

University of Mumbai

Examination First Half of 2022 (Summer-2022)

Program: _First Year (All Branches) Engineering-SEM-I

Program No - 1T01821

Applied Mathematics-I

Paper Code(58601)

Time: 2Hour 30 minutes

Marks: 80

Q1. (20 Marks)	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
Q1.	If $y = \sin 2x \cos 3x$ then,
OptionA:	$y_n = \frac{1}{2} \left(5^n \sin \left(5x + \frac{n\pi}{2} \right) - \sin \left(x + \frac{n\pi}{2} \right) \right)$
OptionB:	$y_n = \frac{1}{2} \left(5^n \sin \left(5x + \frac{n\pi}{2} \right) + \sin \left(x + \frac{n\pi}{2} \right) \right)$
OptionC:	$y_n = \frac{1}{2} \left(5^n \sin \left(5x + \frac{n\pi}{2} \right) - \cos \left(x + \frac{n\pi}{2} \right) \right)$
OptionD:	$y_n = \frac{1}{2} \left(5^n \sin \left(5x + \frac{n\pi}{2} \right) + \cos \left(x + \frac{n\pi}{2} \right) \right)$
Q2.	Find the solution of following system of equations given by $2x-3y+7z=5$, $3x+y-3z=13$, $2x+19y-47z=32$.
Option A:	No Solution Exist
Option B:	$x=2, y=4, z=5$
Option C:	$x=2, y=-4, z=5$
Option D:	$x=-2, y=4, z=-5$
Q3.	Find the rank of matrix $A = \begin{bmatrix} 1 & 1 & 1 \\ 1 & -1 & -1 \\ 3 & 1 & 1 \end{bmatrix}$.
Option A:	Rank (A)=1
Option B:	Rank (A)=2
Option C:	Rank (A)=3
Option D:	Rank (A)=0

Q4.	The system of equations $2x-2y+z=tx$, $2x-3y+2z=ty$, $-x+2y=tz$, will possess a solution for which values of constant t.
Option A:	$t=1,3$
Option B:	$t=-1,3$
Option C:	$t=1,-3$
Option D:	$t=-1,-3$
Q5.	If $\tanh x = 1/2$, then find the value of x and $\sinh 2x$
Option A:	$x = 1/2 \log(3), \sinh 2x = 4/5$
Option B:	$x = -1/2 \log(3), \sinh 2x = 4/5$
Option C:	$x = 1/2 \log(3), \sinh 2x = 4/3$
Option D:	$x = -1/2 \log(3), \sinh 2x = 4/3$
Q6.	For the unitary matrix $A = \frac{1}{\sqrt{3}} \begin{bmatrix} 1 & 1+i \\ 1-i & -1 \end{bmatrix}$, find A^{-1}
Option A:	$\begin{bmatrix} 1 & 1+i \\ 1-i & -1 \end{bmatrix}$
Option B:	$\frac{1}{\sqrt{3}} \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix}$
Option C:	$\begin{bmatrix} 1 & 1+i \\ 1-i & -1 \end{bmatrix}$
Option D:	$\frac{1}{\sqrt{3}} \begin{bmatrix} 1 & 1+i \\ 1-i & -1 \end{bmatrix}$
Q7.	If $u(x,y) = \tan^{-1} \left(\frac{x^2 + y^2}{x-y} \right)$, then find the value of $I = x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y}$.
Option A:	$I = \frac{1}{4} \sin u$
Option B:	$I = \frac{1}{4} \cos u$
Option C:	$I = \frac{1}{2} \sin 2u$
Option D:	$I = \frac{1}{4} \sin 2u$
Q8.	Simplify $\frac{(\cos 3\theta + i \sin 3\theta)(\cos \theta - i \sin \theta)}{(\cos 5\theta - i \sin 5\theta)}$
Option A:	$(\cos 7\theta + i \sin 7\theta)$
Option B:	$(\cos 3\theta + i \sin 3\theta)$

