

Reg. No.

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BSCMTC 381

**Choice Based Credit System VI Semester B.Sc. Degree
Examination, July/August 2023
(2021-22 Batch Onwards)**

MATHEMATICS

Paper – VII : Numerical Analysis

Time : 3 Hours

Max. Marks : 80

Note : A single answer booklet containing 40 pages will be issued.
No additional sheets will be issued.

- Instructions :**
- 1) Answer **any ten** questions from Part – A. Each question carries 2 marks.
 - 2) Answers to Part – A should be written in the **first few** pages of the answer book before answers to Part – B.
 - 3) Answer **any twelve** questions from Part – B. Each question carries 5 marks.
 - 4) Scientific calculators are **allowed**.

PART – A

Answer **any ten** questions.

(10×2=20)

1. Round-off the numbers 1.6583 and 3.14159 to four significant figures.
2. If $X = 0.51$ and is correct to 2 decimal places, then find the percentage error.
3. Find an interval in which the equation $x^3 - 3x + 1 = 0$ has a real root.
4. Write the condition for convergence of iteration method while finding the roots.
5. Find the missing term in the following table using forward difference table :

x	y
0	1
1	3
2	9
3	–
4	81

P.T.O.

6. Evaluate $\Delta^2(\cos x)$.
7. Define the divided difference $[x_0, x_1, x_2]$.
8. Write the formula for $\left[\frac{d^2y}{dx^2}\right]_{x=x_0}$.
9. Form a table of differences for the function $f(x) = x^3 + 5x - 7$ for $x = 0, 1, 2, 3$.
10. Write Newton's general formula for integration.
11. Using Trapezoidal rule, evaluate $\int_0^1 x \, dx$ with $h = 0.5$.
12. Find $y(0.01)$ using Euler's method for $\frac{dy}{dx} = -y$; $y(0) = 1$ with $h = 0.01$.
13. Write Runge-Kutta second order formula.
14. Write Adams-Bashforth predictor formula.

PART – B

Answer any twelve questions.

(12×5=60)

1. Find a real root of the equation $f(x) = x^3 - x - 1 = 0$ correct to two decimal places, by using Bisection Method.
2. Explain the method of False Position to find the roots of the equation.
3. Find a real root of the equation $x^3 - x - 4 = 0$ correct to two decimal places, by using Regula-Falsi Method.
4. Use the iterative method to find a real root of the equation $x^3 = 1 - x^2$ correct to four significant digits.
5. Derive Newton-Raphson formula to find the root of the equation.
6. Use Gauss elimination method to solve the system.
 $2x + y + z = 10$
 $3x + 2y + 3z = 18$
 $x + 4y + 9z = 16.$



- 7. Derive Newton's forward difference interpolation formula.
- 8. Find the cubic polynomial which takes the following values :
 $y(1) = 24, y(3) = 120, y(5) = 336$ and $y(7) = 720$. Hence, or otherwise, obtain the value of $y(8)$.
- 9. Express $f(x) = \frac{x^2 + x - 3}{x^3 - 2x^2 - x + 2}$ as a sum of partial fractions, using Lagrange's formula.
- 10. Derive Newton's general interpolation formula.
- 11. The distances (x cm) traversed by a particle at different times (t seconds) are given below :

t	0.0	0.1	0.2	0.3	0.4	0.5	0.6
x	3.01	3.16	3.29	3.36	3.40	3.38	3.32

Find the velocity of the particle at $t = 0.3$ seconds.

- 12. From the following table of values of x and y, obtain $\frac{dy}{dx}$ for $x = 1.2$:

x	y
1.0	2.7183
1.2	3.3201
1.4	4.0552
1.6	4.9530
1.8	6.0496
2.0	7.3891
2.2	9.0250

- 13. Using Newton's general formula for integration, derive Simpson's one-third rule.
- 14. Evaluate $\int_0^1 \frac{1}{1+x} dx$ correct to three decimal places, taking $h = \frac{1}{6}$, by using Simpson's (3/8)th rule.

15. Given $\frac{dy}{dx} = 1 + xy$, $y(0) = 1$. Obtain the Taylor series for $y(x)$ and compute $y(0.1)$, correct to four decimal places.
16. Derive Adams-Bashforth predictor formula.
17. Using Euler's modified formula, find $y(0.1)$ for the equation $\frac{dy}{dx} = x^2 + y$; $y(0) = 1$ with $h = 0.1$.
18. Use Runge-Kutta fourth order formula to find $y(0.1)$ with $h = 0.1$ given that $\frac{dy}{dx} = y - x$; $y(0) = 2$.



