

JC Bose University of Science and Technology, Faridabad, Haryana
Sessional-2
B. Tech Semester II
Subject: English

MM: 15

Time: 90 minutes

Note: All the questions are compulsory.

Part A (5):

Write short notes on (5):

1. Define sensible writing (1)
2. Introduction of an essay (1)
3. What is the use of Sensible Writing (1)
4. Why should you not use cliches (2)

Part B: Attempt both of the given questions here:

1. Fill in with correct options from the bracket given here:

1. The herd of horses ---- (gallop/s) wildly around the field.
2. The company CEO or the department managers ____ (has/have) the power to approve changes in the project.
3. The department managers and the CEO ____ (has/have) the power to approve changes in the project.
4. One in five students ____ (regret/s) choosing to attend that school.
5. Every qualified associate in any of the firm's offices, plus many accountants from the outside, ____ (has/have) the opportunity to apply for the open manager's position.

2. Fill in these sentences with suitable prepositions

1. Most people like basketball, but ____ my opinion it's too chaotic.
2. You shouldn't pick _____ him just because he's different.
3. Being a nurse is hard work, especially if you're _____ call all the time.
4. She's the kind of girl who knows everything _____ everyone.
5. It's _____ time you told him the truth!

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J.C.BOSE UNIVERSITY OF SCIENCE AND TECHNOLOGY

B.Tech (ECE) II Semester BSC 202

Sesⁿional II (Sep 2022)

CHEMISTRY

Max. Time: 90 min

Max. Marks: 15

Answer all the questions. All questions carry marks.

1. Draw the PES diagram of HCN and explain saddle point and mountain pass.
2. Write two significance of Ψ and write the expression for Energy and normalized wavefunction for a particle of mass m in a 1-D box with Length (L).
3. Define Chemical shift in NMR and give the number of signals observed in propanal and 1,3,5-Trimethylbenzene.
4. Draw the pi-molecular orbital diagram for benzene.
5. Derive Nernst Equation. Explain with example one application of solubility product.

Sr. No.....

Sessional II

B.Tech./II SEMESTER

Basic Electrical Technology (ECE, EEIOT, ENC)

Max. Marks:30

Time: 3 Hours

Instructions:

1. It is compulsory to answer all the questions (2 marks each) of Part -A in short.
2. Answer any two questions from Part -B in detail.
3. Different sub-parts of a question are to be attempted adjacent to each other.

PART -A

- Q1 (a) What do you understand by Half power Bandwidth for a series Resonating circuit. (2)
(b) Why core of the transformer is laminated? (2)
(c) Write the advantages of a Three phase AC circuit over a single phase AC circuit. (2)
(d) What is the application of a parallel A C circuit. (2)
(e) Why the transformer is called a static device? (2)

PART -B

- Q2 (a) Describe the principle of operation of a single phase transformer using suitable diagram. (5)
(b) Draw the phasor diagram of a single phase transformer on load condition for inductive load. (5)
- Q3 (a) Describe the condition of Parallel resonance using appropriate circuit diagram and waveforms. (5)
(b) A series R-C circuit consists of a resistance of 110 ohms and a capacitance of 50 micro farads is connected across 220 V, 50Hz mains, calculate (i) Impedance, phase angle and power factor (ii) the current in the circuit. (iii) Voltage across resistance and capacitance (5)
- Q4 (a) Explain the Two Wattmeter method of power measurement in a three phase AC circuit. (5)
(b) The load connected to a 3 phase supply comprises of three similar coils connected in star. The line current is 25 A. The KVA and KW inputs are 20 and 15 respectively. Find the line and phase voltage and KVAR input. (5)



J C Bose University of Science and Technology

Department of Mathematics
Second Sessional Test – September 2022
Subject: Mathematics I (BSC103E)

Course: B. Tech (Civil)

Time allotted: 90 minutes

Semester: 1st

Maximum marks: 15

Attempt all questions:

Each question carry equal marks.

1. Solve $y'' - 5y' + 6y = e^{4x}$
2. Solve $\frac{y^2 z}{x} p + xz q = y^2$ where $p = \frac{\partial z}{\partial x}$ and $q = \frac{\partial z}{\partial y}$
3. Solve $(D^2 + 3DD' + 2D'^2)z = x + y$ where $D = \frac{\partial z}{\partial x}$ and $D' = \frac{\partial z}{\partial y}$
4. Definition of partial differential equation, linear PDE and non-linear PDEs.
5. Solve the non-homogeneous partial differential equation
$$(D^2 - D'^2 + D - D')z = 0$$

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J. C. Bose University of Science & Technology, YMCA Faridabad
Sessional-1st (B-Tech 2nd Semester Civil)
BASIC ELECTRICAL TECHNOLOGY (ESC 101A)

Time: 1:30 hrs

M. Marks: 15

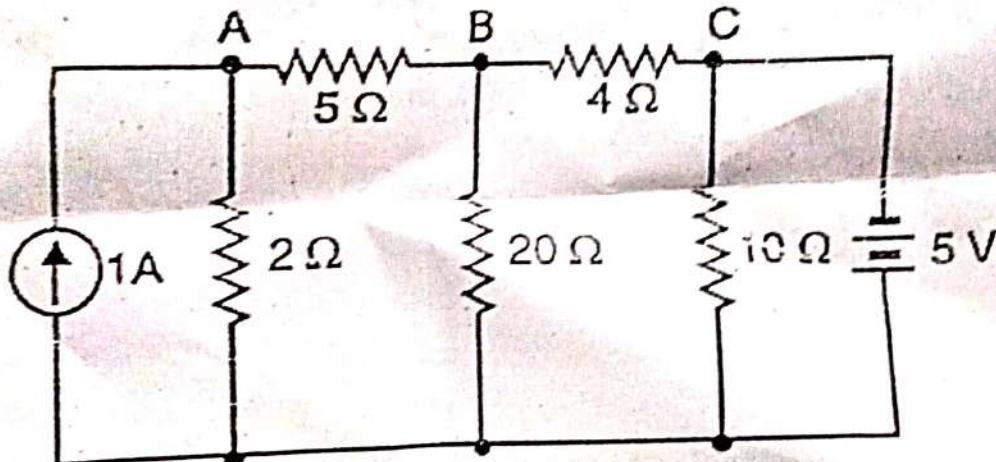
Note: Part -A is compulsory. Attempt any two questions from part-B