Option C:	$(\cos 5\theta + i \sin 5\theta)$
Option D:	$(\cos \theta + i \sin \theta)$
Q9.	Find the maxima of $f = x^2 + y^2$, subjected to the condition $x + y = 2$.
Option A:	2
Option B:	4
Option C:	5
Option D:	8
Q10.	Find the value of $\log(\sqrt{3} - i)$
OptionA:	$\log 4 + i \frac{\pi}{6}$
OptionB:	$\log 2 + i \frac{\pi}{6}$
OptionC:	$\log 4 - i \frac{\pi}{6}$
OptionD:	$\log 2 - i \frac{\pi}{6}$

Q2. (20 Marks)	Solve any Four out of Six (5 marks each)
A	If $u = \log \tan\left(\frac{\pi}{4} + \frac{\theta}{2}\right)$, Prove that i) $\text{Cosh} u = \sec \theta$, ii) $\text{Sin} h u = \tan \theta$
B	If $u = \log(\tan x + \tan y + \tan z)$ prove that $\text{Sin} 2x \frac{\partial u}{\partial x} + \text{Sin} 2y \frac{\partial u}{\partial y} + \text{Sin} 2z \frac{\partial u}{\partial z} = 2$
C	Show that $\text{Sin} x \text{Sin} h x = x^2 - 8 \frac{x^6}{6!} + \dots$
D	Prove that $\log(1 + e^{i\theta}) = \log\left(2 \cos \frac{\theta}{2}\right) + i \frac{\theta}{2}$
E	Evaluate $\lim_{x \rightarrow 0} \frac{\text{Sin} x \sin^{-1} x - x^2}{x^6}$
F	Find the Rank of the following matrix by reducing to Normal Form $A = \begin{bmatrix} 1 & -1 & 3 & 6 \\ 1 & 3 & -3 & -4 \\ 5 & 3 & 3 & 11 \end{bmatrix}$

Q3. (20 Marks)	Solve any Four out of Six (5 marks each)
A	Show that $\frac{\sin 5\theta}{\sin \theta} = 16\cos^4\theta - 12\cos^2\theta + 1$
B	Test for consistency the following system & solve them if consistent $\begin{aligned}x_1 - 2x_2 + x_3 - x_4 &= 2 \\x_1 + 2x_2 + 2x_4 &= 1 \\4x_2 - x_3 + 3x_4 &= -1\end{aligned}$
C	Examine the function $u = x^3y^2(12 - 3x - 4y)$ For extreme values.
D	If $y^{1/m} + y^{-1/m} = x$ prove that $(x^2 - 1)y_{n+2} + (2n + 1)xy_{n+1} + (n^2 - m^2)y_n = 0$
E	Using Newton-Raphson method find the root of equation $2x^3 - 3x + 4 = 0$ lying between -2 and -1 correct to four places of decimals.
F	If $u = f\left(\frac{y-x}{xy}, \frac{z-x}{xz}\right)$, then show that $x^2 \frac{\partial u}{\partial x} + y^2 \frac{\partial u}{\partial y} + z^2 \frac{\partial u}{\partial z} = 0$

Q4. (20 Marks)	Solve any Four out of Six (5 marks each)
A	Show that minimum value of $u = xy + a^3\left(\frac{1}{x} + \frac{1}{y}\right)$ is $3a^2$.
B	Find the n^{th} derivative of $\frac{x}{1+3x+2x^2}$
C	Solve $x^5 = 1 + i$ and find the continued product of the roots.
D	Apply Gauss elimination method to solve the equations $x+3y-2z=5, 2x+y-3z=1, 3x+2y-z=6$.
E	If $u = \tan^{-1}\left(\frac{x^2+y^2}{x-y}\right)$ P.T $x^2 \frac{\partial^2 u}{\partial x^2} + 2xy \frac{\partial^2 u}{\partial x \partial y} + y^2 \frac{\partial^2 u}{\partial y^2} = -2\sin^3 u \cos u$
F	For what value of λ the equations $x + 2y + z = 3, x + y + z = \lambda, 3x + y + 3z = \lambda^2$ have a solution and solve them completely in each case.