- 7) If A and B are similar matrices then show that $\text{rank } A = \text{rank } B$.
- 8) Prove that each elementary matrix is non-singular.
- 9) By giving an example, show that for any $A, B \in M_n(F)$,
 $\text{rank}(A + B) < \text{rank } A + \text{rank } B$.
- 10) Find the dimension of the space of solution $2x_1 + x_2 - 3x_3 - x_4 = 0$;
 $x_1 + 2x_3 = 0$; $3x_1 - x_2 - x_3 + x_4 = 0$.
- 11) Prove that the minimum polynomial of $A \in M_n(F)$ is unique.
- 12) Show that every characteristic root of $A \in M_n(F)$ is a root of the minimum polynomial of A .
- 13) Show that zero is a characteristic root of A if and only if A is singular.
- 14) Let $A \in M_n(F)$ and let A^t be the transpose of A . Show that $P_A(t) = P_{A^t}(t)$.

PART - B

(12x5=60)

II. Answer any 12 questions.

- 1) Show that a linear transformation $T : V \rightarrow V'$ is 1-1 mapping if and only if $\ker T = \{0\}$.
- 2) Let $T : V \rightarrow V'$ be a linear transformation of V onto V' and let $W = \ker T$. Show that $V/W \cong V'$.
- 3) Let V be a vector space over F and let W be a subspace of V . Let v_1, v_2, \dots, v_n be basis of V such that v_1, v_2, \dots, v_m ($m \leq n$) is a basis of W . Show that $\overline{v_{m+1}}, \overline{v_{m+2}}, \dots, \overline{v_n}$ is a basis of V/W .
- 4) Let V and V' be vector space over F with fixed basis $\{v_1, v_2, \dots, v_m\}$ and $\{v'_1, v'_2, \dots, v'_m\}$ respectively. Show that the mapping $m : L(V, V') \rightarrow M_{mn}(F)$ given by $T \rightarrow m(T)$ defines an isomorphism of the space $L(V, V')$ of all linear transformation of V in V' onto the space $M_{mn}(F)$ of all $m \times n$ matrices over F .
- 5) Let V be a vector space over F with basis v_1, v_2, \dots, v_n and let $T \in L(V, V)$. If $m(T)$ is the matrix of T with respect to the basis v_1, v_2, \dots, v_n , then prove that $m(T_1 T_2) = m(T_1) m(T_2)$, for all $T_1, T_2 \in L(V, V)$.
- 6) Let $V = V^1 = F_n[x]$, the space of all polynomials over f of degree atmost n . Define $T : V \rightarrow V^1$ by $T(f) = f'$. Write the matrix of T w.r.t. the basis $\{1, x, x^2, x^3, \dots, x^n\}$.



- 7) Find the rank of matrix $\begin{bmatrix} 6 & -2 & -18 \\ -4 & 1 & 11 \\ -5 & 2 & 6 \end{bmatrix}$ by performing elementary operations.
- 8) Let $A \in M_n(F)$ and $B \in M_n(F)$. Then show that
- $\text{rank}(AB) \leq \text{Min}\{\text{rank} A, \text{rank} B\}$
 - $\text{rank}(AB) = \text{rank}(BA) = \text{rank} A$, if B is non-singular.
- 9) Find whether the system of equations given below are consistent or not.
 $x_1 - 2x_2 + x_3 = \frac{1}{2}$; $2x_1 - 5x_2 + 2x_3 = 1$; $x_1 + x_2 + x_3 = 1$.
- 10) Find A^{-1} if $A = \begin{bmatrix} 1 & 0 & 0 \\ 2 & 2 & -1 \\ 1 & -1 & 1 \end{bmatrix}$ by performing elementary operations.
- 11) Show that a system of n non-homogenous linear equations of n unknowns has a unique solution if and only if the associated matrix is non-singular.
- 12) Determine the value of a for which the system of equation $x_1 + x_2 + x_3 = 2$; $x_1 + 2x_2 + x_3 = -2$; $x_1 + x_2 + (a - 5)x_3 = a$ has (i) no solution (ii) a unique solution.
- 13) Let $A \in M_n(F)$ and let $q(x) \in F[x]$, a minimum polynomial of A . If $f(x) \in F[x]$ is any other polynomial satisfied by A , then prove that $q(x)$ divides $f(x)$.
- 14) Show that two similar matrices have the same minimum polynomial.
- 15) Find the minimum polynomial of the matrix $\begin{bmatrix} 2 & 1 & -1 \\ 3 & 4 & 2 \\ 0 & 0 & 1 \end{bmatrix}$.
- 16) Let $A \in M_n(F)$ and let $\lambda \in F$. If λ is a characteristic root of A , then prove that for any $f(x) \in F[x]$, $f(\lambda)$ is the characteristic root of $f(A)$.
- 17) Let $A \in M_n(F)$ and let $P_A(t)$ be the characteristic polynomial of A . Show that $P_A(A) = 0$.
- 18) Find the characteristic roots of the matrix $A = \begin{bmatrix} 2 & 3 & 5 \\ 0 & -1 & 4 \\ 0 & 0 & 3 \end{bmatrix}$.