Part-A

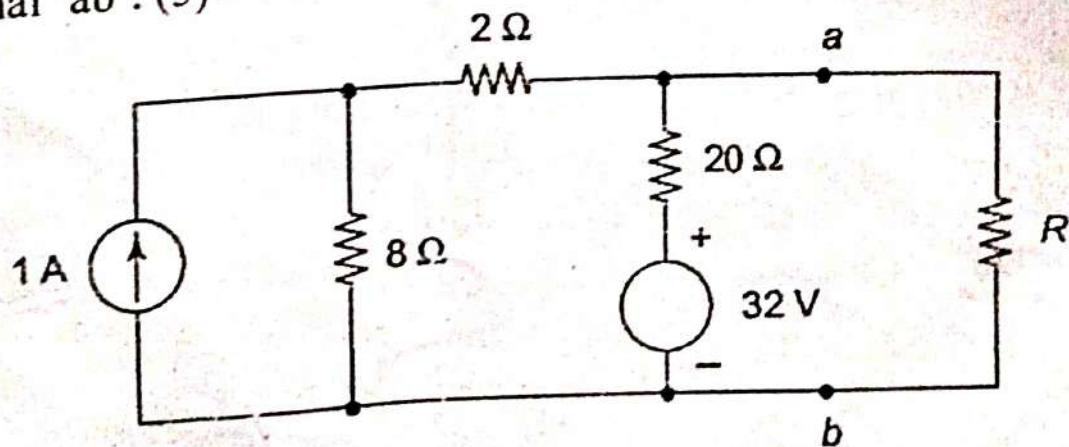
- Q.1.a) Distinguish between bilateral and unilateral networks. (1)
- b) State applications of maximum power transfer theorem? (1)
- c) What are the limitations of ohm's law? (1)
- d) Define dependent and independent sources. (1)
- e) State superposition theorem. (1)

Part-B

- Q.2.) Determine current in each branch using nodal analysis. (5)



- Q.3) State and explain Thevenin's theorem with suitable example.(5)
 Q.4) Find the Thevenin and Norton equivalents of the given circuit at terminal 'ab'. (5)

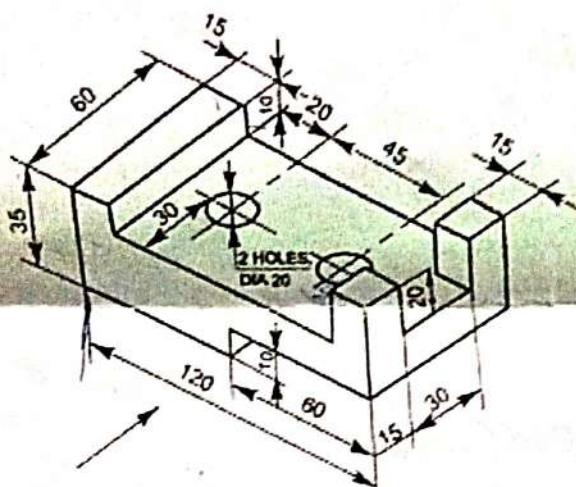


Note : Attempt any four questions. Each question carries 10 marks

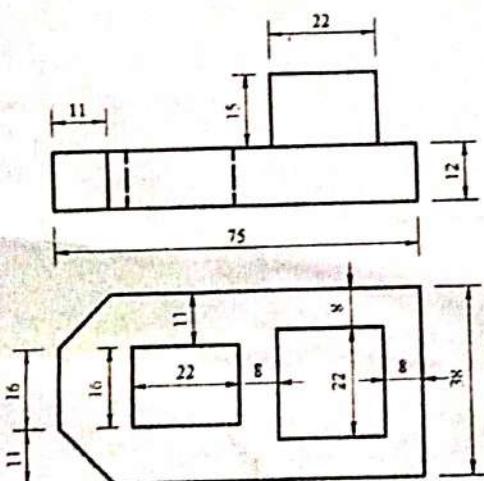
Time : 2hrs

MM:40

1. A 70 mm long line PQ has an end P at 20 mm above the HP and 30 mm in front of the VP. The line is inclined at 45 degree to the HP. Draw the projections of line.
2. A cylinder with a 50 mm base diameter and a 65mm long has generator in the VP and is inclined at 45 degree to HP. Draw its projections.,
3. Draw the orthographic projections of the figure given below in first angle projections.



4. Draw the isometric projections of the figure given below



- Q5 . A hexagonal prism having a base with a 30 mm side and 70 mm axis, is resting on its base on the ground with a side of the base inclined at 45 degree to VP. It is cut by an auxiliary inclined plane making an angle 45 degree the HP . and passing through the point 15 mm below the top end of the axis. Obtain the development of the lateral surface of the truncated prism.

April 2022

**B.Tech. (ECE/ECO/EEE/EL) I SEMESTER
Physics (Waves and Optics) (BSC-101C)**

Time : 3 Hours] [Max. Marks : 75

Note :

1. It is compulsory to answer the questions of Part-1. Limit your answers within 20-40 words in this part.
2. Answer any four questions from Part-2 in detail.
3. Different parts of the same question are to be attempted adjacent to each other.

