JALPAIGURI GOVERNMENT ENGINEERING COLLEGE

[A GOVERNMENT AUTONOMOUS COLLEGE]

JGEC/B.TECH./CE/EE/ME/ES-CS101/2022-23

2023

PROGRAMMING FOR PROBLEM SOLVING

Full Marks: 70 Times: 3 Hours

The figures in the margin indicate full marks.

Candidates are requested to write their answers in their own words as far as practicable.

GROUP-A
[OBJECTIVE TYPE QUESTIONS]

Answer ***all*** questions 5x2=10

1. Convert $(52479)_{10}=(?)_8$

2. Differentiate between break and continue with suitable example?

3. Which will be the access specifier and according output?
```
char name[ ]= "Computer Science";
printf("% ",*name);
```

4.
```
#define CAL(x)(x*10)
void main( )
{
int a=3, b;
   b= CAL(a + 2);
printf("\n%d",b);
}
```
What will be the output?

5. Which of the following operator takes only integer value
a)+ b) - c) % d) /

GROUP-B
[LONG ANSWER TYPE QUESTIONS]

Answer any ***four*** questions 4x15=60

6. i) Write down the difference between while loop and do while loop with suitable example.
   ii) Write a C program to calculate the length of the string without using library function **strlen()?**
   iii) Write about the different bitwise operators and their function with suitable example.
   iv) Let a 2 D array is declared as int **arr[4][3];** What is the total memory size allocated by this array and maximum how many elements can be stored in this array? If the base address is **2000**, compute the address of **arr[2][3].** [Size of an integer variable **4** bytes by a typical compiler].

3 + 3+ 4+5

7. i) Write a user friendly C program to search an element from a 1-D array using linear search technique.
   ii) What is void pointer? Write a C function to add to values using pointer (call by address representation)?
   iii) Write auser friendly C program to check whether a number is Armstrong number or not(for example 153 is an Armstrong number since $153=1^3+5^3+3^3$).

5+(2+3)+5

8. i) Write a C program to print the sum of the following series:
   S= 1/1! + 1/2! + 1/3! + 1/4! + ... + 1/N! (Input N).

PTO

ii)Write a user friendly program in C to find & print the *Sum of all the numbers divisible* by 7 within a given Range and the range will be taken by user.

iii) Write auser friendly C program to multiply two matrices A[m][n] and B[n][m] and display the resultant matrix. Input should be given by the user.

5+5+5

9. i) Define a recursive function with suitable conditions?
   ii) Write a user friendly program in C to calculate the **GCD**of three numbers using recursion.
   iii) Write a user friendly program in C to find the sum and mean of all elements in a floatarray using pointers.

5+5+5

10. i) Define a structure called student that will describe
    {student name, roll number, year, marks}
    Using student, declare an array student with n elements and write a program to read the information about all the students and display them
    ii) Calculate the total required memory of the structure student that you have created.
    iii) Give an example of a ternary operator. Explain it with a suitable example.
    iv) Describe operator precedence and associativity with examples.

7+2+(1+2)+3

11. i) Write a user friendly C program to check whether a given alphabet is vowel or not using switch case.
    ii) Write a C program to print the following pattern

```
    *
   ***
  *****
 *******
*********
```

iii) What is function prototype? What do you mean by actual argument and formal argument?

5+5+(2+3)

12. i) What is array? Write the different properties of an array?
    ii) Write a user friendly C program to find the largest of an array with n integer elements using function.
    iii) Write a user friendly C program to convert the uppercase letter to lower case and vice versa.

(2+3)+5+5

END

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JGEC/B.TECH/ CE/EE/ME/BS-PH101/ 2022-23
2022
PHYSICS

Full Marks: 70 Times: 3 Hours

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GROUP-A
[OBJECTIVE TYPE QUESTIONS]

$2 \times 5 = 10$

Answer ***all*** questions

1. What will be the Brewster angle for a glass slab $(\mu = 1.5)$ immersed in water $(\mu = 4/3)$? 2

2. The wave function for a particle is given by $\psi(x) = ce^{-\alpha^2 x^2}, -\infty < x < \infty$, where C and α are constant. Calculate the probability of finding the particle in the region $0 < x < \infty$. 2

3. Show that $y = Asin(kx - bt)$ satisfy the 1-D wave equation. 2

4. Show that, $\vec{E} = x^2yz\hat{i} + xy^2z\hat{j} + xyz^2\hat{k}$ cannot represents a probable electrostatic field 2

5. An electron and a proton are accelerated through same potential. If rest mass of the proton is **1836** times higher than the mass of the electron, then calculate the ratio between the de-Broglie wavelengths of the proton and the electron 2

