X'= Y+X(Shx)
Option D:	X'=X+ Y(Shx)
2.	Combination of geometric primitives are used for following type of modeling
Option A:	Wire frame modeling
Option B:	Surface modeling
Option C:	Constructive Solid Geometry (CSG)
Option D:	Parametric modeling
3.	With reference to the manual part programming of CNC Machine, Tool change and coolant off refers to:
Option A:	M03 and M07
Option B:	G03 and G07
Option C:	M06 and M09
Option D:	M06 and M08
4.	For a billet having dia 40mm and tool is set at postionZ-1 and X40 to take 1mm facing cut , followed by ejection of 2mm ,the line of code would be (Given:zero,zero of the work part is Set at center and last free end of the billet and using dimetral format,absolute CS)
Option A:	N200 G01 X-1 F100; N300 G00 Z2;
Option B:	N200 G00 X0 F100; N300 G00 Z2;
Option C:	N200 G01 X0 F100; N300 G01 X2;
Option D:	N200 G00 X-1 F100; N300 G01 Z2;
5.	Choose the correct sequence to generate prototype.
Option A:	STL file - CAD Model - Slicing - Post processing - Build object
Option B:	CAD Model - STL file - Slicing - Build object - Post processing
Option C:	CAD Model - Slicing - STL file - Post processing - Build object
Option D:	CAD Model - STL file - Post processing - Build object - Slicing
6.	For a Bezier curve, having 5 control points $P_0P_1P_2P_3P_4$, and having value of parameter "u" as, "0" at P_0 and "1" at P_4 , the resulting equation of a this Bezier

Q1. 20 Marks	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	Which of the following is a common application of UJT?
Option A:	Amplifier
Option B:	Rectifier
Option C:	Multivibrator
Option D:	Sawtooth generator
2.	Which of the following is a characteristics of an ideal Op-Amp?
Option A:	Finite voltage gain
Option B:	Finite Bandwidth
Option C:	Infinite output resistance
Option D:	Infinite input resistance
3.	In inverters, to make the supply voltage constant
Option A:	an inductor is placed in series with the load
Option B:	capacitor is connected in parallel to the load side
Option C:	an inductor is placed in parallel with the load
Option D:	capacitor is connected in parallel to the supply side
4.	NAND gate means
Option A:	Inversion followed by AND gates
Option B:	AND gate followed by an inverter
Option C:	AND gate followed by OR gate
Option D:	OR gate followed by AND gate
5.	MSP 430 microcontroller has a dual _____ D/A converters with synchronization
Option A:	8-bit
Option B:	16-bit
Option C:	12-bit
Option D:	32-bit
6.	What happens when the speed of a DC motor increases ?
Option A:	Back emf falls and line current increase.
Option B:	Both back emf as well as line current increase.
Option C:	Both back emf as well as line current fall.
Option D:	Back emf increase but line current falls.
7.	Typical brushless motor doesn't have
Option A:	Commutator
Option B:	Permanent magnet
Option C:	Electronic controller
Option D:	Fixed armature
8.	Zener diodes allow a current to flow in the reverse direction, when the
Option A:	voltage reaches above a certain value
Option B:	temperature reaches above a certain value
Option C:	current always flows in the reverse direction only

	current cannot flow in the reverse direction
9.	Which of the following instructions means "Jump if carry = 0"?
Option A:	JNC label
Option B:	JNE label
Option C:	JNZ label
Option D:	JC label
10.	To turn off the SCR, which of the following is done?
Option A:	Reduce gate voltage to zero
Option B:	Reverse bias the gate
Option C:	Reduce anode voltage to zero
Option D:	Reduce cathode voltage to zero

Q2. (20 Marks)	
A	Solve any Two 5 marks each
i.	Compare DIAC and TRIAC.
ii.	Draw and explain astable mode of operation of IC 555.
iii.	Draw functional block diagram of microcontroller and explain it..
B	Solve any One 10 marks each
i.	Explain UJT triggering method of SCR in brief with circuit diagram.
ii.	Draw circuit diagram and waveforms of three phase bridge inverter with 180° conduction mode and explain the working of the same.

Q3. (20 Marks)	
A	Solve any Two 5 marks each
i.	State and prove De-Morgan's theorem.
ii.	Draw and explain equivalent circuit of an OP-AMP.
iii.	List the feature of MSP 430.
B	Solve any One 10 marks each
i.	Explain the functional block diagram of IC-555 Timer.
ii.	What is a flip flop? Explain different types of flip flops.

Q4. (20 Marks)	
A	Solve any Two 5 marks each
i.	Explain the operation of JK flip-flop.
ii.	Draw and explain first order low pass filter.
iii.	Draw the characteristics of power BJT, power MOSFET and IGBT.
B	Solve any One 10 marks each
i.	Draw and Explain characteristics of DC shunt motor.
ii.	Explain speed control method of induction motor using microcontroller.