S.Y.B.Sc.

Oct. 2024-25.

Regular Exam.

Sem- III

S10102401M

(मराठी रुपांतर)

वेळ-२ तास ३० मिनिटे | एकूण गुण - ७५

सुचना - १) सर्व प्रश्न अनिवार्य आहेत.

२) उजवीकडील अंक पूर्ण गुण दर्शवितात.

प्र.१) अ) खालील संकल्पना स्पष्ट करा.(कोणत्याही पाच). १५

१) तर्कशक्ती युग
२) अंधविश्वास
३) देहबोली
४) संघ बांधणी
५) मानवी हक्क
६) समतेचा अधिकार
७) अवर्षण
८)आपत्ती व्यवस्थापन

किंवा

ब) पायाभूत अभ्यासक्रम (सत्र - ३) साठी तुम्ही सादर केलेल्या प्रकल्पावर सविस्तर चर्चा करा.

प्र.२) अ) अनुसूचित जमातींच्या मानवी हक्कांचे उल्लंघन कशा प्रकारे केले जाते ते सांगा. १५

किंवा

ब) 'कौटुंबिक हिंसाचार कायदा २००५' सविस्तर स्पष्ट करा.

प्र.३) अ) आपत्तीचे शारीरिक आणि मानसशास्त्रीय परिणाम विशद करा. १५

किंवा

ब) पुनर्वसन आणि पुनर्रचना याविषयी मानवी दृष्टिकोन सांगा.

प्र.४) अ) 'न्यूटन' आणि 'गॅलिलिओ' या शास्त्रज्ञांच्या विज्ञानाच्या विकासातील योगदानावर भाष्य करा. १५

किंवा

ब) दैनंदिन जीवनातील विज्ञानाचे महत्त्व सांगा.

प्र.५) अ) प्रभावी संप्रेषणातील अडथळ्यांवर चर्चा करा. १५

किंवा

ब) श्रवण क्रियेचे महत्व सविस्तर स्पष्ट करा.

S19102401M

Total Marks – 75

Time – 2 ½ hrs.

N.B: **1) All questions are compulsory.**
2) Figures to the right indicate full marks.

Q.1) A) Explain the following concepts. (Any five). 15

1) Age of Reason
2) Blind Belief
3) Body Language
4) Team Building
5) Human Rights
6) Right to Equality
7) Drought
8) Disaster Management

OR

B) Discuss in detail on the Foundation Course (Semester – III) project submitted by you.

Q.2) A) What are the forms of violation of the Human rights of the scheduled Tribes? 15

OR

B) Explain in details the domestic Violence Act – 2005.

Q.3) A) Explain the physical and psychological effects of disaster. 15

OR

B) State the Humanitarian Approach to Rehabilitation and Resettlement.

Q.4) A) Comment on – contribution of 'Newton' and 'Galileo' toward the growth of science. 15

OR

B) State the importance of science in everyday life.

Q.5) A) Discuss barriers to effective communication. 15

OR

B) Explain in detail 'importance of listening'.

S10102402 M

Time – 2 1/2 h..... Marks–75

Note: Attempt **All** questions.
All questions carry **equal** marks.
For **Q.2,Q.3 and Q.4** attempt A and B **OR** C and D

Q1. A) रिकाम्या जागा भरा. (08)

1. टीव्ही, रेफ्रिजरेटर आिण कॉम्प्युटर ही या ..... कचरा प्रकाराची उदाहरणे आहेत.
2. इन्फंट्री बटालियन ही फायर आणि ..... तत्त्वावर आधारित आहे.
3. .....भारताचे संरक्षण मंत्री आहेत.
4. सर्वात लहान लढाऊ युनिट आहे.....
5. SSC म्हणजे....
6. अम्लपाऊस हा ..... डायऑक्साइड आणि नायट्रोजन ऑक्साईड सारख्या ....हानिकारक रसायनांच्या उत्सर्जनामुळे होतो.
7. भारतीय सैन्याचे ..... कमांड आहेत.
8. NDA महाराष्ट्रात ..... येथे आहे.

Q.1 B सत्य किंवा असत्य ते लिहा. (07)

1 शारीरिक कचरा हे जैव-वैद्यकीय कचऱ्याचे एक उदाहरण आहे.
2 ड्रिल के उसूल हैं– स्मार्टनेस, स्थिरता आणि समन्वय.
3 राष्ट्रीय एकात्मता म्हणजे एकतेची भावना.
4 मानवी आरोग्य आिण पर्यावरणाचे रक्षण करण्यासाठी किरणोत्सर्गी कचरा सरकारी संस्थांद्वारे नियंत्रित केला जातो.
5 मुलाखतीसाठी निवड होणे म्हणजे कोणालातरी तुमच्या कौशल्यांमध्ये आणि ज्ञानात रस आहे.
6 ग्लोबल वार्मिंग ही पृथ्वीच्या तापमान वाढीशी संबंधित घटना आहे.
7 आयएमए डेहराडून येथे आहे.

Q.2 A) राष्ट्रीय एकात्मता म्हणजे काय? ते साध्य करण्यासाठी उपाययोजना स्पष्ट करा. (08)
Q.2 B) व्यक्तिमत्व उजळवणारी विविध कौशल्ये समजावून सांगा. (07)

OR

Q.2 C) प्रदूषणाचा धोका रोखण्यासाठी एनसीसी कॅडेट्सची भूमिका स्पष्ट करा. (08)
Q.2 D) प्रशिक्षण क्रियाचे कोणते फायदे आहेत? (07)
Q.3 A) सायकल चालवताना सुरक्षेचे उपाय स्पष्ट करा. (08)
Q.3 B) ट्रेकिंगसाठीआवश्यक असलेल्या वस्तूंची यादी द्या. (07)

OR

Q.3 C) ' विविधतेत एकता ' ही संकल्पना तपशीलवार सांगा. (08)
Q.3 D) मुलाखती दरम्यान तुम्ही कसे वागाल ते स्पष्ट करा? (07)
Q.4 A) प्रदूषण म्हणजे काय? त्याचे प्रकार स्पष्ट करा. (08)
Q.4 B) कचरा व्यवस्थापन म्हणजे काय? कचऱ्याचे प्रकार स्पष्ट करा. (07)

OR

Q.4 C) 'राष्ट्रीय एकात्मता हे कोणत्याही राष्ट्राचे अस्तित्व असते त्यावर टिप्पणी करा. (08)
Q.4 D) CV म्हणजे काय? मुलाखतीची पूर्वतयारी द्या. (07)
Q.5 टिपा लिहा. (कोणतेही तीन) (15)

1. वेळेच्या व्यवस्थापनासाठी आवश्यक गोष्टी.
2. एनसीसी गीत.
3. IMA मध्ये प्रवेश मिळवण्याचे मार्ग.
4. कमिशन प्रकार
5. NCC पुरस्कार

S101022.02 M

Time – 2 1/2 hours | Marks–75

Note: Attempt **All** questions.
All questions carry **equal** marks.
For **Q.2,Q.3 and Q.4** attempt A and B **OR** C and D

Q.1 A) **FILL IN THE BLANKS** (08)

1. TVs, refrigerators and computers are examples of .... Waste.
2. Infantry Battalion is based on principle fire and.....
3. .....is the Defence Minister of India.
4. ..... is the smallest fighting unit.
5. SSC stands for.....
6. Acid rain is caused by emission of harmful chemicals as .....dioxide and nitrogen oxide.
7. Indian Army has ..... Commands.
8. NDA is situated at.....in Maharashtra.

