S 09 1122 01 E

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

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 Scheduled Tribes? **15**

OR

B) Explain in detail 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) State the contribution of ' Newton ' and ' Galileo 'toward the growth of science. **15**

OR

B) State the importance of science in everyday life.

Q.5) A) Briefly explain the advantages of oral communication. 15

OR

B) State the physical barriers to communication.

S09112201E

मराठी रूपांतर

एकूण गुण – ७५ वेळ - २ तास ३० मिनिटे

सुचना - १) सर्व प्रश्न अनिवार्य आहेत.

२) उजवीकडील अंक पूर्ण गुण दर्शवितात.

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

१) मानवी हक्क ५) तर्कशक्ती युग

२) समतेचा अधिकार ६) अंधविश्वास

३) अवर्षण ७) देहबोली

४) आपत्ती व्यवस्थापन ८) संघ बांधणी

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' शास्त्रज्ञांच्या विज्ञानाच्या विकासातील योगदानावर भाष्य करा. १५

किंवा

ब) दैनंदिन जीवनातील विज्ञानाचे महत्त्व सांगा.

प्र.५) अ) मौखिक संज्ञापनाचे फायदे तोटे थोडक्यात स्पष्ट करा. १५

किंवा

ब) संज्ञापनातील भौतिक अडथळे सांगा.

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. DGAR stands for…….
2. Infantry Battalion is based on principle ……..
3. 'Vishram main' dono adiyon ke bich ……. ka fasala hota hain.
4. ……. is the smallest fighting unit.
5. ……. founded Indian National Congress.
6. The communication range of Radio set GP-338 Motorola is…….
7. ……..security force has dedicated transport aircraft which is always stationed at Palam airport Delhi.
8. AEC stands for……

Q.1 B STATE TRUE OR FALSE **07**

1. 'Drill ki koi bhi harkat savdan position se hi shuru hoti hain, par apane se senior ke saath baat vishram position mein bhi kar sakate hain.'
2. Refined oil is not a natural resource as human create it.
3. 'BASS' defines principles of R.T.Procedure, where 'B' stands for Bandwidth.
4. Short service commission is granted through OTA Chennai.
5. Ralwllet act was passed in year 1919.
6. Indian philosophy was developed on Indian soil and not borrowed from anywhere.
7. There are two types of drill in NCC.

Q.2 A) What is National Integration? Give measures to achieve it. **(08)**

Q.2 B) What are the challenges of National Integration? **(07)**

OR

Q.2 C) What is conflict? What are the motives for it? **(08)**

Q.2 D) Define communication. Explain the process of communication. **(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) Give an organization of Infantry Battalion. **(08)**

Q.4 B) What is waste management? Explain types of waste. **(07)**

OR

Q.4 C) Discuss early life and Coronation Ceremony of Ch.Shivaji Maharaj. **(08)**

Q.4 D) Define curriculum vitae. Give pre-interview preparation. **(07)**

Q.5 Write short notes on.(ANY THREE) **(15)**

1. An Infantry support weapons.
2. NCC song.
3. Kadwar sizing
4. Communication and its types.
5. Modem and its significance.

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. DGAR का मतलब .....
2. इन्फैंट्री बटालियन .....सिद्धांत पर आधारित है .....
3. 'विश्राम मैं दोनों एड़ियों के बीच ..... का फासला होता हैं.
4. .....सबसे छोटी लड़ाकू इकाई है।
5. .....भारतीय राष्ट्रीय कांग्रेस की स्थापना की।
6. रेडियो सेट जीपी-338 मोटोरोला की संचार रेंज .....
7. ..... सुरक्षा बल के पास समर्पित परिवहन विमान हैं जो हमेशा दिल्ली के पालम हवाई अड्डे पर तैनात रहते हैं।
8. एईसी का मतलब .....

Q. 1 B STATE TRUE OR FALSE **07**

1 'ड्रिल की कोई भी हरकत सावधान पोजीशन से ही शुरू होती हैं, पर अपने से सीनियर के साथ बात विश्राम पोजीशन में भी कर सकते हैं.'

2 रिफाइंड तेल एक प्राकृतिक संसाधन नहीं है क्योंकि मानव इसे बनाता है।

3 'BASS' आरटी प्रक्रिया के सिद्धांतों को परिभाषित करता है, जहां 'बी' बैंडविड्थ के लिए है।

4 ओटीए चेन्नई के माध्यम से शॉर्ट सर्विस कमीशन दिया जाता है।

5 1919 में रॉलेट एक्ट पारित हुआ।

6 भारतीय तत्त्वज्ञान भारतीय धरती पर विकसित हुआ और कहीं से उधार नहीं लिया गया।

7 एनसीसी में ड्रिल के 2 प्रकार हैं।

Q.2 A) राष्ट्रीय एकता क्या है? इसे प्राप्त करने के उपाय बताएं.. **(08)**

Q.2 B) राष्ट्रीय एकता की क्या चुनौतियाँ हैं? **(07)**

OR

Q.2 C) संघर्ष क्या है? इसके क्या मकसद हैं? **(08)**

Q.2 D) संचार को परिभाषित कीजिए। संचार की प्रक्रिया की व्याख्या करें। **(07)**

Q.3 A) साइकिल चलाने के दौरान सुरक्षा के उपाय बताएं। (08)

Q.3 B) ट्रेकिंग गतिविधि के लिए आवश्यक वस्तुओं की सूची दें। (07)

OR

Q.3 C) 'विविधता में एकता' की अवधारणा को विस्तार से समझाइए। (08)

Q.3 D) समझाएं कि साक्षात्कार के दौरान आप स्वयं को कैसे संचालित करेंगे? (07)

Q.4 A) इन्फैन्ट्री बटालियन पर संगठन दीजिए। (08)

Q.4 B) कचरा प्रबंधन क्या है ? कचरे के प्रकार समझाइए। (07)

OR

Q.4 C) शिवाजी महाराज के प्रारंभिक जीवन और राज्याभिषेक समारोह पर चर्चा करें। (08)

Q.4 D) व्यक्तिगत आख्यान को परिभाषित कीजिए। साक्षात्कार पूर्व तैयारी दें। (07)

Q.5 **Write short notes on.(ANY THREE)** (15)

1. इन्फैंट्री सपोर्ट हथियार
2. एनसीसी गान।
3. कदवार साइज़िंग
4. संचार को परिभाषित कीजिए तथा इसके प्रकार बताइए।
5. मॉडेम और इसका महत्व।

****

SYBSc 200
10/11/2022

S10112209E

Time : Three Hours **Marks : 100**

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

Q. 1) A) Choose correct answer and complete the following sentences. **05**

i) Meaning of Greek word gen is ..... .
a) to grow into. b) growth.
c) cross . d) centre.

ii) A monohybrid cross involves ..... of contrasting characters.
a) one pair b) two pairs
c) three pairs d) four pairs

III) The terminal region of chromosome is known as ..... .
a) centromere b) chromatonema
c) telomere d) chromatine

iv) Sex-determination method in grasshopper is ..... .
a) XX-XY b) XX-X0
c) ZZ-ZW d) haplodeploidy.

v) rRNA occurs in .....
a) mRNA b) Amino acids
c) Ribosome d) Endoplasmic reticulum

B) State whether the following sentences are true or false. **05**

1) All chromosomes are made up of DNA and proteins
2) Unit of heredity is protein
3) Environmental factors do not affect sex determination in *Bonellia*
4) In human sex is determined by XX-XY method
5) In bacteria RNA is principal genetic material

C) Define the following terms. **05**

1) Phenotype
2) Chromatonema
3) Alleles
4) Single crossing over
5) Nucleotide

D) Answer in one sentence. **05**

1) What is monohybrid cross?
2) Define recessive gene
3) What is chromatonema?
4) What is Autosome?
5) Define operator gene

Q. 2)A) Answer <u>any one</u> of the following. **10**

1) Explain inheritance of Blood groups in human with suitable example
2) Explain recessive epistasis with suitable example

B) Write short notes on <u>any two</u> of the following. **10**

1) Double dominant epistasis
2) Chromosomal theory of inheritance
3) Rh blood group system
4) Types of linkages

Q. 3) A) Answer <u>any one</u> of the following. **10**

1) What is chromosome? With neat labelled diagram explain its structure
2) Explain the XX-XY and ZZ-ZW mechanism of sex determination

B) Write short notes on <u>any two</u> of the following. **10**

1) Polytene chromosome
2) Sex chromosomes
3) Haplodeploidy
4) Lyon's hypothesis

Q. 4)A) Answer <u>any one</u> of the following. **10**

1) Explain Avery, Macleod and MacCarty's experiment
2) Describe types of DNA.

