Registration No :

2nd Semester Back Examination: 2022-23
Applied Chemistry
CSE, EEE, ELECTRICAL, ECE, ETC, MECH, MME
Time : 3 Hour
Max Marks : 100
Q. Code : M550
Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1   **Answer the following questions:**   **(2 x 10)**
   a) For a particle of mass m in a one-dimensional box of length 2L, find the expression for the energy of the level corresponding to n = 8.
   b) Write the Schrodinger wave equation.
   c) What is EAN rule?
   d) What is hydroformylation reaction?
   e) What is octane number?
   f) What are chromophores?
   g) State Gibb's phase rule & explain each term.
   h) Name one catalyst for alkene hydrogenation and draw the structure.
   i) Explain calorific value.
   j) What is Galvanizing?

Part-II

Q2   **Only Focused-Short Answer Type Questions- (Answer Any Eight out of**   **(6 × 8)**
          Twelve)
   a) State and explain Lambert Beer's law.
   b) Discuss the phase diagram of sulfur system.
   c) Discuss alkene isomerization reaction with a suitable example.
   d) How calorific value of a fuel is determined? Explain with a suitable example.
   e) Explain with suitable examples the corrosion due to differential aeration and dry corrosion?
   f) Discuss the postulates of quantum mechanics.
   g) Discuss hydroformylation reaction with a suitable example.
   h) Discuss the refining of petroleum.
   i) Write a short note on differential aeration corrosion.
   j) Give a brief account of gaseous fuel.
   k) Discuss the electrochemical theory of corrosion.
   l) Discuss the effect of conjugation on chromophores.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3   Discuss the energy levels, quantum numbers and selection rules for particle in a box. **(16)**

Q4   What are organometallic compounds? Discuss the characteristics. Name few organometallic compounds which are used as catalysts. Discuss how ethylene is hydrogenated? **(16)**

Q5   What is calorific value of a fuel? Explain the terms H.C.V. and L.C.V. of a fuel. Discuss Dulong's formula for determination of calorific value of fuels. **(16)**

Q6   What is corrosion? Discuss different types of corrosion and factors affecting corrosion. **(16)**

2nd Semester Regular/Back Examination: 2022-23
Basic Electrical Engineering
AEIE, AUTO, BIOMED, CHEM, CIVIL, CSE, CSEAI, CSEAIME, CSEDS, CST, ECE, EEE,
ELECTRICAL,ELECTRICAL & C.E,ETC, IT,MECH,METTA,MINING,MME,PT/CE,CSE,EE
Time : 3 Hour
Max Marks : 100
Q. Code: M382

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two
from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1   Answer the following questions :   (2 x 10)

a)   When a resistor is placed across a 230-volt supply, the current is 12 A. What is the
     value of resistor that must be placed in parallel to increase the load to 16 A ?

b)   Write the rectangular and polar form expression of the " j-operator".

c)   Find the equivalent impedance of two impedances $30\angle45^0$ and $20\angle-30^0$ connected
     in parallel. What is the resistance of this equivalent impedance?

d)   State & explain briefly the Thevenin's theorem.

e)   The load taken by a three-phase induction motor is measured by the two-
     wattmeter method, and the readings are 860 W and 240 W. What is the active
     power taken by the motor and at what power factor is it working?

f)   Why 3-phase, 4 wire Y connection is used for distributing electrical power? Briefly,
     explain.

g)   Find the reluctance of an air gap of 0.5mm width and cross-sectional area of 10
     cm^2. Consider the standard value of μ_0.

h)   In a transformer, the hysteresis loss is found to be 52 Watt at 40 Hz. Compute the
     hysteresis loss at 50 Hz.

i)   State two differences between a squirrel cage and slip ring induction motor.

j)   Draw the symbol of a long shunt DC compound generator.

Part-II

Q2   Only Focused-Short Answer Type Questions- (Answer Any Eight out of   (6 × 8)
        Twelve)

a)   A circuit, consisting of three resistances 12 Ω, 18 Ω and 36 Ω respectively, joined
     in parallel, is connected in series with a fourth resistance. The whole is supplied at
     60 V and it is found that the power dissipated in the 12 Ω resistance is 36 W.

Determine the value of the fourth resistance and the total power dissipated in the group.

