MSc

Sem - I

April 2024-25

Pages - (48)

MSC Sem - 1

Paper / Subject: Code: 94603 / Chemistry: Physical Chemistry (Rev)

[Time: 2:30 Hours] [Marks: 60]

Please check whether you have got the right question paper.

N.B.: 1. All questions are compulsory.
2. Figure to the right indicates full marks.
3. Use of non – programmable scientific calculator is allowed.

**Useful constants**

| | |
|---|---|
| $c = 2.998 \times 10^{8}$ m.s$^{-1}$ | $e = 1.602 \times 10^{-19}$ C |
| $R = 8.314$ J.K$^{-1}$mol$^{-1}$ | $k = 1.3811 \times 10\text{-}23$ J.K$^{-1}$ |
| $= 2.0$ cal.K$^{-1}$ mol$^{-1}$ | |
| $h = 6.626 \times 10^{-34}$ Js | $1J = 6.24 \times 10^{18}$ eV |
| $m_e = 9.110 \times 10^{-31}$ kg | $1eV = 8.06 \times 10^{3}$ cm$^{-1}$ |
| $N_A = 6.022 \times 10^{23}$ mol$^{-1}$ | 1 amu $= 1.66 \times 10^{-27}$ kg |

Atomic mass of H = 1, C = 12, N = 14, O = 16, S = 32, Cl = 35.5

1. A) Attempt ***any two*** of the following:

i) What is inversion temperature? Show that Joule Thomson Effect is isoenthalpic. 4

ii) Derive the expression to show the variation of the entropy with temperature at constant pressure and volume. 4

iii) Write the expression for entropy change in the following phase transitions. 4

a. Melting b. Vapourization
c. Sublimation d. Allotropic transformation

iv) Explain the concept of residual entropy with suitable example. 4

1. B) Attempt ***any one*** of the following:

i) Calculate $\mu_{j.t.}$ for a certain gas at 273 K and 100 bars taking Cp as 35.5 JK$^{-1}$mol$^{-1}$. The van der Waal's constant 'a' and 'b' are 0.139 Nm$^{4}$mol$^{-2}$ and $3.92 \times 10^{-5}$ m$^{3}$ mol$^{-1}$. 4

ii) Calculate the entropy change for conversation of one mole of steam at 373K to one mole of ice at 273K. Cp of water = 75.6 JK$^{-1}$mol$^{-1}$, Molar enthalpy of vaporization = 40.645 KJ$^{-1}$ mol$^{-1}$ and Molar enthalpy of fusion = 6.003 KJ$^{-1}$mol$^{-1}$ 4

2. A) Attempt ***any two*** of the following:

i) What is meant by normalization of wave function? Normalize the following wave Function. $\psi = A \sin n\pi x/L$ in the limit zero to L. 4

ii) What is linear harmonic oscillator? Derive Hermit equation for one dimensional simple harmonic oscillator. 4

iii) What is the condition for orthogonality of wave function? Show that two normalized wave function $\psi_1$ and $\psi_2$ are orthogonal to each other. 4

iv) Starting with equation 4

$$\frac{\partial^2\psi(x,t)}{\partial x^2} = \frac{1}{C^2}\frac{\partial^2\psi(x,t)}{\partial t^2}$$

Setup the time independent Schrodinger equation.



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2. B) Attempt ***any one*** of the following:

i) A hockey ball of mass 0.2 kg moving with a velocity of $3 \times 10^3$ $ms^{-1}$. If the ball can be located within an error equal to 600 nm, calculate the uncertainty in momentum of the ball so compared with the momentum of the ball itself. 4

ii) If $\hat{A} = \frac{d}{dx}$ and $\hat{B} = \frac{d^2}{dx^2}$ and f(x) = sinx. Show that, $\hat{A}$ and $\hat{B}$ are commutative or noncommutative. What does it mean when two operators are said to be non-commutative? 4

3. A) Attempt ***any two*** of the following:

i) Write the reaction mechanism for the decomposition of acetaldehyde and using steady state principle show that 4

$\frac{d}{dx}[CH_4] = k[CH_3CHO]^{3/2}$

ii) Explain the Rice – Ramsperger – Kassel (RRK) theory. 4

iii) Explain the mechanism of decomposition of ozone. 4

iv) In the case of the organic decomposition of ethane, use the steady state equations for the reaction scheme and show that the rate of production of ethylene is given by $\frac{d}{dx}[C_2H_4] = k[C_2H_6]$ 4

3. B) Attempt ***any one*** of the following:

i) The following process follows the first order kinetics

$$L \xrightarrow{14d} M \xrightarrow{21d} N$$ 4

where **14d** and **21d** are the half life time of the reaction in days from L to M and M to N respectively. At what stage of time will the concentration of M become maximum?

ii) The rate of formation of C in the reaction, $2A + B \rightarrow C$ is 0.25 mol $L^{-1}$ $s^{-1}$. State the reaction rate and the rates of consumption of A and B. 4

4. A) Attempt ***any two*** of the following:

i) What is meant by strong electrolyte? Explain electrophoretic effect for conductance of strong electrolytes. 4

ii) Explain in detail the Debye-Falkenhagen effect for the conductance of strong electrolytes. 4

iii) With the help of well labelled diagram explain construction and working of solid oxide fuel cell. 4

iv) Write a note on the electrochemical enzyme – catalysed oxidation of Styrene. 4

(3)

4. B) Attempt ***any one*** of the following:

i) Calculate the mean ionic activity coefficient of $AlCl_3$ in aqueous solution containing 0.02m $AlCl_3$ and 0.04m KCl at 298K. (Given: A = 0.509 at 298 K) 4

ii) Calculate the resting membrane potential for the following: 4

| Ion Species | Intracellular concentration in mM | Extracellular concentration in mM |
|---|---|---|
| $K^+$ | 0.0002 | 5 |
| $Na^+$ | 250 | 10 |

(Given that $\frac{2.303RT}{F}$ at 298K = 61)

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

a) Derive the following Maxwell's relation, $\left[\frac{\partial T}{\partial V}\right]_S = -\left[\frac{\partial P}{\partial S}\right]_v$ 3

b) Standard molar entropies depend upon structure of the substance. Give reason. 3

c) What is Hermitian operators? 3

d) Write a note on magnetic quantum number. 3

e) Explain three explosion limits of $H_2$ and $O_2$ reaction. 3

f) Explain the principle of microscopic reversibility. 3

g) What is fuel cell? Write any two applications of phosphoric acid fuel cell. 3

h) Write Debye-Huckel-Onsager equation and explain its validity for aqueous solutions. 3

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MSC-Chemistry Sem-I

TIME: 2 ½ HOURS

MAX.MARKS:60

N.B. 1) All questions are compulsory.
2) Figures to the right indicate full marks.
3) Use of logarithmic table/non programmable calculator is allowed.
4) At. Wts: At. Wts: H=1, C=12, N=14, O=16, Na=23, Al=27, S=32, Cl=35.5, K=39, Ca=40, Ag=108, Ba=137, Pb=207, Mg=24.3, F=19, Cu=63.5, Cr=52, Sn=118.7