B) Write short notes on <u>any two</u> of the following. **10**

1) Pentose sugar
2) DNA packaging of eukaryotes
3) Z-DNA
4) RNA as genetic material in viruses

Q. 5) Write short notes on <u>any four</u> of the following. **20**

1) Types of crossing over
2) pleiotropy
3) Intersex
4) Sex determination in birds
5) Chromosomal and plasmid DNA in Prokaryotes
6) tRNA

****

S10112210

SYBSC Maths
10/11/2022

Total marks: 75M **Duration: 2 ½ hrs.**

N.B.1) All questions are compulsory.

2) Figures to the right indicate full marks.

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

1. State and prove Cauchy's Criterion of convergence of series.
2. The series of the type $\sum_{n=1}^{\infty}\frac{1}{n^p}$ converges if $p > 1$ and diverges if $p \leq 1$.

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

1. Discuss the convergence of series $\sum_{n=0}^{\infty}(\frac{5}{2^n}-\frac{1}{3^n})$.
2. Discuss the convergence of series $\sum_{n=1}^{\infty}\frac{3n^2}{4n^5+n^2+1}$ by Comparison test.
3. Discuss the convergence of series $\sum_{n=1}^{\infty}\frac{n!}{5^n}$ by ratio test.

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

1. State and Prove Reimann criterion for integrability.
2. Let $f:[a,b]\to\mathbb{R}$ be integrable function and $\alpha\epsilon\mathbb{R}$, then αf is integrable and $\int_a^b(\alpha f)\,(x)\,dx = \alpha\int_a^b f(x)\,dx$.

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

1. Let $f(x) = x$ where $f:[0,1]\to\mathbb{R}$ prove that f is integrable using the criterion for integrability.
2. Let $f(x) = 3x$, I=[0,1], P={0, 1/3, 2/3, 1}.Find L(P, f), U(P, f).
3. Let $f, g:[a,b]\to\mathbb{R}$ be integrable function such that $f(x)\geq g(x)$ for all $x\in[a,b]$ then $\int_a^b f(x)\,dx \geq \int_a^b g(x)\,dx$.

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

1. State and prove First fundamental theorem of integral calculus.
2. Let $I=[\alpha,\beta]$ and let $\emptyset: I\to\mathbb{R}$ be continuosly differentiable. If $f:[a,b]\to\mathbb{R}$ is a continuos function such that $\emptyset(\alpha)=a, \emptyset(\beta)=b$ and $\emptyset(I)\subseteq[a,b]$ then $\int_\alpha^\beta f(\emptyset(t))\,\emptyset'(t)dt = \int_a^b f(x)\,dx$.

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

1. Define Beta function and prove that $\beta(m,n) = \beta(n,m)$.
2. Discuss the convergence of improper integrals $\int_0^\infty \frac{1}{x^2+1}\,dx$.
3. Find Indefinite integral of $f\colon [0,1] \to \mathbb{R}$ be defined by

   $f(x) = 0$ for $0 \le x < 1/2$

   $=1$ for $1/2 < x \le 1$.

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

1. Let $f\colon [a,b] \to \mathbb{R}$ be integrable function such that $f(x) \ge 0$ for all $x \in [a,b]$ then $\int_a^b f(x)\,dx \ge 0$.
2. Let $f\colon [a,b] \to \mathbb{R}$ be bounded function and let Pbe partition, then $L(P,f) \le U(P,f)$.
3. Prove that $\Gamma(1) = 1$.
4. Discuss the convergence of series $\sum_{n=1}^\infty \frac{(-1)^n n}{15^n}$ by Root test.
5. Discuss the convergence of series $\sum_{n=1}^\infty \frac{1}{5n^2-n}$ by limit comparison test.

*****

SYBSc 200
11/11/2022

S11112218E

Time: 3 Hrs. Marks: 100.

Please check whether you have got the right question paper.

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

Que.1. **A** **Fill in the blanks by choosing the correct options.** 05

a .....is the process of obtaining energy from the absorbed food molecules. (Assimilation, Digestion, Absorption,)

b Almost all multicellular organisms need.....to transport oxygen and nutrients through the body. (Excretory system, Respiratory system, Circulatory system)

c .....animals excrete urea as the main end product of nitrogen metabolism. (Uricotelic, Ammonotelic, Ureotelic)

d In .....the parent organism splits into several parts and each part grows into a new individual. (Fission, Budding, Fragmentation)

e Gametogenesis is the process whereby a haploid cell (n) is formed from a diploid cell (2n) through..... (Meiosis and cell differentiation, Mitosis and cell differentiation, Meiosis and cell fusion)

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

	column I		column II
a	Hind gut	i	Crustaceans
b	Double circulation	ii	*Clarius*
c	Haemocyanin	iii	Sperm
d	Arborescent organ	iv	Proctodaeum
e	Acrosome	v	Frog

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

a Midgut is also known as mesenteron.
b The complex type of excretory system is the protonephridia.
c Interclavicular air sac is an unpaired air sac.
d Cockroach heart has 3 muscular chambers in abdomen.
e Simple binary fission occurs in *Hydra.*

D **Define the following.** 05

a Reticulum
b Direct respiration
c Plasma
d Geotropism
e Spermiogenesis

Que.2. **A** Discuss the digestion in cockroach. 10

OR

A Explain the structure of kidney. 10

B **Explain any Two from the following:** 10

a Digestion in ruminants
b Types of animals based on principal nitrogenous excretory products
c Contractile vacuole in *Amoeba*
d Structure of renal corpuscle.

Que.3. **A** Discuss various modes of respiration in frog. 10

OR

A Differentiate the single and double circulations. 10

B **Explain any Two from the following:** 10

a Respiration in Earthworm
b Blood

Que.4.	**A**	Describe the types of neurons based on structure and function.	**10**
		OR	
	A	Discuss the process of oogenesis.	**10**
	B	**Explain any Two from the following:**	**10**
	a	Irritability in *Paramecium*	
	b	Fins in Fishes	
	c	Budding in Hydra	
	d	Viviparity.	
Que.5.		**Write short notes on any four.**	**20**
	a	Ruminant stomach	
	b	Food vacuole in *Amoeba*	
	c	Heart of Shark	
	d	Classification of fertilization.	
	e	Malpighian tubule of cockroach	
	f	Gemmule in sponge	

****

S111122 19 E

S4B3Se math
11/11/2022

Duration :2.30hrs **Maximum marks:75**

N.B. 1) All questions are compulsory.
2) Figures to right indicate full marks.
3) Use of calculator is not allowed.