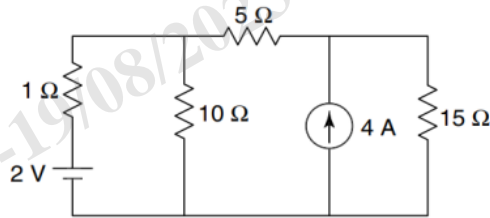**b)** Using Norton's theorem find current flowing through the 10Ω resistor in Figure 1.

Fig.1

c) Find the magnitude of current through 2Ω resistor by using mesh analysis method in the circuit of Fig.2.
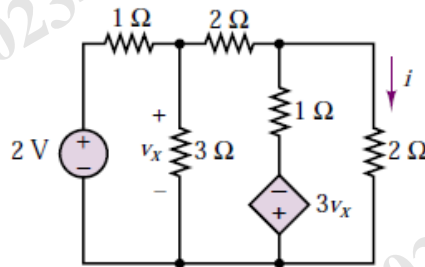

Fig.2

d) Two impedances given by $Z_1=(10+j5)$ and $Z_2=(8+j6)$ are joined in parallel and across a voltage of $V=(200+j0)$ volts. Calculate the circuit current, power factor, its phase and branch currents. Draw the phasor diagram.

e) Write a short note on -3 Phase power measurement by 2 wattmeter method.

f) Three similar coils each having a resistance of 20 Ω and an inductance of 0.05 Henry are connected in Delta to a 3-phase, 50 Hz, 400 V supply. Calculate i) line current, ii) power factor, iii) power absorbed iv) total apparent power.

g) Draw the B-H curve and briefly describe about hysteresis loop.

h) The uneven ring-shaped core shown in Fig.3 below has $\mu_r = 1000$ and the flux density in the thicker section is to be 0.75 T. If the current through a coil wound on the core is to be 500 mA, determine number of coil turns required.
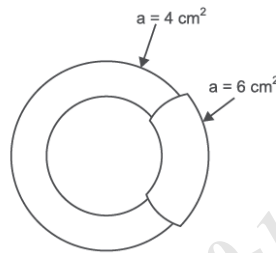

Fig.3

i) A single phase 4kVA transformer has 400 primary turns and 1000 secondary turns. The net cross-sectional area of the core is 60 cm². When the primary winding is connected to 500V, 50Hz supply, calculate: (i) the maximum flux density in the core (ii) the voltage induced in the secondary winding and (iii) the secondary full load current.

j) Explain the principle of operation and constructional features of a 3-phase Induction Motor.

k) Derive the torque equation for a DC motor? And, justify why DC series motors are

used for high torque applications?

I) An 8-pole dc generator has 500 armature conductors and a useful flux of 0.05 Wb per pole. What will be the emf generated if it is lap connected and runs at 1200 rpm? What must be the speed at which it is to be driven to produce the same emf if it is wave wound?

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Two impedances Z_1 and Z_2 are connected in parallel across applied voltage of (100+j200) volts. The total power supplied to the circuit is 5kW. The first branch takes a leading current of 16A and has a resistance of 5 ohms while the second branch takes a lagging current at 0.8 power factor. Calculate: **(16)**
i)   Current in second branch. ii) Total current . iii) Value of the circuit elements

Q4 Three equal impedances of resistance 6Ω and impedance 10Ω are connected in star and given supply from a 3-phase 400V 50Hz source. Find the Line current, Phase current and active power consumed. Also find the phase current, line current and active power consumed, if the three impedances are connected in delta. Comparing the power consumption in both the connections, what can be inferred? **(16)**

Q5 Discuss the principle of operation of a single-phase transformer. Derive the emf equation. Also discuss the constructional features of it. **(16)**

Q6 Draw and explain the 'torque – speed' characteristics of a three phase induction motor **(16)**

2nd Semester Reg. / Back Examination: 2022-2023
Basic Electronics Engineering
AERO, AE, AUTO, BIOTECH,CHEM,CIVIL,CST,CSEAI, CSEDS,CSE,CSIT,CSEAIME,ELECTRICAL &
C.E,EEE,ELECTRICAL,ECE,ETC,EIE,MANUTECH,MECH,MME,METTA,MINERAL,MINING,PLASTIC,IT
Time : 3 Hour
Max Marks : 100
Q.Code : M383
Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1		Answer the following questions:	(2 x 10)
	a)	Draw the equivalent circuit diagram of a diode.	
	b)	Draw V-I characteristics of the ideal zener diode.	
	c)	Write the applications of CE, CB, CC configuration of transistors.	
	d)	Define slew rate.	
	e)	Distinguish between BJT and FET.	
	f)	Draw the circuit diagram of an Op Amp differentiator.	
	g)	Write 4 applications of closed loop Op amp circuits.	
	h)	Draw logic gate symbols for NOR & X-OR gates.	
	i)	Draw the OR gate using NAND gates.	
	j)	$(127)_{10} = (?)_8$ and $(110110)_2 = (?)_{16}$	