GROUP-B
[LONG ANSWER TYPE QUESTIONS]

$4 \times 15 = 60$

Answer any ***four*** questions

6. i) Find the total work done in moving a particle of mass **1 kg** in a force field given by $\vec{F} = 3xy\hat{i} - 5yz\hat{j} + 10zx\hat{k}$ N along the curve $x = t^2 + 1, y = 2t^2, z = t^3$ from $t = 1$ to $t = 2$. 3
   ii) Show that the Coulomb force is conservative. 4
   iii) Show that $\vec{\nabla} \times \vec{\nabla}\varphi = 0$. If $\varphi = x^2y - 3xz^2 + 2xyz$, verify that $\vec{\nabla} \times \vec{\nabla}\varphi = 0$ 2+3
   iv) Show that $\vec{A}.\frac{d\vec{A}}{dt} = A\frac{dA}{dt}$ 3

7. i) A polaroid is introduced in the path of the light beam. When it is rotated about the direction of propagation, it is found that the intensity of light oscillates in between a maximum and non-zero minimum value. In this context what do you conclude? 3
   ii) Comment on the state of polarization of the given electric vector: $\vec{E} = \hat{i}E_0\cos(kz - \omega t) - \hat{j}E_0\sin(kz - \omega t - \pi/2)$ 3
   iii) A left circularly polarized beam ($\lambda = 589$ nm) is incident normally on a calcite crystal (with optic axis cut parallel to the surface) of thickness **0.0025705** mm. What will be the state of polarization of the emergent beam? $[n_o = 1.65836, n_e = 1.48641]$ 4
   iv) Derive Brewster's Law 5

8. i) An electron is confined to a box of length 10^{-8} cm. Calculate the minimum uncertainty in the measurement of its velocity. $[m_e = 9.11 \times 10^{-31}$ kg$]$ 3
   ii) What is Compton effect? Derive an expression for the Compton shift in the wavelength of a photon when it is scattered from a free electron. 6
   iii) At what wavelength does a cavity at **6000** K radiate most per unit wavelength? 3
   iv) The wavelength of the yellow spectral emission is **589** nm. At what kinetic energy would an electron have the same de Broglie wavelength? 3

20 → (i) $\nabla \cdot D = 0$ (ii) $\nabla \cdot B = 0$ (iii) $\nabla \times E = -\frac{\partial B}{\partial t}$ (iv) $\nabla \times H = J_D$ $[\because J_C = 0]$

$\vec{P} = D_0 - D_i$

$K\varepsilon_0 E - \varepsilon E_0$

$\vec{P} = \varepsilon_0 (K-1) E$

& $\vec{D} = \varepsilon_0 (K-1) + P$

$\therefore D$ is displacement density

9. i) Find the commutator $[A, B]$ where $A = x^3, B = x\frac{d}{dx}$ 3
   ii) Argue that $\psi^*(x,t)\psi(x,t)$ must be real, and either positive or zero. 3
   iii) Calculate $< x >$ for a particle confined in 1-D infinite potential well. 5
   iv) Show that $< p >$ is real. 4

10. i) Write down 4-Maxwell's equation inside a dielectric medium in EM theory. 4
    ii) Show that EM wave is transverse in nature. 4
    iii) Define Poyinting vector. Find the Poyinting vector associated with an EM wave whose electric vector is 4
    $\vec{E} = \hat{\imath} E_0 \sin(kz - \omega t)$
    iv) Write a short note on "displacement current density". 3

11. i) A particle of mass **5 *gm*** moves along x-axis under the influence of two forces: (a) a force of attraction to the origin ***O*** which in dyne is numerically equal to **40** times the instantaneous distance from ***O*** and (b) a damping force proportional to the instantaneous speed such that when the speed is **10 *cm/s*** the damping force is **200 *dyne***. Assuming that the particle starts from rest at a distance **20 *cm*** from ***O***.
    Set up the differential equation and conditions describing the motion and find the position of the particle at any time. 2+4
    ii) N number of SHMs, all in the same straight line and having the same amplitude and frequency, but with a constant phase difference, are superposed. Calculate the amplitude of the resultant. 5
    iii) A parallel beam of light ($\lambda = 5000\ \AA$) to be incident on a narrow long slit of width **0.2 *mm***. A screen is placed at distance **3 *m*** from the slit. Assuming that the screen is so far away that the diffraction is essentially of the Fraunhofer type, calculate the total width of the central maxima. 4