University of Mumbai

Curriculum Scheme: Rev2016

All Programs

Examination: FE Semester I

_FH2022

Course Code: FEC102_____

Course Name: _Applied Physics-I_____

Time: 2 hours

Max. Marks: 60

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	The square of the magnitude of the wave function is called_____
Option A:	current density
Option B:	probability density
Option C:	zero density
Option D:	Volume density
2.	Fermi energy level is defined as
Option A:	is the top most filled energy level at 0 Kelvin temperatures
Option B:	is the top most filled energy level at 0 degree Centigrade temperature
Option C:	separates valance band and conduction band
Option D:	is the top most empty energy level at 0 Kelvin temperatures
3.	The critical magnetic field for vanadium is 10^5 A/m at 8.58 K & 3×10^5 A/m at 0 K. Its critical temperature is
Option A:	10.50 K
Option B:	1.050 K
Option C:	105 K
Option D:	15 K
4.	For an empty assembly hall of size 20 x 15 x 10 cubic meter with absorption coefficient 0.106. Calculate reverberation time.
Option A:	3.5 sec
Option B:	5.3 sec
Option C:	35 sec
Option D:	35 millisecond
5.	The inter-planar spacing between the (2 2 1) planes of a cube lattice of edge length 450 pm is:
Option A:	50 pm
Option B:	150 pm
Option C:	300 pm
Option D:	450 pm

6.	The audible frequency range of human ear is
Option A:	20 Hz to 200 Hz
Option B:	2 Hz to 20 Hz
Option C:	200 Hz to 2000 Hz
Option D:	20 Hz to 20000 Hz

Q2. (16 Marks)	<i>Please delete the instruction shown in front of every sub question</i>
A	Answer Two out of Three 8 marks each
i.	Derive Bragg's law. Calculate the wavelength of X-rays reflected from the faces of a FCC crystal with lattice constant 2.82 \AA , if the second order Bragg reflection occurs at a glancing angle of 17.167° .
ii.	Derive one dimensional time dependent Schrodinger equation for matter waves. An electron is bound in one dimensional potential well of width 2 \AA but of infinite height. Find its energy values in the ground state & first excited state.
iii.	State & explain Hall effect. Derive an expression for Hall voltage & Hall coefficient.

Q3. (16 Marks)	<i>Please delete the instruction shown in front of every sub question</i>
A	Answer Four out of Six 4 marks each
i.	An electron has a speed of 400 m/sec with uncertainty of 0.01%. Find the accuracy in its position.
ii.	Show that for an intrinsic semiconductor Fermi level lies in the middle of forbidden band.
iii.	Find the resistivity of intrinsic Germanium at 300° K . Given density of carrier is $2.5 \times 10^{19} / \text{m}^3$. Mobility of electron is $0.39 \text{ m}^2/\text{V}\cdot\text{sec}$. & mobility of holes is $0.19 \text{ m}^2/\text{V}\cdot\text{sec}$. Charge on electron is $1.6 \times 10^{19} \text{ C}$.
iv.	Calculate the number of atoms per unit cell, atomic radius & atomic packing factor for diamond unit cell
v.	Distinguish between type -I & type-II superconductor.
vi.	What will be the Young's modulus of quartz if a 5.5 mm thick quartz plate is used to produce an ultrasonic wave of frequency 0.4999 MHz? the density of quartz is $2.65 \times 10^3 \text{ kg/m}^3$.

Q4. (16 Marks)	<i>Please delete the instruction shown in front of every sub question</i>
A	Answer Four out of Six 4 marks each
i.	Draw the diagram of magnetostriction oscillator & explain its working as an ultrasound generator.

ii.	Explain the conditions necessary for good acoustical design of an auditorium.
iii.	Explain the construction & working of a solar cell
iv	What is probability of an electron being thermally excited to the conduction band is Silicon at 27°C. the band gap energy is 1.12 eV.
v	A sample of n-type Silicon has a donor density of 10^{20} /m^3 . It is used in the Hall effect experiment. If the sample of thickness 4.5 mm is kept in a magnetic field of 0.55T with current density of 500 A/m ² . Find i) Hall voltage developed in it ii) Hall coefficient if mobility of electron is 0.17 m ² /V-sec.
vi	Using Heisenberg's principle show that electrons cannot exist within the nucleus.

