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Program Name-B.Sc. Physics
 Semester V/III Year Examination
 Subject Code- B010501T

Subject Name- Classical Mechanics & Statistical Mechanics
 [Time : 03:00 Hours] [Max. Marks: 75]

Note: I. Attempt all the questions as per given instructions.

I. Multiple Choice Questions (MCQs) [01×15 = 15]

- I Torque $\vec{\tau}$ is expressed as:
 (a) $\vec{\tau} \times \vec{F}$ (b) $\vec{\tau} - \vec{F}$ (c) $\vec{\tau} \times \vec{F}$ (d) $\vec{F} \times \vec{\tau}$
- II Stoke's theorem connect
 (a) line integral $\leftrightarrow$ surface integral
 (b) closed line integral $\leftrightarrow$ surface integral
 (c) surface integral $\leftrightarrow$ volume integral
 (d) closed surface integral $\leftrightarrow$ volume integral

III Which is the correct identity?

- (a) curl grad $S = 0$ (b) div grad $S = 0$
 (c) div grad $S \neq 0$ (d) curl grad $S \neq 0$

IV What is relation between angular momentum ($\vec{L}$) and linear momentum ($\vec{p}$)?

- (a) $\vec{L} = \vec{p} \times \vec{r}$ (b) $\vec{L} = \vec{r} \times \vec{p}$ (c) $\vec{p} = \vec{r} \times \vec{L}$ (d) $\vec{p} = \vec{L} \times \vec{r}$

V In classical mechanics the speed v of a body is given as:

- (a) $v < c$ (b) $v < c$ (c) $v = c$ (d) $v \approx c$

VI What is/ are invariant (s) in classical mechanics?

- (a) Time (b) Mass (c) Both (d) None of these

VII Work done by conservative force is

- (a) 0 (b) must be 0 (c) > 0 (d) < 0

VIII Lagrangian L is expressed as:

- (a) $L = T + V$ (b) $L = T - V$ (c) $L = T \times V$ (d) $L = T/V$

IX Holonomic constraints can be expressed as:

- (a) $f(r_1, r_2, \dots, r_n, t) = 0$ (b) $f(r_1, r_2, \dots, r_n, t) > 0$
 (c) $f(r_1, r_2, \dots, r_n, t) \leq 0$ (d) $f(r_1, r_2, \dots, r_n, t) \geq 0$

X Hamiltonian function H is expressed as

- (a) $H = T + V$ (b) $H = T - V$ (c) $H = T/V$ (d) $H = H = T * V$

XI A simple pendulum has number of generalized coordinate

- (a) 0 (b) 1 (c) 2 (d) 3

XII Equation of motion of a simple pendulum is

- (a) $\ddot{\theta} = \frac{g}{l} \theta$ (b) $\ddot{\theta} = \frac{l}{g} \theta$ (c) $\ddot{\theta} = \sqrt{\frac{g}{l}} \theta$ (d) $\ddot{\theta} = \sqrt{\frac{l}{g}} \theta$

Enrollment No.									
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Program Name: B.Sc. Mathematics
 V-Semester / III-Year Examination

Subject Code: B030501 T

Subject Name: Group & Ring Theory & Linear

Algebra

[Time : 03:00 Hours] [Max. Marks : 75]

Note: Attempt all the questions as per given instructions.

I. Multiple Choice Questions (MCQs) [01×15=15]

I Let V be the vector space of all 3×5 matrices over the field F . The dimension of V is
 (a) 2 (b) 8 (c) 14 (d) 15

II Matrix is a
 (a) Scalar (b) Vector (c) both (a) and (b) (d) none

III An automorphism from a group G is defined to
 (a) G itself (b) Ring R (c) Vector space V (d) Null Space

IV Relation of isomorphism in rings is
 (a) not reflexive (b) an equivalence relation (c) not symmetric (d) none

V The set of all n matrices of m order forms a
 (a) not a ring (b) noncommutative ring (c) commutative ring (d) a field

VI The dimension of the vector space spanned by $(3, -1)$ and $(1, 1)$ is
 (a) 1 (b) 2 (c) 5 (d) 4

VII If W be a subspace of a finite dimensional vector space $V(F)$, then $\dim V/W =$
 (a) $\dim V - \dim W$ (b) $\dim V + \dim W$ (c) $\dim V/\dim W$ (d) none