$A = x^3, \quad B = k\frac{d}{dx}$

$[A,B] = AB - BA$

$= x^3 \times \frac{d}{dx} - x\left(\frac{d}{dx} \cdot x^3\right)$

$= x^3 \times \frac{d}{dx} - 3x^3 \frac{d}{dx}$

$= x^3 \frac{d}{dx}(x - 3)$,

1 D,

$-\frac{\hbar^2}{2m}\frac{\partial^2\psi}{\partial x^2} = -i\hbar\frac{\partial\psi}{\partial t}$.

$-\frac{\hbar^2}{2c}\cdot\frac{\partial^2\psi}{\partial y^2} = -i\hbar\frac{\partial\psi}{\partial t}$.

$+\frac{\hbar^2}{2a}\cdot\frac{\partial^2\psi}{\partial z^2} = -i$

0.75092 x 20

The tangent of the Polarisation angle

i) ~~$\theta = \tan$~~ = to the μ of μ.

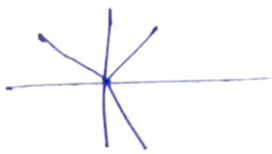
$\mu = \frac{\mu_\theta}{\mu_w} = \frac{15}{4/3} = 1.125$

By Brewsters law

$\therefore \tan I_p = \mu$

$\therefore I_p = \tan^{-1} 1.125$ θ_P = Polarisation angle

$I_p = 48.366°$



from Snil $\mu = \frac{\sin\theta_1}{\sin\theta_2} = \frac{\sin\theta_P}{\cos\theta_P} = \mu$

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JGEC/B.TECH/CE/EE/ME/ECE/BS-M101B/2022-23
2022
MATHEMATICS IB

Full Marks: 70 Times: 3 Hours

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GROUP-A
[OBJECTIVE TYPE QUESTIONS]

$5 \times 2 = 10$

Answer ***all*** questions

1. Examine the function $f(x) = x^3 - 6x^2 + 24x + 4$ for maxima or minima. 2
2. Find $\Gamma(1)$. 2
3. Find the directional derivative of $f(x, y, z) = x^2yz + 4xz^2$ at the point $(1,2,-1)$ in the direction of the vector $2\hat{\imath} - \hat{\jmath} - 2\hat{k}$. 2
4. Find the radius of convergence of the series $\frac{1}{2}x + \frac{1.3}{2.5}x^2 + \frac{1.3.5}{2.5.8}x^3 + \ldots\ldots\ldots$ 2
5. If $y = 2\cos x(\sin x - \cos x)$, show that $(y_{10})_0 = 2^{10}$. 2

GROUP-B
[LONG ANSWER TYPE QUESTIONS]

$5 \times 12 = 60$

Answer any ***five*** questions

6. (a) Reduce the matrix $\begin{pmatrix} 1 & 3 & 4 & 3 \\ 3 & 9 & 12 & 3 \\ 1 & 3 & 4 & 1 \end{pmatrix}$ in a row reduced echelon form and hence find its rank. 4

(b) Determine the value of k for which the system of equations

$$x + y + z = 1$$
$$2x + y + 3z = -2$$
$$x + y + kz = k + 4$$

has (i) no solution, (ii) a unique solution, (iii) has infinitely many solution. 4

(c) $A = \begin{pmatrix} 0 & -1 & 2 \\ 1 & 0 & 3 \\ 2 & 3 & 0 \end{pmatrix}$. Find A^{-1} using Cayley-Hamilton theorem. 4

7. (a) For the matrix $A = \begin{pmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{pmatrix}$, find a matrix P such that $P^{-1}AP$ is a diagonal matrix. 7

(b) Prove that $\int_0^1 \frac{dx}{(1-x^6)^{\frac{1}{6}}} = \frac{\pi}{3}$. 5

8. (a) Given the function $f(x, y) = \begin{cases} \frac{xy(x^2-y^2)}{x^2+y^2}, & (x, y) \neq (0,0) \\ 0, & (x, y) = (0,0) \end{cases}$

Show that $f_{xy}(0,0) \neq f_{yx}(0,0)$. 4

(b) If $z = (1 - 2xy + y^2)^{-\frac{1}{2}}$, show that $\frac{\partial}{\partial x}\left\{(1-x^2)\frac{\partial z}{\partial x}\right\} + \frac{\partial}{\partial y}\left\{y^2\frac{\partial z}{\partial y}\right\} = 0$. 3