Q 1. A] Attempt Any One. **(8)**

i) Define row echelon form of a matrix and convert the following matrix into row echelon form:

$$\begin{pmatrix} -2 & 1 & -6 \\ 3 & -2 & -1 \\ -2 & -3 & 4 \\ -4 & -1 & 2 \end{pmatrix}$$

ii) Define elementary matrix. Also show that a square matrix A is invertible if it can be written as the product of elementary matrices.

B] Attempt Any Two. **(12)**

i) The community college theater department sold three kinds of tickets to its latest play production. The adult ticket sold for $ 15, the student ticket for $10 and the child ticket for $8. The theater department was thrilled to have sold 250 tickets and brought in $ 2,825 in one night. The number of student tickets sold is twice the number of adult tickets sold. How many of each type did the department sell?

ii) Discuss whether the following matrix are row equivalent. If yes, then write it as $B=E_kE_{k-1}\ldots E_2E_1A$.

$$A = \begin{pmatrix} 4 & 3 & -2 \\ -1 & 5 & 8 \end{pmatrix} \qquad B = \begin{pmatrix} 4 & 3 & -2 \\ 14 & -1 & -22 \end{pmatrix}$$

iii) Define symmetric matrix, idempotent matrix, orthogonal matrix & nilpotent matrix with one example each.

iv) For what values of μ & λ the following equations have no solution, unique solution & infinite solutions?

$$x + y + z = 6 \ , \ x + 2y + 3z = 10 \ , \ x + 2y + \lambda z = \mu.$$

Q 2. A] Attempt Any One. **(8)**

i) Define vector space. And state & prove subspace criteria.

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

B] Attempt Any Two. **(12)**

i) Define row space & column space. Find bases & dimension of row space and column space for $\begin{pmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 1 & 1 & 1 \end{pmatrix}$

ii) Let $W = \{(x, y, z, w) / x + 2y - 3z - w = 0\}$. Justify whether W is a subspace of $\mathbb{R}^3$ or not.

iii) Show that $\mathbb{R}^3$ is a vector space.

iv) Extend $\{(0,1,0), (-2,0,1)\}$ to form a basis of $\mathbb{R}^3$.

Q 3. A] Attempt Any One. **(8)**

i) State & prove Cramer's rule.

ii) Let A be a non-singular matrix then prove that A. AdjA= $|A|$.

B] Attempt Any Two. **(12)**

i) Define Vandermonde determinant. & solve $\begin{pmatrix} 1 & 1 & 1 & 1 \\ a & b & c & d \\ a^2 & b^2 & c^2 & d^2 \\ a^3 & b^3 & c^3 & d^3 \end{pmatrix}$

ii) Solve the following system by using Cramer's rule.

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

iii) Find $|A|$ by using Laplace expansion by 3rd row & 2nd column.

$$A = \begin{pmatrix} 1 & -1 & 3 \\ 2 & 3 & 4 \\ 3 & -4 & -3 \end{pmatrix}$$

iv) Define invertible matrix. Also, show that an $n \times n$ real matrix A is invertible iff $|A| \neq 0$.

Q 4. Attempt any Three. **(15)**

i) Solve the following system by Gauss elimination method.

$$x + y + z = 7, 3x - 2y - z = 4, x + 6y + 5z = 24$$

ii) Find k, if area of Δ LMN is 33/2 square unit and vertices are $L(3, -5), M(-2, k), N(1,4)$.

iii) Check that given vectors are linearly dependent or linearly independent.

{(1,4,2, -3), (7,10, -4, -1), (-2,1,5, -4)}

iv) Find A^{-1} by using adjoint method for, $A = \begin{pmatrix} 3 & 1 & 0 \\ -2 & -4 & 3 \\ 5 & 4 & -2 \end{pmatrix}$

v) The cost of 4 kg potato, 3 kg wheat and 2 kg rice is Rs. 150. The cost of 1 kg potato, 2 kg wheat and 3 kg rice is Rs. 125. The cost of 6 kg potato, 2 kg wheat and 3 kg rice is Rs. 175. Find the cost of each item per kg.

SYBSC. 200
12/11/2022

S12112227E

Time: Three hours. **Marks: 100**

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

Q. 1. A) Fill in the blanks by choosing the correct option given below. **05**

1) The response to a mother figure is called.....
a) Filial imprinting b) Sexual imprinting c) Insight learning d) Habituation

2) The .....is performed by forager bees when the food source is located far away from the bee hive.
a) Round dance b) Belly dance c) Waggle dance d) Floor dance

3) Anthrax is.....disease caused by *Bacillus anthracis*.
a) Fungal b) Bacterial c) Viral d) Protozoan

4) The wax moth is a major pest of.....which causing colonies to leave suddenly.
a) *Apis dorsata* b) *Apis mellifera* c) *Apis florae* d) *Apis cerana*

5) Whole milk usually contains .....of fat.
a) 2.25 % b) 3.25 % c) 4.25 % d) 5.25 %

Q. 1. B) Match the columns I and II and rewrite. **05**

Column I	Column II
1) Yogurt	a) W. D. Hamilton
2) American foulbrood disease	b) Julian Huxley
3) Ritualization	c) Hydrophobia
4) Kinship	d) Honey bee
5) Rabies	e) Milk product

Q. 1. C) State whether True or False. **05**

a) The Waggle dance in honey bees is shaped in the form of figure 'eight'.
b) Social behaviour is less complex in primates.
c) Filariasis is caused by *Wuchereria bancrofti.*
d) H1N1 is causative influenza virus of Bird flu.
e) The Shells and tube coolers are used in Vermiculture.

Q. 1. D) Answer the following in one sentence only. **05**

a) What is insight learning?
b) What is Allomothering?
c) Define obligatory parasite.
d) Write two names of bacterial diseases of honey bee.
e) Write two names of methods of ghee making.

(P.T.O.)

Q. 2. A) Describe different types of mimicry with suitable example. **10**

OR

A) Describe different types of migration in fish with suitable example. **10**

Q. 2. B) Answer any two of the following: **10**

a) Describe instrumental learning.
b) Comment on displacement activities in animals.
c) Comment on kinship in animals.
d) Describe habitat selection in animals.

Q. 3. A) Describe life cycle of *Taenia solium*. **10**

OR

A) Describe life cycle of *Wuchereria bancrofti*. **10**

Q. 3. B) Write short notes on (any two) **10**

a) Parasitic adaptations in ectoparasites.
b) Morphology of Head louse.
c) Types of host.
d) Control measures and treatment of amoebiasis.

Q. 4. A) Describe the methods used in Vermiculture. **10**

OR

A) Describe different methods used for processing of milk. **10**

Q. 4) Answer any two of the following: **10**

a) Describe the insect pest enemies of honey bees.
b) Describe different sweets manufactured by using milk.
c) Describe maintenance and harvesting of worms in Vermiculture.
d) Describe different bacterial diseases of honey bee.

Q. 5) Write short notes on (any four) **20**

a) Types of imprinting in animals.
b) Innate behaviour.
c) Anthrax.
d) Life cycle of Liver fluke.
e) Sac-brood disease.
f) Ghee.

****

S121122-28E

SYBSc. Maths
12/11/2022

Time: 2:30 Hrs

Marks:75

N.B. 1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Use of calculator is allowed.

Q.1 A. Attempt any **one** question from the following. (8)

a) Solve $(D^2-2D+1)y = \frac{e^{2x}}{(1+e^x)^2}$ by using method of variation of parameters.

b) If $y_1, y_2, \ldots\ldots y_k$ are k solutions to the nth order linear homogeneous linear differential equation $b_0(x)y^n(x) + b_1(x)y^{n-1}(x) + \ldots + b_{n-1}(x)y'(x) + b_n(x)y = 0$ then $c_i y_i + c_2 y_2 + \ldots\ldots + c_k y_k$ is also a solution to given equation where $c_1, c_2, \ldots\ldots c_k \in \mathbb{R}$.