Q.1 A) Attempt **Any two** of the following:

a) Define the following terms with respect to performance characteristics of an analytical instrument, **4**
1. Dynamic range 2. Selectivity 3. Sensitivity 4. Precision

b) What are advantages of implementing ISO 9000 series. **4**

c) Define "biosensor" with respect to analytical device. Give classification of transducer. **4**

d) Explain the "piezoelectric effect" that forms the basis of quartz crystal microbalance (QCM) sensor with diagram. **4**

B) Attempt **any one** of the following:

a) Define: Data domain. What is electrical domain and non-electrical domain? **4**

b) Discuss quality audits and quality reviews. **4**

Q.2 A. Attempt **any two** of the following:

a) (i) Assign oxidation number to each element in $Cr(OH)_4^-$ **4**
(ii) Solid BaSO4 is dissolved in water at 25°C. Its solubility is $2.45 \times 10^{-3}$ g /dm$^3$. Calculate the solubility product (Ksp) of the compound.

b) Calculate the volume of HCl (density 1.19 gm / cm$^3$, 42% HCl by weight) required to prepare 10 dm$^3$ of 0.2N HCl. **4**

c) Determine the mole fraction of both the substances, when 45 g of acetone is mixed with 55 g of methanol. **4**

d) 16.98 g of $AgNO_3$ is treated with 6.5 g of NaCl, producing AgCl. Calculate the amount of AgCl produced, in grams. Which is the limiting reagent? **4**

B. Attempt **any one** of the following:

a) A buffer solution was prepared by mixing 0.05 mole acetic acid with 0.06 mole sodium acetate in distilled water to make 1 dm$^3$ solution. Calculate the pH of the solution. Given $K_a$ for acetic acid is $1.75 \times 10^{-5}$. **4**

b) Calculate the amount of $KNO_3$ required, in grams , to prepare 250 cm$^3$ of a 100 ppm solution of $KNO_3$. Find the concentration of the solution in terms of ppm of $K^+$. **4**

Q.3 A. Attempt **any two** of the following:

a) With the help of schematic diagram, discuss the instrumentation of the dispersive IR spectrophotometer. **4**

b) Derive Beer Lambert's law and state its limitations. **4**

c) Explain:
i. Optical arrangement of a dual wavelength spectrophotometer. 4
ii. Photo conducting transducers used in IR spectrometer.

d) Discuss the fiber optics used in optical instruments. 4

B Attempt **any One** of the following

a) Simultaneous determination of two elements P and Q spectrophotometrically at two different wavelengths gave the following results: 4
[Given: b= 1cm]

| Elements | Concentration (mol $dm^{-3}$) | Absorbance | |
|---|---|---|---|
| | | 447nm | 650nm |
| P | **$2.8 \times 10^{-3}$** | **0.645** | **0.180** |
| Q | **$7.2 \times 10^{-3}$** | **0.128** | **0.874** |
| P + Q | ------- | **0.427** | **0.412** |

Calculate the molar concentration of P and Q.

b) Discuss the different techniques for preparation of solid samples for IR absorption measurements. 4

Q.4 A. Attempt **any two** of the following:

a) What is Differential scanning calorimetry (DSC)? Discuss the principle of heat-flux DSC. 4

b) What is a DSC curve? With a suitable example, discuss the nature of DSC curve. 4

c) Discuss the application of DSC in the study of specific heat, liquid crystals and percentage crystallinity. 4

d) Describe the role of multi-layered films in automated analysis. 4

B. Attempt any one of the following:

a) What is an automatic titrator? What are the benefits of using automatic titrator? 4

b) Discuss the principle of flow injection analysis. 4

Q.5 Attempt **any four** of the following: 12

a) Discuss quantitative method of analysis with respect to standard addition method.

b) Define: 1. Technique 2. Method 3. Procedure

c) 2.94 g of $K_2Cr_2O_7$ is dissolved in acidic medium to prepare 100 cm3 solution. Calculate the normality of the solution. Express the concentration in terms of molarity.

d) Calculate the pH of a 0.1 M $NH_4OH$ solution. Given $K_b = 1 \times 10^{-5}$.

e) What is diffuse reflectance spectroscopy? Explain the diffuse reflectance spectrum.

f) What are the major advantages of an FTIR spectrometer compared with a dispersive instrument?

g) Describe what quantity is measured and how the measurement is performed for each of the following techniques: TGA, DTA and DSC.

h) Draw a block diagram of power compensated DSC. Discuss how the DSC experiment is carried out.

MSc - sem I = IT

(2½ Hours) [Total Marks: 75]

N. B.:(1) All questions are compulsory.
(2) Make suitable assumptions wherever necessary and state the assumptions made.
(3) Answers to the same question must be written together.
(4) Numbers to the right indicate marks.
(5) Draw neat labelled diagrams wherever necessary.
(6) Use of Non-programmable calculators is allowed.

**Q1. Attempt three of the following.** 15 Marks

a. Write a short note on soft computing.
b. What are the premises and guiding principle of soft computing techniques?
c. What is artificial neural network? Explain its components and learning methods.
d. Explain the working of Adaptive Resonance Theory.
e. Explain probabilistic reasoning.

**Q2. Attempt three of the following** 15 marks

a. Mention the characteristics of an artificial neural network.
b. Compare the similarities and differences between biological and artificial neuron.
c. Write a short note on McCulloch Pitts Neuron model.
d. What are the two main types of associative memory?
e. What are Back Propagation networks?

**Q3. Attempt three of the following.** 15 marks

a. Write a short note on Fixed Weight Competitive Nets.
b. Explain the Architecture of Hamming Network.
c. Write a short note on Kohonen Self-Organizing Feature Maps.
d. What are the Limitations of CNN Model?
e. Write a short note on Deep Learning Neural networks.

**Q4. Attempt three of the following.** 15 marks

a. Enlist and explain any three fuzzy sets operations.
b. Describe fuzzy logic in detail.
c. Compare classical relations and fuzzy relations
d. What is membership function? Enlist and explain its features.
e. Explain any three methods of membership value assignments in detail.

**Q5. Attempt three of the following.** 15 marks

a. State Charles Darwin's theory of evulsions
b. What is meant by genetic algorithm?
c. Compare and contrast traditional algorithm and genetic algorithm.
d. List the various cypes of hybrid systems.
e. Explain in detail about the various operators involved in genetic algorithm.

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M.Sc. computer science NEP-2020 Sem 1

Time :2 Hours [Total Marks: 50]

N.B: (1) All questions are compulsory.
(2) Figures to the **right** indicate full marks.
(3) **Assume additional data if necessary** but state the same clearly.
(4) Symbols have their usual meanings and tables have their usual standard design unless stated otherwise.

**Q.1** Attempt **any two** of the following **(10)**
**a)** Define Research. State and explain the characteristics of research.
**b)** Discus the key components of a Literature Review.
**c)** Write a short note on Grounded Theory Research.
**d)** Differentiate between Experimental and Non-Experimental Research.

**Q.2** Attempt **any two** of the following **(10)**
**a)** Explain the following:
i) Research variables
ii) Hypotheses
**b)** Write a short note on Ethnography.
**c)** What is Secondary Data Analysis? Explain in brief.
**d)** Discuss in brief the Data Collection Development Plan.