(c) Find the maximum and minimum values and saddle points of the following function $f(x, y) = x^3 + y^3 - 3axy, \quad (a \neq 0)$. 5

9 (a) Find the equation of the tangent plane and normal line to the surface $2x^2 + y^2 + 2z = 3$ at the point $(2,1,-3)$ 5

(b) For any scalar point function $f(x,y,z)$, show that $grad f$ is irrotational. 3

(c) If $f(x,y) = \begin{cases} \frac{x^2y^2}{x^2y^2+(x-y)^2}, & for\ (x,y) \neq (0,0) \\ 0, & for\ (x,y) = (0,0) \end{cases}$ 4

then show that $\lim_{(x,y)\to(0,0)} f(x,y)$ does not exist.

10. (a) Verify Rolle's theorem for the function $f(x) = x\sqrt{a^2 - x^2}$ in $0 \leq x \leq a$. 3

(b) State and prove Lagrange's mean-value theorem and give its geometric interpretation.

(c) Use mean-value theorem to prove that 1+3+2

$$0 < \frac{1}{log(1+x)} - \frac{1}{x} < 1 \ \forall x > 0$$ 3

11. (a) State Taylor's theorem with Lagrange's form of remainder. Expand the function $f(x) = \cos x$ in powers of x in infinite series satisfying the conditions under which the expansion is valid. 1+(2+1)

(b) Find the values of a and b such that $\lim_{x\to 0} \frac{x(1-a\cos x)+b\sin x}{x^3} = \frac{1}{3}$, assuming that L'Hospital rule is applicable. 4

(c) Check the convergence of the sequence $\{a_n\}$ where

$$a_n = 1 + \frac{1}{2!} + \frac{1}{3!} + \ldots\ldots + \frac{1}{n!}\ .$$ 4

12. (a) Test the convergence of the series 6

$$\frac{x}{1} + \frac{1}{2}.\frac{x^3}{3} + \frac{1.3}{2.4}.\frac{x^5}{5} + \frac{1.3.5}{2.4.6}.\frac{x^7}{7} + \cdots\cdots\cdots (x > 0.$$

(b) Prove that the series $x - \frac{x^2}{2} + \frac{x^3}{3} - \cdots\cdots\cdots$ is absolutely convergent when $|x| < 1$ and conditionally convergent when $x = 1$. 6

13. (a) Find the Fourier series of the function $f(x)$ defined by 6

$$f(x) = \begin{cases} 0\ , -\pi < x \leq 0 \\ x, \quad 0 < x \leq \pi \end{cases} \text{ with } f(x + 2\pi) = f(x)\ .$$

(b) Obtain the cosine series for the function $f(x) = x$ in $0 < x < \pi$. Use Parseval's theorem to show that $\sum_{n=1}^{\infty} \frac{1}{(2n-1)^4} = \frac{\pi^4}{96}$. 4+2

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COE/B.TECH.(ME/CE/EE/ECE)/ BS-M201B/2022-23

2023

MATHEMATICS-IIB

Full Marks: 70 Time: 3 Hours

The figures in the margin indicate full marks.

Candidates are requested to write their answers in their own words as far as practicable.

GROUP-A
[OBJECTIVE TYPE QUESTIONS]

5x2=10

Answer ***all*** questions

1. Transform the differential equation $xy\cos x^2\,dx + 2\sin x^2\,dy = 0$ into an exact differential equation. 2

2. Show that $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}}\sin x$. 2

3. Using Green's theorem, show that $\frac{1}{2}\oint_C (xdy - ydx)$ = area of the region enclosed by the closed curve C. 2

4. Locate and classify (with reason) the singular points of the equation 2

$$x(x-1)^3\frac{d^2y}{dx^2} + 2(x-1)^3\frac{dy}{dx} + 3y = 0$$

5. Show that the function $f(z) = \bar{z}$ is continuous at $z = 0$ but not differentiable there. 2

GROUP-B
[LONG ANSWER TYPE QUESTIONS]

5x12=60

Answer any ***five*** questions

6. i) Solve : $xydx + (2x^2 + 3y^2 - 12)dy = 0$ 4

ii) Solve: $\frac{dy}{dx} + y = y^3(\cos x - \sin x)$ 4

iii) Find the general solution and the singular solution of the differential equation $y = x\frac{dy}{dx} + \sqrt{49(\frac{dy}{dx})^2 + 25}$. 2+2