Q.1 B STATE TRUE OR FALSE (07)

1 Anatomical waste is an example of Bio-medical waste.
2 Drill ke usool hain-Smartness, steadiness and coordination.
3 National integration means feeling of togetherness.
4 Radioactive waste is regulated by government agencies in order to protect human health and the environment.
5 Being chosen for an interview means somebody is interested in your skills and knowledge.
6 Global warming is the phenomenon associated with the increase of earth's temperature.
7 IMA located at Dehradun.

Q.2 A) What is National Integration? Give measures to achieve it. **(08)**
Q.2 B) Explain various types of skills which brighten the personality. **(07)**

OR

Q.2 C) Explain role of NCC cadets in curbing the menace of pollution. **(08)**
Q.2 D) What are the advantages of training activity? **(07)**
Q.3 A) Explain safety measures during cycling. **(08)**
Q.3 B) Give the list of items which are essential for trekking activity. **(07)**

OR

Q.3 C) Explain 'Unity in Diversity' concept in detail. **(08)**
Q.3 D) Explain how will you conduct yourself during the interview? **(07)**
Q.4 A) What s pollution? Explain its types. **(08)**
Q.4 B) What is waste management? Explain types of waste. **(07)**

OR

Q.4 C) 'National integration is survival of any nation' comment on it. **(08)**
Q.4 D) What is CV? Give pre-interview preparation. **(07)**
Q.5 Write short notes on.(ANY THREE) **(15)**

1. Essentials of time management.
2. NCC song.
3. Ways to get entry into IMA.
4. Types of Commission
5. NCC awards

S4B8L
11/10/24

S11B2409M

Time: 2.30 hrs. Marks: 75

N.B: 1.All Questions are compulsory.
2. Figures in the right indicates full marks
3. Draw neat labelled diagrams wherever necessary.

Q.1 Solve multiple choice questions (Any Fifteen) **15**

Q1. A Solve the following using correct option. **5**

1) In Aabb x aaBb cross, the genotypic ratio of its progeny will be
A. 9:3:3:1 B. 1:2:1 C. 4:1 D. 1:1:1:1

2) Who is known as father of genetics?
A. Gregor Mendel B. Augustinian Fria C. Norman Borlaug D. M.S.Swaminathan

3) Study of family history about inheritance of a particular trait in several generations of a family called
A. Phylogeny B. Ontogeny C. Pedigree analysis D. Cladistics

4) The genotypic ratio of a monohybrid cross is
A. 1:2:1 B. 3:1 C. 2:1:1 D. 9:3:3:1

5) A sudden change in the gene which is heritable from one generation to other is Known as?
A. Variation B. Cloning C. Totipotency D. Mutation

Q.1 B) Match the pair of column A and Column B. **5**

Column A	Column B
1) Heterozygous	a) Identical Allele
2) Phenotype	b) Different Alleles
3) Mutation	c) RNA Synthesis
4) Homozygous	d) Physical Appearance
5) Transcription -	e) Change in Nucleotide sequence

Q.1 C) Write true or false from following Statements. **5**

1. RNA is a double -stranded molecule.
2. The gene is the basic unit of heredity.
3. Mutation in nuclic acid can lead to genetic disorders.
4. Natural selection acts on genetic variation within populations.
5. The Sugar molecule in DNA is deoxyribose.

Q.1 D) Write answers in one sentence **5**

1) What is genome?
2) What is back cross?
3) Define Centromere.
4) Define acrocentric chromosome.
5) Define the term mutation.

(P.T.O)

Q.2 A) Explain Mendel's Monohybrid and dihybrid Cross with suitable example. 8

OR

A) Describe the coat colour in Rabbit.

Q.2 B) Explain the Principles of law of segregation and independent assortment with suitable example 7

OR

B) Describe the process of pedigree analysis and explain autosomal Recessive inheritance.

Q.3 A) Describe the Structure and function of chromosome and write the role of centromere, telomeres and histone proteins. 8

OR

A) Explain the deferent types of Autosome and sex chromosomes.

Q.3 B) Explain sex determination write the role of XX-XY mechanism. 7

OR

B) Comment on inheritance of hemophilia.

Q.4 A) Describe the Hershey and Chase experiments? 8

OR

A) Comment on experimental evidence that DNA is a genetic material.

Q.4 B) Explain the deferent types of RNA. 7

OR

B) Write the difference between DNA and RNA.

Q.5 Write a Short note on any three of the followings. **15**

A) Rh blood group system.

B) Chromosome theory of inheritance.

C) Comment on polytene chromosome.

D) Colour blindness.

E) Silent feature of Watson and Crick model.

F) Mechanism of DNA relication.

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SYBSC
11/10/24

S11104 10 M

Time: 02:30 hours | Total Marks: 75

Instructions: 1) All questions are compulsory.
2) Figure to the right indicates full marks.
3) Use of calculator is not allowed.

Q.1 A) Attempt any one questions of the following. **(8)**

a) Prove that a positive term geometric series $\sum_{n=0}^{\infty} r^n$ converges for $r < 1$ and diverges to infinity for $r \geq 1$.

b) Using sequence of partial sum show that $\sum_{n=1}^{\infty}(\frac{4}{5})^n$ is convergent. Also find its limit.

B) Attempt any two questions of the following. **(12)**

a) Discuss the convergence of the series $1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \ldots\ldots$

b) Show that the series $\sum \frac{(-1)^{n+1}}{3n+2}$ is conditionally convergent.

c) Prove that the series $\sum \frac{1}{\sqrt{n+2}+\sqrt{n}}$ is divergent.

Q.2 A) Attempt any one questions of the following. **(8)**

a) Prove that every constant function is Riemann integrable.

b) A function $f: [a, b] \to \mathbb{R}$ be integrable function and $\alpha \in \mathbb{R}$, then prove that αf is Riemann integrable and $\int_a^b \alpha . f(x) dx = \alpha \int_a^b f(x)\ dx$.