**Q.3** Attempt **any two** of the following **(10)**
**a)** What is Data Analysis? Explain the importance of Data Analysis in Research.
**b)** Write a short note on Exploratory Data Analysis (EDA).
**c)** Explain how to interpret research findings.
**d)** Discuss the steps involved in Data Analysis.

**Q.4** Attempt **any two** of the following **(10)**
**a)** Write a short note on ethics in research and responsible conduct.
**b)** Explain how Slide Design can help in preparing effective research presentations.
**c)** Explain the different types of Peer Review.
**d)** State and explain the various citation styles.

**Q.5** Attempt **any two** of the following **(10)**
**a)** State the guidelines for formulating Research Questions.
**b)** Differentiate between Primary and Secondary data for research.
**c)** Discuss the key challenges in Data Analysis.
**d)** Write a short note the structure of a research paper

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MSc = Sem I = chemistry (NEP 2020)

**TIME: 2 HOURS** **MAX. MARKS: 50**

**NB:**

1) **All questions are compulsory.**
2) **Figures to the right indicate full marks.**
3) **Use of logarithmic table/non-programmable calculator is allowed.**
4) **At. Wts: H=1, C=12,N=14,O=16,Na=23,Al=27,S=32, Cl=35.5, K=39, Ca=40,Ag=108 , Ba=137, Pb=207,Mg= 24.3,F=19,Cu= 63.5, Cr = 52, Sn=118.7 Fe = 55.8**

Q.1 Answer **any two** of the following: 10

A. Discuss performance characteristics of analytical method.

B. Write note on basic safety in laboratory.

C. Give classification of Analytical methods.

D. What is the principle of NABL accreditation?

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

A. A buffer solution was prepared by mixing 0.05 mole acetic acid with 0.06 mole sodium acetate in distilled water to make 1 $dm^3$ solution. Calculate the pH of the solution. [Given Ka for acetic acid is $1.8 \times 10^{-5}$].

B. Calculate the volume of HCl (density 1.19 gm / $cm^3$, 38% HCl by weight) required to prepare 18 $dm^3$ of 0.02 N HCl.

C. 161 g of ethanol and 145 g of acetone are mixed together. Find the mole fraction of each compound in the mixture.

D. 100 g of $Na_2CO_3$ reacts with 100 g of HCl. Calculate the amount of NaCl formed, in moles and in grams. Which is the limiting reagent.

Q.3 Answer **any two** of the following: 10

A. Draw a labelled schematic diagram of Michelson's interferometer. Explain its working in FTIR

B. Name the Infra-red (IR) sources and describe any two in detail.

C. In what way the Fourier Transform (FT) instruments differ from the optical instruments?

D. With the help of block diagram describe the dual wavelength spectrophotometer. What type of samples can be analysed by it?



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

A. Explain the principle of Differential Scanning Calorimetry (DSC) and discuss any one of its application. 10

B. Differentiate between power-compensated and heat-flux DSC instruments.

C. Discuss the factors affecting DSC Curves.

D. Describe the role of multilayered films in automated analysis.

Q.5 Answer **any five** of the following:

A. What are determinate errors? Enlist two determinate types of error. 10

B. What is the meaning of government standards like HALLMARK and AGMARK?

C. Assign oxidation number to each element in $Cr(OH)_4^-$ .

D. Solid $BaSO_4$ is dissolved in water at 25 °C. Its solubility is $1.04 \times 10^{-5}$ $mol/dm^3$. Calculate the solubility product ( Ksp ) of the compound.

E. Explain the effect of temperature on the $\lambda_{max}$ values in the UV-visible spectra.

F. What are the photoconducting transducers in FTIR?

G. Describe the quantity measured for each of the following techniques.

a) TGA b) DTA

H. Discuss the advantages of automated analyses.

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msc - chem - NEP2020 - sem I

Time: 2 Hours Marks-: 50

N.B. -1) All questions are compulsory.

2) Figures to the eight indicate full marks.

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Q.1) Answer the following (Any Two) (10)

1) What are three types of sources? Explain each with suitable example.

2) What is a search engine? Discuss any four types of search engine.

3) Write a short note on- Citation index and impact factor of journal.

4) What are the internet and the world wide concept?

Q. 2) Answer the following (Any Two) (10)

1) Define- Accuracy, Precision, Mean, Mode, and Median.

2) What is a scientific method? Give different steps involved in scientific method?

3) Write a short note on- Curve fitting.

4) What is ANOVA? Give its basic principle? Why is ANOVA method used? Give various types of ANOVA.

Q.3) Answer the following (Any Two) (10)

1) Give different types of scientific writing.

2) Discuss outline for writing of scientific papers?

3) Define plagiarism. How can be plagiarism avoided?

4) What is a research? Give various steps involved in scientific research?



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Q.4) Answer the following (Any Two) (10)

1) What are the safe working procedure and protective environment in laboratory?

2) What is chemical waste? Write a short note on- Recycling of laboratory chemicals

3) Discuss the methods for laboratory disposal of explosive?

4) What is a chemical hazard? Explain different types of chemical hazards?

Q.5 Answer the following (Any Five) (10)

1) Define H-index. If a researcher has published 66 articles and out of these 23 articles having minimum 23 citations then what is the H-index of the author?

2) How do you cite publication information?

3) Differentiate between correlation and Regression.

4) What is SI system? Give SI unit of mass?

5) Why publishing research article is important?

6) Write a short note on- Scientific poster.

7) What are the examples of protective clothing?

8) Mention the full form and three types of first aid.

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MSc = organic chemistry = semI NEP 2020

**Time: 2 Hours** **Marks: 50**

1. Attempt **ANY TWO** of the following.

   i) On the basis of molecular orbital theory explain the structure and bonding in diborane molecule. 5

   ii) On the basis of hybridization explain the structure and bonding of iodine heptafluoride & sulphur tetrafluoride. 5

   iii) Derive the wave functions for $sp^2$ hybrid orbitals considering sigma bonding only. 5

   iv) Explain the concept of resonance. Draw the resonating structures for carbonate ion. 5

2. Attempt **ANY TWO** from the following.

   i) Derive the matrix representation for translation operation. 5

   ii) Show that $C_{2v}$ point group is an Abelian group. 5

   iii) Define subgroup. Give its characteristics 5

   iv) What are Mullikens notations for irreducible representations? 5

3. Attempt **ANY TWO** of the following.

   i) What is Band Theory? Explain the property of solids as semiconductors and insulators on the basis of Band theory. 5

   ii) Explain the structural features of Rutile ($TiO_2$) compound. 5

   iii) Discuss with suitable example, the role of rare earth ions in solid state laser materials. 5

   iv) Write a note on,' Biological method for preparation of nanomaterials' 5



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4. Attempt **ANY TWO** of the following.

i) Explain how absorption spectra and pH method help in detection of complex formation. 5

ii) Derive the expression for stepwise formation constant in complexes. 5

iii) Draw Orgel diagram for $d^4$ metal ion in octahedral complex. Assign the electronic transitions. 5

iv) Explain the significance of Tanabe-Sugano diagrams in interelectronic repulsions. 5

5. Attempt **ANY FIVE** of the following 10

i) Calculate the formal charge of sulphur in the sulphate ion.

ii) What is hydrogen bonding. Give two examples of molecules which shows hydrogen bonding.

iii) Define group and symmetry elements with examples.

iv) Construct character table for $C_2h$ point group with suitable example.

v) State the principle underlying the preparation of nanomaterial by ceramic method.

vi) Explain in brief the terms: 1. Fermi Energy 2. First Brillouin zone

vii) Give electronic transitions for $d^1$ and $d^3$ configurations on the basis of Orgel diagram.

viii) State any four methods of detection of complex formation.