Part-II

Q2		Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)	(6 × 8)
	a)	Draw the VI characteristics of a diode and explain about its current equation.	
	b)	Explain the principle of operation of a pnp transistor.	
	c)	What is a zener diode? Explain about its constructional details with applications.	
	d)	Explain the operation of a digital inverter.	
	e)	Explain about MOSFET and its characteristics.	
	f)	Explain the principle of operation of a JFET.	
	g)	Design a circuit which produces the output voltage $V_0 = 2V_1 - 6V_2 + 9V_3$ using Op-amp with minimum resistance value 50kΩ.	
	h)	Write the ideal characteristics of Op-amp, with its physical interpretation.	
	i)	Derive the output voltage of a differentiator circuit using Op-amp.	

j)	Design a full adder using NOR gates only.
k)	Design a X-OR gate using minimum number of NOR gates.
l)	Explain about number systems and its conversion details.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3	Explain various types of transistors, its constructional details and input output characteristics.	**(16)**
Q4	Explain in detail about CMOS, its constructional details, merits and applications.	**(16)**
Q5	What is an op-amp, its equivalent circuit, applications with neat circuits.	**(16)**
Q6	Design a half adder, full adder, full substractor with NAND gates only.	**(16)**

B.Tech/
Integrated Dual Degree (B.Tech and M.Tech)
RCH2A002

2ⁿᵈ Semester Reg/Back Examination: 2022-23
Chemistry
BRANCH(S): AEIE, CIVIL, CST, CSEAI, CSEDS, CSE, CSIT, CSEAIME, ELECTRICAL & C.E, EEE, ELECTRICAL, ECE, ETC, EIE, IT, MANUTECH, MECH, METTA, MINING, PLASTIC, AE, AUTO
Time: 3 Hour
Max Marks: 100
Q. Code: M553
Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1   **Answer the following questions:**   **(2 x 10)**

a) State Lambert Beer's law.
b) Draw the phase diagram of water system.
c) What is producer gas?
d) Explain the term component. How many components are present in the following system ?

Water $\rightleftharpoons$ Water - vapour

e) What is an Eutectic system?
f) What is synthetic petrol
g) What is cathodic protection?
h) What are chromophores?
i) What is power alcohol?
j) What is stress corrosion?

Part-II

Q2   **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)**   **(6 × 8)**

a) Discuss the postulates of quantum mechanics.
b) Discuss the effect of conjugation on chromophores.
c) Write a short note on refining of petroleum.
d) Explain triple point and eutectic point with examples.
e) Discuss main features of the phase diagram of water system, explaining especially why the slope of solid-liquid line is negative for water.
f) Write a short note on cathodic protection.
g) Classify the nano materials based on the size of particles and distinguish between 0D, 1D and 2D nano materials.

h) Give an account of gaseous fuels.

i) What is calorific value of a fuel? How it is determined by Dulong's formula.

j) Discuss how nanomaterials are synthesized via green synthetic routes.

k) Discuss the principles and application of vibrational spectroscopy.

l) How G.C.V. and N.C.V. of a fuel is calculated?

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Discuss the Lambert Beer's law and its application in analyzing samples by UV-Visible spectroscopy. **(16)**

Q4 What is phase rule? Discuss the phase diagram of Bi-Cd system. **(16)**

Q5 What is corrosion? Discuss different types of corrosion and factors affecting corrosion. **(16)**

Q6 Explain the synthesis of nanomaterial by top-down and bottom-up approaches. Discuss the application of nanomaterials in environmental fields and electronic devices. **(16)**

2nd Semester Regular/Back Examination: 2022-23
Engineering Mechanics
AERO, AE, AEIE, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CST, CSEAI, CSEDS, CSE, CSIT, CSEAIME, ELECTRICAL & C.E, EEE, ELECTRICAL, ECE, ETC, EIE, IT, MANUTECH, MECH, MME, METTA, MINERAL, MINING, PLASTIC, ELECTRONICS & C.E

