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Time : 2-30 Hours]   March 2019   [Max. Marks : 70

Instructions: [1] Symbols have their usual meanings

Q.1(a)	i.	Explain molecular beam resonance experiments and discuss results of H_2 and D_2 experiments	07
	ii.	Define hyperfine structure and discuss external magnetic field on hyperfine structure.	07

OR

	i.	State the basic nuclear properties and explain Nuclear density, parity and nuclear magnetism qualitatively.	07
	ii.	Discuss electric quadrupole moment using orthogonality condition to the nuclear state, when I≥1.	07
Q.1(b)		Write short answer (Any four)	04

1. State the value of nuclear particle density of matter.
2. A fine structure was discovered by _____ with resolving power interferometer.
3. What do you mean by isotope effect?
4. In case of molecular spectra, state three types of excitations.
5. State the names of experiments can be used for the determination of nuclear radii.
6. Nuclear magnetic moment totally depends on parallel and anti parallel spin. [TRUE/FALSE]

Q.2(a)	i.	Why p-p scattering can be measured more accurately than n-p scattering? Explain p-p scattering at low energies.	07
	ii.	In case of l>0, there is no bound state for D_2, explain.	07

OR

	i.	Discuss the four forces, which account for the saturation property of nuclear matter. Are these forces are sufficient to describe the saturation phenomena explain?	07
	ii.	Write a short note on scattering length.	07
Q.2(b)		Write short answer (Any four)	04

1. Which statistics obeyed by the deuteron?
2. In the ground state of D2, the orbital angular momentum quantum number _____ and spin quantum number _____.
3. Ground state of D2 may be mixture of _____ states.
4. What is the parity of bound state of D2?
5. Scattering depends on ___ and _____.
6. Scattering phase shift depends on ___ and ___.

Q.3(a)	i.	State and prove optical theorem.	07
	ii.	Discuss Eikonal approximation and derive necessary equation for scattering amplitude.	07

OR

	i.	How solution of radial schrodinger equation can be obtained to calculate phase shift due to l^{th} partial wave? Obtain an equation of phase shift $Sin\delta_l$.	07
	ii.	Obtain condition for low energy scattering and high energy scattering in case of Yukava Potential.	07

P. T. O

Q.3(b)   Write short answer (Any Three)   03
    1. What is the unit of differential scattering cross section?
    2. Write $Pl(\cos\theta)$ for $l=2$.
    3. What is the unit of exponent α in Yukava Potential?
    4. What is the unit of centrifugal distortion term in radial schrodinger equation?
    5. If wavelength increased by 10%, what will be the change in wave vector?

Q.4(a) i. State the importance of transducer in equipment. Describe Linear Variable Differential   07
    Transformer.

    ii. Briefly explain any two temperature transducers.   07

<div align="center">OR</div>

    i. Show that in a multi-stage cascaded amplifier, efforts should be made to   07
    reduce the noise due to the first stage.

    ii. With illustration explain the concept of phase sensitive detection. Using block   07
    diagram, explain lock In amplifier.

Q.4(b)   Write short answer (Any Three)   03
    1. Draw the noise power spectra of a typical lab. environment.
    2. Define resolution of a transducer.
    3. Draw the block diagram of a typical DC signal conditioning system.
    4. State any two applications of capacitor transducer.
    5. Name any two applications of photomultiplier tube.
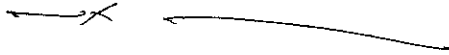
0503E1668

Candidate's Seat No : _____

M.Sc. (Sem.-3) Examination

501

Chemistry (Inorganic)

Time : 2-30 Hours]   March 2019   [Max. Marks : 70

Que. 1	(A)	Explain the stereochemistry of coordination compounds with special reference to chelating ligands.	14
		OR	
	(A-i)	State and explain different types of stability constants with example.	07
	(A-ii)	Write a short note on hydrate isomerism in coordination compounds.	07
Que. 1	(B)	**Answer in one or two lines (any four out of six)**	04
	(i)	Which methods are used to determine the stability constants?	
	(ii)	What is delta bond?	
	(iii)	What do you understand by lability of a complex?	
	(iv)	What do you understand by instability constant?	
	(v)	Name a pi acid ligand.	
	(vi)	Give an example of an linkage isomerism.	

Que. 2	(A)	Draw and describe the Tanabe - Sugano diagram for high spin $[CoF_6]^{3-}$ and low spin $[Co(en)_3]^{3+}$ complex.	14
		OR	
	(A-i)	Write a short note on high spin and low spin cross over in coordination compounds.	07
	(A-ii)	Distinguish CFT, LFT and MOT.	07
Que. 2	(B)	**Answer in one or two lines (any four out of six)**	04
	(i)	What is nephelauxetic effect?	
	(ii)	What is Laporte selection rule?	
	(iii)	What is the ground state term for Ti (III)?	
	(iv)	State Pauli exclusion principle.	
	(v)	Do states of same symmetry cross each other?	
	(vi)	What is spectrochemical series?	