VIII Rank $T =$ Dimension (domain of T) + Nullity T then Nullity (T) is
 (a) 0 (b) 2 (c) 5 (d) Any non zero number

IX The dimension of the vector space $R(R)$ is.....
 (a) 1 (b) 2 (c) 3 (d) 4

X If $(k, 4, 2)$ is a linear combination of vectors $(3, 2, 1)$ and $(2, 1, 0)$ in R^3 , then the value of k is.....
 (a) 8 (b) 4 (c) 6 (d) 7

XI If T is a linear transformation on a vector space V such that $T^2 - T + 7I = 0$, then T is
 (a) invertible (b) non invertible (c) both (a) and (b) (d) none

- XII** If T is a linear transformation on n -dimensional vector space V , and suppose that T has n -distinct eigen vectors, then T is
- (a) invertible
 - (b) non invertible
 - (c) diagonalizable
 - (d) symmetric
- XIII** Linear Transformation is a
- (a) linear function
 - (b) trigonometric function
 - (c) exponential function
 - (d) any function
- XIV** The subset $\{(1,1,0), (0,1,0)\}$ of vector space R^3 is
- (a) Linearly dependent
 - (b) Linearly independent
 - (c) both
 - (d) none
- XV** Let R be the commutative ring and P be an ideal of the ring R . Then P is a prime ideal of R iff
- (a) R/P is an integral domain
 - (b) R/P is not an integral domain
 - (c) R/P is a ring
 - (d) R/P is a field
- 2. Answer in long (any three)** [10×3=30]
- Show that the necessary and sufficient condition for a non-empty subset S of a ring R to be a subring if
- (i) $a \in S, b \in S \Rightarrow a - b \in S$,
 - (ii) $a \in S, b \in S \Rightarrow ab \in S$.
- Let F be the field of complex numbers and let T be the function from R^3 onto R^3 defined by $T(a_1, a_2, a_3) = (a_1 - a_2 + 2a_3, 2a_1 + a_2 - a_3, -a_1 - 2a_2)$. Verify that T is a linear transformation. Describe the null space of T .
- Let U and V be vector spaces over the field F and let T be a linear transformation from U into V . Suppose U is finite dimensional, then show that $\text{rank}(T) + \text{nullity}(T) = \dim(U)$.
- If $\alpha_1, \alpha_2, \dots, \alpha_n \in V$ are linearly independent then every element in their linear span has a unique representation in the form $a_1\alpha_1 + a_2\alpha_2 + \dots + a_n\alpha_n$ with the $a_i \in F$.
- Show that the intersection of any two ideals of a ring R is again an ideal of R .
- 3. Answer in short (any five)** [6×5=30]
- Define polynomial ring with suitable example.
 - Explain inner product with basic properties.
 - Show that the ring I of all integers is an Euclidean ring.
 - The intersection of any two subspaces of a vector space is a subspace.
 - Show that the intersection of two sub rings is again a sub ring.
 - Prove that every homomorphic image of a commutative ring is a commutative ring.
 - Show that the vectors $(1, 1, -1), (2, -3, 5)$ and $(-2, 1, 4)$ of R^3 are linearly independent.

XIII The equation of motion of two masses M_1 and M_2 over a pulley is given as

$$(a) \ddot{y} = \frac{M_1 - M_2}{M_1 + M_2} g$$

$$(b) \ddot{y} = \frac{M_1 + M_2}{M_1 - M_2} g$$

$$(c) \ddot{y} = \sqrt{\frac{M_1 - M_2}{M_1 + M_2}} g$$

$$(d) \ddot{y} = \sqrt{\frac{M_1 + M_2}{M_1 - M_2}} g$$

Printing Pages :2

Paper Code: B030502 T A (SVSU:2024-25/R)

Enrollment No.

Program Name: B.Sc. Mathematics
V-Semester / III-Year Examination
Graph Theory & Discrete Mathematics

B030502T

[Max. Marks :75]

[Time : 3:00 Hours]

Note: Attempt all the questions as per given instructions

I. Objectives Question: Answer All Question

[15x1=15]

- In Boolean Algebra, $a + a$ is equal to :
(i) 2a (ii) a (iii) 1 (iv) 0
- In Boolean Algebra, $a + a'$ is equal to :
(i) 2a (ii) a (iii) 1 (iv) 0
- In Boolean Algebra, $a + (a.b)$ is equal to :
(i) b (ii) a (iii) 1 (iv) 0
- The output of a 2 input OR gate is 0 only when its
(i) both input are 0 (ii) either input is 0
(iii) both input are 1 (iv) either input is 1
- In Boolean Algebra, $a.(a + b)$ is equal to :
(i) a (ii) c (iii) $a + b$ (iv) c.b