Time : 3 Hour
Max Marks : 100
Q.Code : M310
Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** (2 x 10)
a) State Lami's theorem.
b) Find the resultant of two forces equal to 50 N and 30 N acting at an angle of 60°.
c) State the Varignon's principle of moments.
d) What is a couple? What is the arm of a couple and its moment ?
e) What is a free-body diagram?
f) Define coefficient of friction and limiting friction.
g) State the perpendicular axis theorem.
h) What do you understand by perfect truss, deficient truss and redundant truss structure?
i) State D' Alembert's Principle.
j) A body is moving with a velocity of 3 m/s. After five seconds the velocity of the body becomes 13 m/s. Find the acceleration of the body.

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** (6 × 8)
a) Define and explain the following terms:
(i) Coplanar and non-coplanar forces
(ii) Collinear and concurrent forces
(iii) Parallel and non-parallel forces.
b) A uniform plank ABC of weight 30 N and 2 m long is supported at one end A and at a point B 1.4 m from A as shown in Fig 1. Find the maximum weight W, that can be placed at C, so that the plank does not topple.
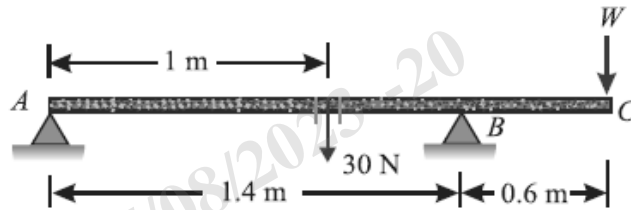
Fig. 1

c) Two identical rollers P and Q, each of weight W, are supported by an inclined plane and a vertical wall as shown in Fig. 2. Assume all the surfaces to be smooth. Draw the free body diagrams of:

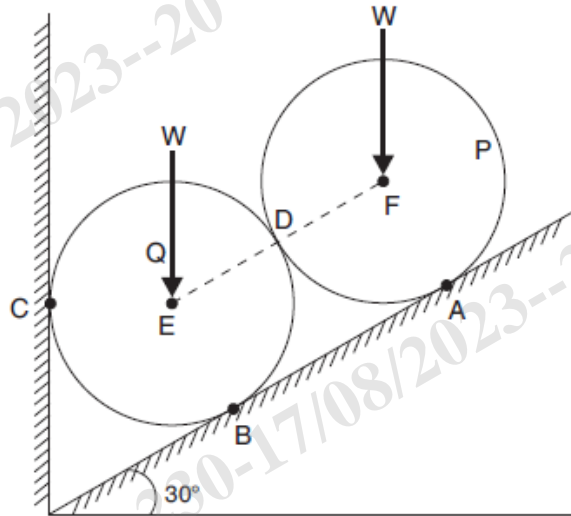   (i) roller Q, (ii) roller P and (iii) rollers P and Q taken together.

Fig. 2

d) The force required to pull a body of weight 40 N on a rough horizontal plane is 15 N. Determine the co-efficient of friction if the force is applied at an angle of 20° with the horizontal.

e) Consider the triangle ABC of base 'b' and height 'h'. Determine the distance of centroid from the base.

f) Find the centroid of a 100 mm × 150 mm × 30 mm T-section as shown in Fig. 3.
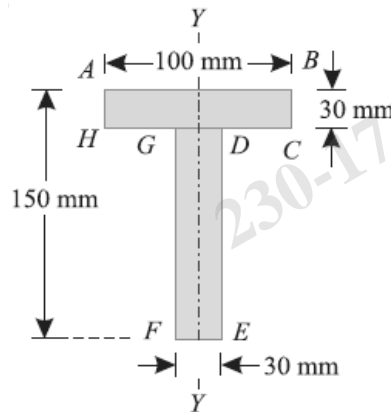

Fig. 3

g) Find the moment of inertia of a rectangular section 60 mm wide and 40 mm deep about its centre of gravity.

h) State and prove the theorem of parallel axis.

i) State the principle of virtual work. Explain the application of the principle of virtual work in case of lifting machines.

j) The equation of motion of a particle moving in a straight line is given by

$$s = 18t + 3t^2 - 2t^3$$

where *s* is the total distance covered from the starting point is metres at the end of *t* seconds. Find:

(i) the time, when the particle reaches its maximum velocity

(ii) the maximum velocity of the particle.