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BSCPHC 382

**Choice Based Credit System VI Semester B.Sc. Degree
Examination, July/August 2023
(2021 – 22 Batch Onwards)**

**PHYSICS
Electronics**

Time : 3 Hours

Max. Marks : 80

- Instructions :** i) Answer questions from **all** Units.
ii) Scientific calculators are **allowed**.

PART – A

1. Answer **any 8** questions.

(8×1=8)

- i) Give the relation connecting input and output frequencies of a full wave rectifier.
- ii) What is the percentage regulation of an ideal voltage regulator ?
- iii) What is the phase difference between input and feedback signal in positive feedback ?
- iv) How many flip-flops are required to construct a decade counter ?
- v) Realize NOT gate using NAND gate.
- vi) What is the logical state for the XOR gate output when both of its inputs are high ?
- vii) In which layer of earth's atmosphere does space wave propagate ?
- viii) How many sidebands does an FM wave contain ?
- ix) Name the first man-made satellite launched into space.

2. Answer **any 6** questions.

(6×2=12)

- i) What are the four differential amplifier configurations ?
- ii) What is meant by virtual ground with respect to an OPAMP ?
- iii) Give any two differences between positive and negative feedback.
- iv) Explain briefly how OR operation is different from decimal addition.

P.T.O.



- v) Write the logic diagram for the Boolean expression $Y = AC + \bar{B}$.
- vi) Construct AND gate using NAND gates.
- vii) A carrier wave 100 V, 1.2 MHz is amplitude modulated by a 50 V, 1 kHz sine wave signal. Find the modulation index.
- viii) Mention any two advantages of linear diode detector.
- ix) Give any two comparisons between LCD and LED monitors.

PART – B

Unit – I

3. a) Explain any three characteristics of an ideal OPAMP. 3
- b) With a circuit diagram explain the action of Wien-bridge oscillator using OPAMP. 5
- c) Explain the working of full wave bridge rectifier using diodes and obtain the expressions for its efficiency and ripple factor. 8
- OR
4. a) Define CMRR of an OPAMP. Why is its value very high ? 3
- b) With a circuit diagram explain the action of OPAMP non-inverting amplifier and obtain expression for its voltage gain. 5
- c) Describe the types of feedback. Obtain the expression for voltage gain of an amplifier with feedback. Hence arrive at Barkhausen criterion for the oscillations. 8
5. a) A bridge rectifier has the secondary voltage $v_s = 150 \sin \omega t$. It supplies power to a load of 450Ω . Calculate
- i) DC output voltage.
- ii) Percentage efficiency. 4

OR

- b) In a Zener voltage regulator, if $V_z = 40 \text{ V}$, $V_i = 100 \text{ V}$, $R_L = R_S = 5 \text{ k} \Omega$, find current through the Zener diode. 4



Unit – II

- 6. a) Realize XOR gate using NAND gates and write Boolean expression at each stage. 3
- b) Explain the working of JK flip-flop with relevant diagram and truth table. 5
- c) What is a register ? Explain the working of serial shift register using D Flip-Flop. 8