6. The Conditional is represented by :

- (i) v (ii) $\wedge$ (iii) $\rightarrow$ (iv) $\leftrightarrow$

7. The maximum number of edges in a simple graph with n vertices is :

- (i) $\frac{n(n-1)}{2}$ (ii) $\frac{n(n+1)}{2}$
(iii) $\frac{(n-1)}{2}$ (iv) $\frac{n(n-1)}{3}$

8. The minimum number of edges in a connected graph with n vertices is

- (i) $n-1$ (ii) $n+1$ (iii) n (iv) none of these

9. The list of all of the minterms of the two variables x and y are

- (i) $xy, x'y, xy', x'y'$ (ii) $xy, x', xy', x'y'$
(iii) $xy, x'y, x'y', x'y$ (iv) $xy, x'y, xy', x'$

10. The D' Morgan's law is:

- (i) $lp \wedge lq = lp \wedge lq$ (ii) $l(pvq) = lp \wedge lq$
(iii) $l(pvq) = p \wedge lq$ (iv) $l(pvq) = lp \wedge lq$

11. The value of $T(k) - 5T(k-1) = 0$ with $D(0) = 5$

- (i) 2. 5^k (ii) 5. 5^k (iii) 5. 5^{k-1} (iv) none

12. The value of recurrence relation $T(n) - 7T(n-1) = 0$

(iv) none

Printing Pages :2

Paper Code: BPCM-505S

A (SVSU:2024-25/R)

Enrollment No.

Program Name - B.Sc. PCM

Year/Semester- III/V Examination

Subject Name- Food Chemistry

Subject Code-BPCM-505S

Timing: 3:00 Hours

[Max. Marks: 70]

Note: 1. Attempt all the questions as per given instructions.

2. Fill the correct answer of MCQs

I. Multiple Choice Questions (MCQs) [01x15=15]

I. An enzyme that joins the ends of two strands of nucleic acid is:

- (a) Polymerase (b) Ligase (c) synthetase (d) Helicase

II. Which one among them is the example of competitive inhibition

of an enzyme:

- (a) Succinic dehydrogenase by malonic acid
(b) Cytochrome oxidase by cyanide
(c) Hexokinase by glucose-6-phosphate
(d) Carbonic anhydrase by carbon dioxide

III. Enzymes are made Up of:

- (a) Fats (b) Proteins (c) Nucleic acids (d) Vitamins

IV. Koshland proposed which model:

- (a) Fluid mosaic model (b) Induced fit model
(c) Lock and key model (d) Reflective index model

V. Mg^{+2} is an inorganic activator for enzymes:

- (a) Phosphatase (b) Carbonic anhydrase
(c) Amylase (d) Enterokinase

VI. An amino acid yielding acetyl CoA during catabolism is

- (a) ketogenic (b) glucogenic
(c) essential (d) both glucogenic and ketogenic

VII. The first amino acid of any polypeptide chain in eukaryotes is

- (a) valine (b) methionine (c) glycine (d) alanine

VIII. Amino acids with aromatic side chain are-

- (a) tryptophan, asparagine, tyrosine
(b) tryptophan, threonine, tyrosine
(c) phenylalanine, tryptophan, serine
(d) phenylalanine, tryptophan, tyrosine

IX. The naturally occurring proteins consist of

- (a) D-amino acids (b) L-amino acids
(c) both (a) and (b) (d) none of these

X. Which of the following amino acids has to be supplemented in the diet?

- (a) phenylalanine (b) cysteine (c) glutamine (d) asparagine

[1]

The list of all of the maxterms of the two variables x and y are

- (i) $x + y, x' + y, x + y', x' + y'$
- (ii) $x + y, x' + y, x + y', x' + y'$
- (iii) $xy, x'y, x'y', x'y'$
- (iv) $x + y, x' + y, x + y', x' + y'$

In Boolean Algebra, $a(a + b)$ is equal to:

- (i) b
- (ii) a
- (iii) 1
- (iv) 0

In Boolean Algebra, aa' is equal to

- (i) b
- (ii) a
- (iii) 1
- (iv) 0

Long Question : Answer Any Three

Using generating function, solve the recurrence relation:

$y_n = 3y_{n-1} + 2; n \geq 1$ with $y_0 = 1$.