k) A particle is thrown with a velocity of 5 m/s at an elevation of 60° to the horizontal. Find the velocity of another particle thrown at an elevation of 45° which will have (a) equal horizontal range, and (b) equal maximum height.

l) A body of mass 50 kg, moving with a velocity of 6 m/s, collides directly with a stationary body of mass 30 kg. If the two bodies become coupled so that they move on together after the impact, what is their common velocity.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Two smooth spheres of weight 'W' and radius 'r' each are in equilibrium in a horizontal channel of 'A' and 'B' vertical sides as shown in Fig. 4. Find the force exerted by each sphere on the other. Calculate these values, if r = 250 mm, b = 900 mm and W = 100 N. **(16)**
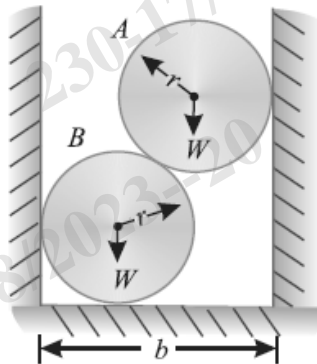

Fig. 4

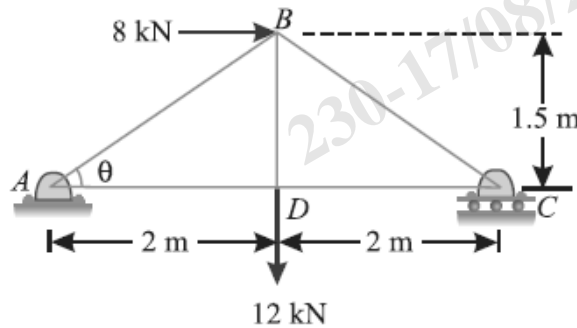**Q4** Find the reactions and forces in the members of the truss as shown in Fig. 5. **(16)**

Fig. 5

Q5   Two smooth inclined planes whose inclinations with the horizontal are 30° and   **(16)**
20° are placed back to back. Two bodies of mass 10 kg and 6 kg are placed
on them and are connected by a light inextensible string passing over a
smooth pulley as shown in Fig 6. Find the tension in the string. Take g = 9.8
m/s^2.
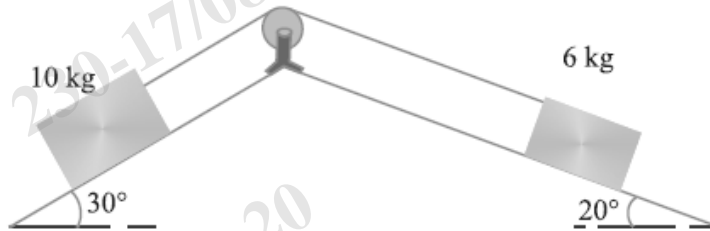
Fig. 6

Q6   A body weighing 196.2 N slides up a 30° inclined plane under the action of an   **(16)**
applied force 300 N acting parallel to the inclined plane. The co-efficient of
friction, μ is equal to 0.2. The body moves from rest.
Determine:
(i) acceleration of the body,
(ii) work done on the body in four seconds,
(iii) momentum of the body after four seconds,
(iv) impulse applied in four seconds.

Registration No :

B. Tech./
Integrated Dual Degree (B. Tech & M.Tech)
RMA2A001

2ⁿᵈ Semester Regular/Back Examination: 2022-23
Mathematics II
All branches
Time : 3 Hour
Max Marks : 100
Q. Code : M442
Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1   **Answer the following questions :**   **(2 x 10)**
- **a)** Write the definition of a basis for a vector space V.
- **b)** Under what condition a nonhomogeneous system of m linear equations in n unknowns will have no solution?
- **c)** If $A = \begin{pmatrix} 1 & 0 & 0 \\ 1 & -2 & 0 \\ 3 & 1 & 4 \end{pmatrix}$, what are the eigenvalues of the matrix A?
- **d)** Eigen values of skew-symmetric matrices are either_____ or _____.
- **e)** Express the straight line parametrically which passes through the point (2, -1, 4) in the direction of the vector (1, 2, -1).
- **f)** Find curl of $\vec{F} = x^2\hat{i} + y^2\hat{j} + z^2\hat{k}$.
- **g)** State Green's Theorem in a plane.
- **h)** Find the surface normal $\vec{N}$ to the surface f(x, y ,z)= $x^2 + y^2 - z^2$.
- **i)** What is the fundamental period of the function $\cos \pi x$?
- **j)** Define Fourier series of a function f(x) in $(-\pi, \pi)$.