7. i) Solve: $\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 6y = (xe^x)^3$. 4

ii) Solve by the method of variations of parameters : $\frac{d^2y}{dx^2} + a^2y = x\cos ax, a \neq 0$. 4

iii) Solve: $x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + 4y = x\,sin(logx)$. 4

8. i) Find the power series solution of the equation $(1+x^2)\frac{d^2y}{dx^2} + x\frac{dy}{dx} - xy = 0$ in powers of x. 6

ii) Use Rodrigue's formula to evaluate $P_0(x), P_1(x), P_2(x), P_3(x)$. Hence express $f(x) = 4x^3 + 6x^2 + 7x + 2$ in terms of Legendre's polynomials. 2+2

iii) Write the solution of the equation $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + (k^2x^2 - n^2)y = 0$ by reducing it to Bessel's equation. 2

9. i) Evaluate $\iint_R \frac{\sqrt{a^2b^2-b^2x^2-a^2y^2}}{\sqrt{a^2b^2+b^2x^2+a^2y^2}}dxdy$ where R is the positive quadrant of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$. 6

ii) Evaluate $\iint_R xy(x+y)dxdy$ where R is the region enclosed by the curves $y=x, y=x^2$. 6

10. i) State Green's theorem. Use Green's theorem to evaluate $\int_C [(3x-8x^2)dx+(4y-6xy)dy]$ where C is the boundary of the region bounded by $x=0, y=0$ & $x+y=1$. 1+5

ii) State Stoke's theorem. Evaluate $\int_C \vec{F}.d\vec{r}$ by Stoke's theorem, where $\vec{F}=y^2\hat{\imath}+x^2\hat{\jmath}-(x+z)\hat{k}$ and C is the boundary of the triangle with vertices at (0,0,0), (1,0,0), (1,1,1). 1+5

11. i) Prove that the function $f(z)$ defined by $f(z)=\begin{cases}\frac{(\bar{z})^2}{z}, z\neq 0\\ 0, z=0\end{cases}$ is not differentiable at the origin though Cauchy-Riemann equations are satisfied at that point. 3+3

ii) Show that the function $u(x,y)=e^x(xcosy-ysiny)$ is harmonic and find a function $v(x,y)$ such that $f(z)=u+iv$ is analytic. Then express $f(z)=u+iv$ as a function of z. 2+2+2

12. i) State Laurent's theorem. Expand the function $f(z)=\frac{z^2-1}{z^2+5z+6}$ as a Laurent's series in the region $2<|z|<3$. 2+4

ii) Evaluate $\int_\Gamma z^2dz$ where Γ is the boundary of the triangle with vertices $0, 1+i, -1+i$ and traversed in the clockwise sense. 6

13. Find the bilinear transformation which maps the points $z=1, i, -1$ into the points $w=i, 0, -1$ respectively. 3

ii) Use Cauchy's integral formula to evaluate $\iint_C \frac{e^z}{z^2+4}dz$ where C is the positively oriented circle $|z-i|=2$. 3

iii) Evaluate $\int_0^{2\pi}\frac{\cos 2\theta}{5+4\cos\theta}d\theta$, using Cauchy's residue theorem. 6

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JGEC/B.TECH/ CE/EE/ME/ ES- EE 201/ 2022-23
2023
BASIC ELECTRICAL ENGINEERING

Full Marks: 70 Times: 3 Hours

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GROUP-A
[OBJECTIVE TYPE QUESTIONS]

Answer *all* questions 5x2=10

1. Differentiate between active and passive circuit element.
2. How much power is represented by a circuit in which the equations of voltage across and current through the circuit are given by $e(t) = 160 \sin 314t$ and $i(t) = 42.5 \sin 314t$? Find both the instantaneous power and average power.
3. What is 'exciting current' of a transformer and what is the function of it?
4. What for brushes are employed in dc machines? Why the armature core of a dc machine is laminated?
5. How is the capacity of a storage battery determined- explain.