$y_n = 3y_{n-1} + 2; n \geq 1$ and $a, b = 0$ than show that $b = a'$

(i) In Boolean Algebra if $a + b = 1$ and $a, b = 0$ than show that $b = a'$

(ii) Use Karnaugh map to simplify the:

$$X = ABC' + ABC$$

(i) Without truth table, prove that the function:

$$(lp \vee q) \wedge (p \wedge (p \wedge q)) \equiv (p \wedge q)$$

(ii) Construct a truth table of: $(p \wedge q) \vee (q \wedge r) \vee (r \wedge p)$.

The Maximum number of edges in a simple disconnected graph G with n

$$\frac{(n-k)(n-k+1)}{2}$$

vertices and k component is

Explain Kruskal's algorithm on tree with an example.

Short Question: Answer any Five

1. Write down the De Morgan's Law for set theory.

2. Prove that by truth table: $\sim(p \vee q) \equiv \sim p \wedge \sim q$.

3. Construct the truth table of the following: $1(p \wedge lq)$.

4. In Boolean Algebra, show that:

$$(a + b')(b + c') = (a' + b)(b' + c) + (a' + b)(c' + a)$$

5. Define derived connectives NAND, NOR and XOR gates with the help of truth table.

6. Define degree of a vertex.

7. Prove that a graph G with n vertices is a tree if and only if it has n-1 edges and no cycles.

8. Solve the recurrence relation $a_n - 6a_{n-1} + 9a_{n-2} = 0$.

9. Describe the various type of phase structure grammars.

10. Define Finite State Automata.

XI. Which of the following monosaccharides is the majority found in the human body?

- (a) D-type (b) L-type (c) LD-types (d) None of the above

XII. HACCP stands for

- (a) Physical, Chemical and Biological hazards
- (b) Accurately monitoring food hygiene hazards
- (c) Identifying CCPs, inclusive of procedure, location and process
- (d) A systematic analysis of all steps and regular monitoring of control points

XIII. In cattle, this factor is critical that would lead to increased milk yield

- (a) Selection of good breeds
- (b) Provision of ideal environmental conditions to cattle
- (c) Hygiene and stringent cleanliness
- (d) disease-resistant

XIV. This step improves crops

- (a) germplasm collection (b) hybridization
- (c) selection (d) mutation breeding

XV. This is an adulterant

- (a) Pesticides (b) Urea (c) Iron filings in tea (d) All of the above

Long answers type questions (any three) [10x3=30]

I. What do you mean by glucose? Explain the mechanism of conversion of glucose to glucosazone.

II. Explain the geometry of peptide bond? Discuss the two main types of secondary structure of proteins.

III. Discuss the following:

(i). Zwitterion structure of amino acids

(ii). Gabriel phthalimide synthesis of α - amino acids.

IV. What do you mean by carbohydrate? Discuss on classification of carbohydrate with example.

Short answers type questions (any five) [5x5=25]

I. How will you convert aldohexose into ketohexose and ketohexose into an aldohexose.

II. Derive Michaelis-Menten equation for enzyme kinetics.

III. What are proteins? Discuss the secondary structure of proteins.

IV. Give the synthesis of glycine from potassium phthalimide? Explain with example.

V. What do you understand by food adulteration? Why is food adulteration done? Explain with example.

VI. Differentiate between pure proteinous and conjugated proteinous enzymes giving an example of each.

VII. Describe the lock and key hypothesis of mechanism of enzyme action.

Printing Pages : 2

Paper Code: B010502T A (SVSU:2024-25/R)

Enrollment No.

[illegible]

Program Name: B.Sc. Physics/Math's

V Semester / 3rd Year Examination

Subject Code: B010502T

 $[10 \times 3 = 30]$

1. Describe Construction and working of CO₂ laser.

Note: Attempt all the questions as per given instructions.

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1. Using which of the following components is the generated x-rays focused upon the specimen?

a) X-ray tube
b) Monochromator
c) Collimator
d) Detector

 $[5 \times 5 = 25]$

a) Polarization

III. Which of the following is not a characteristic of wave function?

a) Continuous

IV. Any wave fun

a) Eigen vectors
b) Eigen values
c) Eigen Functions
d) Operators

v. in the wave-mechanical model of an atom, degenerate energy levels have:

have.

c) Same shape
d) Electrons with the same spin

nucleus;

b) Electrons in ground state cannot radiate energy.