B) Attempt any two questions of the following. **(12)**

a) Let the function $f: [1, 6] \to \mathbb{R}$ be defined by $f(x) = \begin{cases} 1 - x \text{ if } 1 \leq x < 2 \\ x \text{ if } 2 \leq x < 4 \\ 1 + x \text{ if } 4 \leq x \leq 6 \end{cases}$

And P is the partition of $[1, 6]$. Prove that $L(P, f) \leq U(P, f)$.

b) Let $f: [a, b] \to \mathbb{R}$ be a bounded function and P be a partition of $[a, b]$. Prove that $L(P, f) \leq U(P, f)$.

c) Let $f: [0, 4] \to \mathbb{R}$ defined by $f(x) = 2x^2 + 4$. Prove that f is integrable on $[0, 4]$ and obtain $\int_0^4 f(x)\ dx$.

Q.3 A) Attempt any one questions of the following. **(8)**

a) Prove that a positive term series $\sum \frac{1}{n^p}$ is convergent for $p > 1$ and diverges for $p \leq 1$.

b) Prove that $\beta(m, n) = \int_0^1 \frac{x^{m-1}+x^{n-1}}{(1+x)^{m+n}}$.

B) Attempt any two questions of the following. **(12)**

a) Show that $n\Gamma(n) = \Gamma(n + 1)\ for\ n > 0$.

b) Show that $\beta(m, n) = 2\int_0^{\frac{1}{2}} (sin\theta)^{2m-1}(cos\theta)^{2n-1}\ d\theta$.

c) Show that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$.

Q.4 **Attempt any three questions of the following.** **(15)**

a) Prove that $\Gamma(1) = 1$.

b) Test for convergence of the series $\sum \left(\frac{n^2-1}{n^2+1}\right) x^n$.

c) Prove that $\sum \frac{1}{n^p}$ is divergent for $n = 1$.

d) Let $f: [0,1] \to \mathbb{R}$ defined by $f(x) = x$. Prove that f is Riemann integrable on $[0, 1]$.

e) Prove that $\sum \frac{1}{\sqrt{n+2}+\sqrt{n}}$ is divergent series.

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S4BSC
14/10/24

S14102424M

Time – 2 1/2 hours | Marks–75

N.B. - 1) All questions are compulsory.
2)Figures to the right indicate full marks.
3) Draw neat labeled diagrams wherever necessary.

Q.1 **Answer the following questions. (Any fifteen)** **(15)**

1. What is apoenzyme?
2. Define elimination reaction.
3. Give biological role of peroxidase.
4. State the role of calcium in biological system.
5. Give an example of metal complexes used in medicine.
6. Define enzyme.
7. Give significance of transferase enzyme.
8. What is the fixed angle of rotors in centrifuge?
9. Define counterions.
10. Which centrifugation depends on buoyant densities?
11. Give disadvantages of ion exchange chromatography.
12. State an application of affinity chromatography.
13. Give two examples of gels used in gel permeation chromatography.
14. How do you calculate the relative centrifugal force (RCF) of a centrifugation?
15. State the role of urea in PAGE separation of DNA.
16. Give factors affecting electrophoretic mobility.
17. What does TEMED stand for?
18. Mention the application of IEF electrophoresis.
19. Define electrophoresis.
20. Which fluorescence dye is used to visualize DNA in the electrophoresis?

Q.2 A) Discuss in brief biological role of carboxypeptidase. **(08)**

Q.2 B) Explain functions of haemoglobin in detail. **(07)**

OR

Q.2 C) Explain any two essential elements with their role in biological systems. **(08)**

Q.2 D) Discuss in brief addition reaction. **(07)**

Q.3 A) Explain types of ion exchange resins in ion exchange chromatography. **(08)**

Q.3 B) Describe density gradient centrifugation in brief. **(07)**

OR

Q.3 C) Explain principle and working of affinity chromatography. **(08)**

Q.3 D) Discuss rate-zonal centrifugationin brief. **(07)**

Q.4 A) Explain in detail supporting matrixes used in electrophoresis. **(08)**

Q.4 B) Elaborate on discontinuous gel electrophoresis. **(07)**

OR

Q.4 C) Explain principle and application of electrophoresis. **(08)**

Q.4 **D)** Discuss in brief paper electrophoresis. **(07)**

Q.5 **Write short notes on <u>any three</u> of the following.** **(15)**

a. SN^2 reaction
b. Catalase
c. Principle of size exclusion chromatography
d. Applications of centrifugation
e. Gel documentation

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5488C
14/10/24

S14102418M

Time: 2. 30 Hrs. Marks: 75

NB: 1.All questions are compulsory and carry equal marks.
2. Figures to the right indicate full marks.
3. Draw neat and labeled diagrams wherever necessary.
4. Attempt the questions in order.

Que.1. **Solve Multiple Choice Questions (Any Fifteen).** 15

A **Fill in the blanks by choosing the correct options.** 05

a Organisms that are unable to synthesize their own food material and depend on other plants and animals are called as .....(Autotrophs, Heterotrophs, Saprophytes)

b .....animals excrete uric acid as the main end product of nitrogen metabolism. (Uricotelic, Ammonotelic, Ureotelic)

c Buccopharyngeal respiration is predominantly occurs in .....(Frog, Earthworm, Cockroach)

d .....have few granules in the cytoplasm that shows affinity to basic dyes.(Eosinophils, Basophils, Neutrophils)

e .....are primitive neurons having neither of cytoplasmic dentrites nor axon. (Unipolar, Multipolar, Apolar)

B **Match the column I and II and rewrite.** 05

	Column I		**Column II**
a	Arborescent organ	i	Crustaceans
b	Open circulation	ii	*Planaria*
c	Haemocyanin	iii	Sperm
d	Flame cells	iv	*Clarius*
e	Acrosome	v	Cockroach

C **State whether true or false.** 05

a Foregut is also known as stomodaeum.
b The simplest type of excretory system is the meta nephridia.
c Clavicular air sac is an unpaired air sac.
d Cockroach heart has 10 muscular chambers in thorax.
e Simple binary fission occurs in Hydra.