Part-II

Q2   **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)**   **(6 × 8)**

- **a)** Solve the equations 4y +3z = 8; 4x – 2z = 10; 3x +2y = 5 by any suitable method.
- **b)** Find the inverse of the matrix $\begin{pmatrix} 4 & 2 & 1 \\ 3 & 2 & 5 \\ 2 & 0 & 5 \end{pmatrix}$.
- **c)** Show that the product of two orthogonal matrix is orthogonal.

d) Diagonalize the matrix $\begin{pmatrix} 2 & 3 \\ 5 & 1 \end{pmatrix}$.

e) Show that the eigenvalues of Hermitian matrix is always real.

f) Find the directional derivative of the function $f(x, y, z) = e^x + e^y + e^z$ at the point P(-4, 2, 3) in the direction $\vec{a} = [1, 2, 1]$

g) Find the area bounded by the line $y = x$ and the curve $y = x^2$.

h) Evaluate $\int_C \vec{F}(\vec{r}).d\vec{r}$ where $\vec{F} = [1, y, z]$ and C: $\vec{r} = [t, \cos t, \sin t]$ from $(0, 1, 0)$ to $(\pi/2, 0, 1)$.

i) Use Stokes' theorem to compute $\oiint_S curl\vec{F}.d\vec{S}$ where $\vec{F} = x^2\hat{i} + 2x\hat{j} + 2z\hat{k}$ and S is the surface given by $x^2 + \dfrac{y^2}{4} + \dfrac{z^2}{a^2} = 1, \quad z \geq 0.$

j) Find the Fourier series of the given function $f(x) = \begin{cases} k, & -\pi < x < 0 \\ -k, & 0 < x < \pi \end{cases}$

k) Find the Fourier cosine transform and Fourier sine transform of $f(x) = \begin{cases} 5, & -1 < x < 1 \\ 0, & otherwise \end{cases}$

l) Show by Fourier integral that $\displaystyle\int_0^\infty \dfrac{\cos wx + w \sin wx}{1 + w^2}dw = \begin{cases} 0, & x < 0 \\ \pi e^{-x}, & x > 0 \end{cases}$

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Solve the system of equations $2x_1 + x_2 - 2x_3 + 2x_4 = 5$; $4x_1 + 5x_2 - 3x_3 + 6x_4 = 9$; **(16)**
$-2x_1 + 5x_2 - 2x_3 + 6x_4 = 4$; $4x_1 + 11x_2 - 4x_3 + 8x_4 = 2$.

Q4 Find the eigenvalues and eigenvectors of the matrix $\begin{pmatrix} -2 & -4 & 2 \\ -2 & 1 & 2 \\ 4 & 2 & 5 \end{pmatrix}$. **(16)**

Q5 Find the Fourier series of the function $f(x) = \begin{cases} 0, & -2 < x < 0 \\ 2x, & 0 < x < 2 \end{cases}$ with period 4. **(16)**

Q6 Evaluate $\oiint_S \vec{F}.\vec{n}\,dA$ where $\vec{F} = [6x, 0, -2z]$, over the sphere S: **(16)**
$x^2 + y^2 + z^2 = 4$ (i) directly and (ii) using Gauss Divergence theorem.

2nd Semester Reg/Back Examination: 2022-23
PHYSICS
BRANCH(S): AERO,AE,AUTO,BIOMED,BIOTECH,CHEM,CIVIL,CST,CSEAI,
CSEDS,CSE,CSEAIME,ELECTRICAL & C.E,EEE,ELECTRICAL,
ECE,ETC,IT,MECH,MME,METTA,MINERAL,CSIT,ENV,MANUTECH,MINING,PLASTIC

Time : 3 Hour
Max Marks : 100
Q. Code : M554
Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1   **Answer the following questions:**   **(2 x 10)**

a) How does the time period of damped oscillator relate to damping constant?

b) The amplitudes of two coherent waves are in the ratio 2:3. Find the ratio of maximum to minimum intensities when they superpose.

c) Mention the conditions necessary for production and observation of an interference pattern.

d) The brightest image formed by a zone plate is at a distance of 30 cm from it. At what distance is the next bright image formed?

e) What do you mean by population inversion?

f) A step index optical fiber has a core of refractive index 1.5 and a cladding of refractive index 1.47. Estimate the numerical aperture of the fiber?

g) What do you mean by reciprocal lattice?

h) State Stoke's theorem. Write down the theorem mathematically. What is the use of this theorem?

i) Find the value of divergence of position vector '**r**'.

j) What is stopping potential in Photo electric effect? Is it dependent on intensity or frequency of radiation?