GROUP-B
[LONG ANSWER TYPE QUESTIONS]

Answer any ***four*** questions **4x15 = 60**

6. i) For the circuit shown in Figure-1, find V_X. 5
   ii) For the circuit of figure-2 calculate the value of current through 15 Ω resistor. 5

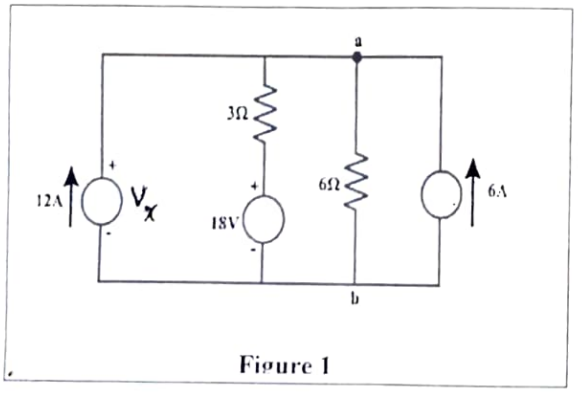


Figure 1

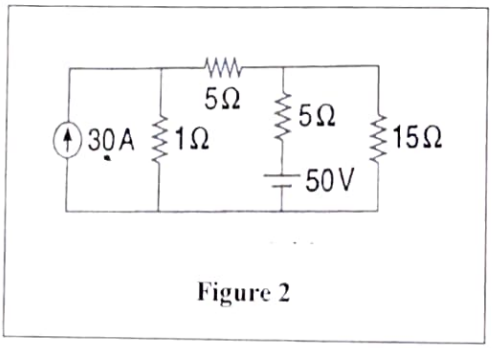


Figure 2

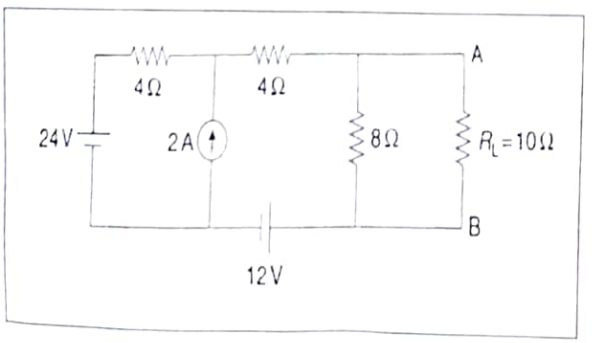


Figure 3

iii) Apply Thevenin's theorem to the circuit of figure-3, to obtain current through the load resistance $R_L = 10\Omega$ 5

7 i) What is the relationship between apparent power, true power, and reactive power of an ac circuit? Draw the power triangle. 2

ii) A 50 Hz voltage of 230 volts (rms) is impressed on an inductance of 0.2H. Write down the time domain (instantaneous) equations for the voltage across and current through the inductance at steady state. Let the zero point of the voltage wave be at t=0. 2

iii) A voltage $v(t) = 100 \sin 314t$ is applied to a circuit consisting of 25 Ω resistance and an 80 μF capacitance in series. Determine a) instantaneous current b) power factor c) Draw the phasor diagram. 6

iv) Prove that for star connected three phase circuit, the line voltage is equal to 1.732 times the phase voltage, whereas line current is equal to phase current. Also draw phasor diagram in support of your answer. 5

8. i) What is Maximum power transfer theorem? Prove the theorem. 1+4

ii) Calculate the value of R_L for which maximum power will be transferred from the source to the load in the network shown in the Figure-4. Hence calculate the value of maximum power transferred also. 3+1

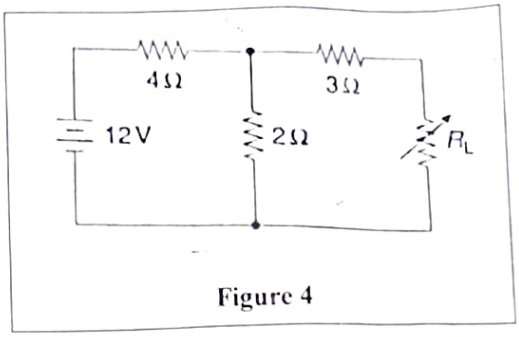


Figure 4

iii) A circuit consists of the following in parallel:
a) A resistance of 500 Ω
b) An inductance of 2 H
c) A capacitance of 10 μF.
A source voltage of 200 volts 50 Hz is applied. Determine the total current drawn from the supply and active power, Draw the phasor diagram. 6

9. i) In what way a practical transformer differs from an ideal transformer? Develop an equivalent circuit for the practical transformer in support of your answer and explain the working of it on load. 5+3

ii) Draw the phasor diagram of it. 2

iii) A 200 kVA, 6600/400 V, 50 Hz single phase transformer has 80 turns on the secondary. Calculate 3
a) the approximate values of the primary and secondary currents.
b) the approximate number of primary turns and
c) the maximum value of core flux.