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

a) Using exponential shift method find particular solution and also general solution to the given equation. $(D-2)^3y = 16e^{2x}sinx$

b) Find particular solution for the following differential equation

$y''-5y'+6y=0$ with $y(0)=e^2$, $y'(0)=3e^2$

c)) Let P(x) & Q(x) are continuous function on (a , b). Let $x_0 \in (a, b)$. Suppose y_1 is a solution to the differential equation $y'' + P(x)y' + Q(x)y=0$ with $y_1(x_0)=0$, $y'_1(x_0) = 0$ $\forall\, x \in (a, b)$

d) Solve Cauchy equation $x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + y = logx$

Q.2 A Attempt any **one** question from the following. (8)

a) If the roots of the auxiliary equation to the linear homogeneous system

$\frac{dx}{dt} = a_1(t)x + b_1(t)y$ $\quad\frac{dy}{dt} = a_2(t)x + b_2(t)y$ with constant coefficients are complex conjugates $m_1 = a+ib$, $m_2 = a-ib$, then there exists non trivial real constants A_1, A_2, B_1, B_2 such that

$x = e^{at}(A_1 cosbt - A_2 sinbt)$

$y = e^{at}(B_1 cosbt - B_2 sinbt)$

$x = e^{at}(A_1 \sin bt - A_2 \cos bt)$

$y = e^{at}(B_1 \sin bt - B_2 \cos bt)$ are solutions to given system of equation.

b) Using method of variation of parameters Find particular solution to the system

$\frac{dx}{dt} = -2x + y \quad \frac{dy}{dt} = \frac{-3x+2y}{2sint}$ with general solution

$X_n(t) = c_1e^t + c_2e^{-t} \qquad y_n(t) = 3c_1e^t + c_2e^{-t}$

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

a) $x = 3t+2$, $y = 2t-1$ is a particular solution to the non homogeneous linear system

$\frac{dx}{dt} = x+y-5t+2 \qquad \frac{dy}{dt} = 4x-2y-8t-8$

Find the general solution to the above system.

b) Find the general solution to the following system.

$\frac{dx}{dt} = 4x-3y \quad , \quad \frac{dy}{dt} = 8x-6y$

c) Find the general solution to the following system.

$\frac{dx}{dt} = -2x + y \qquad \frac{dy}{dt} = -3x + 2y + 2sint$

d) Find the general solution to the following system.

$\frac{dx}{dt} = 3x - 2y + t \qquad \frac{dy}{dt} = 2x - 2y + 3e^t$

Q.3 A. Attempt any **one** question from the following. (8)

a) Solve the boundary value problem for the differential equation

$y'' - y = 0$ with $y(0) = 0$, $y(2) = 3.62686$ using finite difference method.

Find the value of $y(1)$ taking (i) $h = 0.5$ (ii) $h = 0.25$

b) Compute the value of $y(0.2)$, $y(0.4)$, $y(0.6)$ using first 4 terms of the Taylor series for the differential equation $y' = 2x-4y$ where $y(0) = 1$ taking step size $h = 0.2$.

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

a) Find the polynomial approximation of solution to differential equation $y' = 7xy+5$ with $y(0) = 0.6$ using Picard method and evaluate upto 2nd approximation and estimate the value of $y(0.25)$

b) Use Runge-Kutta second order method to find the approximate value of y at

specified points for the following: $\frac{dy}{dx} = \frac{7x-4y}{x+y^2}$, y(0) = 1 and estimate y(0.15) taking step size h = 0.15

c) Solve $y' = 5x^2+2xy$, y(1) = 0.25 and estimate y(1.6) using step size h=0.15 by using Euler Method.

d) Estimate the value of y(1.25) using Runge-Kutta fourth order method for differential equation $y' = 2x^3y - 3$ with y(1) = 1.3 taking step size h = 0.25.

Q.4. Solve any **three** from the following. (15)

a) Find particular solution to the following initial value problem.

$(4D^2-4D+1)\, y = 0$ with y(0) = -2, y'(0) = 2,

b) Find particular solution to the following initial value problem.

$(D^3 + D^2+4D+4)\, y = 0$ with y(0) = 0, y'(0) = -1, y''(0) = 5

c) Find the equivalent system of first order differential equations

$$\frac{d^3x}{dt^3} - 4t^3\frac{d^2x}{dt^2} - 7t\frac{dx}{dt} + 5cost$$

d) Using Wronskian check whether the following solutions are linearly independent or not $x = e^{4t}$ $y = e^{4t}$ $x = e^{-2t}$ $y = -e^{-2t}$

e) Solve $y' = \frac{2x+3}{7-x}$ with y(0)=2 using Euler's method to estimate y(1) with step size h= 0.25.

f) 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

5YBSc Chem
14/11/2022

S14112235E

Duration: 3 hours Total marks: 100

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

Q.1 **Select the correct option and complete the following sentences.** 12
(Attempt any **twelve**)

A. i) Chemical potential is -------- property.
a) extensive b) intensive c) colligative

ii) The sum of transport number of ions is always --------.
a) equal to one b) less than one c) greater than one

iii) For spontaneous process change in Gibbs free is -------.
a) Positive b) negative c) zero

iv) Transport number of ions increases with --------.
a) increase in concentration
b) decrease in concentration
c) decrease in temperature

v) The unit of cell constant is ----------.
a) cm^{-1} b) S cm^{-1} c) cm^{-2}

vi) Partial molal property is applicable to ---------- system.
a) Open b) closed c) isolated

vii) In ionic crystal radius ratio greater than 0.732 is --------
a) suitable for fitting in octahedral hole
b) suitable for fitting in tetrahedral hole
c) too large for close packing

viii) In Born Lande's equation -------- is the term which is depends upon the geometry of the crystal lattice.
a) Madelung constant b) Avogadro number c) empirical number.

ix) In the formation of Hydrogen molecule if constituent atoms contribute electrons of same spin it --------.
a) results in bond formation
b) won't result in bond formation
c) it reduces the energy of system.

x) In resonating structures the sequence of atoms in molecule should remain .....
a) different b) same c) alternate

xi) Bond order in Ne2 molecule is --------- indicate it is noble gas element.
a) two b) one c) zero

xii) Zero overlap of constituent atomic orbitals will result in non-bonding molecular orbital where .....
a) $S < 0$ b) $S = 0$ c) $S > 0$

xiii) In SN^2 reaction, the rate of reaction depends on concentration of ----------.
a) alkyl halide b) base c) alkyl halide and base

xiv) Ethyl magnesium bromide reacts with water gives ----------.
a) Ethanol b) Ethane c) Butane

xv) Phenol on nitration with conc. HNO_3 gives ----------.
a) o-Nitrophenol b) p-Nitrophenol c) Picric acid

xvi) 1-Phenyl ethanol can be prepared by reaction of phenyl lithium with ------ ------ followed by hydrolysis.
a) Formaldehyde b) Acetone c) Acetaldehyde

xvii) Epoxides can be prepared by action of --------- on alkenes.
a) Chromic acid b) $KMnO_4$ c) Peroxy acetic acid

xviii) The correct reactivity order of the following for SN^1 reaction is------
a) t-alkyl halide > p-alkyl halide>s-alkyl halide
b) s-alkylhalide>t-alkyl halide>p-alkyl halide
c) t-alkyl halide>s-alkyl halide>p-alkyl halide

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

a) The degree of dissociation of weak electrolyte is inversely proportional to square root of concentration.

b) For a spontaneous process the change in entropy is negative.

c) Higher the resonance energy, greater is the stability of the molecule.

d) In O_2 molecule the $\pi 2pz$ and $\pi 2py$ molecular orbitals are lower in energy than $\sigma 2pz$ molecular orbital.

e) SN^1 reactions are favoured by less polar solvents.

f) p-Cresol is less acidic than phenol.