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msc – CS – NEP2020 – sem I

Time: 02 Hours [Total Marks: 50]

N.B: (1) All questions are compulsory.
(2) Figures to the **right** indicate full marks.
(3) **Assume additional data if necessary** but state the same clearly.
(4) Symbols have their usual meanings and tables have their usual standard design unless stated otherwise.
(5) **Draw suitable illustrations** wherever necessary.

Q.1 Attempt **any two** of the following **(10)**

a) Explain the concept of periodic signals. Provide examples of periodic signals and discuss their significance in digital signal processing. **05**

b) What is the difference between white noise, Brownian noise, pink noise, and Gaussian noise? What effect does noise have on signal and image processing? **05**

c) Define autocorrelation and explain its significance in signal and image processing **05**

d) Discuss the process of representing an image as a signal. How does sampling and the Fourier Transform contribute to this representation? **05**

Q.2 Attempt **any two** of the following **(10)**

a) Define image processing and discuss its various applications in real-world scenarios. How does image processing enhance the quality and usability of images? **05**

b) Discuss intensity transformations in image processing. Explain the concepts of log transform, power-law transform, and contrast stretching with suitable examples. **05**

c) Describe the techniques used for linear and non-linear smoothing of images. How do these techniques differ in their approach to reducing noise and preserving image details? **05**

d) Define image derivatives and gradients. Explain the Laplacian operator and its role in edge detection. **05**

Q.3 Attempt **any two** of the following **(10)**

a) Discuss the process of skeletonizing in morphological image processing. How does this technique reduce an image to its essential structure? **05**

b) Discuss the LoG (Laplacian of Gaussian) and DoG (Difference of Gaussian) filters. How are these filters used in edge detection, and what are their respective strengths and weaknesses? **05**

c) What are image pyramids, and why are they used in image processing? Explain the concepts of Gaussian Pyramid and Laplacian Pyramid. **05**

d) Define morphological image processing. Describe the operations of erosion and dilation and their effects on binary images. **05**



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

a) Describe the Harris Corner Detector. How does it detect corners in an image, and what makes it robust for corner detection?

b) What is the Histogram of Oriented Gradients (HOG) method? Describe its application in feature extraction and object detection.

c) Describe Haar-like features. How are these features used in object detection, particularly in the context of face recognition?

d) Compare and contrast edge-based and region-based segmentation techniques.

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

a) Compare and contrast the techniques of smoothing using lowpass filters and sharpening using high-pass filters. How does the Fast Fourier Transform (FFT) facilitate these operations?

b) What is thresholding in image processing? Describe its importance and provide examples of how thresholding is used to segment images.

c) What is the purpose of opening and closing operations in morphological image processing? Explain with suitable example.

d) Explain the concept of Scale-Invariant Feature Transform (SIFT). How does SIFT achieve scale and rotation invariance in feature detection?

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MSC – CS – NEP 2020 Sem. 1

Time :2 ½ Hours [Total Marks: 50]

N.B: (1) All questions are compulsory.
(2) Figures to the **right** indicate full marks.
(3) **Assume additional data if necessary** but state the same clearly.
(4) Symbols have their usual meanings and tables have their usual standard design unless stated otherwise.

| | | |
|---|---|---|
| Q.1 | Attempt **any two** of the following | (10) |
| a) | State and Explain the any five differences between LAN and MAN. | 05 |
| b) | Write a short note on TCP/IP model. | 05 |
| c) | Discuss the Implementation of IPv4 along with their components. | 05 |
| d) | Explain reverse encapsulation (de-encapsulation) process. | 05 |
| Q.2 | Attempt **any two** of the following | (10) |
| a) | What are different elements of Modern Technology? Explain any One in detail. | 05 |
| b) | Discuss Openflow in detail with example. | 05 |
| c) | State and Explain any five disadvantages of Software Defined Networking. | 05 |
| d) | Explain key elements in unified communication. | 05 |
| Q.3 | Attempt **any two** of the following | (10) |
| a) | Write a short note on NFV along with domain component. | 05 |
| b) | Explain the advantages of SDN Virtualization. | 05 |
| c) | Write a short note on Fog Compting. | 05 |
| d) | Write a short note on Virtualization Quality of Services. | 05 |
| Q.4 | Attempt **any two** of the following | (10) |
| a) | Write a short note on Route Redistribution. | 05 |
| b) | Write a short note on Natting. | 05 |
| c) | How does hello message help in OSPF? | 05 |
| d) | Explain Policy based routing in detail. | 05 |
| Q.5 | Attempt **any two** of the following | (10) |
| a) | Explain any one routing protocol in detail. | 05 |
| b) | Write a short note on SDN Data Plane. | 05 |
| c) | How Virtualization plays important role in Software Defined Networking? | 05 |
| d) | Write a short note on Access control List(ACL). | 05 |

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MSc - Sem I Computer Science (NEP 2020)

(Time :1 Hours) [Total Marks: 25].

N.B: (1) **All questions are compulsory.**
(2) Figures to the **right** indicate full marks.
(3) **Assume additional data if necessary** but state the same clearly.
(4) Symbols have their usual meanings and tables have their usual standard design unless stated otherwise.

**Q.1** Attempt **any two** of the following **(10)**

a) Define regular expression. Generate regular expression for the following statement. **05**
- (0+1) * 0
- (b* (aaa)* b*) *

b) List out drawbacks of top- down parser. Eliminate left recursion from the following production set. **05**

S → P

P → Pd / Pe / aQ / ac

Q → bQc / f

c) Write a note on syntax analyzer generator YACC. **05**

d) Consider the grammar **05**

E –> 2E2
E –> 3E3
E –> 4

Perform Shift Reduce parsing for input string "32423"

**Q.2** Attempt **any two** of the following **(10)**

a) What is Loop Optimization in Compiler Design? Perform induction variable elimination for the following three address code. **05**

i:= i+1
x:= 3*i
y:= a[x]
if y< 15, goto B2

b) What is activation record? Explain the activation record. **05**

c) Explain machine dependent and machine independent optimization techniques. **05**

d) Discuss debugging and testing process used in compilation. **05**

**Q.3** Attempt **any one** of the following **(05)**

a) State the general form of Postfix and infix notation. convert the following infix expression to postfix form **05**

(A-B)*(C/D)$F
A+B/C$E+F*G

b) Explain the phases of compiler. **05**

**********

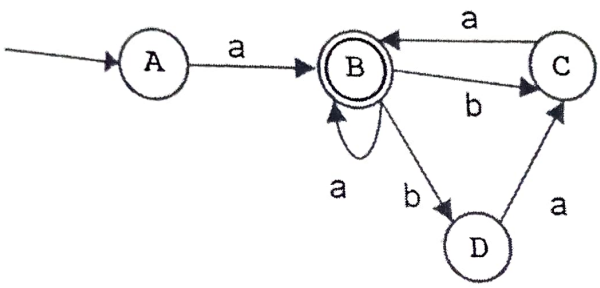
M.Sc (C.S) Nf P 2020

(Time :1 Hours) [Total Marks: 25].