iv) Define voltage regulation of a transformer. 2

10. i) Derive the torque equation of dc motor. 6

ii) A 4-pole, 220 V dc shunt motor has armature and shunt field resistances of 0.2 Ω and 220 Ω respectively. It takes 20 A at 220 V from the source while running at a speed of 1000 rpm. Find 4
a. field current
b. armature current
c. back emf
d. torque developed.

iii) Explain why 3-Φ induction motor cannot run at synchronous speed 5

11. Write short notes on any three: 3x5
i) Superposition theorem
ii) Transformer losses and efficiency.
iii) Speed control of DC motors
iv) UPS(Battery backup device)
v) Single phase auto transformer

JALPAIGURI GOVERNMENT ENGINEERING COLLEGE
[A GOVERNMENT AUTONOMOUS COLLEGE]
JGEC/B.TECH/CE/EE/ME/**BS-CH201**/2022-23
2023
CHEMISTRY

Full Marks: 70

Times: 3 Hours

The figures in the margin indicate full marks.
Candidates are instructed to write the answers in their own words as far as practicable.

GROUP-A
[OBJECTIVE TYPE QUESTIONS]

Answer ***all*** questions 5x2=10

1. Define the term electron affinity.
2. Comment on the behavior of urea in liquid ammonia.
3. State the second law of thermodynamics.
4. How many stereoisomers are possible for the compound $CH_3CH(Br)CH=CHBr$?
5. Explain the term meso form with a suitable example.

GROUP-B
[LONG ANSWER TYPE QUESTIONS]

Answer any ***four*** questions 4x15=60

6. i) What is the physical significance of Ψ. Derive the energy expression for a particle in one dimensional box. 2+3
   ii) Evaluate the value of normalization constant for a general wave function describing a particle confined in 1- dimensional box. Explain Heisenberg uncertainty principle considering a particle in 1-dimensional box. 3+2
   iii) For the free particle, the energies vary almost continuously – justify the statement. 2
   iv) Calculated the wave number associated with the first transition of butadiene molecule. Given that the length of the molecule is 5.78×10^{-8} cm. 3

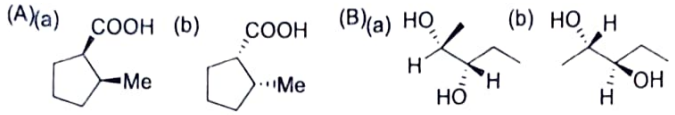
7. i) What is electronegativity? Electron affinity of chlorine is greater than fluorine atom. Explain with proper reasons. Calculate the electronegativity of Pb (82) in Allred-Rochow's scale of electronegativity. Given r_{cov} = 120 pm. 1+2+3
   ii) Determine the first ionization energy for Lithium using the Slater's rule. 3
   iii) Write down the basic postulates of crystal field theory. What are the coordination number and spin-only($\mu_{spin-only}$) magnetic moment value of the central metal ion of complex $[Mn(H_2O)_6]^{2+}$. 2+2
   iv) LiCl is soluble in pyridine but not in water -why? 2

8. i)'AgCl' is more covalent than NaCl'-explain with proper reasons. 3
   ii) First electron gain enthalpy of oxygen is an exothermic process where as second electron gain enthalpy is an endothermic- explain. 2
   iii)Calculate the effective nuclear charge (Z_{eff}) for 4s and 3d electron in Cu (Z=29). 3
   iv) Draw the molecular orbital diagram for $N_2$and O_2 molecules. From this diagram state the magnetic character ofN_2 and O_2 molecules. Calculate the bond order of each molecule. 3+2+2

9. i)If TdS = dE + P dV, prove that $(dS/dV)_T = (dP/dT)_V$. Symbols have usual significances. 3
   ii)Using Carnot cycle prove that the efficiency of a cyclic heat engine is always less than one. 4
   iii) Discuss the term Gibb's free energy. What is its physical significance? 2+2
   iv) Explain the physical significance of entropy. Calculate the entropy change involved in the isothermal reversible expansion of 5 moles of an ideal gas from a volume 10 litres to a volume of 100 litres at 300 K. 2+2

10. i) A sample of pure 2-butanol has specific rotation of $+129^o$. A solution of 2-butanol placed in 5cm polarimeter tube shows a rotation of $+85^o$. Calculate the concentration of 2-butanol in the solution. 3
    ii) Define the term enantiomer. An enantiomeric mixture shows an optical purity 50% with respect to (+)-enantiomer. What is the composition of enantiomers in mixture? 1+3