C. **Match the following. (Attempt any five)** 5

	Column A		Column B
a)	Fugacity	i)	Organometallic compound
b)	Transport number	ii)	Forms hcp sublattice
c)	Sulfur atom in zinc blende structure	iii)	Measure of escaping tendency
d)	Sulfur atom in wurtzite structure	iv)	Fraction of the total current carried by an ion.
e)	SN^1 reaction	v)	Forms ccp sub lattice
f)	Diethyl zinc	vi)	retention in configuration
		vii)	Speed of cations and anions
		viii)	E-Z configuration
		ix)	Forms BCC sub lattice

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

a) Explain the variation of molar conductance of an electrolyte with the concentration. 5

b) Define free energy. Show that, Helmholtz free energy is a measure of maximum work. 5

c) Explain, ionic product of water. How will you determine the ionic product of water experimentally? 5

d) The conductance of 0.1M KCl solution is 12.900 S at 25 ^{0}C. With same conductivity cell the measured conductance of 0.1 M CH_3COOH solution is found to be 0.456×10^{-3} S. Calculate the molar conductance of the CH_3COOH solution. 5
(Specific conductance of 0.1M KCl = 12.880 S cm^{-1})

e) Derive Gibbs-Helmholtz equation. 5

f) The equilibrium constant for a gaseous reaction gets doubled when the temperature is raised from 300 K to 310 K. Calculate the heat of a reaction. 5
($R = 8.314$ J K^{-1} mol^{-1})

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

a) Draw molecular orbital energy level diagram of Fluorine molecule showing distribution of electrons. Calculate its bond order and state magnetic property. 5

b) Define terms i) σ sigma molecular orbital ii) Hybridization iii) Resonance energy. Explain any one in details. 5

c) Explain the shape of NH_3 molecule on the basis of Covalent bonding. 5

d) What is Kapustinskii equation? Explain in brief. 5

e) Explain with the help of MOT, the paramagnetic nature of B_2 molecule. 5

f) What is formal charge? Calculate it for CO molecule. 5

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

a) Explain the mechanism of alkaline hydrolysis of t-Butyl bromide. 5

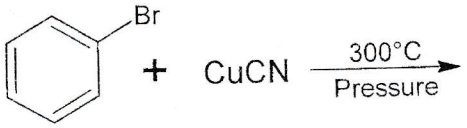
b) What are Grignard reagents? How are they prepared? What is the function of ether? 5

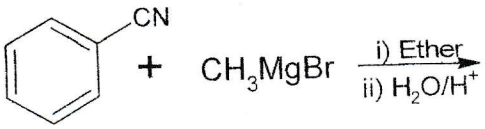
c) How do alcohols prepared by using hydration of alkenes and hydroboration reaction? 5

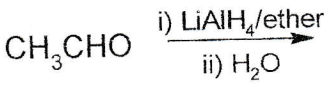
d) Write short note on Fries rearrangement of phenolic ester. 5

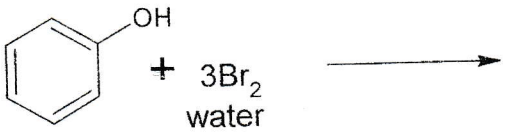
e) How will you obtain the following compounds using ethylene oxide? 5
i) Ethylene glycol ii) 2-bromoethanol iii) 2-chloroethanol

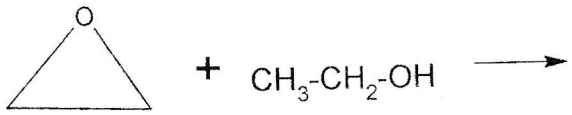
f) Complete the following reactions. 5

1. 

2. 

3. 

4. 

5. 

Q.5 **Attempt any four of the following.**

a) Derive Van't Hoff reaction isotherm. 5

b) Explain: 5
i) Specific conductance
ii) Cell constant of conductivity cell.

c) On the basis of potential energy curve explain the quantum mechanical treatment to the formation of H_2 molecule. 5

d) State the rules or conditions for drawing resonating structures for a molecule. 5

e) Explain the mechanism of action of sodamide in liquid ammonia on chlorobenzene. 5

f) i) Explain: Ortho-nitro phenol is steam volatile whereas para-isomer is not. 5
ii) What is the action of $K_2Cr_2O_7$ and conc. H_2SO_4 on n-propyl alcohol and iso-propyl alcohol?

S4BSc Che
15/11/2022

S15112244E

Duration: 3 hours Total marks: 100

N. B.

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

Q.1 **Select the correct option and complete the following sentences.** 12
(Attempt any twelve)

A. i) The unit of activation energy is ----------.
a) kJ /mole b) kJ / mole / K c) J / K

ii) The reaction of the type A → B → C is called ---------- reactions.
a) reversible b) consecutive c) parallel

iii) The chain carriers in the reaction, $H_2 + Br_2 \rightarrow 2HBr$ are ----------.
a) H_2 and Br_2 b) H and Br c) HBr molecules

iv) Phenol –water system has ---------- consolute temperature.
a) upper b) lower c) upper and lower

v) In solvent extraction process two solvents should be --------- with each other.
a) miscible b) immiscible c) partially miscible

vi) Steam distillation is used for ---------- of organic compound.
a) purification b) separation c) mixing

vii) Boron tri haldes are _____in nature and their solutions in organic solvents are bad conductor of electricity.
a) covalent b) ionic c) dimeric

viii) The type of hybridization boron undergo in tetrborane is ____
a) sp_2b) sp^3 c) sp_3d

ix) The best method for refining the silicon would be using ____ technique.
a) graphite crucible b) crucibleless c) platinum crucible

x) Argyrodite is the ore of _____.
a) Germanium b) Silicon c) Tin

xi) _____ only exist in the solid state & and in the liquid state it is dissociated in nitrc oxide and nitrogen dioxide.
a) N_2O_5 b) N_2O_4 c) N_2O_3

xii) In Habers process of synthesis of ammonia the compressed gases are passed through heat exchanger where they are preheated to about _____ .
a) 500 K b) 1800k c)823 K.

xiii) Aldehydes are ---------- reactive towards nucleophilic reagents than ketones.
a) less b) non c) more

xiv) Action of CH_3MgI on ethyl formate gives ----------.
a) acetaldehyde b) ethanol c) acetic acid

xv) Ketones may be prepared by oxidation of ----------
a) primary alcohols b) secondary alcohols c) tertiary alcohols

xvi) ---------- reacts with $NaHSO_3$ to give crystalline solids ?
a) Ethanol b) Acetic acid c) Benzaldehyde

xvii) The compound ---------- is an example of aliphatic ketone.
a) Acetophenone b) Benzophenone c) Propanone

xviii) Aryl ether are prepared by ---------- reaction.
a) Williamson b) Fries c) Claisen

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

a) Nitration of phenol is an example of parallel reaction.
b) Nicotine -water system has lower consolute temperature.
c) Zone refining process is the only technique to purify Silicon which is carried out in graphite crucible.
d) The important ore of tin is cassiterite and that of the Lead is Galena.
e) The carbonyl compounds react with sodium bisulphate to form substitution product.
f) In the carbonyl group both 'C' and 'O' are sp^2 hybridized.