(c) At very small distances, protons cannot radiate energy

Inner electronic shells (these in outer shells)

d) Inner electrons repel those in outer orbitals

VII. Number of atomic orbitals in run shell is:

a) n^- b) $2n^-$ c) $2n + 1$ d) $n - 1$

b) Magnetic Field

a) Electric Field

Gauss law can be evaluated in which coordinate system?

- a) Cartesian
- b) Cylinder
- c) Spherical
- d) Depends on the Gaussian surface

What is the unit of the coefficient of spontaneous emission?

- a) s^{-1}
- b) s
- c) J^{-1}
- d) J

Which of the following is a four-level laser?

- a) ND: YAG
- b) Ruby
- c) He-Ne
- d) Semiconductor laser

Electric field intensity due to infinite sheet of charge σ is

- a) Zero
- b) Unity
- c) σ/ϵ
- d) $\sigma/2\epsilon$

The Coulomb law is an implication of which law?

- a) Ampere law
- b) Gauss law
- c) Biot Savart law
- d) Lenz law

The Gaussian surface is

- a) Real boundary
- b) Imaginary surface
- c) Tangential
- d) Normal

When a material has zero permittivity, the maximum potential that it can possess is

- a) ∞
- b) $-\infty$
- c) Unity
- d) Zero

The Ampere law is based on which theorem?

- a) Green's theorem
- b) Gauss divergence theorem
- c) Stoke's theorem
- d) Maxwell theorem

d) Integral form of Ampere law

Biot Savart law in magnetic field is analogous to which law in electric field?

- a) Gauss law
- b) Faraday law
- c) Coulomb's law
- d) Ampere law

Gauss law can be used to compute which of the following?

- a) Permittivity
- b) Permeability
- c) Radius of Gaussian surface
- d) Electric potential

Gauss law cannot be expressed in which of the following forms?

- a) Differential
- b) Integral
- c) Point
- d) Stokes theorem

With Gauss law as reference which of the following law can be derived?

- a) Ampere law
- b) Faraday's law
- c) Coulomb's law
- d) Ohm's law

Which of the following is true regarding magnetic lines of force?

- a) Real
- b) Imaginary
- c) Does not exist
- d) Parallel to field

[2]

IX. Which of the Bohr's postulates was incorrect?

- a) Energy of electrons is quantized
- b) Momentum of electrons is quantized
- c) Electrons release energy when shifting from excited state to ground state
- d) Electrons revolve around the nucleus in fixed circular orbits

X. Zeeman Effect could not be proved by

- a) Quantum Mechanics
- b) Bohr's Model
- c) Hamiltonian operators
- d) L-S coupling

XI. Zeeman effect is used to study which property of sun?

- a) Solar flares
- b) Sun spots
- c) Magnetic fields
- d) Electric fields

XII. At-higher magnetic fields, the splitting of spectral lines is disturbed.

This effect is called

- a) Stark Effect
- b) Inverse Zeeman Effect
- c) Paschen-back effect
- d) Anomalous Zeeman effect

XIII. The melting point of alkali metal is

- a) depends on the atmosphere
- b) low
- c) high
- d) zero

XIV. For a quantum wave particle, $E =$

- a) $h k$
- b) $h \omega$
- c) $h \omega/2$
- d) $h k/2$

XV. Which of the following can be a wave function.

- a) $\tan x$
- b) $\sin x$
- c) $\cot x$
- d) $\sec x$

2. Answer in long (any three) | $10 \times 3 = 30$ |

I. Derive Schrödinger wave equation of a free particle in a one dimensional closed box with infinitely hard walls.

II. Write detailed notes on Zeeman Effect.

III. What are X-rays? How they are produced. Write their properties.

IV. Write a note on fine structure of hydrogen atomic spectrum.

3. Answer in short (any six) | $5 \times 6 = 30$ |

I. Write the uses of X rays.

II. State Heisenberg uncertainty principle for position and momentum.

III. Write the postulates of Quantum Mechanics.

IV. What do you mean by Molecular spectra.

V. What do you mean by expectation value?

VI. Derive the Eigen value equation for kinetic energy.

VII. What is the total angular momentum of a free electron?

VIII. What are symmetric and anti-symmetric wave functions?

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