D **Define the following.** 05

a Abomasum
b Direct respiration
c Lymph
d Geotropism
e Spermiogenesis

Que.2. **A** Explain digestion in ruminants. 08

OR

A Discuss physiology of urine formation in man. 08

B Describe process of formation of contractile vacuole in Amoeba. 07

OR

B Types of animals based on principle nitrogenous excretory products. 07

Que.3.	A	Discuss the structure of lungs in man.	08
		OR	
	A	Elaborate the types of circulations.	08
	B	Explain the type of respiration in Earth worm.	07
		OR	
	B	Describe the mechanism for working of heart in man.	07
Que.4.	A	Annotate types of neurons based on structure and function.	08
		OR	
	A	Discuss the structure of male and female gametes in human.	08
	B	Give brief account of Sol - Gel theory.	07
		OR	
	B	Explain structure of tube feet in Starfish.	07
Que.5.	**Write short notes on any Three.**		**15**
	a	Ruminant stomach	
	b	Air sacs in Pigeon	
	c	Heart of Frog	
	d	Structure of uriniferous tubule	
	e	Classification of fertilization	
	f	Viviparity.	

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SYBSc
14/10/24

S1410241 9M

Time: 02.30 hours

Total Marks: 75

Instructions: 1) All questions are compulsory.
2) Figure to the right indicates full marks.
3) Use of calculator is not allowed.

Q.1 A) **Attempt any one questions of the following.** **(8)**

a) Define row echelon form of a matrix and convert the following matrix into row echelon form: $\begin{bmatrix} -3 & 1 & 1 \\ 2 & 1 & 1 \\ 1 & 4 & 0 \\ -1 & 2 & 2 \end{bmatrix}$

b) Define elementary matrix. Express the following matrix and their inverse as a product of elementary matrices: $\begin{bmatrix} 1 & 6 \\ 2 & 3 \end{bmatrix}$

B) **Attempt any two questions of the following.** **(12)**

a) The sum of three numbers is six. Thries the third number when added to the first number gives 7. On adding, three times the first number to the sum of second and third number, we get 12. Find the three numbers.

b) Solve the following system by Gauss elimination method.
$x + 2y + z = 8$, $2x + 3y - z = 11$, $3x - y - 2z = 5$

c) Define Skew-symmetric matrix, scalar matrix, orthogonal matrix & nilpotent matrix with one example each.

Q.2 A) **Attempt any one questions of the following.** **(8)**

a) Prove that every subset of linearly independent set is linearly independent and every superset of linearly dependent set is linearly dependent.

b) Prove that intersection of two subspace is a subspace. What can you say about union of two subspaces?

B) **Attempt any two questions of the following.** **(12)**

a) Show that $\mathbb{R}^2$ is a vector space

b) State & prove subspace criteria.

c) Let $A = \{(7x + z,\ 3x + z,\ 4z)/\ x, z \in \mathbb{R}\}$. Justify whether A is a subspace of $\mathbb{R}^3$ or not.

Q.3 A) **Attempt any one questions of the following.** **(8)**

a) State & prove Cramer's rule.

b) Prove that, for each n, if there exists an $n \times n$ determinant function then it is unique.

B) **Attempt any two questions of the following.**

a) Solve the following system by using Cramer's rule. (12)

$$\frac{1}{x}+\frac{1}{y}+\frac{1}{z}=-2,\quad \frac{1}{x}-\frac{2}{y}+\frac{1}{z}=3,\quad \frac{2}{x}-\frac{1}{y}+\frac{3}{z}=-1$$

b) Find the inverse of the matrix $\begin{bmatrix}1 & 2 & 3\\ 0 & 2 & 4\\ 0 & 0 & 5\end{bmatrix}$ by using adjoint method.

c) Find the volume of tetrahedron formed by vectors (1,1,3), (4,3,2), (5,2,7), (6, 4, 8).

Q.4 **Attempt any three questions of the following.**

a) Determine for which values of a and b , the following system has unique solutions, no solutions, infinite solutions. (15)

$x + 2y + 3z = 4$, $x + 3y + 4z = 5$, $x + 3y + a\,z = b$

b) Find $|A|$ by using Laplace expansion by 2nd row & 1st column.

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

c) Check that given vectors are linearly dependent or linearly independent.{(4, -1, 3), (0, -4, 1), (-2, -5, 2)}

d) If area of Δ LMN is 33/2 square unit and vertices are L (3, −5), M (−2, k), N (1,4) then find k.

e) Find the rank of matrix : $\begin{bmatrix}1 & 1 & 1\\ 3 & 1 & -2\\ 2 & 4 & 7\end{bmatrix}$

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S15102428M

SYBSC
15/10/24

Time: 02.30 hours | Total Marks: 75

Instructions: 1) All questions are compulsory.
2) Figure to the right indicates full marks.
3) Use of scientific calculator is allowed.

Q.1 A) Attempt any one questions of the following. **(8)**

a) Let $f(D)$ be a polynomial in the linear operator D. Prove the following identity : $e^{ax} f(D)y = f(D-a)(e^{ax} y)$.
Where e^{ax} is the exponential function and f(D) represents a function of the operator $D = \frac{d}{dx}$

b) Evaluate $A+B, B+A$ and verify that $A+B = B+A$ where $A = xD^2 - 4D, B = 7x^3D + 5$. Also represent them in $\frac{d}{dx}$ form.

B) Attempt any two questions of the following. **(12)**

a) Show that $y_1 = e^x$ and $y_2 = xe^x$ are two linearly independent solutions to the differential equation $y'' - 2y' + y = 0$. Then, find the general solution to this differential equation.

b) Using differential operator, evaluate $(D-2)(D+4)^2$, where $D = \frac{d}{dx}$

c) Show that $y_p = e^{3x}$ is a particular solution to the differential equation $y'' - 2y' + y = 4e^{3x}$. Hence, find the general solution to this differential equation.

Q.2 A) Attempt any one questions of the following. **(8)**

a) Solve the following system of first-order differential equations:
$\frac{dx}{dt} = 4x - 3y, \frac{dy}{dt} = 8x - 6y$.
Find the general solution.

b) Prove the following two identities:
i) $(D-a)^n(x^k e^{ax}) = 0$ for $k = 0,1,2, \ldots, n-1$.
ii) $(D-a)^n(x^n e^{ax}) = n!\ e^{ax}$, where $D = \frac{d}{dx}$ and a is a constant.

B) Attempt any two questions of the following. **(12)**

a) Using differential operator, evaluate the expression
$(xD-1)(3x^2D+4)$, where $D = \frac{d}{dx}$

b) Let $f(D)$ be a polynomial in linear operator D. Prove the identity:
$f(D)(e^{ax}) = f(a)(e^{ax})$, where a is a constant and $D = \frac{d}{dx}$

c) Show that $x = 3t-2, y = -2t+3$ is a particular solution to the non homogeneous system: $\frac{dx}{dt} = x + 2y + t - 1, \frac{dy}{dt} = 3x + 2y - 5t - 2$.