PART-1

1. (a) A particle vibrates with SHM of amplitude 0.06 m and time-period 31.4 seconds. Calculate the maximum velocity. (1.5)
- (b) For damped harmonic oscillator, the relaxation time is 50 seconds. Find the time in which the amplitude and energy of the oscillator fall to $1/e$ times initial value. (1.5)
- (c) Sodium light of wavelength 5890 Å falls on a double slit of separation 2 mm. The distance between the slit

PART-2

- and the screen is 1.9×10^{-3} m and fringe spacing is 0.31×10^{-3} m of 1 m from the slit. Calculate the distance of 10th fringe from the centre. (1.5)
- (d) What will be the shape of incident wavefront on the single slit in the case of Fraunhofer diffraction? Explain your answer. (1.5)
- (e) For an ordinary source, coherence time is 10^{-10} second. Calculate the degree of non-monochromaticity for light of wavelength 5400 Å. (1.5)
- (f) An object is placed at a distance of 15 cm in front of a concave mirror of focal length 10 cm. Find the magnification produced by the mirror. (1.5)
- (g) Find the ray transfer matrix for transmission through a thin lens. (1.5)
- (h) A certain sound wave in air is described by the expression $400 \sin(6300t - 18.3x)$ pascals, where t is measured in seconds and x in meters. What is speed of sound in air? (1.5)
- (i) In diffraction through a single slit, the focal length of the lens used is 50 cm, wavelength of light is 4500 Å and the width of the slit is 10^{-1} cm. Find the width of the central maximum. (1.5)
- (j) Using Fermat's principle, prove the laws of refraction. (1.5)

- 16
31.5
2.1
1.5*
3. (a) Explain the formation of Newton's rings. How the wavelength is determined using Newton's rings experiment? (5)
- (b) A grating has 8000 rulings per inch. It is illuminated with light of wavelength 4000 Å at normal incidence. Find the angle at which first and second order maxima occur. (5)
- (c) What are the drawbacks of simple pendulum? Obtain the expression for time-period of a simple pendulum for finite amplitude. (5)
4. (a) Discuss the Fraunhofer diffraction at a single slit and derive the positions of maxima and minima. Show that the relative intensities of successive maxima are nearly $1 : 1/22 : 1/61 : 1/121 : \dots$ (8)
- (b) Assuming damping to be proportional to the velocity, write the differential equation for damped harmonic oscillator and find its solution. Discuss over-damped, critically-damped and under-damped cases. (7)
4. (a) Derive the Fresnel's Equations for plane polarized light in a non-magnetic media. (7.5)
- (b) Explain the terms absorption, spontaneous and stimulated emission of radiation. Obtain a relation between transition probabilities of spontaneous and stimulated emission. (7.5)
- $\lambda' = \frac{\lambda}{n}$
 $\lambda' = \frac{\lambda}{n}$*

5. (a) What do you understand by Impedance matching? If two strings of characteristic impedances Z_1 and Z_3 need to be joined through another string of impedance Z_2 for minimum loss, prove that $Z_2 = \sqrt{Z_1 Z_3}$. (10)
- (b) Find the ray transfer matrix for refraction at a spherical boundary. (5)

6. (a) A series LCR circuit is connected to an AC supply at 220 V and 50 Hz. If the resistance $R = 10\Omega$ and the inductance $L = 100 \text{ mH}$, what is the capacitance C so as to obtain maximum current? How much is this current? (5)
- (b) With the help of a neat diagram, explain the construction and working of a simple microscope. (5)
- (c) Differentiate between superior and inferior mirages. Explain the formation of an inferior mirage using Fermat's principle. (5)

7. Write short notes :
- (a) He-Ne Laser.
 - (b) Dispersive and Resolving power of a diffraction grating
 - (c) Michelson Interferometer
- (5×3=15)

April 2022

B.Tech. (ECE/FAE/ECO/EEE) 1st SEMESTER
Mathematics-I
(Calculus and Linear Algebra) (BSC-103D)

Time : 3 Hours]

[Max. Marks : 75

Instructions:

1. It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.
2. Answer any four questions from Part-B in detail.
3. Different sub-parts of a question are to be attempted adjacent to each other.

PART-A

1. (a) Evaluate $\int x^2 \sin 2x dx$.
(b) Find the equation of the tangent to the curve $y = x^2 + 2$ at $x = 3$.
(c) Verify Rolle's theorem for $f(x) = x^3 - 6x^2 + 11x - 6$ in $[1, 3]$.
(d) Using L'Hospital rule, solve the indeterminant form

$$\lim_{x \rightarrow 0} \left(\frac{1}{x^2} - \frac{1}{\sin^2 x} \right)$$

- (e) Define Even and odd functions. Also give two example

of each

- (i) Expand $\log(1+x)$ using Maclaurin's series for one variable upto third degree

- (g) Show that $\lim_{x \rightarrow \infty} (x^2 - x^2) = \infty$

- (b) Find $\sin \theta$:

- (i) Find the rank of the matrix

$$\begin{bmatrix} 0 & 0 & 2 \\ 5 & 3 & -1 \\ 7 & 4 & 3 \end{bmatrix}$$

- Q Find the sum and product of:
:

- given matrix

$$\begin{bmatrix} 2 & 1 & 0 \\ 0 & 2 & 1 \\ 0 & 0 & 2 \end{bmatrix}$$

- (1.5x10=15)

PART-B

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- (b) State and Prove relation between Beta and Gamma
functions.

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- (a) Using Taylor's series expansion, expand $\tan^{-1} x$ in powers of $(x - 1)$ upto four terms.

Find the inverse matrix for the given matrix

4. (a) Discuss the convergence of the given series :

$$\frac{x}{1} + \frac{1}{2} \cdot \frac{x^3}{3} + \frac{1.3}{2 \cdot 4} \cdot \frac{x^5}{5} + \frac{1.3.5}{2 \cdot 4 \cdot 6} \cdot \frac{x^7}{7} + \dots \quad (8)$$

- (b) Find the fourier series expansion for the function $f(x) = x - x^3$ in the interval $-1 < x < 1$ (T)

$f(x) = x - x^3$ in the interval $-1 < x < 1$. (7)

$$\left(\frac{\partial}{\partial x} + \frac{\partial}{\partial y} + \frac{\partial}{\partial z} \right)^2 u = -\frac{g}{(x+y+z)^2}$$

- (b) Prove that the rectangular solid of maximum volume which can be inscribed in a sphere is a cube.