OR

- 7. a) What is a half adder ? Write its logic diagram and truth table. 3
- b) State and prove De-Morgan's theorems using truth table and logic diagrams. 5
- c) What is a counter ? Explain the working of 4-bit ripple counter using JK Flip-Flop and write the timing diagram and truth table. 8

- 8. a) Prove $A + BC = (A + B)(A + C)$ and write the logic diagram. 4

OR

- b) Write the truth table and logic diagram for the Boolean expression $Y = (A\bar{B} + \bar{A}C)$. 4

Unit – III

- 9. a) Write a note on structure of ionospheric layers. 3
- b) With waveforms at different blocks explain super heterodyne AM receiver. 5
- c) Derive an expression for the instantaneous voltage of an amplitude modulated wave and obtain the expression for modulation index in terms of maximum and minimum amplitudes. 8

OR

- 10. a) Give any three comparisons between AM and FM. 3
- b) Explain AM radio transmitter with the help of different blocks. 5
- c) Explain the working of Cathode ray tube with a neat diagram. Give the block diagram of CRO and label the different blocks. 8



11. a) The total power content of an AM wave is 1200 W for 80% modulation. Determine
- i) Carrier power
 - ii) LSB and USB power.

4

OR

- b) A 500 W, 100 KHz carrier is amplitude modulated to a depth of 60% by a modulating signal of frequency 1 kHz. Calculate
- i) Total power transmitted
 - ii) Efficiency
 - iii) Band width.

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BSCPHC 381

**Choice Based Credit System Sixth Semester B.Sc. Degree
Examination, July/August 2023
(2021-22 Batch Onwards)
PHYSICS
Nuclear Physics**

Time : 3 Hours

Max. Marks : 80

- Instructions :* i) Answer questions from **all** Units.
ii) **Scientific calculators are allowed.**

PART - A

1. Answer any eight of the following questions : (1×8=8)
- Why Uranium series is called $(4n+2)$ series ?
 - Define range of an alpha particle.
 - What is negatron emission ?
 - What is Q value of a nuclear reaction ?
 - What is electric quadrupole moment ?
 - What is the role of the moderator in thermal reactor ?
 - Why electrons cannot be accelerated in cyclotron ?
 - What are soft cosmic rays ?
 - What are Bosons ?
2. Answer any six of the following questions : (2×6=12)
- Explain tunnel effect in alpha decay.
 - Define Curie and Becquerel.
 - What is induced radioactivity ? Give one example.
 - Define binding energy of a nucleus. What is the energy equivalent of mass 1 amu ?
 - What are magic numbers ? Why they are called so ?

P.T.O.



- vi) What are fissile and fertile materials ?
- vii) What is quenching ? Name the organic compound used in quenching.
- viii) How secondary cosmic rays are produced ? What is their main composition ?
- ix) What are hyperons ? Give example.

PART – B

UNIT – I

- 3. a) Obtain the expression for threshold energy of an alpha particle. 3
- b) What is radioactive dating ? Explain radiocarbon dating. 5
- c) Derive the expression for alpha ray disintegration energy. Explain Geiger-Nuttal law and alpha ray spectra. 8

OR

- 4. a) Explain interaction of gamma ray with matter. 3
 - b) Explain the characteristics of beta ray spectra. 5
 - c) With elements A, B and C forming a radioactive series, (C being stable), derive an expression for the number of atoms of B. Hence derive the condition for transient equilibrium. 8
- 5. a) How long will it take for a sample of Ra-D to decrease by 10%, if its half life is 22 years ? 4

OR

- b) Calculate the threshold energy required to initiate the reaction $^{31}\text{P}(n, p)^{31}\text{Si}$. Given atomic masses of $^1\text{H} = 1.00814$ amu, $^1_0\text{n} = 1.00895$ amu, $^{31}_{15}\text{P} = 30.98356$ amu, $^{31}_{14}\text{Si} = 30.98514$ amu. 4

UNIT – II

- 6. a) Explain Yukawa's meson field theory. 3
- b) Explain any five characteristics of nucleus. 5
- c) Define nuclear fission and fusion. Derive four factor formula. 8

OR



7. a) Explain how the mass of π meson is estimated using Heisenberg's uncertainty principle. 3
- b) Give the similarities between a nucleus and the liquid drop. 5
- c) Explain the construction, working and theory of Dempster's mass spectrograph. 8
8. a) A 5 Mev alpha particle approaches gold nucleus of atomic number 79 with an impact parameter of 2.6×10^{-13} m. Calculate the angle of scattering. 4