University of Mumbai

Curriculum Scheme: Rev-2016

All Programs

Examination: FE Semester I

Course Code: FEC103 Course Name: Applied Chemistry I

Time: 2 hours

Max. Marks: 60

NOTE: All questions are compulsory

Atomic weights: - H=1, C= 12, O=16, N=14, S=32, Ca= 40, Mg=24, K= 39, Si= 28

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry 2 marks each.
1.	Which of the following is the eutectic composition of Ag-Pb system?
Option A:	2.6% Pb + 97.4% Ag
Option B:	26% Pb + 74 %Ag
Option C:	74 %Pb + 26% Ag
Option D:	97.4% Pb + 2.6% Ag
2.	Which of the following dissolved salt does not contribute to any kind of hardness to the water?
Option A:	KCl
Option B:	Mg(HCO ₃) ₂
Option C:	CaCl ₂
Option D:	Mg(NO ₃) ₂
3.	The chemical reaction between which of the following can give Kevlar Polymer?
Option A:	Hexamethylenediamine + adipic acid
Option B:	Ethylene glycol + Adipic acid
Option C:	Terephthalic acid + p-Amino aniline
Option D:	1,4 phenylenediamine + terephthaloyl chloride
4.	Extrusion molding cannot be used for manufacture of which of the following?
Option A:	Telephone
Option B:	Buckets
Option C:	Pipes
Option D:	Tubes
5.	Which of the following is not a thermoplast?
Option A:	Polyethylene
Option B:	Polyvinyl chloride
Option C:	Bakelite
Option D:	PMMA
6.	In Reverse Osmosis the flow of solvent is through semi permeable membrane from
Option A:	Higher concentration to lower concentration solution
Option B:	Lower concentration to higher concentration solution
Option C:	Equal concentration of solutions
Option D:	Independent of concentration

Q2	Solve any 4 questions out of 6	4 marks each
A	Draw a neat diagram and explain the ion exchange process of demineralization of hard water	
B	Draw a neat diagram and explain compression moulding	
C	Explain phase diagram for one component system	
D	Explain Thin film Lubrication mechanism	
E	a) A water sample contains $\text{Ca}(\text{HCO}_3)_2 = 32.4\text{mg/L}$ $\text{Mg}(\text{HCO}_3)_2 = 29.2\text{ mg/L}$ $\text{CaSO}_4 = 13.6\text{ mg/L}$ Calculate Temporary, Permanent and Total Hardness of the given sample of the water	
F	Explain Vulcanization of rubber	
Q3	Solve any 4 questions out of 6	4 marks each
A	What is the function of plasticizers ,fillers and catalyst in compounding of plastics	
B	Give the preparation, properties and uses of PMMA	
C	Write a brief note on Electro dialysis process of purification of water	
D	Give the advantages and limitations of phase rule	
E	A 50 ml water sample contain 840 ppm of dissolved oxygen. After 5 days the dissolved oxygen value becomes 230 ppm after the sample has been diluted to 80 ml .Calculate the BOD of the water sample.	
F	Explain :- 1) viscosity and viscosity index 2) flash point and fire point	
Q4	Solve any 4 questions out of 6	4 marks each
A	Write four points of comparison between COD and BOD.	
B	What are factors that affect glass transition temperature?	
C	State Gibbs phase rule and explain the terms involved in it by giving two examples.	
D	Give characteristic of good paint	
E	Give comparison between thermoplastic and thermosetting plastic	
F	Explain Setting and hardening of cement	

University of Mumbai

Examinations Summer 2022

Curriculum Scheme: Revised 2016

Examination: First Year Semester I (All Branches)

Course Code: 58603/20189 and Course Name: Basic Electrical Engg.