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6. (a) Check the consistency of the given system of linear equation :
$$\begin{cases} x + y = 1 \\ 2x - y = 7 \end{cases}$$

- Given system of linear equation :

3. (a) Using Taylor's

Find the maximum and minimum values of $f(x) = \sin 2x + 5$. (7)

7. (a) Diagonalize the given matrix :

$$A = \begin{bmatrix} -1 & 3 \\ -2 & 4 \end{bmatrix}, \text{ also find } A^4. \quad (8)$$

(b) Test the convergence and absolute convergence :

$$1 - \frac{1}{2\sqrt{2}} + \frac{1}{3\sqrt{3}} - \frac{1}{4\sqrt{4}} + \dots \dots \quad (7)$$

April 2022

**B.Tech. (EL/ECE/IT/ME/CSE/CIVIL/FAE/
ECO/EEE/EVS) - I SEMESTER**

Programming for Problem Solving (ESC-103)

[Max. Marks : 75]

Time : 3 Hours]

Instructions :

1. It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.
2. Answer any four questions from Part-B in detail.
3. Different sub-parts of a question are to be attempted adjacent to each other.

PART-A

1. (a) Define Linked List. (1.5)
- (b) What is the purpose of break statement? (1.5)
- (c) What is '\0' ? (1.5)
- (d) Which is better: switch-case or nested if-else? (1.5)
- (e) Mention the advantages of algorithm. (1.5)
- (f) Describe working of linear search in brief. (1.5)
- (g) Can we have two return statements in a function? (1.5)

- (a) What are syntax errors? (1.5)
(b) What are logical and relational operators? (1.5)
(c) Differentiate between RAM and ROM. (1.5)

(1.5)

6. (a) Differentiate between array and structures. Explain array of structures with the help of a program. (10)
(b) Write a program to count the number of vowels in a string without using inbuilt functions. (5)

PART-B

2. / (a) Explain the types of iterative loops in detail. (10)
(b) Write a program to calculate the area and circumference of a circle using call by reference. (5)

7. Define Flowchart. Draw a flowchart to compute factorial for a given number N, where N is a non-negative integer.
Write an algorithm for the same problem. (15)

3. (a) What is Operating System? Discuss its various functions. (5)
(b) Write a program to print the upper and lower triangular of the matrix along with the sum of their elements. (10)
4. What is recursion? How is it different from iteration?
Write a program to print the Fibonacci series up to n terms using recursion. (15)
5. (a) Write a program to copy the contents of one file to another. (5)
(b) Explain each step for sorting the given array using selection sort. (10)
- 5, 10, 15, 20, 18, 12, 8, 1, 30. (10)

J.C. Bose University of Science & Technology, YMCA, Faridabad
Sessional-II April, 2022

Subject-Physics

Max. Marks: 20

Note: Attempt any four questions.

Each question carries 05 marks.

B. Tech (ECE)

Program: B. Tech (ECE)

Time Allowed: 60 min.

1. Write the distinctions between Spontaneous and Stimulated Emission.
2. Establish relation between Einstein Coefficients.
3. Discuss the three essential component of a LASER.
4. Define the principle and working of a Ruby Laser.
5. Explain, how the population inversion is achieved by optical pumping.

Subject: Physics

Max. Marks: 20

Note: Attempt any four questions. Each question carries 05 marks.

1. What is simple harmonic motion (SHM)? Write the total energy for a simple harmonic oscillator.
2. Define damped oscillations. Also, explain the weak and heavy damping.
3. What is a wave? Differentiate the travelling and standing waves.
4. Discuss the reflection and transmission phenomena of wave at a boundary.
5. Establish the relation between phase velocity and group velocity.

August/September 2022

B.Tech - II SEMESTER

Basic Electrical Technology (ESC-101-A)

Max. Marks: 75

Time: 3 Hours

Instructions:

1. It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.
2. Answer any four questions from Part -B in detail.
3. Different sub-parts of a question are to be attempted adjacent to each other.
4. Any other specific instructions

PART -A

- Q1 (a) Enumerate various limitations of ohms law. (1.5)[CO1]
- (b) Convert A source with its parallel resistance of 15Ω into its equivalent voltage source. (1.5)[CO1]
- (c) Differentiate between active and passive components. (1.5)[CO1]
- (d) Define dynamic impedance. Also write its unit. (1.5)[CO2]
- (e) Explain why a series resonance is called voltage resonance. (1.5)[CO2]
- (f) List various applications of autotransformer. (1.5)[CO3]
- (g) In case of power measurement by two-wattmeter method for 3-phase balanced load, under what conditions: the one wattmeter will give zero reading and whole of the power will be measured by the other wattmeter. (1.5)[CO2]
- (h) List various methods of starting a single-phase Induction motor. (1.5)[CO3]
- (i) What is the function of commutator in dc machines? (1.5)[CO3]
- (j) Why earthing is provided? (1.5)[CO4]

PART -B

- Q2 (a) Determine i_1 , i_2 and i_3 using Nodal analysis for a given circuit shown in Fig.1. (8)[CO1]

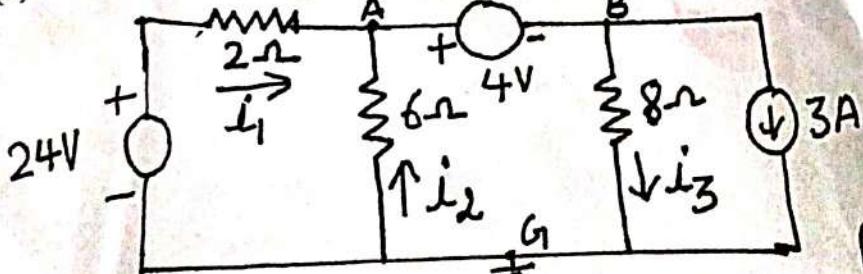
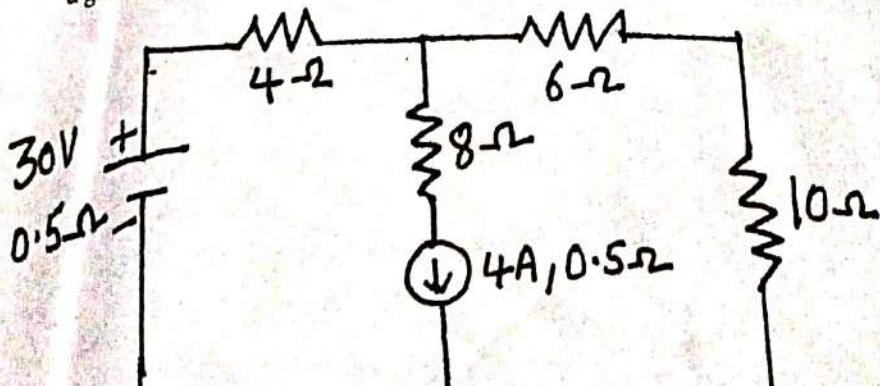


Fig.1.