C. **Match the following. (Attempt any five)** 5

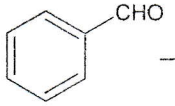
	Column A		Column B
a)	Arrhenius equation	i)	active methylene compound
b)	Fractional distillation	ii)	Cyanide ion
c)	$B_n H_{n+4}$	iii)	Separation of miscible liquid mixture
d)	$B_n H_{n+6}$	iv)	$k = Z \cdot e^{-Ea/RT}$
e)	Malonic ester	v)	nidoboranes
f)	Benzoin condensation	vi)	$k = A \cdot e^{-Ea/RT}$
		vii)	Archnoboranes
		viii)	Lithium compound
		ix)	Closoborane

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

a) Define ideal solutions. What are the criteria for the solution to be an ideal? 5
b) Discuss the application of collision theory to the bimolecular reaction. 5
c) With suitable example explain; 5
i) Reversible reactions.
ii) Drawbacks of collision theory of reaction rates.
d) State Raoult's law and explain the positive deviation shown by non-ideal solution from it. 5
e) For a given reaction, the energy of activation was found to be 112600 J/mol at 299 K and the frequency factor is 5.3×10^{13} per second. Calculate the rate constant of reaction. 5
(R = 8.314 J/K/mol)
f) Define, lower consolute temperature and explain the variation of mutual miscibility with temperature for triethylamine – water system 5

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

a) Explain the structure and bonding in Tetra borane 5
b) Explain inert pair effect in 13 group elements. 5
c) Explain extraction of Germanium from its ore. 5
d) Explain the structure of silica 5

	e)	Explain the preparation of Borax.	5
	f)	Write note on hydrides of elements of nitrogen family	5
Q.4		Attempt any four of the following.	
	a)	Explain the use of following reagents in preparation of aldehydes and ketones : i) Pd on $BaSO_4$, ii) Grignard reagent	3 2
	b)	What is Claisen-Schmidt reaction? Explain it with mechanism.	3 2
	c)	Complete the following reactions and name the products.	5
		i) Benzaldehyde + Ethyl magnessium bromide $\xrightarrow[\text{ether}]{\text{Dry}}$ A $\xrightarrow{\text{HCl}}$ B + C	
		ii) Benzaldehyde + 2,4-DNP $\longrightarrow$ A	
	d)	What is enolisation ? Give the mechanism of base catalysedenolisation.	5
	e)	Complete the following reaction and name the reaction. Give its mechanism.	5
		2  $\xrightarrow[\Delta]{\text{conc. NaOH}}$ A + B	
	f)	i) What is the action of following reagents on acetone? (Reactions expected) a) HCN b) ethanol /HCl	5
		ii) How will you convert benzene into benzaldehyde?	
Q.5		**Attempt any four of the following.**	
	a)	Define energy of activation. Explain the experimental methods to determine the energy of activation.	5
	b)	State Nernst distribution law and write its applications.	5
	c)	Explain the flow sheet fo the synthesis of ammonia by Haber-Bosch process.	5
	d)	Explain the Czochralski pulling technique for the synthesis of single crystal of Silicon.	5
	e)	How is acetyl acetone converted into 2-Butanone and 2-Pentanone?	5
	f)	What are stabilized enols? Explain with examples.	5

S161122 54E

5 YBSc Che
16/11/2022

...

Duration: 3 hours Total marks: 100

N. B.

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

Q.1 **Select the correct option and complete the following sentences. (Attempt any twelve)** 12

A. i) ---------- is the classical method of analysis
a) Optical method b) Chromatographic method c) Gravimetric method

ii) Micro analysis refers to the sample size of ---------- mg.
a) 0-10 b) 10-100 c) 100-150

iii) In Emission spectroscopy method the property measured is ----
a) intensity of scattered radiation
b) measurement of quantity of electricity passed
c) intensity of emitted radiation

iv) In mass spectrometry method the property measured is ----
a) change in mass of the sample
b) weight of a sparingly soluble compound formed
c) measurement of mass-to-charge ratio

v) A definite amount of the material withdrawn from the sampling unit is known as --------.
a) subsample b) increment c) analysis sample

vi) ---------- is an example of methodic errors
a) Improper response of the instrument
b) weighing of hot crucibles
c) addition of excess amount of the titrant

vii) Precipitation of the ionic solid takes place if _____
a) solubility product > ionic product
b) solubility product < ionic product
c) solubility product = ionic product

viii) _____ indicators are used in complexometric titrations
a) adsorption b) neutralizationc) metallochromic

ix) The point at which the reaction between titrant and analyte is stoichiometrically complete is known as _____.
a) equivalence point b)end point c) reference point

x) A _____ electrode is that electrode whose potential is known and remains constant
a) indicator b) reference c) platinum

xi) _____ refers to the process by which a coagulated colloid reverts back to its original colloidal state.
a) Flocculation b) Coagulation c) peptisation

xii) _____ of a solution is equal to the number of equivalents of the substance per litre of the solution.
a) Molarity b) Normality c) Formality

xiii) ---------- cuvettes are used for the analysis in the UV region.
a) Glass b) Quartz c) Fibre

xiv) Saturated organic compounds absorb in ---------- region.
a) vacuum U. V. b) visible c) infra red

xv) --------- converts the transmitted light from the sample into an electric current.
a) Analyte b) Stimulus c) Transducer

xvi) Photometric titrations can be carried out in the concentration range of -----.
a) 10^{-6} to 10^{-2} M b) 10^{-4} to 10^{-1} c) 10^{-5} to 10^{-1}M

xvii) Absorbance is measured by an instrument ----------.
a) potentiometer b) conductometer c) spectrophotometer

xviii) According to Beer-Lambert's law, absorbance of solution increases with ---- of solution.
a) increase in concentration
b) decrease in concentration
c) decrease in path length

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

a) Analytical sample is sample subjected to analysis.
b) A good degree of accuracy accompanied by good precision.
c) In ideal washing of precipitate, it should have no action on the precipitate but dissolve foreign substances only.
d) Primary standard substance may be hygroscopic or efflorescent.
e) The molar absorptivity depends on the refractive index of the absorbing medium.
f) The functional group which impart a colour to the compound is called auxochrome

C. **Match the following**. (Attempt any five) 5

	Column A		Column B
a)	Coulometry	i)	Photomultiplier tube
b)	HPLC	ii)	Red to Yellow
c)	Eriochrome black T, for Zinc	iii)	Diffraction grating
d)	Xylenol orange, for Co	iv)	Electroanalytical Method
e)	Monochromator	v)	Chromatographic method
f)	detector	vi)	Wine red to blue
		vii)	Stimulus
		viii)	Blue to green
		ix)	Thermal method

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

a) What are personal errors? Give an account of operational errors. 5
b) Describe in brief i) Instrumental errors ii) methodic errors 5
c) What are instrumental methods of analysis? 5
d) Explain the following terms 5
a) Proximate analysis b) Trace analysis c) Partial analysis
e) What is the purpose of sampling? Discuss random and systematic sampling with example. 5
f) Write a short note on sampling of heterogeneous liquids. 5