Time: 2 hour 30 minutes

Max. Marks: 80

Q1.	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks
1.	The sinusoidal current reaches 15 A first time at $t=3.375$ ms and second time at $t=9.125$ ms. Find maximum value of current.
Option A:	10 A
Option B:	15 A
Option C:	20 A
Option D:	30 A
2.	The sinusoidal current reaches 15 A first time at $t=3.375$ ms and second time at $t=9.125$ ms. Find frequency of current waveform
Option A:	30 Hz
Option B:	40 Hz
Option C:	50 Hz
Option D:	60 Hz
3.	If $1\mu\text{F}$, $2\mu\text{F}$, $4\mu\text{F}$, $6\mu\text{F}$ are connected in parallel, which capacitor will carry maximum current. Supply frequency is constant.
Option A:	$1\mu\text{F}$
Option B:	$2\mu\text{F}$
Option C:	$4\mu\text{F}$
Option D:	$6\mu\text{F}$
4.	If $1\mu\text{F}$, $2\mu\text{F}$, $4\mu\text{F}$, $6\mu\text{F}$ are connected in series, which capacitor will have maximum voltage across it?. Supply frequency is constant.
Option A:	$1\mu\text{F}$
Option B:	$2\mu\text{F}$
Option C:	$4\mu\text{F}$
Option D:	$6\mu\text{F}$
5.	A circuit consists of resistance R and capacitive reactance of $60\ \Omega$ connected in series. Determine the value of R for which p.f of the circuit is 0.8
Option A:	$50\ \Omega$
Option B:	$60\ \Omega$
Option C:	$70\ \Omega$
Option D:	$80\ \Omega$
6.	A transformer has full load copper loss of 64 W, what will be copper loss at half load
Option A:	128 W
Option B:	64 W

Option C:	32 W
Option D:	16 W
7.	If 2 Watt meters are used for 3 phase power measurement, if pf is unity, the relation between two Watt meters reading (W1 & W2) is
Option A:	$W1 = W2$
Option B:	$W1 > W2$
Option C:	$W1 < W2$
Option D:	$W1 = -W2$
8.	According to Thevenin's theorem, any bilateral network can be replaced by a network with—
Option A:	An independent current source in parallel to the equivalent resistance
Option B:	An independent voltage source in series with the equivalent resistance
Option C:	An independent voltage source in parallel to the resistance
Option D:	An independent current source in series to the equivalent resistance
9.	A circuit contains two un-equal resistances in parallel
Option A:	current is same in both
Option B:	large current flows in larger resistance
Option C:	potential difference across each is same
Option D:	smaller resistance carry smaller current
10.	Three resistance 14.5 Ω , 25.5 Ω and 60 Ω are connected in series across 200 V. What will be the voltage drop across 14.5 Ω
Option A:	29 V
Option B:	13.5 V
Option C:	14 V
Option D:	18 V

Q2	
A	Solve any Two 5 marks each
i.	In a particular R-L circuit voltage of 10 V at 25 Hz produces 100 mA, while the same voltage at 75 Hz produces 60 mA. Draw the circuit diagram and insert values of the constants
ii.	Two voltage sources have equal emf's and a phase difference α , when they are connected in series, the voltage is 200 V. when one source is reversed, the voltage is 15 V. Find their emf's and phase angle α
iii.	A 50 KVA, single phase transformer has an efficiency of 98 % at full load, 0.8 pf and 97 % at half full load, 0.8 pf. Determine the full load copper loss and iron loss.
B	Solve any One 10 marks each
i.	Explain how two watt-meters can be used to measure power and power factor in a three phase balanced delta connected load lagging pf.

ii.	<p>Find current through 22Ω by mesh analysis</p>
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Q3	Solve any Two Questions out of Three	10 marks each
A	<p>Find current through 4 Ω by Thevenin's theorem</p>	
B	A 600 KVA, single phase transformer has an efficiency of 92 % at both full load and half load at unity pf. Determine the efficiency at 75% of full load, 0.9 pf lagging	
C	Coil A takes 2 Amps at a power factor of 0.8 lagging with an applied voltage of 10 Volts. A second coil B takes 2 Amps with a power factor of 0.7 lagging with an applied voltage of 5 Volts. What voltage will be required to produce a total current of 2 Amps With A and B in parallel	