N.B: (1) All questions are compulsory.
(2) Figures to the **right** indicate full marks.
(3) **Assume additional data if necessary** but state the same clearly.
(4) Symbols have their usual meanings and tables have their usual standard design unless stated otherwise.

**Q.1** Attempt **any two** of the following **(10)**

**a)** Write algorithm for conversion of NDFA to DFA and convert the following NDFA to DFA **05**




**b)** Compare between top-down and bottom-up parsing. Consider a simple grammar given it recognizes strings containing number of *a*'s followed by at least one *b* **05**

$S \rightarrow AC$
$A \rightarrow aA \mid \varepsilon$
$C \rightarrow b \mid bC$

Generate the top-down derivation for the string *aaab*.

**c)** Compute FIRST and FOLLOW for the following production **05**

E->TE
E'->+TE'
E->λ
T->FT'
T-> *FT'
T' -> λ
F-> (E)
F-> id **05**

**d)** $A \rightarrow C$
$A \rightarrow (A * C)$
$C \rightarrow 0$
1) Is G LL (1) justify?
2) Prepare Predictive Parsing table for G.
3) Parse the string (0 * 0)

Q.2 Attempt **any two** of the following (10)

a) Apply Loop Optimization Technique on the given Three Address Code 05

1) a=10

2) B=1

3) C=7*b

4) D= A-4

5) E= D *5

6) B= B*2

7) if B <=10 go to 3

8) go to 8

b) Translate the following expression into Quadruples, Triples, Three-address code. 05

1) (a+b)*(c+d)+(a+b+c)

2) A+(b*c)/(-b*-c+d)

c) Discuss loop unrolling and loop jamming with suitable example. 05

d) What is DAG? Draw the DAG for the following expression. 05

(a + a * (b - c)) + ((b - c) * d)

Q.3 Attempt **any one** of the following (05)

a) Draw a block diagram of compiler and explain front phases of complier. 05

b) Explain various notations used in regular expression. Draw the following regular expressions. 05

1. (a * b ) + a * b * b

2. b * a + a * + a b b b *

**********

MSc = Sem I CS (NEP 2020)

(Time : 1 Hours) [Total Marks: 25].

**N.B:** (1) **All questions are compulsory.**
(2) Figures to the **right** indicate full marks.
(3) **Assume additional data if necessary** but state the same clearly.
(4) Symbols have their usual meanings and tables have their usual standard design unless stated otherwise.

**Q.1** Attempt **any two** of the following **(10)**

**a)** Define regular expression. Generate regular expression for the following statement. **05**

- (0+1) * 0
- (b* (aaa)* b*) *

**b)** List out drawbacks of top- down parser. Eliminate left recursion from the following production set. **05**

S → P

P → Pd / Pe / aQ / ac

Q → bQc / f

**c)** Write a note on syntax analyzer generator YACC. **05**

**d)** Consider the grammar **05**

E –> 2E2
E –> 3E3
E –> 4

Perform Shift Reduce parsing for input string "32423"

**Q.2** Attempt **any two** of the following **(10)**

**a)** What is Loop Optimization in Compiler Design? Perform induction variable elimination for the following three address code. **05**

i:= i+1
x:= 3*i
y:= a[x]
if y< 15, goto B2

**b)** What is activation record? Explain the activation record. **05**

**c)** Explain machine dependent and machine independent optimization techniques. **05**

**d)** Discuss debugging and testing process used in compilation. **05**

**Q.3** Attempt **any one** of the following **(05)**

**a)** State the general form of Postfix and infix notation. convert the following infix expression to postfix form **05**

(A-B)*(C/D)$F
A+B/C$E+F*G

**b)** Explain the phases of compiler.

**********

MSC - Zoology - Sem I

**Duration:** 2.5 h

**Maximum Marks:** 60

**Instructions-**

1. **All questions are compulsory.**
2. **All questions carry equal marks.**
3. **Draw neat and labeled diagram wherever necessary.**

Q. 1 Answer **any three** questions from the following.

a) Buccal cavity of Prawn. 4
b) Digestive glands of starfish. 4
c) Parapodia in clamworm. 4
d) Pericardium in Pila. 4
e) Compound eyes of Prawn. 4
f) Female gonads in starfish. 4
g) Graptolite fossils. 4
h) Affinities of Annelida with Hemichordata 4

Q. 2 Answer **any two** questions from the following.

a) Explain the general organization of digestive systems of Annelids. 6
b) Describe the denticles in Clamworm. 6
c) Describe the Glomerulus or Proboscis gland digestive systems of Balanoglossus. 6

Q. 3 Answer **any two** questions from the following.

a) Describe the dermal papulae and tube feet of Starfish. 6
b) Explain the dorsal and ventral blood vessel of Clamworm. 6
c) Describe the Heart and Blood lacunae of Prawn. 6

Q. 4 Answer **any two** questions from the following.

a) Describe the cerebral ganglia,and buccal ganglia of Pila. 6
b) Explain the Gonads - testes and ovaries of Clam worm: 6
c) Describe the Saccular gonads of Balanoglossus: 6

Q. 5. Answer **any two** questions from the following.

a) Describe the trilobites found in Kashmir. 6
b) Explain the fossils of Annelids: Serpula. 6
c) Describe the affinities of Echinodermata with Hemichordata 6

**********



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msc - chem - sem I

[Time: 2 ½ Hours] [Total Marks: 60]

Please check whether you have got the right question paper

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

Q.1 Attempt any **two** of the following:

(A)

(a) What are the kinetic and thermodynamic control of organic reactions? Give suitable examples. 4

(b) Explain the use of the following techniques in determining the mechanism of a reaction: 4
I) Detection and trapping of intermediate.
II) Stereo-chemical evidence.

(c) Discuss primary and secondary kinetic isotope effects using suitable examples. 4

(d) What is specific acid and base catalysis? Illustrate specific base catalysis with a suitable example. 4

(B) Attempt any **one** of the following:

(a) Discuss the Hammond postulates. 4

(b) Arrange the following in increasing order of basicity and justify your answer: Phenol, o-nitrophenol, m-nitrophenol, p-nitrophenol. 4

Q.2 Attempt any **two** of the following:

(A)

(a) Give the $AAL^1$ mechanism for ester hydrolysis with suitable example. 4

(b) Explain the following term with a suitable example. 4
i) Tele Substitution
ii) Ambident nucleophiles

(c) Draw Frost-Musulin diagram for cyclobutadiene and cyclopentadienyl anion. Show distribution of electron in MO's and comment on its aromaticity. 4

(d) Explain the followings 4
i) Comparative reactivity of 1-Bromopropene and 3-Bromopropene to $SN^1$ reaction.
ii) Comparative nucleophilicity of methoxide and t-butoxide ion.