Q.3		**Attempt any four of the following.**	
	a)	Explain effect of any two factors on solubility of precipitate.	5
	b)	Explain conductometric titration of weak acid versus strong base.	5
	c)	Explain the concept of pH and its importance in neutralization titration.	5
	d)	What are the steps involved in precipitation gravimetry? State the types of precipitates.	5
	e)	Explain the acid base titration by potentiometry and the type of curve.	5
	f)	Explain the theory of acid base Indicators.	5
Q.4		**Attempt any four of the following.**	
	a)	State Beer's law. Derive mathematical expression for Beer's law.	5
	b)	Explain; i) Molar absorptivity ii) Wavelength of maximum absorption	5
	c)	What are the advantages of photometric titration?	5
	d)	The absorbance of 1×10^{-5} M was measured by using a cuvette of path length 1.0 cm. If the molar absorptivity of the solution is 3500 dm^3 mol^{-1} cm^{-1}. Calculate i) absorbance and ii) % transmittance of the solution	5
	e)	Explain calibration curve method in context of quantitative analysis.	5
	f)	Explain the photometric titration curve when, i) Reactant is absorber ii) Product is the absorber	5
Q.5		**Attempt any four of the following.**	
	a)	What are compact and particulate solids? Explain any two equipment used for sampling of solids.	5
	b)	A sample of steel was analyzed for its chromium content, Calculate the absolute and relative error in ppt and pph. % of chromium : 16.21 , 16.27 ,and 16.26 If the true chromium content is 16.27%	5
	c)	Explain Common ion effect in precipitation.	5
	d)	What are complexometric titration? Explain suitable example.	5
	e)	With help of diagram explain the principle and working of single beam spectrophotometer.	5
	f)	i) Define, monochromatic and polychromatic light. ii) State and explain Beer-Lambert's law.	5

S171122 63E

5YBSc Physics
17/11/2022

Time: 3 hrs **Max. Marks: 100**

N.B.: (1) All questions are compulsory. (2) Figures to the right indicate full marks. (3) Use of non-programmable calculators is permitted. (4) Symbols have their usual meaning.

Q-1 A) Select the correct option. **(12)**

i. The highest velocity attained by a rocket is called.....
a) Exhaust velocity b) Burn out velocity c) critical velocity d) None of above

ii. An adiabatic process occurs at constant .....
a) Temperature b) pressure c) volume d) heat

iii. Maxwell's thermodynamics relation is....
a) $\frac{dS}{dT_T} = \frac{dP}{dV_T}$ b) $\frac{dT}{dV_S} = -\frac{dP}{dS_V}$ c) $\frac{dT}{dP_S} = -\frac{dV}{dP_V}$ d) $\frac{dT}{dP} = -\frac{dV}{dP_V}$

iv. Four thermodynamics potentials are ....
a) pressure, volume, temperature and internal energy function.
b) pressure, volume, internal energy and Helmholtz function
c) internal energy function, Helmholtz function, enthalpy and Gibbs Function,
d) none of these.

v. Isobaric process occurs at constant .....
a) Temperature b) pressure c) volume d) none of these

vi. In Otto engine fuel is used as....
a) Petrol b) Air c) Oil d) Water

(B) Answer in one sentence. **(3)**

i) State law of conservation of energy.
ii) State the second law of thermodynamics
iii) Define center of mass.

(C) Fill in the blanks. **(5)**

i) A complete conversion of heat into useful work is .....
ii) The process in the porous plug experiment is .....
iii) The third law of thermodynamics in an attainability of .....
iv) Efficiency of Carnot engine is 100 % if the temperature of the sink is.....
v) In diesel engine the heat is absorbed at constant....

Q-2 A) Attempt any one. **(8)**

i. What is Damped harmonic oscillator? Obtain the differential equation of a damped harmonic oscillator.

ii. Set up the equation of motion for rocket- motion and derive an expression for the maximum velocity attained by a rocket.

B) Attempt any one.

i) Show that $\omega_o^2 = \omega_1\omega_2$ **(8)**
ii) Explain the principle of the conservation of angular momentum.

C) Attempt any one. (4)

i) Find an expression for the total energy over one complete cycle of a driven damped oscillator.

ii) Explain conveyor Belt and collision of particle which stick together.

Q-3 **A) Attempt any one.** (8)

i. Describe different parts of an ideal Carnot's engine stages. Explain with a Schematic diagram the working of Carnot's cycle.

ii. Show that the thermodynamic scale and the ideal gas scale are identical.

B) Attempt any one. (8)

i. Give the Kelvin-Plank and Clausius statements of the second law of thermodynamics. Show that although the two statements seem to be different they are in fact equivalent as far as the consequences are concerned.

ii. Explain the concepts of reversible and irreversible process.

C) Attempt any one. (4)

i. A reversible engine works between two temperatures whose difference is 100 °C, if it absorbs 746 Joule of heat from the source and gives 546 Joule to the sink, calculate the temperature of source and sink.

ii. Calculate the rise in internal energy when 5 kg of air is raised by 2 °C at constant volume. (Given: $\gamma = 5/3$, $C_p = 993$ J kg^{-1} K^{-1})

Q-4 **A) Attempt any one.** (8)

i. Derive an expression for an efficiency of Diesel engine in terms of expansion and compression ratio.

ii. Briefly explain the equivalence of laws of statement.

B) Attempt any one. (8)

i. Write uses of liquid Helium.

ii. Compare the diesel engine and Otto engine.

C) Attempt any one. (4)

i. Show that for Vander Walls gas with b= 0, cooling is produced

ii. Find the efficiency of a Diesel engine for which the adiabatic compression ratio is 17 and adiabatic expansion ratio is 5. Take $\gamma = 1.4$

Q-5 **Attempt any four.** (20)

i. State and explain the third law of thermodynamics.

ii. Show that the amplification factor, for low damping, is equal to the Q-factor.

iii. Draw a neat lebelled diagram and explain the working of steam engine.

iv. State and explain the angular momentum for a system of particle.

v. Explain the terms, forced oscillator and resonance with suitable example.

SYBSc Physics
18/11/2022

S181122655E

Time: 3 hours **Max. Marks: 100**

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

Q1. A) Select the correct answer. **(12)**

1. If $\int V.\,dr$ is path independent then vector field is said to be-----
a) Solenoidal b) conservative c) nonconservative d) irrotational
2. The range of θ in cylindrical coordinates is ----
a) $[0, 2\pi]$ b) $[0, \pi]$ c) $[0, \pi/2]$ d) $[-\pi, \pi]$
3. The value of the potential barrier of germanium transistor is ----
a) 1V b) 0.7 V c) 1.2 V d) 0.5 V
4. If voltage feedback is in phase with the input, then it is called as----
a) Negative b) regenerative c) degenerative d) none of above
5. Barkhausen criteria are used to produce-----
a) simple harmonic oscillations b) oscillator
c) continuous undamped oscillations d) damped oscillations
6. In an ideal Op-amp, the input impedance is ----
a) finite b) infinite c) low d) zero

B) Answer in one sentence. **(03)**

1. When is the vector point function said to be solenoidal?
2. What is the value of 1 dB?
3. What is a formula for slew rate?

C) Fill in the blanks. **(05)**

1. The reduction of volume to surface integral is ----- theorem.
2. The self-destruction of an unstabilized transistor is known as----.
3. The knee voltage of the silicon transistor is----
4. Current gain is the ratio of ----
5. The same signal is applied at both inputs of Op-amp, then it is known as

Q.2 A) Attempt any **one.** **(08)**

1. Discuss in detail the surface integral of a vector function.
2. Derive an expression for the conversion of cartesian coordinates into a spherical polar coordinate system.

B) Attempt any **one.** **(08)**

1. S is the surface of the plane $2x + y + 3z = 3$ in the first octant. Evaluate $\iint A.\hat{n}ds$ where $\vec{A} = (x^2 + y^2)\hat{i} - 2x\hat{j} + 2yz\hat{k}$ plane.
2. Test the divergence theorem for a given function $\vec{V} = (xy)\hat{i} + (2yz)\hat{j} + 3(zx)\hat{k}$. Take into consideration the volume of the cube with a side of a length of 2 units and situated at the origin in the first quadrant.