Part-II

Q2   **Only Focused-Short Answer Type Questions- (Answer Any Eight out of**   **(6 × 8)**
         Twelve)

a) What do you mean by normal mode of oscillation? Compare between Q1 and Q2 mode oscillations.

b) Solve the differential equation of damped harmonic motion and discuss the motion of oscillator in under damped condition.

c) State principle of superposition. Two waves of same frequency and having amplitudes A1 and A2 superpose coherently producing interference pattern. Derive the expression for maximum and minimum intensity of resultant wave.

d) (i) Differentiate zone plate from convex lens.   **4+2**
       (ii) A zone plate is constructed in such a way that radii of the zone are same as that

of Newton's rings formed in reflected light with radius of curvature of Plano convex lens 1 cm. Find the principal focal length of the zone plate.

e) Discuss the working of He-Ne laser.

f) With neat block diagram explain the working of Fiber Optic Communication Link.

g) What is energy band? Classify conductor, semiconductor and insulator in terms of band theory.

h) State Gauss' law of electrostatics and derive the Maxwell's 1st equation in differential form.

i) Derive the equation of electromagnetic wave in terms of $\vec{E}$ and $\vec{B}$.

j) (i) What do you mean by matter wave? Discuss de Broglie hypothesis.   **4+2**
(ii) Calculate de Broglie wavelength of a neutron whose kinetic energy is 0.025eV. Take mass of neutron = 1.67×10^{-27} kg.

k) Solve the Schrodinger's time independent equation to find the energy eigen values of a free particle.

l) (i) Derive the Bragg's law in crystals?   **4+2**
(ii) Find the wavelength of the first order Bragg's reflection if the glancing angle is 50°, assuming that the grating spacing is 8.0 Å.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 **a** Solve the differential equation for one dimensional oscillator subjected to damping force proportional to velocity and an external periodic force to obtain amplitude, velocity, energy and power dissipated. Derive the condition of resonance. How the maximum amplitude at resonance does depends on the damping constant.   **14+2**

b In a forced oscillator, the damping coefficient $\beta = 0.8$ s^{-1} and the resonant frequency is 800 Hz. Find the Q-factor of the oscillator.

Q4 **a** Describe in detail with necessary theory and experiment to determine the refractive index of a liquid using Newton' ring apparatus.   **12+4**

b A source of light emitting two wavelengths $\lambda_1 = 6000$ Å and $\lambda_2 = 4500$ Å is used in a normal setup for Newton's rings. It is found that the n_{th} dark ring due to λ_1 coincides with $(n+1)^{th}$ dark ring for λ_2. If the radius of curvature of the concave surface is 100 cm, find the diameter of nth dark ring for λ_2.

Q5 **a** Derive the expression for intensity in Fraunhofer diffraction through a single slit. Discuss the position of maxima and minima.   **(8)**

b (i) Discuss the construction, principle and working of an optical fiber in detail.   **6+2**
(ii) The light output of laser is 694.3 nm. Calculate the energy difference in eV between the two levels.

Q6 **a** i) What is Poynting vector? Deduce Poynting theorem.   **6+2**

ii) Capacitance of a parallel plate capacitor is 2 μF. Calculate the rate at which the potential difference between the two plates must change to get a displacement current of 0.4 A.

b i) Using Schrodinger's equation find out the wave function and energy eigen values of a free particle in an one-dimensional box of width 'a'.   **6+2**
ii) In Compton scattering by electrons the incident photons have wavelength of 0.5 nm. Calculate the wavelength of scattered radiation if they are viewed at an angle of 45° to the direction of incidence.