(B) Attempt any **one** of the following:

(a) Explain the mechanism of nucleophilic substitution on 4-Nitrochlorobenzene 4

(b) Write a short note on 4
i) Homoaromatic compound
ii) Antiaromatic compound

Q.3 Attempt any **two** of the following:

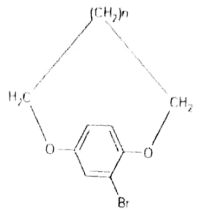
(A)

(a) Explain the chirality of spiranes. Write the structure of pair of enantiomeric spiranes with their configurational descriptors. 4

(b) Explain the stereochemistry of tri and tetra coordinated sulphur compounds. 4

(c) Define pseudoasymmetric centre. Draw structure of two isomeric structures containing pseudoasymmetric centre. Assign configurational descriptors to them. 4

(d) Using substitution addition criterion, identify relationship between $H_A$ and $H_B$ Write stereochemical descriptor to $H_A$ and $H_B$ 4




(B) Attempt any **one** of the following:

(a) Explain the following with suitable example

1) Simple Axis of Symmetry 4

2) Plane of Symmetry

(b) Explain the following with suitable example

1) *Syn and Anti* System. 4

2) Erythro and Threo System

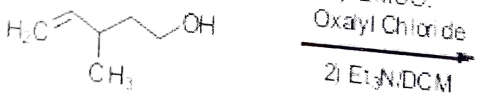
Q.4A) Attempt any **two** of the following:

(a) What is Oppenauer oxidation? Give its Mechanism 4

(b) Explain the mechanism of Wolff Kishner reduction with suitable example. 4

(c) Predict the products in the following reactions: 4

i)

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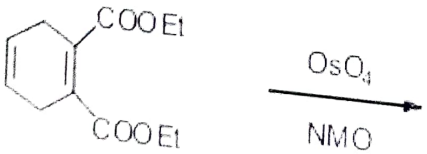


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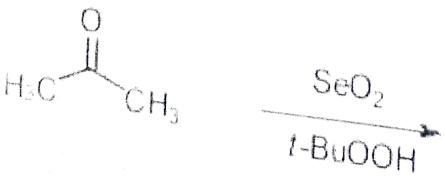

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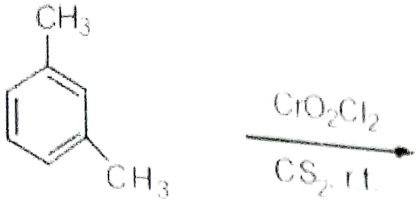



(d) What are L and K selectrides? Give two applications of each. 4

(B) Attempt any **one** of the following:

(a) What is Etard oxidation? Give example with mechanism. 4

(b) Explain Na-liquid $NH_3$ mediated reduction of aromatic compounds and alkynes. 4

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

(A) Explain Curtin-Hammett Principle. 3

(B) Discuss the following factors affecting acidity: 3
I) Electronegativity
II) Resonance
III) Hybridization.

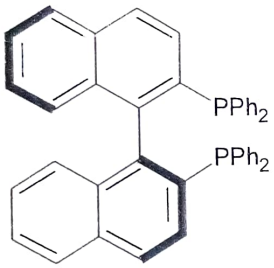
(C) Explain the aromaticity of Pyrrole. 3

(D) Explain the $SN^{2'}$ mechanism with a suitable example 3

(E) Explain the optical activity of Cyclophanes. 3

(F) Write the configurational descriptor to the following molecules 3

i)

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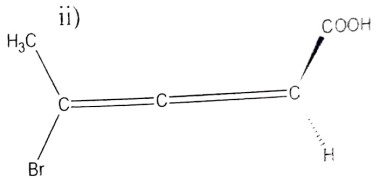


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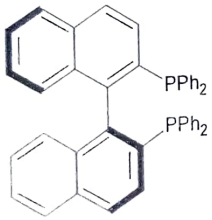
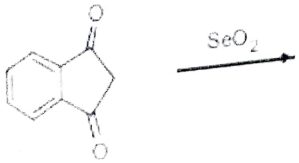



(G) Complete the following reactions. 3

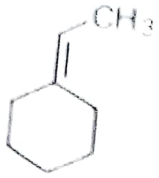
i)





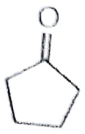

X51Y142524X51Y142524X51Y142524X51Y142524

ii)




$CrO_3$ →

iii)




*m*CPBA OR
Peroxy acids →

(H) What is Collin's reagent? Give one application.

M.Sc Organic Chemistry I - NEP 2020

[Time: 2 hours ] [Total Marks: 50]

**Please check whether you have the right question paper.**

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

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**Q.1) Answer any two of the following:**

a How do the following techniques help in determining the mechanism of the reaction? 5
i)Product analysis
ii) Trapping of intermediates

b What is general and specific catalysis? Explain its mechanism with suitable examples. 5

c Compare the basicity of pyridine, pyrrole, and piperidine. 5

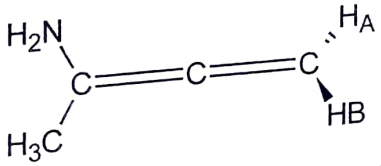
d Give examples and explain the following: 5
i) Primary kinetic isotopic effect
ii) Secondary kinetic isotopic effect

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

a Draw four stereoisomers of 2,3,4-trihydroxy glutaric acid. Label pseudoasymmetric centre present in the stereoisomers and assign configurational descriptors to the pseudoasymmetric centre. 5

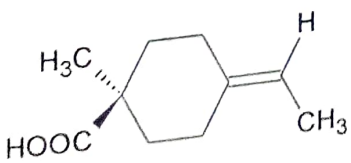
b Explain the stereochemistry of tri coordinated 'C' species namely carbocation, carbanion, carbon free radical 5

c i)State and explain prochiral center with suitable example. 2
ii)Write stereochemical descriptor to $H_A$ and $H_B$. 3

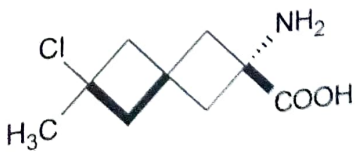



d i)Write the structure of pair of enantiomeric biphenyl with their configurational descriptors. 2
ii)Write the configurational descriptor to the following molecules 3

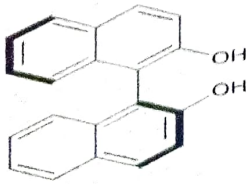
1)




2)




3)



Q.3) **Answer any two of the following:**

a Why inversion of configuration is much more during solvolysis of (I) than (II)? Explain with mechanism. 5