P. T. O

Que. 3	(A)	Discuss the chemistry of compounds containing in P-N bonds.	14
		OR	
	(A-i)	Why compounds containing Si-O bonds are very important in industry.	07
	(A-ii)	Write a note on sulfur nitrides.	07
Que. 3	(B)	**Answer in one or two lines (any Three out of Five)**	03
	(i)	Sketch the structure of $C_2B_4H_8$.	
	(ii)	Give the general formula for conjucto boranes.	
	(iii)	Decode '*styx*'.	
	(iv)	Write the structure of a borane with styx number 2012.	
	(v)	What are neso silicates?	

Que. 4	(A)	Write a detailed note on semi conduction.	14
		OR	
	(A-i)	Explain the super conductivity.	07
	(A-ii)	Give an account of solid electrolytes.	07
Que. 4	(B)	**Answer in one or two lines (any Three out of Five)**	03
	(i)	What is Schottky defect?	
	(ii)	Give the formula for β-Alumina.	
	(iii)	What is Anderson's view on superconductivity in cuprates?	
	(iv)	Define solid solutions.	
	(v)	State the characteristic property of semi-conductors?	

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Time : 2-30 Hours]   [Max. Marks : 70

Que. 1 (A)   Discuss the general chemical properties of flavons and prove the   **14**
presence and position of glucose units in anthocyanin. Give synthesis of
Quercetin and phyllopyrole carboxylic acid.

OR

(A-i)   Give synthesis of anthocyanidin and Dipyrrylmethenes from   **07**
cryptopyrrole.

(A-ii)   What are natural pigments? Classified them with details.   **07**

Que. 1 (B)   **Answer in one or two lines (any four out of six)**   **04**

(i)   What is meant by Sorbet band and porphyrin.

(ii)   Give a name and structure of pyrrane pigments.

(iii)   What are the colors of anthocynins in different medium.

(iv)   Give reaction of flavanol when fused with KOH.

(v)   What product Quercetin gives when reacted with $LiALH_4$.

(vi)   What are the reductive degraded products of Haemin?

Que. 2 (A)   Discuss the structure of meroquinene and give synthesis of vitamin -C   **14**

OR

(A-i)   Give the necessary reactions to prove the presence of phenanthrene   **07**
nucleus in morphine.

(A-ii)   Discuss the presence of cyclic ureide structure and n- valeric acid chain   **07**
in vitamin H.

Que. 2 (B)   **Answer in one or two lines (any four out of six)**   **04**

(i)   Give hydrolysis products of reserpine.

(ii)   Draw the structure of Yobyrine.

(iii)   How do you prove the presence of acetamide group in colchicine.

(iv)   What is parent hydrocarbon of colchicine.

(v)   Show the presence of -COOH group in Vitamin-C

(vi)   Write oxidation reaction of Vitamin-E.

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Que.3 (A) Give classification of sterols and hormones. Discuss the position of double bond in ergosterol and show the presence of -COCH₃ group in female sex hormone. **14**

OR

(A-i) Discuss the position of -OH group in cholesterol and give synthesis of progesterone. **07**

(A-ii) Discuss carbon skeleton, side chain of bile acid and give partial synthesis of cortisone. **07**

Que.3 (B) **Answer in one or two lines (any Three out of Five)** **03**

(i) Give the dehydrogenated product of steroid at 360^0C and 420^0C.

(ii) How do you prove that ring B is six membered in ergosterol?

(iii) What is different Barbier-Wieland degradation products of 5B-Cholatane.

(iv) What is the main source of cholic and lithocholic acid?

(v) Show the presence of keto group in oestrone.

Que.4 (A) Define terpenoids. Give an example of acyclic sesquiterpenoid and prove the structure zingiberene. **14**

OR

(A-i) Acidic hydrolysis of gibberalic acid gives compound I and II. Discuss degradation products of them with conclusion. **07**

(A-ii) Give synthesis of homoretene and farnesol. **07**

Que.4 (B) **Answer in one or two lines (any Three out of Five)** **03**

(i) Give an example of triterpenoid.

(ii) List the ozonalysis products of decahydrosqualene.

(iii) How do you derive retenquinone from retene?

(iv) Give the ozonzlysis products of fernesol.

(v) Give isoprene and special isoprene rule.

Q. 1 **(A)** What is dispersion in FIA? Explain in detail factors affecting   14
dispersion and various applications of FIA.

<div align="center">OR</div>

(A-i) What is process analytical chemistry? Compare and discuss off-   07
line, at-line and on-line analysis.