- (b) State Norton's theorem. Find the current through 10Ω by using Norton's theorem for a given circuit shown in Fig.2. (7)[CO1]



Q3 (a)

Find the average and effective values of voltage for sinusoidal waveform shown in Fig.3.

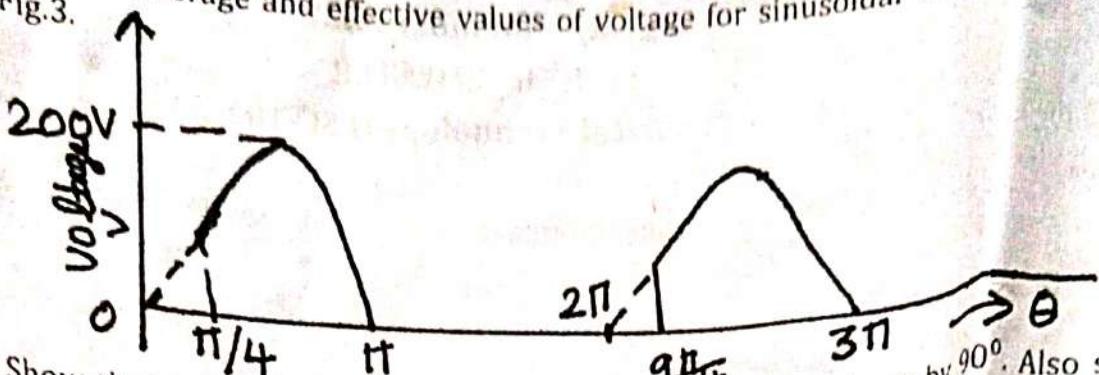


Fig.3.

- (b) Show that in a purely inductive circuit current lags the voltage by 90° . Also show (5)[CO2]
 (c) that the average power consumed by it is always zero. (5)[CO2]

Q4 (a) Discuss two-wattmeter method for power measurement in three-phase system feeding balanced load. Derive the expression for the power delivered and power factor. (8)[CO2]

(b) A balanced three-phase star load impedance of $(5-j10)$ ohms per phase and is supplied from a balanced three-phase 400V, 50Hz ac supply. Calculate the values for (i) line voltages (ii) phase voltages (iii) line currents (iv) phase currents (v) total power consumption and power factor.

Q5 (a) Explain that "The main flux in a transformer remains practically invariable under all conditions of load".
 (b) Define (i) Voltage regulation (ii) Efficiency and (iii) Eddy current and Hysteresis losses in case of transformer.
 (c) Explain the working principle of dc motor. (5)[CO3]

Q6 (a) Explain why single-phase Induction Machine is not self-starting using the concept of double field revolving theory. (8)[CO3]

(b) Explain with neat diagram the construction details of three-phase Synchronous Machine. (7)[CO3]

Q7

Write short notes on the followings

- (a) Earthing (5)[CO4]
 (b) Earth-Leakage Circuit Breaker (ELCB) (5)[CO4]
 (c) Power factor improvement methods (5)[CO4]

September 2022
B.Tech.- II SEMESTER
Chemistry (BSC-102)

Max. Marks:75

Time: 3 Hours

Instructions:

1. It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.
2. Answer any four questions from Part -B in detail.
3. Different sub-parts of a question are to be attempted adjacent to each other.

PART -A

- Q1 (a)** Define the term 'solubility product (K_{sp})'. Discuss its application in calculation of (1.5) solubility of sparingly soluble salt.
- (b)** Which of the following molecule will show a pure rotational spectrum and why: H_2 , (1.5)
CO and NH_3
- (c)** Define residual entropy with a suitable example. (1.5)
- (d)** What is the significance of Van der Waals constant 'a' and 'b'? (1.5)
- (e)** Define conformational isomers with suitable example. (1.5)
- (f)** How many fundamental modes of vibration are expected for the following
(a) CH_4 (b) SO_2 (1.5)
- (g)** What is bathochromic shift in UV-vis spectroscopy? (1.5)
- (h)** Write the difference between E1 and E2 reaction. (1.5)
- (i)** What are n-type and p-type semiconductors? (1.5)
- (j)** What do you mean by ozonolysis? Explain with at least one suitable example. (1.5)

PART -B

- Q2 (a)** Derive Nernst equation for galvanic cell made of Cu and Zn electrode and also (10) illustrate the applications of Nernst equation.
- (b)** What is Corrosion? Explain the electrochemical theory of rusting of Iron. (5)
- Q3 (a)** Describe the thermodynamic principles of Metallurgy. (5)
- (b)** Explain the splitting of degenerate d-orbital in octahedral and tetrahedral (10) complexes in the influence of ligands according to Crystal Field Theory with diagram. How the magnitude of crystal field splitting energy is affected by oxidation state of metal ion and nature of ligands.
- Q4 (a)** What do you understand by Gibb's free energy (G) and Helmholtz work function (A) and what are their physical significance in thermodynamic? (5)
- (b)** What are potential energy surfaces? Draw and explain the potential energy surface of H_3 . (5)

(c) Draw the Pi-Molecular Orbital diagram of 1,3 Butadiene, fill it with Pi-electrons (5) and label the HOMO and LUMO.