Q.3 A) Attempt any one questions of the following. **(8)**

a) Using the fourth order Runge-Kutta method, find y(0.1) for the differential equation : $\frac{dy}{dx} = \frac{x^2+y^2}{10}, y(0) = 1$.

b) Using modified Euler method obtain the value of y(0.1) using 2 approximations for the differential equation $y' = 4xy + y^2$, where y(0) = 1 with step size h = 0.1.

B) Attempt any two questions of the following. (12)

a) Using Picard method, find second approximation polynomial $y_2(x)$ and estimate y(0.25) for the differential equation $y' = 2e^x + y$ with y(0) = 1

b) Use Taylor series method to obtain the solution of differential equation $\frac{dy}{dx} = x - y^2$, given that y(0)=1. Find y(0.2).

c) Find the approximate solution of a differential equation $y'' + y + 1 = 0$ with the boundary conditions $y(0) = 0$ and $y(1) = 0$ using finite difference method taking n=2.

Q.4 Attempt any three questions of the following. (15)

a) Prove that the set of functions $\{3, 1 + x, 5 - x - x^2\}$ is linearly independent using Wronskian.

b) Derive the formula for approximate solution of a first order differential equation by Euler's method.

c) Find the general solution of the differential equation $(D^3 + 2D^2 - 15D)y = 0$.

d) State the formula for approximate solution of a first order differential equation given by Runge-Kutta fourth order method.

e) Factorize $D^3 - 21D + 20$ using differential operator.

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54858
15/10/24

S15102427M

Time: 2 1/2 hours. **Marks: 75**

N. B. 1) All questions are **compulsory.**
2) All questions carry **equal marks.**
3) **Draw** neat labeled **diagrams** wherever **necessary.**

Q. 1. Attempt the following sub-questions (any 15). **15**

A) Fill in the blanks by choosing the correct option given in the bracket. **05**

a) .....demonstrated classical conditioning in dogs.
(Wolfgang Kohler, Thorndike, Ivan Pavlov)

b) In .....the female langurs allow other females to take care of their offsprings.
(Habituation, Allmothering, Altruism)

c) Anthrax is a..... disease caused by *Bacillus anthracis.*
(Viral, Protozoan, Bacterial)

d) .....disease of *Apis mellifera* first reported in 1970 from Maharashtra.
(Chalk brood, American foulbrood, European foulbrood)

e) .....is a chhena-based sweet and is popular in Bengal and rest of the India.
(Cheese, Shrikhand, Rasogulla)

B) Match the columns I and II and rewrite. **05**

Column I	Column II
1) Classical conditioning	a) Vermiculture
2) Kinship	b) Honey bee
3) Filariasis	c) W. D. Hamilton
4) American foulbrood disease	d) Ivan Pavlov
5) Top-fed Windrows method	e) *Wuchereria bancrofti*

C) State whether True or False. **05**

a) Habituation is a learning wherein there is a gradual fall of behavioural response.
b) In catadromous migration fishes migrate from marine water to fresh water.
c) In helminthes, egg changes into capsule with yolk sac.
d) H1N1 is causative influenza virus of Bird flu.
e) Buffalo milk contains less amount of fat than cow milk.

D) Answer the following in one sentence only. **05**

a) What is insight learning?
b) What is sibling-sibling conflict?
c) Define mechanical vector.
d) Write two names of honey bee eater birds.
e) Write two names of methods of ghee making.

(P.T.O.)

Q. 2. Answer the following. 15

A) What is social behaviour? Give types of social groups in Non-human primates. 08

OR

A) Describe the different types of migration in fish with suitable example. 08

B) Describe the communication in ants. 07

OR

B) Explain the innate behaviour in animals. 07

Q. 3. Answer the following. 15

A) Describe the life cycle of *Taenia solium*. 08

OR

A) Describe the life cycle of *Wuchereria bancrofti*. 08

B) Give details on the parasitic adaptations in endoparasites. 07

OR

B) Describe the morphology of Head louse. 07

Q. 4. Answer the following. 15

A) Describe the different bacterial diseases of honey bee. 08

OR

A) Give account on the different methods used for processing of milk. 08

B) Describe the Stacked bins method used in Vermiculture. 07

OR

B) Explain the economic importance of honey. 07

Q. 5. Write short notes on (any three) 15

a) Communication in bees.

b) Mimicry.

c) Bird flu.

d) Types of host.

e) Honey bees eater birds.

f) Cheese.

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SYBSC
16/10/24

Q. P. Code: S16102435M

Duration: $2\frac{1}{2}$ hours Total marks: 75

N. B.
1) All questions are compulsory.
2) Figures to the write indicate full marks.
3) Use of log table / non-programmable calculator is allowed.

Q.1 A. **Select the correct option and complete the following sentences.** 09
(Attempt **any nine**)

a) The unit of cell constant is --------
i) cm^{-1} ii) $S\ cm^{-1}$ iii) cm^{-2} iv) $S\ cm^{2}$

b) ---------- is a measure of escaping tendency of the system.
i) Activity ii) Fugacity iii) Activity coefficient iv) Molar concentration

c) The property which depends on the quantity of a system is called ------- property.
i) intensive ii) extensive iii) colligative iv) constitutive

d) For non-spontaneous process ----------.
i) $\Delta G > 0$ ii) $\Delta G < 0$ iii) $\Delta G = 0$ iv) $\Delta G \geq 0$

e) In wurtzite structure, sulphur atoms form --------.
i) FCC close packing ii) hexagonal close packing iii) cubic close packing iv) BCC close packing

f) In resonating structures the sequence of ------- in molecule should remain same.
i) cations ii) atoms iii) free radicals iv) anions

g) Resonance energy of CO molecule is.....$kjmol^{-1}$ as its calculated bond energy and actual bond energy respectively 726 $kjmol^{-1}$ and 1057 $kjmol^{-1}$
i) 395 ii) 727 iii) 331 iv) 277

h) When the atomic orbitals overlaps along the line joining the two nuclei, they form .....molecular orbitals.
i) pi ii) non bonding iii) sigma iv) antibonding

i) Epoxides can be prepared by action of --------- on alkenes.
i) Chromic acid ii) $KMnO_4$ iii) $K_2Cr_2O_7$ iv) Peroxy acetic acid

j) Aryl ethers are prepared by heating sodium phenoxide with alkyl halide is known as ----------.
i) Fries reaction ii) Claisen reaction iii) Williamson synthesis iv) Schmidt reaction

k) Which of the following alcohol is an example of secondary alcohol?
i) n-butanol ii) t-butyl alcohol iii) cyclohexanol iv) ethanol

l) Benzoic acid can be prepared by reaction of ---------- with solid CO_2.
i) cyclohexyl magnesium bromide iii) phenyl magnesium bromide
ii) bromobenzene iv) chlorobenzene

m) Which of the following statement is correct?
i) SN^1 reaction is bimolecular reaction iii) SN^1 reaction is one step reaction
ii) SN^2 reaction is bimolecular reaction iv) SN^2 reaction is two step reaction

B. **State whether the following statements are true or false.** 03
(Attempt any three)

a) The sum of transport number of ions is always equal to one.
b) Benzoic acid is a strong electrolyte.
c) In superoxide ion, bond order is1.5.
d) In peroxide ion , bond order is1.5

e) Grignard reagents react with dry ice to form carboxylic acids.