$C_6H_{13}CH(CH_3)Cl$ (I) $C_6H_5CH(CH_3)Cl$ (II)

b Explain aromatic nucleophilic substitution reaction in pyridine with suitable mechanism. 5

c Explain acid catalyzed hydrolysis of ester using $A_{AC}^2$ mechanism. 5

d Explain aromaticity of the following: 5

i) Thiophene (ii) Pyridine

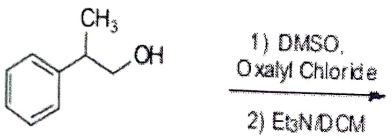
Q.4) **Answer any two of the following:**

a What is Corey-Kim oxidation? Give example with mechanism 5

b Write note on Wolf Kishner Reduction. 5

c Predict the product in the following reactions: 5

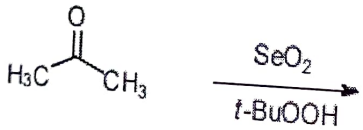
i)



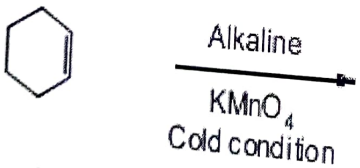

ii)



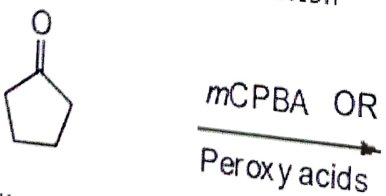

iii)




iv)




v)




d Illustrate use of the DIBAL-H and K-selectrids in organic synthesis, with two example each. 5

Q.5) Answer **any FIVE** of the following:

a State the principle of microscopic reversibility 2

b Compare acidity of Trifluoroacetic acid and acetic acid 2

c Explain with suitable example improper axis of symmetry 2

d Explain *erythro-threo* system of nomenclature with suitable examples. 2

e What is an antiaromatic compound? Give one example. 2

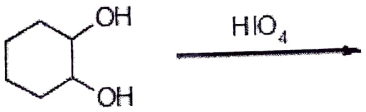
f Why cyclopropenyl cation is called smallest aromatic system? 2

g Complete the following reactions. 2

1)




2)




h Illustrate the use of Red Al in organic synthesis, with two examples. 2

M.Sc - Zoology - NEP2020 - Sem I

Duration: 2 Hours

Maximum Marks: 50

Instructions-

1. All questions are compulsory.
2. All questions carry equal marks.
3. Draw neat and labeled diagram wherever necessary.
4. Answer precisely with suitable example if necessary

Q. 1) Attempt **any four** questions from the following. 10

a) List the various characteristics of research.
b) Define hypothesis and state its function in research.
c) What are secondary sources of data collection?
d) Explain the purpose of the Mann-Whitney test.
e) Enlist and write the importance of any 2 types of reference management software.
f) Explain the concept of impact factors in research journals.
g) What are model organisms and why are they important in scientific research?
h) List advantages and limitations of using *Drosophila* in research.

Q. 2) Attempt **any two** questions from the following. 10

a) Explain the different types of research with examples.
b) Describe the process of reviewing literature and its significance.
c) Explain the strategies for determining sample size in research design.

Q. 3) Attempt **any two** questions from the following. 10

a) Describe any three types of charts used in data presentation.
b) Explain multivariate analysis with a focus on ANOVA and its types.
c) Discuss the importance of level of significance and p-value in hypothesis testing.

Q. 4) Attempt **any two** questions from the following. 10

a) What is the difference between single-blind and double-blind peer review?
b) Explain research grants, scholarships, & fellowships available to Indian students.
c) What is the process of obtaining an ISSN?

Q. 5) Attempt **any two** questions from the following. 10

a) Explain the importance of earthworms in regeneration studies.
b) List the advantages and limitations of using *Mus musculus* in research.
c) What is RNAi, and how was it discovered using *C. elegans*?

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(39)

MSC = Sem I = Zoology (NEP 2020)

Duration: 1 Hours

Maximum Marks: 25

General instructions-

1. **All questions are compulsory.**
2. **All questions carry equal marks except question no. 1 that carries 9 marks.**
3. **Draw neat and labelled diagram wherever necessary.**
4. **Answer precisely with suitable example if necessary.**

Q. 1 Attempt **any three** questions from the following. 9

a) Describe structure of Cytochrome 'c in eukaryotes
b) Describe concept of haemogobin as model of evolution
c) Write major events in evolutionary time scale
d) Describe concept of pseudogenes
e) Describe concept of overlapping genes
f) Describe strategies of gene cloning

Q. 2 Attempt **any two** questions from the following. 8

a) Describe theory of evolution of sex chromosomes
b) Explain concept of frozen Zoo
c) Explain maternal mtDNA inheritance in humans

Q. 3 Attempt **any two** questions from the following. 8

a) Explain concept of structural genes with example
b) Explain theory of evolution of split genes
c) Explain applications of gene cloning in DNA analysis in research

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X51Y196BACX51Y196BAC

(4)

Paper / Subject Code: N57421 / Developmental Biology I

MSC - 2001 ogy NEP2020 Sem - I

**Duration: 2 h**

**Maximum Marks: 50**

Instructions-

1. All questions are compulsory.
2. All questions carry equal marks.
3. Draw neat and labeled diagram wherever necessary.
4. Answer precisely with suitable example if necessary

Q. 1 Attempt **any four** questions from the following. 10

a) Write a note on concept and types of fertilization. 2.5

b) Comment on coelom formation between Protostomes and Deuterostomes. 2.5

c) Write the significance of cell induction during development of organism. 2.5

d) Describe the syncytial mode of cell specification. 2.5

e) Discuss on the cleavage pattern in *Caenorhabditis elegans*. 2.5

f) Describe how *Drosophila*'s anterior-posterior axis develops. 2.5

g) Describe how hormones affect the insect metamorphosis. 2.5

h) Explain morphallaxis type of regeneration using suitable example. 2.5

Q. 2 Attempt **any two** questions from the following. 10

a) Describe the sperm capacitation mechanism. 5

b) Explain fertilizin-antifertilizin reaction in gamete recognition? 5

c) Describe the events that occur during the activation of sea urchin egg metabolism. 5

Q. 3 Attempt **any two** questions from the following. 10

a) Explain competence with an appropriate example. 5

b) Using an appropriate example, describe the mosaic development pattern. 5

c) Compare and contrast autonomous and conditional specification. 5

Q. 4 Attempt **any two** questions from the following. 10

a) Describe the process of gastrulation in *Caenorhabditis elegans*. 5

b) Explain the cleavage pattern in *Drosophila*. 5

c) Comment on homeotic genes in *Drosophila*. 5

Q. 5. Attempt **any two** questions from the following. 10

a) Explain various types of insect metamorphosis with suitable example. 5

b) Describe the process of conjugation in *Paramecium*. 5

c) Describe the importance of imaginal discs in insect development. 5

**********

MSC- Computer Science Semister I

Time :2 ½ Hours

[Total Marks: 60]

N.B: (1) **All questions are compulsory.**
(2) Figures to the **right** indicate full marks.
(3) **Assume additional data if necessary** but state the same clearly.
(4) Symbols have their usual meanings and tables have their usual standard design unless stated otherwise.