OR

- b) A reactor develops nuclear energy at the rate of 12000 kW. How many kg of Uranium would be used for 1000 hrs. of operation ? Each fission of ^{235}U produces 200 Mev of energy. 4

UNIT – III

9. a) Write a note on cosmic ray shower. 3
- b) Describe the principle and working of a betatron. 5
- c) Describe the construction, working and theory of a cyclotron. 8

OR

10. a) What are Van Allen radiation belts ? Explain. 3
- b) Explain the construction and working of a GM counter. 5
- c) Describe the construction, working and theory of a linear accelerator. 8
11. a) Calculate the average energy per revolution and the energy gained by the electron in a betatron to which the applied magnetic field is 1.5 T, operating at 50 Hz in an orbit of diameter 0.2 m. 4

OR

- b) In cyclotron alpha particles are accelerated in a magnetic field of strength 1.5 T. The diameter of the Dees is 30 cm. Calculate the energy gained by the particles and the frequency of the oscillator. 4

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BSCCHC 384

**Choice Based Credit System VI Semester B.Sc. Degree
Examination, July/August 2023
(2022 – 2023 Batch Onwards)
CHEMISTRY (Paper – VII)**

Time : 3 Hours

Max. Marks : 80

- Instructions :**
- 1) Write the question numbers and sub-divisions clearly.
 - 2) Write the equations and diagrams **wherever** necessary.
 - 3) Answer Part – A in the first **two** pages of answer book.
 - 4) Scientific calculators are **allowed**.

PART – A

1. Answer **any ten** of the following : **(2×10=20)**
- a) What is liquid junction potential ?
 - b) Define fuel cell. Give an example.
 - c) Give any two applications of fluorocarbon polymer.
 - d) Give the synthesis of urea-formaldehyde resin.
 - e) What are composites ? Give an example.
 - f) What are alkaloids ? Give an example.
 - g) Write the structural formulae of menthol and camphor.
 - h) What are herbicides ? Give an example.
 - i) Define green chemistry.
 - j) Mention the applications of mass spectroscopy.
 - k) Define cetane number.
 - l) What are biodegradable polymers ? Give an example.

P.T.O.



PART – B

Answer **any four** of the following questions choosing **one** from **each** Unit.

(15×4=60)

Unit – I

2. a) Explain the construction and working of calomel electrode. 4
b) How do you determine the pH of solution using quinhydrone electrode ? 4
c) i) Explain conductometric titration of mixture of acids against strong base. 4
ii) Calculate EMF of the cell formed by the combination of standard zinc and silver electrodes. (Given $E_{zn}^0 = -0.76$ V, $E_{Ag}^0 = +0.8$ V). Represent the cell. 3
3. a) Write the importance of fuel cell. 3
b) What are concentration cells ? Explain how the valency of mercurous ion is determined using concentration cells ? 5
c) i) Derive Nernst equation for cell EMF. 4
ii) Explain potentiometric titration of HCl against NaOH. 3

Unit – II

4. a) Give a method of preparation of Phosphonitrilic halide and any two applications of it. 4
b) Describe the mechanism of free radical polymerization of vinyl polymers. 4
c) i) What are the advantages of synthetic rubber over natural rubber ? 4
ii) Describe the role of matrix in composites. 3
5. a) Explain the structure of layer polymer of Boron nitride. 3
b) Explain in brief the preparation, structure, properties and applications of silicones. 5
c) i) How is Buna - S manufactured ? Give any two uses of it. 4
ii) Write a note on reinforcement material in composites. 3

**Unit – III**

6. a) Explain the exhaustive methylation of alkaloids. 4
b) Explain any two methods of isolation of terpenes. 4
c) i) What is Bordeaux mixture? Mention its applications. 4
ii) Write a note on prevention of waste by-products. 3
7. a) Why is water considered as green solvent ? 3
b) Elucidate the structure of Citral. 5
c) i) Write a note on the properties of Alkaloids including physiological activity. 4
ii) Discuss the importance of the pesticides. 3