B **Match the following. (Attempt any three)** 03

	Column A		Column B
a)	Chemical potential	i)	Reciprocal of resistance
b)	Conductance	ii)	Retention in configuration
c)	Bond angle in BCl_3	iii)	Intensive property of system
d)	SN^1 reaction	iv)	Extensive property of system
e)	Diethyl zinc	v)	150^0
		vi)	120^0
		vii)	Organometallic compound

Q.2 Attempt any **four** questions of the following. 20

a) Define free energy. Show that, decrease in Helmholtz free energy is a measure of maximum work.

b) Explain;
i) Distinguish between strong and weak electrolytes.
ii) Degree of dissociation

c) Derive Gibbs – Helmholtz equation.

d) The standard free energy change for a gaseous reaction is 70135 J. Calculate the equilibrium constant for the reaction at 1800 K.
(Given: R = 8.314 J/K/mole)

e) Define transference number.
Describe the moving boundary method to determine it.

f) The conductance of 0.05M acetic acid solution is 0.455×10^{-3} S at 298 K. Calculate the molar conductance of acetic acid solution, if the electrodes in the cell are 1.00 cm apart and have cross sectional area of 1.0 cm^2.

Q.3 **Attempt any four questions of the following.** 20

a) State the applications of Born-Haber cycle.

b) On the basis of valence bond theory describe the structure of $SiCl_4$.

c) Define formal charge. Calculate the formal charge on the C and O atom in **C = O** molecule.

d) Distinguish between sigma molecular orbitals and pi molecular orbitals

e) Draw molecular orbital energy level diagram of fluorine molecule showing distribution of electrons. Calculate its bond order and state magnetic property.

f) Explain formation of Hydrogen on the basis of VBT.

Q.4 **Attempt any four questions of the following.** 20

a) Explain the mechanism of alkaline hydrolysis of methyl bromide giving energy profile diagram.

b) Prepare following compounds using suitable Grignard reagent.
i) 2-Phenyl ethanol ii) 2-butanol

c) How will you obtain the following compounds using ethylene oxide?
i) Ethylene glycol ii) 2-bromoethanol

d) How are α- and β- naphthols prepared by using the naphthalene?

e) Explain the following terms giving examples.
i) Hydroboration oxidation ii) Esterification

f) Explain the following:
i) Lower alcohols are soluble in water.
ii) The nucleophilic substitution in chlorobenzene is difficult.

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SYBSC
17/10/24

Q. P. Code: S171024 44M

Duration: $2\frac{1}{2}$ hours Total marks: 75

N. B.

1) All questions are compulsory.
2) Figures to the write indicate full marks.
3) Use of log table / non-programmable calculator is allowed.

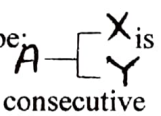
Q.1 **Select the correct option and complete the following sentences.** 09

A. (Attempt **any nine**)

a) Decomposition of ethylene oxide is an example of ---------- reaction.
i) reversible ii) consecutive iii)parallel iv) chain

b) Polyethylene is ---------- polymer.
i) natural ii) semisynthetic iii) synthetic iv) copolymer

c) ---------- system has lower consolute temperature.
i) Triethylamine –water ii) Phenol - water iii) Nicotine - water iv) Aniline - water

d) The reaction of the type:  is called --------.
i) reversible ii) consecutive iii)parallel iv) chain

e) Diborane molecule has ..... centres two electron hydrogen bridge bonds.
i)four ii) two iii)three iv) one

f) Boron trihalides are .....in nature and their solutions in organic solvents are bad conductor of electricity.
i)covalent ii) ionic iii)dimeric iv)polymeric

g) In the hydrides of nitrogen family element's thermal stability ..... from NH_3 to SbH_3.
i)increases ii) remain same iii) decreases iv) increases or decreases

h) The general outer electronic configuration of the elements of group 13 is -----.
i)ns^2np^1 ii)ns^2np^2 iii) ns^2np^3 iv) ns^2np^4

i) IUPAC name of formaldehyde is ----------.
i)methanal ii) ethanal iii)propanal iv) butanal

j) Rosenmund reduction is carried out with H_2 in presence of Pd catalyst supported on ----------.
i) $CaSO_4$ ii) $BaSO_4$ iii) $BaCl_2$ iv) $CaCl_2$

k) The carbonyl compounds commonly undergo ---------- reactions.
i) electrophilic substitution ii) nucleophilic addition iii) electrophilic addition iv) elimination

l) Butanal can be reduced to ---------- using $NaBH_4$.
i)1-butanol ii) 2-butanol iii) 1-butanal iv)Butanoic acid

m) Enols of β-diketones are stabilized by ----------.
i)solvation ii)intermolecular H-bonds iii) intramolecular H-bonds iv) hydration

B. **State whether the following statements are true or false.** 03
(Attempt any three)

a) For addition polymerization monomers must have two or more than two functional groups.
b) A homogeneous mixture consists of two or more phases.
c) Amorphous silicon is dark known powder whereas crystalline silicon is hard.
d) Tetraborane belongs to nidoborane class of boron hydride.
e) Aromatic ketones can be prepared by Friedel Craft reaction.

C. **Match the following. (Attempt any three)** 03

	Column A		Column B
a)	Constant boiling mixture	i)	Separation of completely miscible liquid mixture
b)	Distillation	ii)	Zeotropic mixture
c)	Galena	iii)	1,2-Ethandial
d)	Glyoxal	iv)	Azeotropic mixture
e)	PCC	v)	Oxidizing agent
		vi)	Ore of lead
		vii)	Reducing agent

Q.2 **Attempt any four questions of the following.** 20

a) Define polymer. How will you classify polymers on the basis of their structure?

b) With suitable example discuss the concept of elementary steps involved in the thermal chain reaction.

c) Size exclusion chromatographic data of a new polymer shows the following molecular weight distribution.