Q4	Solve any Two Questions out of Three	10 marks each
A	An equipment consumes 2 KW when connected across a 110 V, 100 Hz supply and takes a lagging current of 25 A. If a capacitor is connected in parallel with equipment to make the pf unity, Determine the value of capacitance	
B	A source of 1MHz is connected across series R L C circuit. The capacitor 'c' is variable. When capacitor is 500 pf. maximum current is passed through circuit. For 600 pf. The current is half of the previous case. Calculate parameters R , L , Bandwidth & Quality factor at resonance.	
C	A 100 Ω resistor is connected in series with a choke coil when a 400 V , 50 Hz supply is applied to this combination the voltage across the resistance and the choke coil are 200 V and 300 V respectively. Find the power consumed by the choke coil. Also calculate the power factor of choke coil and power factor of the circuit	

University of Mumbai

Curriculum Scheme: Rev2016

All Programs

Examination: FE Semester I _FH2022

Course Code: FEC104
Time: 2 hour 30 minute

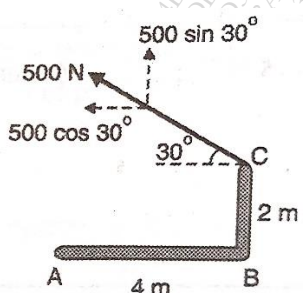
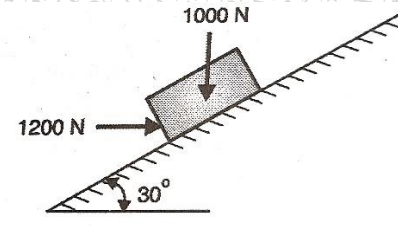
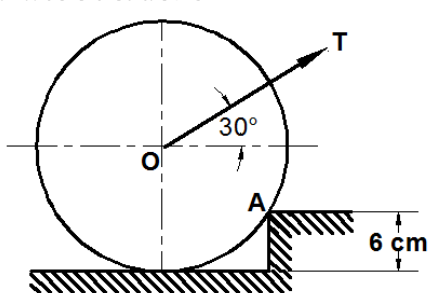
Course Name: ENGINEERING MECHANICS

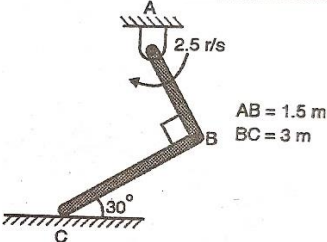
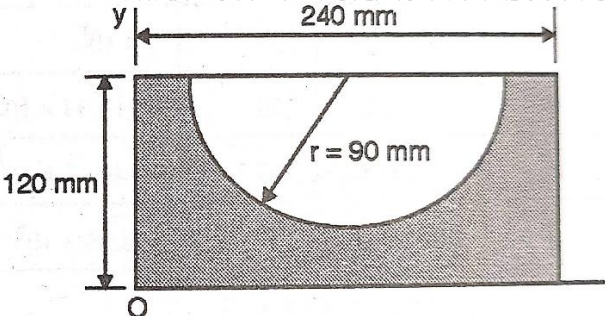
Max. Marks: 80