Q5 (a) Solve the Schrodinger wave equation for particle in one-dimensional box. (5)

(b) Explain the following: (5x2)

- (i) Plane of symmetry(σ) and Centre of symmetry(i)
- (ii) Optical activity and Chirality
- (iii) Enantiomers and Racemic mixture
- (iv) Ionization isomers and Hydrate isomerism
- (v) Diels-Alder reaction

Q6 (a) Discuss the basic principle and applications of vibrational spectroscopy. Using the (10) energy level expression and selection rule, draw the spectral transitions of the vibration spectrum of diatomic molecule as a simple harmonic oscillator.

(b) Explain the following with suitable example (2x2.5)

- (i) Polarizability and polarizing power
- (ii) Fajan's rule for ionic and covalent Characters.

Q7 (a) Explain the basic principle and applications of NMR spectroscopy. (5)

(b) Write the synthesis and uses of Chloroxylenol and Paracetamol. (5)

(c) What is critical temperature (T_c) and critical pressure (P_c)? Prove that (i) (5)
 $P_c = a/27b^2$ (ii) $T_c = 8a/27Rb$

J.C. Bose University of Science and Technology, YMCA, Faridabad
B. Tech 2nd semester Civil Engineering
Sessional 2nd (Basic Electrical Technology)

Note: - attempt any three.

Q1. A three phase star connected load consists of three identical inductive coils of resistance 50Ω and inductance $0.3H$. The supply voltage is $415V$, 50 Hz. Calculate, (i) phase current, (ii) line current, (iii) power factor, and (iv) Total power consumed. (5)

Q2. Draw and explain the two wattmeter method of power measurement in a three phase circuit.
(5)

Q3. Explain working of auto transformer. What are the advantages of auto transformer over two winding transformer? (5)

Q4. A coil in parallel with a $200\mu F$ is connected across a $200V, 50Hz$ supply. The coil takes $8A$ a loss in the coil is $960W$. Calculate the following- (i) The resistance of the coil, (ii) The reactance of the coil, and (iii) Power Factor of the entire circuit. (5)

019102

April 2022

B.Tech. (FAE/EVS/CIVIL) - 1st SEMESTER
Physics (Mechanics) (BSC-101B)

Time : 3 Hours]

[Max. Marks : 75

Instructions :

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part -B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART-A

1. (a) What are scalar and vector quantities? (1.5)
(b) What are the laws of Friction in mechanics? (1.5)
(c) What you understand by conservative and non-conservative forces? (1.5)
(d) How do you maneuver a satellite in an orbit? (1.5)
(e) What is Foucault pendulum? What does it prove? (1.5)
(f) What is resonance in SHM? (1.5)

019102/200/111/15

16

[P.T.O.]

- (g) What is equation of motion of rigid body? (1.5)
- (h) What is rigid and non-rigid body? (1.5)
- (i) Describe a cylinder in spherical coordinates. (1.5)
- (j) What you understand by conical motion? (1.5)
- PART-B**
2. (a) What is Newton's second law of motion? Show that the form of this law is invariant under the Galilean transformation. (10)
- (b) Obtain the expression of Newton's equation of motion in polar coordinates. (5)
3. (a) What you understand by conservation of angular momentum? How you will prove it for angular momentum of a particle? (10)
- (b) What is equipotential surface? What are its properties? (5)
-
4. (a) What you understand by Five-term acceleration? Derive 5 term acceleration formula of a rotating frame. (10)
- (b) What is coriolis acceleration? How it affects weather? (5)

5. What is a simple harmonic oscillator? How it differs from damped harmonic oscillator? Explain over damped, critically damped and lightly damped oscillators. Use necessary equations. (15)

6. (a) Discuss briefly the rotational motion of a rigid body about a fixed axis. (10)
- (b) State Euler's laws of motion. How they differ from Newton's laws of motion. (5)
7. (a) Explain briefly the distinction between two-dimensional and three-dimensional motions in terms of angular velocity vector and moment of inertia tensor. (10)
- (b) How you show that the three-dimensional motion of a rod executing conical motion with fixed centre of mass looks two-dimensional? (5)

J.C Bose University of Science & Technology, YMC, Faridabad

B.Tech. (CE,ENC,EEIOT)-2nd Semester,

Sessional - II (September- 2022)

Subject Name: Calculus, Ordinary Differential Equation and Complex Variable

Subject Code: BSC106D (Mathematics-II)

M.M:15 Marks

Time : 90 minutes

Note : Attempt all questions .

Each Question carry equal marks.

Que.1 Evaluate $\iint e^{2x+3y} dx dy$ over the triangle bounded by $x = 0, y = 0$ and $x+y = 1$. (CO-1)

Que.2 Evaluate $\iint \log z dz dx dy$.
 $\int \int \int$
 $\int \int \int$
 $\int \int \int$ (CO-3)

Que.3 Define the analytic function $w = u+iv$, if $v = \log(x^2+y^2)+x-2y$.

Que.4 Find the series expansion of $f(z) = (z^2-1)/(z^2+5z+6)$ about $z=0$ in the region $|z|<2$. (CO-4)

Que.5 Calculate $\oint \frac{2z^2 + 5}{(z+2)^2 (z^2 + 4)} dz$, where C is a square with vertices at $1+i, 2+i, 2+2i, 1+2i$. (CO-4)

Time: 1:30 hrs

Note: Part-A is compulsory. Attempt any two questions from Part-B

Part-A

- Q. 1. a) Define Cycle, Time period, Frequency and Phase difference in alternating quantity. (1)
 b) Define Power triangle, Impedance triangle and Power factor? (1)
 c) Derive condition of maximum power regarding Maximum power transfer theorem? (1)
 d) What is the difference between active and passive elements & ideal current and ideal voltage sources? (1)
 e) Define current division rule and voltage division rule with examples. (1)

Part-B

- Q. 2) Derive RMS value (I_{rms}) and Average value (I_{av}) for Full and Half Sinusoidal waves. (5)
 Q. 3) Find Thevenin and Norton models from Fig. 1 and hence find current flowing through $10\ \Omega$ resistor. (5)