Number of molecules	Mass of each molecular
5	20000
3	30000
2	50000

Calculate the number average and weight average molecular mass of this polymer.

d) Define ideal solutions. What are the criteria for the solution to be an ideal?

e) i) Explain, degree of polymerization.
ii) Explain reversible reaction with suitable example.

f) Explain the variation of mutual miscibility with temperature for phenol-water system.

Q.3 **Attempt any four questions of the following.** 20

a) i)Write a short note on oxidation state of 13 group elements.
ii)What are electron deficient compounds? Give one example.

b) Explain the preparation of borax.

c) Explain the structure and bonding in silica.

d) Describe the floating zone process for the purification of silicon.

e) Explain the trends in physical properties of hydrides of elements of nitrogen family.

f) Explain the preparation and properties of nitrous oxide.

Q.4 **Attempt any four questions of the following.** 20

a) How will you prepare carbonyl compounds using following method / reagent? Give suitable examples.
i) Gattermann -Koch reaction ii) Grignard reagent

b) Complete the following reaction and name the reaction involved. Give its mechanism.

$C_6H_5\text{-}CHO + CH_2(COOC_2H_5) \xrightarrow{\text{Pyridine}} ?$

c) Complete the following reactions and name the products.

i) 2-Butanone $\xrightarrow[\text{ii) } H_2O,\ HCl]{\text{i) } LiAlH_4,\ \text{Dry ether}}$ A

ii) Acetophenone + Phenyl hydrazine $\longrightarrow$ A

d) i) How will you convert acetoacetic ester into succinic acid?
ii) What are active methylene compounds? Why are they considered as carbon acids?

e) How will you prepare Cinnamaldehyde using Claisen Schmidt reaction? Give its mechanism.

f) What is the effect of following reagents on benzaldehyde? (reactions are expected)
i) CH_3MgBr ii) $CH_3\text{-}NH_2$ iii) $LiAlH_4$ iv) HCN v) 2,4-DNP

SYBSC
18/10/24

Q. P. Code: 518102454M

Duration: 2 ½ hours | Total Marks: 75

N.B.:
1. All questions are compulsory
2. Figures to the right indicate full marks.
3. Use of logtable/non-programmable calculator is allowed.

Q.1 A) Select the correct option and complete the following sentences. **(Attempt any nine)** **09**

a According to Beer-Lambert's law, absorbance of solution increases with ____ of solution.
i) increase in concentration ii) decrease in concentration iii) decrease in path length iv) increase in path length

b In photometric titration, ____ is plotted against volume of titrant added.
i) absorbance ii)adsorption iii) absorption iv) transmittance

c Saturated organic compounds absorb in ____ region.
i) vacuum UV ii) visible iii) infra-red iv) near-UV

d For analysis in UV region, the cuvette should be made up of ____.
i) glass ii) transparent plastic iii) quartz iv) metal

e Absorbance and transmittance of an absorbing solution related by expression ____
i) $A = 1/T$ ii) $A = \log_{10} 1/T$ iii) $A = -\log_{10} T$ iv) $A = \log_{10} T$

f Iodometry is one of the most important ____ titration method.
i) acid-base ii)complexation iii) redox iv) neutralization

g Difference between end point and equivalence point is called as ____.
i) absolute error ii) relative error iii) titration error iv) constant error

h Nickel can be precipitated in Ni-DMG in ____ medium.
i) highly acidic ii) neutral iii)moderately alkaline iv) weakly acidic

i In titration of weak acid against strong base, pH at half equivalence point is -----.
i) pKa ii) 2pKa iii) ½ pKa iv) log pKa

j Error is the measurement of ____.
i) deviation ii)reproducibility iii) accuracy iv) standard deviation

k Addition of one drop excess to get end point in titration results in ____.
i) random error ii) methodical error iii) personal error iv) instrumental error

l Determinate error is minimized by ____.
i) using repetitive analysis ii) doing instrumental analysis iii) by use of independent method of analysis iv) duplicate analysis

m The sample prepared by mixing the increments is known as ____
i) random sampling ii) systematic sampling iii) gross sampling iv) sub-sample

Q.1 B State whether the following sentences are **true** or **false. (Attempt any three)** **3**

a The unit of radiant Power is Js.

b The range of wavelength which forms vacuum ultraviolet region is 1-180 nm.

c Colloidal Precipitate is easily filterable.

d The difference between highest and lowest numerical value for set of measurement called range

e A stated amount of material to be taken from the sampling unit is increment.

Q.1 C Match the following (**Attempt any three**) 3

Column A	Column B
i) Potassium dichromate	a)Mean
ii) Turbidity	b) Absolute error
iii) Beer lamberts law	c) Quantitative estimation
iv) Measure of central tendency	d) Eosin
v) Accuracy	e) Primary standard
	f) Qualitative estimation
	g) Secondary standard

Q.2 **Attempt any four questions of the following** 20

a Explain the instrumental methods of analysis with examples.

b What is sampling?
Define the following terms:- i) Population ii) Sub sample iii) Analysis sample

c What is an indeterminate error? Explain the instrumental errors and operational errors with examples.

d In the estimation of chromium in a sample of steel, the results of eight replicate measurements gave the following percentage of chromium. Calculate the standard deviation, variance, relative standard deviation and coefficient of variation
15.52, 15.56, 15.62, 15.53, 15.48, 14.54 and 15.53

e Sampling of steel was analyzed for Chromium content. Calculate absolute error, relative error, relative error in pph and ppt. the actual chromium content is 56.77%

Sample No.	1	2	3	4	5	6
Content of chromium	56.28	56.25	56.31	56.31	56.30	56.26

f Explain the following terms: Precision and proportionate errors.

Q.3 **Attempt any four questions of the following** 20

a Discuss in brief- Common ion effect during gravimetric analysis.

b Distinguish between primary and secondary standard.

c Write note on co-precipitation.

d Explain theory of acid –base indicators.

e What are the types of gravimetric analysis? Explain in brief precipitation gravimetric.

f At 298K, 10cm^3 of 0.1M acetic acid is triturated against 0.1M sodium hydroxide. Calculate pH of solution on
i) addition of 7 cm^3 sodium hydroxide from burette
ii) addition of 13 cm^3 sodium hydroxide from burette
($Ka = 1.8 \times 10^{-5}$, $Kw = 10^{-14}$)

Q.4 **Attempt any four questions of the following** 20

a What are thermal methods? Give the classification of it.

b State Beer's law. Derive mathematical expression for Beer's law.

c With the help of diagram explain the principle and working of single beam spectrophotometer.

d Explain the deviation from Beer-lamberts law.

e Explain calibration curve method in context of quantitative analysis.

f The molar absorptivity of a substance in a solution is 4.65×10^3 dm^3 mo^{-1} cm^{-1} at a wavelength of 375nm. If the transmittance of this solution in a cell of 1 cm length is 0.67 then calculate- i) the concentration of the solution
ii) The concentration of the solution that will give a transmittance of 0.798 when placed in the same cell at the same wave length.