Unit – IV

8. a) Explain McLafferty rearrangement with suitable example. 4
b) Explain catalytic reforming of gasoline. 4
c) i) What are conducting polymers ? Mention its properties. 4
ii) Explain nitrogen rule with suitable example. 3
9. a) Explain how mass spectroscopy can be used in the determination of molecular mass of a compound. 3
b) Describe in detail the instrumentation of mass spectrometer. 5
c) i) What are petrochemicals? Give any three applications of it. 4
ii) Explain the preparation and applications of polycaprolactone. 3
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BSCCHC 385

**Choice Based Credit System Sixth Semester B.Sc. Degree
Examination, July/August 2023
CHEMISTRY (Paper – VIII)
(2022-23 Batch Onwards)**

Time : 3 Hours

Max. Marks : 80

- Instructions :**
- 1) **Write the question number and subdivision clearly.**
 - 2) **Write equations and diagrams wherever necessary.**
 - 3) **Answer Part – A in the first two pages of the answer book.**
 - 4) **Scientific calculators are allowed.**

PART – A

1. Answer **any ten** of the following questions : **(2×10=20)**
- a) Define the term absorbance.
 - b) What is the effect of conjugation on absorption maximum ?
 - c) What are allowed and forbidden transitions ?
 - d) Write any two advantages of NMR.
 - e) Explain anisotropic effect.
 - f) What is binding energy ?
 - g) What are essential and non essential amino acids ? Give one example each.
 - h) Write the structure of thyroxine.
 - i) Define the term zwitter ion.
 - j) What are triglycerides ? Give an example.
 - k) Write any two biological importances of cephalin.
 - l) What are chemotherapeutic agents ? Give one example.

P.T.O.

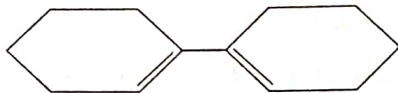


PART – B

Answer any four of the following questions choosing one question from each Unit. (15×4=60)

Unit – I

- 2. a) Derive Beer–Lambert’s law. 4
- b) What are auxochromes and chromophores ? Give example for each. 4
- c) i) Explain different electronic transitions that take place when a molecule absorbs UV or visible radiation. 4
- ii) Calculate the absorption maximum for the following compound. 3



- 3. a) Based on absorption and intensity explain bathochromic and hypsochromic shifts. 3
- b) Describe the instrumentation of spectrophotometer with a neat labelled diagram. 5
- c) i) Mention any four applications of colorimetry and spectrophotometry. 4
- ii) What are allowed and forbidden transitions ? Give examples. 3

Unit – II

- 4. a) Explain spin–spin coupling in NMR spectroscopy with a suitable example. 4
 - b) Describe any two factors affecting the position of signals in NMR spectra. 4
 - c) i) Explain the NMR spectra of ethyl bromide. 4
 - ii) What is the effect of chemical forces on photoelectron spectrum ? 3
- 5. a) Explain the photoelectron spectrum of oxygen atom. 3
 - b) Describe the functioning of NMR spectrometer with neat schematic sketch. 5
 - c) i) Explain the NMR spectra of ethyl acetate. 4
 - ii) Write any three advantages of tetra methyl silane as a reference compound in NMR. 3



Unit – III

- 6. a) Explain Kiliani – Fischer synthesis of chain lengthening of monosaccharides. 4
- b) Write any two reactions due to – COOH group of an amino acids. 4
- c) i) Explain the preparation of adrenaline. What is its function ? 4
- ii) Explain the retro analysis of saccharine. 3
- 7. a) Explain the classification of proteins based on their molecular shape. 3
- b) How is the configuration of D-glucose determined ? 5
- c) i) Describe Gabriel’s phthalimide synthesis of amino acids. 4
- ii) Explain the classification of hormones based on their chemical composition. 3

Unit – IV

- 8. a) Write the structure and biological importance of Lecithin. 4
 - b) How does benzene sulphonic acid reacts with dilute sulphuric acid ?
Give the mechanism. 4
 - c) i) What are liposomes ? Write any of its four applications. 4
 - ii) How is sulphanilamide synthesized from acetanilide ? 3
 - 9. a) Explain the different types of lipids with examples. 3
 - b) Explain the biological importance of triglycerides. 5
 - c) i) Explain addition reactions of halogens and alkyl halides to thioethers. 4
 - ii) How is chloramine T synthesized ? Give the reaction. 3
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BSCPHC 382