| | | |
|---|---|---|
| **Q.1** | Attempt **any two** of the following | (12) |
| **a)** | Explain the features of Object Oriented Database.? And Explain the characteristics of RDBMS. | 06 |
| **b)** | Explain the architectural model of distributed DBMS. | 06 |
| **c)** | Explain conceptual Data models for Spatial database. | 06 |
| **d)** | Explain Object Database Management Group (ODMG) object model. | 06 |
| **Q.2** | Attempt **any two** of the following | (12) |
| **a)** | Explain types of distributed Database system? Explain the disadvantages of Distributed DBMS? | 06 |
| **b)** | Explain different layers of Transparency DBMS ? | 06 |
| **c)** | Explain horizontal and vertical fragmentation. With the help of diagram. | 06 |
| **d)** | Explain Temporal Database with example. | 06 |
| **Q.3** | Attempt **any two** of the following | (12) |
| **a)** | Briefly explain NoSql and its characteristics ?and How Bigdata is related to NoSql? | 06 |
| **b)** | Difference between SQL and NOSQL database. Where to use NoSQL database? | 06 |
| **c)** | Explain Document Database briefly. | 06 |
| **d)** | Explain CAP theorem with diagram. | 06 |
| **Q.4** | Attempt **any two** of the following | (12) |
| **a)** | Write short note on Hive. | 06 |
| **b)** | Compare HQL and SQL. | 06 |
| **c)** | Explain different types of NoSQL. | 06 |
| **d)** | What are Cassandra and MongoDB? | 06 |
| **Q.5** | Attempt **any two** of the following | (12) |
| **a)** | What is Distributed Transparent System? Explain its types. | 06 |
| **b)** | Explain Architectural model of distributed system. | 06 |
| **c)** | How to deal with Big Data and scalability of NoSQL | 06 |
| **d)** | Explain REDIS and its applications and advantages of REDIS. | 06 |

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Paper / Subject Code: 94744 / Computer Science: Algorithms for Optimization (R-2021-22)

MSC - CS - Sem I

Time : 2 ½ Hours | Total Marks : 60

N.B: (1) **All questions are compulsory.**
(2) Figures to the **right** indicate full marks.
(3) **Assume additional data if necessary** but state the same clearly.
(4) Symbols have their usual meanings and tables have their usual standard design unless stated otherwise.
(5) Use of **calculators** and statistical tables are **allowed**. / If required keep it.

| | | |
|---|---|---|
| Q.1 | Attempt **any two** of the following | (12) |
| a) | Discuss design optimization process and basic optimization problem. | 6 |
| b) | What are local minima? What are different types of local minima? | 6 |
| c) | What do you mean by brackets? How we can find initial brackets. | 6 |
| d) | Write a note on Fibonacci series. | 6 |
| Q.2 | Attempt **any two** of the following | (12) |
| a) | Explain concept of Gradient descent in detail. | 6 |
| b) | Discus Adadelt and RMSProp in detail. | 6 |
| c) | Give the difference between first order method and second order method. | 6 |
| d) | Write a note on Newton's Method and Quasi- Newton Method. | 6 |
| Q.3 | Attempt **any two** of the following | (12) |
| a) | Explain the concept of full factorial sampling plan with its algorithm. | 6 |
| b) | Write a note on Stratified Sampling. | 6 |
| c) | Explain the concept of Surrogate Model. How to fit surrogate model to any true objective function? | 6 |
| d) | Write a note on Gaussian process. | 6 |
| Q.4 | Attempt **any two** of the following | (12) |
| a) | What is Uncertainty? What are different types of Uncertainty? | 6 |
| b) | Explain Bayesian Monte Carlo integration. | 6 |
| c) | Explain Ant Colony Optimization algorithm. | 6 |
| d) | Define Grammar with example. | 6 |
| Q.5 | Attempt **any two** of the following | (12) |
| a) | What do you mean by critical point? What are types to optimize the process? | 6 |
| b) | Explain hyper gradient descent. | 6 |
| c) | What is sampling plan? | 6 |
| d) | How genetic programming implemented with Tree? | 6 |

[Time: 2 and 1/2 Hours] [Total Marks: 60]

**Please check whether you have got the right question paper.**

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

Q.1 (A) Attempt any **two** of the following:

(a) Derive expressions for the wave function of $sp^3$ hybrid orbitals using the concept of hybridization. 4

(b) Explain the bonding in $SF_6$ molecule on the basis of molecular orbital theory. Draw the molecular orbital diagram showing the distribution of electrons in various molecular orbitals. 4

(c) What is resonance energy? Draw all possible resonating structures for nitrate ion. Calculate the formal charges for all the atoms in the ion. 4

(d) What are van der Waals forces? Discuss any two types with suitable examples. 4

(B) Attempt any **one** of the following:

(a) On the basis of Valence Bond Theory, explain the structure and bonding of $ClF_3$ and $PF_5$ 4

(b) Construct a labelled molecular orbital diagram of Vanadium molecule. Explain the magnetic behaviour of the molecule. 4

Q.2 (A) Attempt any **two** of the following:

(a) Construct character table for $H_2O$ point group 4

(b) On the basis of SALC, draw Molecular Orbital diagram for ammonia molecule. 4

(c) Define subgroups. Give subgroups of $C2v$ point group 4

(d) Derive the matrix representation for rotational operation. 4

(B) Attempt any **one** of the following:

(a) Discuss the criteria for a set of elements to form a group by giving suitable example. 4

(b) Write a short note on irreducible representations. 4

Q.3 (A) Attempt any **two** of the following:

(a) Describe the properties of conductors and semiconductors on the basis of Band theory. 4

(b) Explain Langmuir-Blodgett method of preparation of nanomaterials. 4

(c) Draw the structure of Rutile compound. State the features of the structure. 4

(d) What are the principles underlying ceramic method and precursor method for preparation of inorganic solids? 4

(B) Attempt any **one** of the following:

(a) Comment on concept of First Brillouin zone in solids. 4

(b) Schematically represent formation of bands in solids using Band Theory. 4

Q.4A) Attempt any **two** of the following:

(a) State the Jahn Teller theorem. Discuss the interpretation of ESR Spectra of octahedral complex of Cu (II). 4

(b) With respect to complex formation, explain the following evidence:
1) pH metric study. 2)dissolution of insoluble precipitate 4

(c) Draw the orgel diagram for the complex ion $[CrF_6]^{3-}$ and assign the electronic transitions. 4

(d) "The measurement of molar conductance of aqueous solution of cobalt amines compounds helps Werner to assigned correct formulae. Justify the statement. 4

(B) Attempt any **one** of the following:

(a) Describe the potentiometric method for determination of formation constant in complexes. 4

(b) Draw the Orgel diagram for $[Ni(H_2O)_6]^{2+}$. Assign the electronic transitions. 4

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

(A) Draw the Lewis dot structure of SCN- ion. Give all possible resonating structure and calculate the formal charge. Predict the most stable structure. 3

(B) HF has a smaller heat of vaporization than water. Explain. 3

(C) Explain group multiplication table for water molecule. 3

(D) Define group, sub group and point group with example. 3

(E) Define the terms : 1. Forbidden gap 2. Fermi Energy 3.Semiconductor 3

(F) Give merits and demerits of microwave method in preparation of nanomaterials. 3

(G) $^{31}P$ NMR spectra shows 1 peak for trans $[PtClBr(PR_3)_2]$ & 2 peaks for the cis $[PtClBr(PR_3)_2]$. Justify. 3

(H) Write a note on Racah parameter. 3