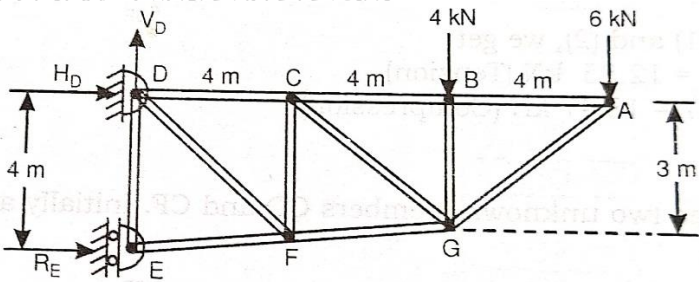
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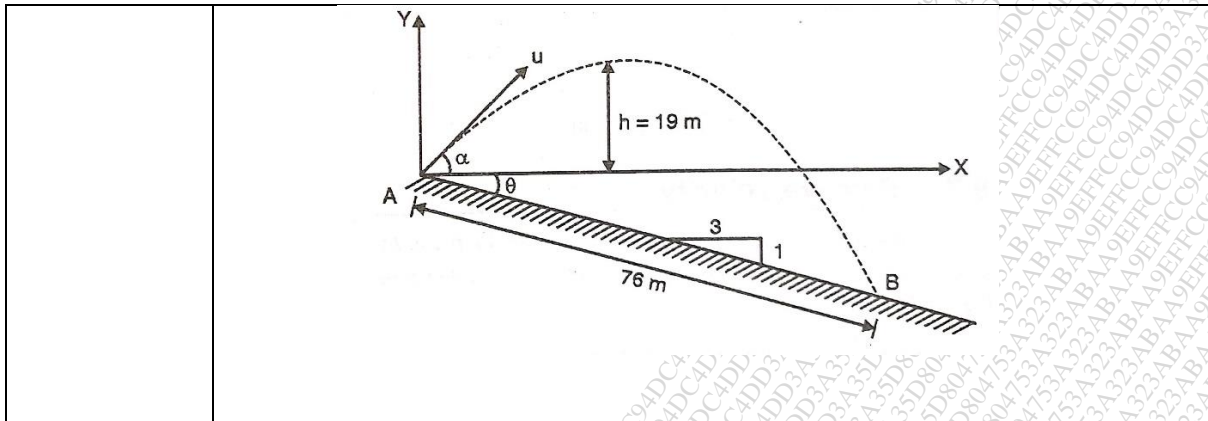
Q 1	Choose the correct option for following questions. All the Questions are compulsory and carry equal marks [20]
1	Two parallel equal forces acting in the opposite direction
Option A:	balance each other
Option B:	constitute a moment
Option C:	constitute a force couple system
Option D:	constitute a moment of the couple
2.	Ratio of limiting friction and normal reaction is _____.
Option A:	Coefficient of friction
Option B:	Angle of friction
Option C:	Sliding friction
Option D:	Coefficient of restitution
3.	Pushing or pulling of a vehicle with same magnitude of force along the same line of action is called as _____.
Option A:	Equilibrium
Option B:	Principle of transmissibility
Option C:	Newtons III law
Option D:	Newtons II law
4	The area under the speed -time graph gives the _____.
Option A:	Distance travelled by the particle
Option B:	Velocity of the particle
Option C:	Acceleration of the particle
Option D:	Momentum of particle
5.	Which of the following statements describes the resultant of two forces?
Option A:	Force that maintains the system in equilibrium
Option B:	Force that has the highest magnitude in the system
Option C:	Force that has the same effect as the two forces
Option D:	Force that has the same effect as one force

6.	Varignon's theorem is used to find _____
Option A:	direction of resultant force
Option B:	location of resultant force
Option C:	magnitude of resultant force
Option D:	nature of resultant force
7.	If an object is dropped from the top of a building and it reaches the ground at $t = 4$ s , then the height of the building is (ignoring air resistance) ($g = 9.8 \text{ m/s}^2$)
Option A:	77.3 m
Option B:	80.5 m
Option C:	79.2 m
Option D:	78.4 m
8.	D' Alembert's principle is used for
Option A:	Reducing the problem of kinetics to equivalent statics problem
Option B:	solving kinematic problems
Option C:	Stability of floating bodies
Option D:	Designing safe structures
9.	What is a free-body diagram?
Option A:	It's a sketch of a moving body that shows internal forces of the body and reaction forces
Option B:	It's a sketch of an undisturbed body that shows external forces of the body
Option C:	It's a sketch of an isolated body that shows external forces of the body and reaction forces
Option D:	It's a sketch of a body in motion that shows bending forces of the body
10.	Which of the following doesn't affect frictional force?
Option A:	Surface roughness
Option B:	Reaction of surface
Option C:	Area of contact
Option D:	Force tending cause motion