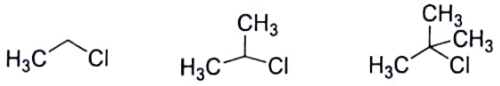
iii) What are the stereochemical relations (identical, enantiomer, diastereomer) of the following pairs? Assign absolute configuration at each stereogenic center. 2+6



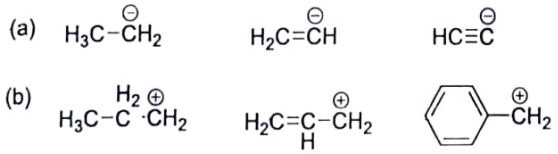
11. i) S_N1 reaction give rise to racemate product but S_N2 reaction result inverted product. explain 3

ii)Write stereochemical formula for all the products that you would expect from each of the following reactions. 4

iii) Compare the rate of nucleophilic substitution reaction of the following compounds through S_N1 and S_N2 path and explain. 4



iv) Compare the stability 4



12. Write short notes on ***any three*** of the following: 3x5

(i) London dispersion forces, (ii) Nernst equation, (iii) Fajan's rule,(iv) resonance and hyperconjugation, (v) Carnot cycle (vi) carbocation and carbanion

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2023

ENGLISH

Full Marks: 70 Times: 3 Hours

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GROUP-A
[OBJECTIVE TYPE QUESTIONS]

5x2=10

Answer ***all*** questions

Point out and correct the errors in the following sentences. 2

1. One of the most widely spread bad habit is the use of tobacco. 2
2. He was not blind from birth. 2
3. Krishna is the taller boy in the class. 2
4. The man is a social animal 2
5. The principal threatened to inform to his father about his misdeeds.

GROUP-B
[LONG ANSWER TYPE QUESTIONS]

4x15=60

Answer any ***four*** questions

6. a) Write an essay in 250 words arguing 'Is Engineering hard?' 10

   b) Fill in the blanks with appropriate prepositions: 5

   i) The truth of the matter finally dawned _____ Tina.
   ii) The employees called _____ the strike.
   iii) The flight will take _____ any minute now.
   iv) The neighbour asked us to turn _____ the music.
   v) Call _____ the surgeon immediately; the patient needs her.

7. a) You are the Sales representative of your company. Write a letter to the business manager of ABC ENTERPRISES introducing one of your new products/services. Be sure to give the important details about the product. 10

   b) Form meaningful sentences with each word in the pair of homophones given below: 5

   i) coral/choral ii) brake/break iii) bury/berry iv)cache/cash v) coughers/coffers

8. a)You have completed your post-graduation recently and wish to start applying for various Ph.D. programmes. In about 250 words, draft your statement of purpose. 10

   b) Put the right alternative in the right place: 5

   i) He has the _____ of keeping regular hour. (custom, habit)
   ii) The building was _____ to the ground. (raised, razed)
   iii) The Irish _____ settled in Canada. (immigrants, emigrants)
   iv) The Third World War is _____. (eminent, imminent)
   v) Guru Nanak Dev led a _____ life. (godly, godlike)

9. a) You have completed your graduation recently. Apply for the post of Junior Engineer in an institution of your choice. Invent necessary details. 10

   b) Rewrite the following sentences according to the instructions given: 5

   i) They haven't stamped the letter. (End:…. Stamped)
   ii) Don't walk on the grass. (use: keep off)
   iii) You have nothing to complain of. (End with: … complain)
   iv) He has refused to help me. (Rewrite using said)
   v) This apple is bigger than any other that I have ever seen. (Begin: I have never…)

10. a) You have been given the responsibility of writing a product launch email on behalf of your institution to promote a new product for a targeted set of customers. Mention the details about the new product. Invent necessary details. 10

    b) Fill in the blanks with the appropriate form of the verb: 5

My guide told me if I wanted to meet these people I would have to walk two miles. We finally _____ (reach) a village where I _____ (meet) a lady whose age I _____ (can) not immediately make out. My translator _____ (find) it difficult to interpret the lady's words because her dialect _____ (be) quite different.

11. a) Write an essay in 250 words on the Importance of perfecting Communication Skills. 10

b) Insert articles where necessary: 5

i) Tiger is native of Asia.
ii) Moon shone through night.
iii) Priest was old Brahmin.
iv) Man cannot survive without water.
v) Sun rises in east.