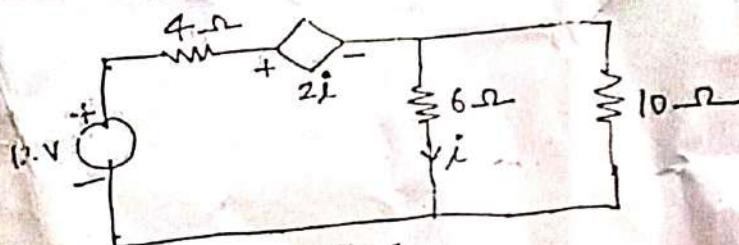


Fig. 1

- Q. 4) From Fig. 2, find: (1) R_L such that maximum power will be transferred to R_L , (2) Value of this maximum power, (3) Power supplied by source under this condition and (4) maximum efficiency. (5)

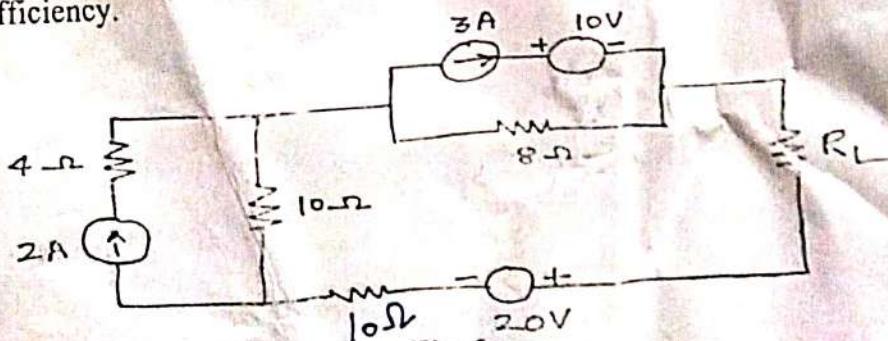


Fig. 2

- Q. 5) State and define Superposition Theorem. Using Superposition Theorem find "I" in Fig. 3. (5)

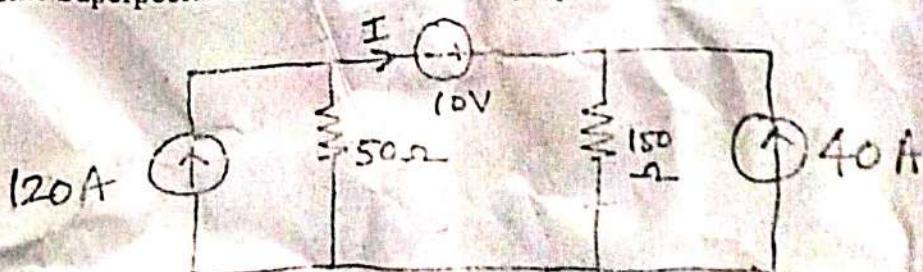


Fig. 3

Time: 3 Hours

Instructions:

1. It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.
2. Answer any four questions from Part -B in detail.
3. Different sub-parts of a question are to be attempted adjacent to each other.

PART -A

- Q1 (a) Form the differential equation by eliminating the arbitrary constants from the (1.5)
 following: $y = c_1 e^x + c_2 \cos x$.
- (b) Write a necessary and sufficient condition that the differential equation (1.5)
 $Mdx + Ndy = 0$ to be exact.
- (c) Find general solution of $y = (x-a)p - p^2$. (1.5)
- (d) Identify the nature of singular points of the differential equation (1.5)
 $y' + x^2 y' + (1-x^2)y = 0$.
- (e) Find the expressions for $J_0(x)$ and $J_1(x)$. (1.5)
- (f) Write the Rodrigue's formula for the Legendre's polynomial. (1.5)
- (g) Find the order and degree of the following partial differential equation: (1.5)

$$\left(\frac{\partial z}{\partial x}\right)^3 + \frac{\partial^2 z}{\partial y^2} = \cos(x+y).$$
- (h) Find Particular integral of the differential equation $(D^2 + D + 4)z = e^{4x-y}$. (1.5)
- (i) Solve the differential equation $(D^2 - DD' - 2D)z = 0$. (1.5)
- (j) Write two-dimensional Heat equation. (1.5)

PART -B

- Q2 (a) Solve $x^2 p^2 - 2xyp + 2y^2 - x^2 = 0$. (8)
- (b) Find the general solution of $x^2(y - px) = yp^2$. (7)
- Q3 (a) Show that the equation $(2x-y)dy + (2y+x)dx = 0$ can be made exact by the (7)
 integrating factor $\frac{1}{x^2 + y^2}$ and hence, solve the equation.
- (b) Solve $2y \cos y^2 \frac{dy}{dx} - \frac{2}{x+1} \sin y^2 = (x+1)^3$. (8)

Q4 Solve $x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} - y = x^2 \log x$, by the method of variation of parameters. (15)

(8)

Q5 (a) Show that $J_{\frac{5}{2}}(x) = \sqrt{\frac{2x}{\pi}} \left[\left(\frac{3}{x^3} - \frac{1}{x} \right) \sin x - \frac{3}{x^2} \cos x \right]$. (7)

(b) Express $x^3 + 2x^2 - x - 3$ in terms of Legendre polynomials. (10)

Q6 (a) Solve $(D^3 - 7DD^2 - 6D^3)y = \sin(x + 2y)$. (5)

(b) Find a partial differential equation of all spheres of given radius.

Q7 By using method of separation of variables, find the solution of the wave equation $\frac{\partial^2 u}{\partial x^2} = \frac{1}{c^2} \frac{\partial^2 u}{\partial t^2}$ such that $u = B_0 \cos bt$, (where B_0 is constant), when $x=a$ and $u=0$, when $x=0$. (15)

2

August/September-2022

B.Tech.(ECE/ENC/EEIOT)- II SEMESTER

(Calculus, Ordinary Differential Equation and Complex Variable)(BSC-106D)

Max. Marks:75

Time: 3 Hours

- Instructions:**
1. It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.
 2. Answer any four questions from Part -B in detail.
 3. Different sub-parts of a question are to be attempted adjacent to each other.