Choice Based Credit System VI Semester B.Sc.
Degree Examination, September 2022
(2021 – 22 Batch Onwards)
PHYSICS
Electronics

Time : 3 Hours

Max. Marks : 80

Instructions : i) Answer questions from **all Units**.
ii) **Scientific calculators are allowed.**

PART – A

1. Answer **any 8** questions. **(8×1=8)**
- i) What is Supply Voltage Rejection Ratio (SVRR) in an OPAMP ?
 - ii) What is positive feedback in a circuit ?
 - iii) What is the use of Pin. No. 8 in an OPAMP ?
 - iv) How many outputs will be there for a binary adder ?
 - v) Give the Boolean expression for the output of a two input NOR gate.
 - vi) Give an example for a universal gate.
 - vii) The modulating frequency of AM wave is f_m . What is its bandwidth ?
 - viii) How many sidebands will be present in FM wave ?
 - ix) What is skip distance in ionospheric communication ?
2. Answer **any 6** questions. **(2×6=12)**
- i) The CMRR of an OPAMP is 10^4 . If common mode gain is 10, find differential mode gain.
 - ii) State Barkhausen criteria for an oscillator.
 - iii) What is a filter ? Name any two filters.
 - iv) Realize OR gate using NAND gates.
 - v) Write the truth table for two input NOR gate.

P.T.O.



- vi) Write the logic diagram for Boolean expression $Y = \overline{AB} + A$, using basic logic gates.
- vii) Mention any two advantages of diode detector.
- viii) Mention any two limitations of AM.
- ix) Give any two comparisons between LED and LCD monitors.

PART – B

Unit – I

- 3. a) Explain input offset voltage, input offset current and CMRR of an OPAMP. 3
- b) Explain the action of capacitor filter with required diagram. 5
- c) Derive an expression for voltage gain of a feedback amplifier in terms of feedback fraction. Explain the action of transistor phase shift oscillator with a circuit diagram. 8

OR

- 4. a) Give any three differences between positive and negative feedback in electrical circuit. 3
- b) Explain OPAMP inverting amplifier and obtain expression for its gain. 5
- c) Explain the working of full wave bridge rectifier with required diagram. What is ripple factor ? Show that ripple factor is 0.482 for a bridge rectifier. 8
- 5. a) For a zener regulator, $V_z = 10\text{ V}$, $R_s = 1\text{ K}\Omega$, $R_L = 2\text{ K}\Omega$ and the input voltage varies from 20 to 50 V. Find the maximum and minimum values of zener current. 4

OR

- b) An amplifier without feedback has an output of 45 V for an input of 0.05 V. If 1% negative feedback is applied, what is the output voltage ? 4

Unit – II

- 6. a) Explain the working of NOT gate using discrete circuit. 3
- b) State and explain De-Morgan's theorems. 5
- c) What is a counter ? Explain the working of ripple counter using JK Flip-Flops and write the timing diagram. 8

OR



7. a) Write the logic diagram, truth table and symbol of a JK Flip-Flop. 3
b) Explain XOR gate using basic logic gates with its logic diagram and truth table. 5
c) Explain the sum of products method for the simplification of Boolean expression with an example. 8
8. a) Simplify Boolean expression $Y = ABC + A\bar{B}C + A\bar{B}\bar{C}$ and draw the logic diagram for simplified expression. 4

OR

- b) Prove (i) $(A + B)(A + C) = A + BC$ (ii) $(\bar{A} + B)(A + B) = B$. 4

Unit – III

9. a) Write a note on classification of radio waves on the basis of modes of propagation. 3
b) Describe AM radio transmitter with a block diagram. 5
c) With required wave diagrams obtain an expression for AM wave. Mention any three advantages of SSB transmission. 8

OR

10. a) Give any three comparisons of AM and FM. 3
b) Explain the working of linear diode detector showing wave forms at different blocks. 5
c) With neat labelled diagram, explain the working of Cathode ray tube. Mention any three uses of CRO. 8

11. a) The maximum and minimum peak to peak voltages of an AM wave are 16 mV and 4 mV respectively. Calculate modulation index. If the carrier power is 5 KW, find the total power. 4

OR

- b) What are carrier, sideband and total power in an AM wave across a load of 100Ω , when the carrier voltage is 100 V and modulation index is 0.5. 4
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Reg. No.