Total Number of Pages: 03

2ⁿᵈ Semester Regular/Back Examination: 2022-23
Programming For Problem Solving Using C
AERO, AE, AEIE, AUTO, BIOMED, BIOTECH, CHEM, CIVIL, CST, CSEAI, CSEDS, CSE, CSIT, CSEAIME, ELECTRICAL & C.E, EEE, ELECTRICAL, ECE, ETC, EIE, IT, MANUTECH, MECH, MME, METTA, MINERAL, MINING, PLASTIC
Time : 3 Hours
Max Marks : 100
Q.Code : M246
Answer Question No.1 (Part-1) which is compulsory, a ny eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1	Answer the following questions:	(2 x 10)
a)	Mention three main purposes of an operating system?	
b)	Represent the following C code using flow chart.	

if (a>b) printf("a>b");
else printf("a<b");

c) What is the ternary operator? Write its syntax and the actual code that it means.
d) Differentiate between compilation error and logical error.
e) Write the use of break statement with example.
f) Write a program segment to swap two variables without using a third variable.
g) What is dangling pointer in C?
h) Consider the following declaration of a 'two-dimensional array in C:
char a[100][100];
Assuming that the main memory is byte-addressable and that the array is stored starting from memory address 0. Find the address of a[40][50]?
i) Predict the output of below program:

```c
#include <stdio.h>
int main()
{
    int arr[5];
    // Assume base address of arr is 2000 and size of integer is 32 bit
    printf("%u %u", arr, &arr[1]);
    return 0;
}
```

j) Write any three library functions to read from a file. If fopen() functions is not able to open a file, what does it returns?

Part-II

Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 × 8)**

a) Explain different type of operators used in C programming with suitable examples.

b) Write a C program to find the number of matching substrings in a string and print their position in the string.

Input: string= abbacccacbac, substring=bac

Output: number of matchings=2, positions=3, 10

c) An electricity board charges the following rates for the use of electricity: for the first 200 units 80 paise per unit: for the next 100 units 90 paise per unit: beyond 300 units Rs 1 per unit. All users are charged a minimum of Rs. 100 as meter charge. If the total amount is more than Rs 400, then an additional surcharge of 15% of the total amount is charged. Write a C program to read the name of the user, number of units consumed and print out the charges.

d) Distinguish between entry-controlled loop and exit controlled loop with suitable examples. Write a program to find the sum of all prime numbers from 1 to n (taking n as user input).

e) Explain with suitable examples the scope, visibility, and lifetime of auto, external, static and register variables.

f) Write a C program to determine if a matrix is symmetric, skew-symmetric, or asymmetric.

g) Write a program in C to test a string whether palindrome or not.

h) Define a pointer? Discuss the declaration and initialization of the pointer variable. Define a function that uses pointers to take two matrices as input and returns their product.

i) What is a self-referential structure? Demonstrate the difference in usage of malloc() and calloc() functions for dynamic memory allocation. Write the C code to allocate space dynamically to a two-dimensional array of size 20 X 30.

j) Define a structure timeDuration that contains a time duration definition in hours, minutes, and seconds. Define a function timeAdder() that takes a list of durations and their number/size as input and calculates the total time elapsed. Use pointer arithmetic with pointers to structures.

k) Define a function binSearch() that performs iterative binary search on a given sorted array of integers. What is the time complexity and space complexity of binary search algorithm.

l) Write a C program to sort the elements of an unsorted array of integers using insertion sort algorithm. What is the worst-case and best-case time complexity of insertion sort algorithm.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 What is an array? Discuss different ways to declare and define one-dimensional and two-dimensional arrays with suitable examples. **(16)**
Write a C program to enter a matrix of order m X n then print the difference between sum of the elements of main diagonal and sum of the elements of first row of the matrix.

Q4 Define function in C programming? Classify the user defined functions in C based on parameter passing and return type with suitable examples. **(16)**
Like Fibonacci, there exists a Tribonacci series where the n-th term is defined as:

$T(n) = T(n-1) + T(n-2) + T(n-3)$, where $T(0) = 0$, $T(1) = T(2) = 1$

Define a recursive function that takes 'n' as user input and prints the n-th Tribonacci term.

Q5   Differentiate between structure and union, with an appropriate example that demonstrates the storage of the data members.   **(16)**

You are required to rank the students of a classroom based on their marks in a particular subject. Define a student structure containing the members – ID, Name, Marks, and Rank. Provide user input facility for 10 students' data (ID, Name, Marks). Give the rank values as per the student ranking in the class. Define functions to print the data as a table.

Q6   Differentiate properly the various modes of opening a file in C programming.   **(16)**

Write a C program to:

   a) create a file to store sequentially a list of products with the data – ID, Name, Rate, Quantity

   b) read the same file after creation and generate total bill amount.