C) Attempt any **one.** **(04)**

1. Use the Divergence theorem to evaluate $\iint (xdydz + ydzdx + zdxdy)$, over

the surface of a sphere radius 'a'.

2. Find the polar coordinates of a point (3,4, -5).

Q3. A) Attempt any **one.** **(08)**

1. Draw a neat diagram of the emitter bias method for transistor amplifier. Find the operating point of the same.
2. Using feedback theory, derive an expression for closed-loop gain of an amplifier.

B) Attempt any **one.** **(08)**

1. With a neat diagram find the operating point of the voltage divider bias method and show how it leads to maximum thermal stability.
2. Derive an expression for phase reversal in CE amplifier with graphical demonstration.

C) Attempt any **one.** **(04)**

1. It is desired to set the operating point at 4V, 1.2 mA by biasing the silicon transistor with collector feedback resistor R_B. If $\beta = 120$, find the value of R_B.
2. If an amplifier, the output power is 1.5 watt at 2 kHz and 0.3 watt at 20 Hz while the input power is constant at 10 mW. Calculate power gain in decibel from 20 Hz is to below 2 kHz.

Q4. A) Attempt any **one.** **(08)**

1. Discuss the essentials and Barkhausen criteria of transistor oscillator.
2. Prove that the gain of inverting amplifier is $(-R_f/R_i)$.

B) Attempt any one **(08)**

1. With a neat diagram, explain the action of the Hartley oscillator.
2. Prove that the output voltage ramp is opposite in polarity equal to 1/RC times input voltage.

C) Attempt any **one** **(04)**

1. In phase-shift oscillator $R_1 = R_2 = R_3 = 1M\Omega$ and $C_1 = C_2 = C_3 = 68$ *pf*. At what frequency does the circuit oscillate?
2. Two voltages of + 0.6 V and -1.4 V are applied to the two input resistors of the summing amplifier. The respective resistors are 400 KΩ and 100 KΩ and the feedback resistor is 200 KΩ. determine the output voltage.

Q5. Attempt any **Four** of the following. **(20)**

i) Discuss the Gauss divergence theorem.

ii) Find the volume of the sphere of radius R in spherical polar coordinates.

iii) What are the inherent variations of transistor parameters and how they arises?

iv) Discuss how negative feedback increases input impedance and decreases output impedance.

v) Describe the working of the oscillatory L – C circuit.

vi) Draw the circuit diagram of the Wien Bridge oscillator. Write the advantages and disadvantages of the same.

*****

SYBSc Phy
19/11/2022

S191122696

Total Marks : 100 Duration : 3 Hours

N.B. 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Draw neat diagrams wherever necessary.
4) Symbols have usual meanings unless otherwise stated.

Q 1 A Select correct **ONE OPTION.** **12**

i) Population inversion in laser means,
a) number of atoms in ground state are more than number of atoms in excited state
b) number of atoms in ground state are less than number of atoms in excited state
c) number of atoms in ground state is equal to number of atoms in excited state
d) number of atoms in neutral state

ii) The number of symmetry elements to a cubic crystal is.....
a) 32 b) 7 c) 23 d) 232

iii) Tetragonal crystal lattice having the symmetry of a, b and c as .....
a) $a = b = c$ b) $a \neq b \neq c$ c) $a = b/2 = c/3$ d) $a = b \neq c$

iv) If atomic weight of the metal is 55.85 having a lattice parameter 0.29 nm and density of 7870 kg/m^3, then the number of atoms per unit cell of a metal.....
a) 1 atoms per unit cell b) 2 atoms per unit cell
c) 3 atoms per unit cell d) 4 atoms per unit cell

v) Bakelite is .....
a) conductor b) semiconductor c) insulator d) superconductor

vi) Better durability is the merit of .....
a) LCD b) LED c) OLED d) panel display

B Answer in **ONE SENTENCE.** **3**

i) What is intensity of spot of a laser beam if it has a power of 30 mW at area $3.6 \times 10^{+7}$ m^2?

ii) What is the axial relationship of α, β *and* γ of triclinic sample in the class of crystal lattice?

iii) Which type of semiconductor is very pure?

C Fill in the **BLANKS.** **5**

i) ..... has applied in interferometry.

ii) ..... means difference between crystal planes at distance d apart from each other.

iii) ..... means mirror symmetry.

iv) High purity ..... is used as the fibre material.

v) Dipoles become randomly oriented in a ..... magnetic materials.

Q 2 A Answer **ANY ONE.** **8**

i) Explain the factors affecting the acoustic quality of building.

ii) What is numerical aperture (NA) of an optical fibre? Derive necessary expression for NA.

B Answer **ANY ONE.** **8**

i) Explain the following processes with the help of a neat labelled diagram.
a) Absorption b) Spontaneous emission c) Stimulated emission

ii) With the help of a neat labelled diagram of optical resonator, explain the basic principle of laser. Also explain the process of amplification.

C Answer **ANY ONE.** **4**

i) The auditorium volume is 545 m^3. The wall area is 250 m^3, the floor area is 150 m^2 and the ceiling area is 120 m^2. The average sound absorption coefficient for the walls is 0.025, for the ceiling is 0.55 and for the floor is 0.08. Calculate the average sound absorption coefficient and reverberation time.

ii) A laser beam of wavelength 6000 A^0 is focused from the earth by means of a mirror of diameter 3 m on the certain objects at a distance of 5 x 10^7 m. Find the areal spread of the spot. If a laser has a power 50 mW, find the intensity of the image formed on the diameter.

Q 3 A Answer **ANY ONE.** **8**

i) Describe the seven systems of crystals with suitable diagrams.

ii) Show that in a crystal of cubic structure, the interplaner spacing between the planes with Miller indices is given by $d = a/\sqrt{h^2 + k^2 + l^2}$ Where 'a' is the lattice constant.

B Answer **ANY ONE.** **8**

i) Show that lattice constants for b.c.c. and f.c.c. crystal structure are $4r/\sqrt{3}$ and $4r/\sqrt{2}$ respectively. Where r is the atomic radius.

ii) Explain what is meant by symmetry of elements in a crystal. Illustrate the various symmetry elements present in the cube.

C Answer **ANY ONE.** **4**

i) Draw (101) and (111) planes in a unit cubic cell. Obtain the Miller indices of directions that are common to both the planes.

ii) Obtain interplaner spacing formula.

Q 4 A Answer **ANY ONE.** **8**

i) Explain the phenomenon of refraction, reflection, absorption and transmission taking place when light is made incident on matter.

ii) What is meant by OLED? Explain the construction and working of typical OLED panel.

B Answer **ANY ONE.** **8**

i) Explain with examples : a) Diamagnetic materials
b) Paramagnetic Materials c) Ferromagnetic materials

ii) Write a note on : i) Piezoelectric materials
ii) Pyroelectric materials ii) Ferroelectric materials

C Answer **ANY ONE.** **4**

i) Sate the advantages and disadvantages of LCD.

ii) Define conductivity and resistivity of a material.

Q 5 Answer **ANY FOUR.** **20**

i) Explain the following properties of a laser.
a) Monochromaticity b) Coherence

ii) Write the advantages of optical fibres in modern communication.

iii) Is there any difference in inversion and reflection symmetry? Explain.

iv) Draw a schematic diagram to show different common planes in simple cubic structure.

v) What is the difference between intrinsic and extrinsic semiconductors?

vi) What is spintronics? Give an example of spintronics based device used in personal and laptop computers.

******* *******