S21102465M

SYBSC
21/10/24

Time: $2\frac{1}{2}$ hours

Max. Marks: 75

NB.:- **1) All questions are compulsory.**
2) Figures to the right indicate full marks.
3) Use of log tables and non-programmable calculators is allowed.
4) Symbols have their usual meanings unless otherwise stated.

Q1. A) Attempt any **one**. **(10)**

i) With giving the circuit analysis of the base resistor method, shows that the stability factor is $\beta+1$.

ii) How input impedance increases and output impedance decreases using negative feedback.

B) Attempt any **two**. **(10)**

i) Derive an expression for stability factor.

ii) Express the following gains as a number; i) power gain of 40dB and ii) Power gain of 50 dB.

iii) Explain the term proper zero signal collector current in transistor biasing.

Q.2 A) Attempt any **one**. **(10)**

i) What are the requirements for sinusoidal oscillations? Explain Barkhausen's criterion.

ii) Show that Op-amp's output voltage is proportional to the algebraic sum of input voltages.

B) Attempt any **two**. **(10)**

i) Show how Op-amp is a voltage follower.

ii) How does Op-amp work as a level detector?

iii) In Colpitt's oscillator L = 0.001H, C_1 = 0.001 μf, and C_2 = 0.005 μf. Find the frequency of oscillation. If the output voltage is 2000 mV.

Q.3 A) Attempt any **one**. **(10)**

i) Draw a circuit diagram of master-slave J-K flip-flop using the NAND gate and describe its conditions.

ii) Describe with waveform MOD-8 synchronous parallel binary counter.

B) Attempt any **two**. **(10)**

i) Explain the basic R-S flip-flop using the NOR gate.

ii) Describe a 3-bit synchronous parallel binary counter.

iii) Give the truth table of SIPO with a block diagram.

Q4. A) Attempt any **three**. **(15)**

i) In the base resistor method, if a silicon NPN transistor of β =125, V_{CE} =12 V is used then find the values of R_C and R_B. Take V_{CE} = 6 V, I_E = 4 mA and V_{BE} = 0.6V.

ii) What is the bandwidth of an amplifier?

iii) Draw a circuit diagram of the Wien bridge oscillator.

iv) Discuss OP-amp comparator as a square wave generator.

v) Construct a 4-bit parallel in serial out (PISO) shift register using JK flip-flop.

vi) Draw the circuit and timing diagram of the MOD-10 counter using a J-K flip-flop.

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S22102469M

[Time: 2 ½ Hours] [Marks: 75]

N. B.: (1) All questions are **compulsory**.
(2) **Figures** to the **right** indicate **full** marks.
(3) Draw **neat labeled** diagrams wherever **necessary**.
(4) Symbols have usual meaning unless otherwise stated.
(5) Use of **non-programmable** calculator is allowed.

Q. 1 (A) **Attempt ANY ONE.** 10

(i) The general first order linear differential equation is given by, $\frac{dy}{dx} + P(x) = Q(x)$, Find the general solution of the equation.

(ii) Write down the equation of a forced one dimensional damped harmonic oscillator when acted upon by a sinusoidal force $E_o \sin(pt)$ and find its particular solution. 10

(B) **Attempt ANY TWO.**

(i) Decay of current in an L – R circuit is given by, $L\frac{di}{dt} + iR = 0$, solve for current.

(ii) Is the equation, $\frac{dy}{dx} = \frac{xy^2 - x}{8y - x^2y}$ exact? If so find its solution.

(iii) Find the order, degree and homogeneity of the following differential equations;

$$(i)\ \frac{dy}{dx} + x^3y^2 = 0 \quad (ii)\ \frac{d^2y}{dx^2} + 2\left(\frac{dy}{dx}\right)^3 + y = x^3$$

(iv) Solve the equation of motion of a damped simple harmonic oscillator;

$$\frac{d^2y}{dt^2} + 2b\frac{dy}{dt} + \omega^2 y = 0.$$

10

Q. 2 (A) **Attempt ANY ONE.**

(i) Explain the method of separation of variables. Hence solve Helmholtz equation. $\nabla^2\phi + K^2\phi = 0$.

(ii) Solve one dimensional wave equation, $\frac{\partial^2\phi}{\partial x^2} = \frac{1}{c^2}\frac{\partial^2\phi}{\partial t^2}$. 10

(B) **Attempt ANY TWO.**

(i) Define partial differential equation. Give the list of some commonly used partial differential equations in physics.

(ii) Solve Laplace's two dimensional equation; $\frac{\partial^2\phi}{\partial x^2} + \frac{\partial^2\phi}{\partial y^2} = 0$.

(iii) Write a short note on Poisson's and Laplace's equations.

(iv) Solve $\frac{\partial^2 u}{\partial x \partial y} = 0$, by the method of successive integration.

Q. 3 (A) Attempt ANY ONE. 10

(i) With neat diagrams, write a short note on space communication.

(ii) Using the expression for an amplitude modulated signal, obtain the expression for frequencies and amplitudes of its sidebands.

Q.3 (B) Attempt ANY TWO. 10

(i) Write a short note on Signal to Noise ratio.

(ii) An radio frequency amplifier has an input resistance of 6 KΩ and works in the frequency range 10 MHz to 16 MHz. Calculate the RMS noise voltage at the input of this amplifier at standard temperature.

(iii) Explain what modulation is and why it is needed?

(iv) The equation $\mathbf{E_m = 10\sin(3.7704 \times 10^5 t + 7\sin 1571t)}$ represents, a frequency modulated wave.Find the carrier and modulating frequencies, the modulation index, frequency spectrum and required bandwidth. Consider the proportionality factor to be one.

Q. 4 Attempt ANY THREE. 15

(i) The equation of a body falling in a resistive medium under gravity from rest is given by; $\frac{dv}{dt} + bv = g$. Find its velocity.

(ii) $(4x^3 + 6xy + y^2)dx + (3x^2 + 2xy + 2)dy = 0$; Is the equation an exact? If so, find its solution.

(iii) Write Laplace's equations for conduction of heat, current density and current in C – R circuit.

(iv) Find the noise temperature corresponding to a noise figure of 3 dB.

(v) What are the advantages of modulated signal?

(vi) The amplitude of a wave 10 sin $47.3 \times 10^4 t$ is modulated by a wave 3 cos 6280t. Find the equation of the modulated wave. The A.M. propagation factor is one.

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