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BSCPHC 381

**Choice Based Credit System Sixth Semester B.Sc. Degree
Examination, September 2022
(2021 – 22 Batch Onwards)**

**PHYSICS
Nuclear Physics**

Time : 3 Hours

Max. Marks : 80

- Instructions :** i) Answer questions from **all** Units.
ii) Scientific calculators are **allowed**.

PART – A

1. Answer **any eight** of the following questions :

(1×8=8)

- What is threshold energy of a nuclear reaction ?
- What is radioactive series ?
- What is radio carbon dating ?
- What are nuclear forces ?
- What is a chain reaction ?
- What is stellar energy ?
- What are quarks ?
- Write the necessary condition for the working of cyclotron.
- What are hard cosmic rays ?

2. Answer **any six** of the following questions :

(2×6=12)

- What is the significance of Q value of a nuclear reaction ?
- What is K-electron capture ? Explain.
- Define curie and becquerel.
- Explain nuclear fission with an example.
- What are magic numbers ? Mention them.
- Write any two drawbacks of liquid drop model.
- What is quenching ? Name the compound used in organic quenching.
- Write the decay scheme of μ^+ and μ^- particles.
- Write any two advantages of cyclotron.

P.T.O.

PART – B
Unit – I

3. a) Explain the interactions of gamma rays with matter. 3
 b) What is an endoergic reaction ? Deduce the expression for the threshold energy of an endoergic reaction. 5
 c) With elements A, B and C forming a radioactive series (C being stable), derive an expression for the number of atoms of B if at start B was not present in the sample. 8

OR

4. a) What is tunnel effect ? Quantitatively account for tunnel effect. 3
 b) What is beta ray spectra ? Explain any four paradoxes of beta ray spectra. 5
 c) Discuss the experiment leading to the discovery of neutrons. Explain any four properties of neutrons. 8
5. a) A carbon specimen found in excavation contain $1/8$ as much ^{14}C as an equal amount of carbon in living matter. Calculate the approximate age of the specimen. Half life of ^{14}C = 5568 years. 4

OR

- b) Calculate the threshold energy required to initiate the reaction $^{31}\text{P}(n, p)^{31}\text{Si}$. Given atomic masses $^1_1\text{H} = 1.00814$ amu, neutron = 1.00895 amu. $^{31}_{15}\text{P} = 30.98356$ amu and $^{31}_{14}\text{Si} = 30.98514$ amu. 4

Unit – II

6. a) Explain Yukawa's meson field theory. 3
 b) Derive four factor formula for a nuclear reactor. 5
 c) Describe with theory the working of Dempster's mass spectrograph and explain how isotopic abundances can be determined. 8

OR

7. a) Explain C-N cycle of fusion in stars. 3
 b) Write any five properties of nuclear forces. 5
 c) With a neat and labelled diagram, explain the working of a nuclear reactor. 8



8. a) An alpha particle of energy 5 MeV approaches the gold nucleus with an impact parameter 2.6×10^{-13} m. Through what angle will it be scattered ?
The atomic number of gold is 79. 4

OR

- b) A city requires 100 MW of electrical power per day which is supplied by a nuclear reactor of efficiency 40%. Calculate the amount of U – 235 fuel required per day of operation. (Assume the average energy of 200 MeV released per fission). 4

Unit – III

9. a) Write a note on origin of cosmic rays. 3
- b) Describe the working of GM tube with the necessary diagram. 5
- c) Explain the principle of a betatron. Hence derive an expression for the final energy gained by the electrons. 8

OR

10. a) Write a note on Van allen radiation belts. 3
- b) Explain the variation of cosmic ray intensity with : 5
- i) Altitude and
- ii) East-west direction. 5
- c) Explain the condition for synchronisation in a linear accelerator and obtain the expression for the maximum energy of the particles ejected from the accelerator. 8

11. a) The radius of cyclotron DEE is 0.4 m and the applied magnetic field is 1.5 Wb/m^2 . What is the maximum energy of a beam of protons ?
Given : Mass of proton = 1.67×10^{-27} kg. 4

OR

- b) Electrons are accelerated in a betatron working at 50 Hz frequency and has a stable orbit of radius 2 meter having the magnetic field strength 5T at the orbit. Calculate the average energy per revolution gained by the particles. (Express the energy in eV). Assume electrons are moving with velocity C. 4
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