PART-A

Que.1(a) Evaluate $\int_0^1 \int_y^{y^2+1} x^2 y dx dy$ (1.5)

(b) Find the area lying between the parabola $y = 4x - x^2$ and the line $y = x$. (1.5)

(c) Solve $(xy^3+y)dx + (2x^2y^2+x+y^4)dy = 0$. (1.5)

(d) Solve the differential equation: (1.5)

$$y = 2px + p^4 x^2 \text{ (solvable for } y\text{).}$$

(e) Solve $(D^4 + 6D^2 + 9)y = 0$, where $D = d/dx$. (1.5)

(f) Write the Bessel's differential equation of order n. (1.5)

(g) State C-R Equations. (1.5)

(h) Define conformal mapping. (1.5)

(i) State Cauchy's integral theorem and Cauchy's integral formula. (1.5)

(j) State Cauchy's Residue Theorem. (1.5)

PART-B

Que.2 (a) Change the order of integration in the given integral and then evaluate $\int_0^{4a} \int_{x^2/4a}^{2\sqrt{ax}} dy dx$ (7)

(b) Verify the Green's theorem in the plane for $\oint_C (3x^2 - 8y^2)dx + (4y - 6xy)dy$, where C is the boundary of the region defined by $x = 0, y = 0, x + y = 1$. (8)

Que.3 (a) Solve the differential equation $(2ysinx + 3y^4 sinxcosx)dx - (4y^3 cos^2 x + cosx)dy = 0$. (7)

(b) Solve the differential equation: $y = 2px + y^2 p^3$ (Solvable for x). (8)

Que.4 (a) Using variation of parameter, solve $(D^2 - 6D + 9)y = \frac{e^{3x}}{x^2}$, where $D = d/dx$. (7)

(b) Express $4x^3 - 2x^2 - 3x + 8$ in terms of Legendre's polynomial. (8)

Que.5 (a) Show that the function $u = e^{-2xy} \sin(x^2 - y^2)$ is harmonic. Find the conjugate function and express $u+iv$ as an analytic function of z. (7)

(b) Under the transformation $w = 1/z$, find the image of the given curve: $|z - 2i| = 2$. (8)

Que.6 (a) Expand $\frac{e^{2z}}{(z-1)^3}$ about the singularity $z = 1$ in Laurent's series. (7)

(b) Evaluate $\int_0^{2\pi} \frac{d\theta}{2 + \cos\theta}$ using Residue theorem. (8)

Que.7 (a) Find the volume bounded by the cylinder $x^2 + y^2 = 4$ and the planes $y + z = 4$ and $z = 0$. (7)

(b) Find the sum of the residues of the function $f(z) = \frac{\sin z}{z \cos z}$ at its poles inside the circle $|z| = 2$. (8)

September 2022
B.Tech - II SEMESTER
English (HSMC-101)

Time: 3 Hours

Max. Marks: 75

- Instructions:**
- It is compulsory to answer all the questions (1.5 marks each) of Part -A in short.
 - Answer any four questions from Part -B in detail.
 - Different sub-parts of a question are to be attempted adjacent to each other.
 - Answers should be attempted in proper order and subparts should be labeled. Spellings should be correct.

PART -A

- Q1** (a) Make any two words from the given prefix: mid- (1.5)
 (b) Make any two words using the given suffix: -free. (1.5)
 (c) What is a misplaced modifier? Explain with example. (1.5)
 (d) Use the phrasal verb 'hang in' in a meaningful sentence. (1.5)
 (e) Expand the terms: DRDA and MoU. (1.5)
 (f) Give three examples of blended words. (1.5)
 (g) Give synonyms for: (a) cordial, (b) diligent, (c) repercussion. (1.5)
 (h) Give antonyms for: (a) professional, (b) ascent, (c) landlord. (1.5)
 (i) What is a phrasal verb? Explain with example. (1.5)
 (j) Make a sentence based on the structure: Adjective + subject + verb (1.5)

PART -B

- Q2** (a) Define all the stages of word formation by giving suitable examples. (10)
 (b) What is a précis? Explain the Do's and Dont's one should keep in mind while writing a précis. (5)
- Q3** (a) What is redundancy in writing? What are the ways to avoid it? (5)
 (b) How can one achieve coherence in writing? Explain the techniques which can help one to achieve coherence. (10)
- Q4** Some people say the government should not put money into building theatres and sports stadiums; they should spend more money on medical care and education. To what extent do you agree or disagree with this opinion? You should write at least 300 words. Give reasons for your answer and include any relevant examples from your own knowledge or experience. (15)
- Q5** (a) Do as directed: (10)
- Every inch of the fields _____ (was/were) searched.
 - He is a man of high _____ (principals/principles).
 - She is very rich, _____ she is not contented. (use conjunction)

4. _____ (beside/besides) being punished, he was fined.
5. Between you and _____ (I/me), we blame _____ (us/ourselves).
6. She is going to look after the cat. I am away on holiday. (Combine the sentence)
7. Use phrase 'look through' in a meaningful sentence.
8. The practice of taking someone else's work (one word substitute)
9. from the mountains to see the gentle flow of the river it is very pleasant
(unscramble and rewrite the sentence with proper punctuation)
10. Quietly she ran past the sleeping man (punctuate the sentence).

- (b) Write a paragraph on any one of the given topics:
(a) Magic pen or (b) Roads

(5)

- Q6 (a) Discuss the importance of evidence and examples as an integral part of (7.5)
sensible writing.
(b) What are the important writing parts? Discuss the significance of introduction (7.5)
and conclusion in the art of writing.
- Q7 Learning a foreign language offers an insight into how people from other (15)
cultures think and see the world. The teaching of a foreign language should be
compulsory at all primary schools. Write an essay in about 300 words
supporting with examples.