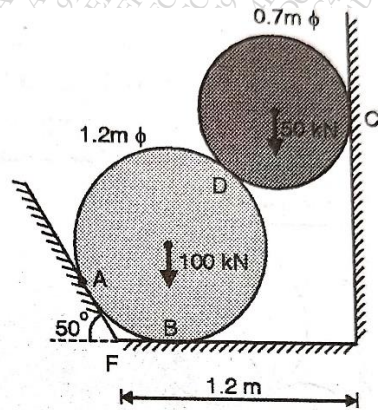
Q 2 20 marks	Solve any four questions out of six 5 marks each
a	<p>Replace the following force system by a force couple system (i) at point A. (ii) at point B</p> 
b	<p>If a horizontal force of 1200 N is applied to block of 1000 N, then block will be held in equilibrium or slide down or move up? Take $\mu = 0.3$</p> 
c	<p>A heavy roller with radius 14 cm and weighing 2000 N is pulled to the right by a pulling force T acting at an angle 30° with respect to horizontal as shown in figure. A 6 cm step stops the rolling motion of the roller. Find the magnitude of force T, to just start the motion of the roller.</p> 

<p>d</p>	<p>At the instant shown in the figure, the rod AB is rotating clockwise at 2.5 rad/sec. If the end C of the rod BC is free to move on a horizontal surface find the angular velocity of rod BC and the velocity of its end point C.</p> 
<p>e</p>	<p>A particle moves in a circular path of 9m radius, calculate after 4 seconds the particles total acceleration and distance travelled if speed is constant at 3 m/s.</p>
<p>f</p>	<p>Locate the centroid of the shaded area w.r.t 'O'</p> 

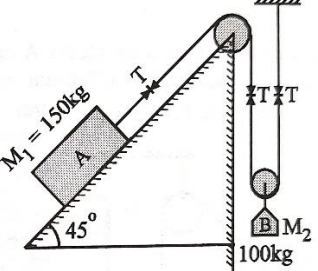
<p>Q 3 20 marks</p>	<p>Solve any two questions out of three 10 marks each</p>
<p>a</p>	<p>For the truss shown find the forces in all the members.</p> 
<p>b</p>	<p>A ball rebounds at A and strikes inclined plane at point B at a distance of 76 m as shown in fig. If the ball rises to a maximum height $h = 19\text{ m}$ above the point of projection, compute the initial velocity and the angle of projection α.</p>



c Two cylinders are kept in a channel as shown in fig. Determine the reactions at all the contact points A, B, C and D. Assume all surfaces smooth



Q 4 (A) 10 Marks	Solve any two questions out of three	5 marks each
1	Three concurrent forces $P = 150\text{ N}$, $Q = 250\text{ N}$, and $S = 300\text{ N}$ are acting at 120° with each other. Determine their resultant force magnitude and direction with respect to P . What is their equilibrant?	
2	Force 5 kN is acting along AB where $A(0,0,-1)\text{m}$ and $B(5,-2,-4)\text{m}$. Another force 8 kN is acting along BC where $C(3,3,4)\text{m}$, Find resultant of two forces and find moment of resultant force about a point $D(0,3,-2)$	
3	A particle is projected with an initial velocity of 2 m/s along a straight line. The relation between acceleration and time is given in the diagram. Draw $v-t$ diagram.	

Q 4 (B) 10 marks	Solve any one question out of two	10 marks each
1	<p>.A block of mass $M_1 = 150 \text{ kg}$ resting on inclined plane is connected by a string with another block of mass $M_2 = 100 \text{ kg}$ as shown in fig. If $\mu = 0.2$ find acceleration of A and tension in the string.</p>	
2	<p>If the 20 kg cylinder is released from rest at $h = 0$, determine the required stiffness k of each spring so that its motion is momentarily stops when $h = 0.5 \text{ m}$. Each spring has unstretched length of 1 m. Refer fig.</p>	