(A-ii) Discuss and explain the relevance of gradient flow injection   07
analysis.

Q. 1 **(B)** **Answer in one or two lines (Any four out of six)**   04

(i) State the difference between segmented and non-segmented flow
methods.

(ii) Explain the terms: Continuous and discrete instruments

(iii) What is the range for medium dispersion in FIA?

(iv) Give the relation between flow rate and residence time in FIA.

(v) Define feedback mechanism.

(vi) What is the basic principle of automation?

Q. 2 **(A)** Discuss in detail adulteration, determination and characterization   14
of fats and oils.

<div align="center">OR</div>

(A-i) Explain in short a non-instrumental method for determination of   07
protein content in food sample.

(A-ii) Give classification of dietary fiber based on water solubility and   07
discuss gravimetric method for determination of fiber.

Q. 2 **(B)** **Answer in one or two lines (Any four out of six)**   04

(i) Mention any four legislations that have been reinforced by USFDA.

(ii) Give the full name of NLEA.

(iii) For what kind of food analysis methods are published by AACC and
AOCS?

(iv) What is the standard format of food labels for nutrition
information?

(v) What is the significance of sampling and sample preparation in
food analysis?

(vi) Name any two scientific organizations which provide official
methods for food analysis.

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Q. 3 (A) Describe the assay procedures for any two antidiabetic or anti HIV drugs based on USP/BP/IP. 14

OR

(A-i) Discuss the significance of heavy metal ion analysis in pharmaceuticals. 07

(A-ii) Explain the use of UV and photodiode array detectors in HPLC for pharmaceutical industry. 07

Q. 3 (B) **Answer in one or two lines (Any three out of five)** 03
(i) What is meant by pharmacopoeia?
(ii) Name any two anticancer drugs.
(iii) State the category for the following drugs:
1. Mefloquine
2. Ciprofloxacin
(iv) The sensitivity of fluorescence detector is higher than UV detectors.-True or false
(v) State the basic principle of IR spectroscopy.

Q. 4 (A) Discuss in detail methods for analysis of different elements including nitrogen, phosphates, calcium, sodium, potassium and ammonia in fertilizers. 14

OR

(A-i) Explain in detail the science for cleansing action of soaps and detergents. 07

(A-ii) Give the classification of pesticides and discuss in brief classical and instrumental methods for analysis of organochlorine pesticides. 07

Q. 4 (B) **Answer in one or two lines (Any three out of five)** 03
(i) Why it is necessary to analyze pesticides?
(ii) Name any two cationic surfactants.
(iii) What is the total amount of potassium in 4:8:9 and 10:7:5 fertilizers?
(iv) State the types of fertilizers.
(v) Give an example of botanical and carbamate pesticides.

0503E1671

Candidate's Seat No :_____

M.Sc. (Sem.-3) Examination

501

Zoology

March 2019

[Max. Marks : 70

Time : 2-30 Hours]

NB: All questions are compulsory. Illustrate your answers with neat diagrams wherever necessary.				
Q-1	(A)		Write the following	
		(i)	Discuss cleavage patterns in vertebrates	07
		(ii)	Discuss morphogenetic movements.	07
			OR	
		(i)	Explain cleavage and importance of yolk.	07
		(ii)	Give an account of types of blastula.	07
	(B)		MCQ / SQ (Any Four out of Six)	04
		(i)	Presumptive gut is termed _____.	
		(ii)	Define invagination.	
		(iii)	Cavity encloses in blastula is called _____.	
		(iv)	Totipotency is noted till _____ cell stage.	
		(v)	What is polyspermy?	
		(vi)	Explain acrosomal reaction.	
Q-2	(A)		Write the following	
		(i)	Write a note on the types of inducer molecules.	07
		(ii)	Explain Vogt method of determining the fate map of frog embryo.	07
			OR	
		(i)	Write a note on the embryonic gradients of Drosophila embryo.	07
		(ii)	Explain Le Douarin's method for determining the fate of embryo.	07
	(B)		MCQ / SQ (Any Four out of Six)	04
		(i)	What is contribution of Conkin in the fate mapping of embryo?	
		(ii)	What is disadvantage of radioactive labelling?	
		(iii)	What is Cre mouse?	
		(iv)	Give example of genetically inducible fate mapping?	
		(v)	What is heteroplastic transplantation?	
		(vi)	What is grey crescent?	
Q-3	(A)		Write the following	
		(i)	Write a note on development of metanephric kidney.	07
		(ii)	Explain the development of heart tube using appropriate diagrams.	07
			OR	
		(i)	Explain zebra fish and C. elegans as a model for studying development.	07
		(ii)	Write a note on development of retina.	07
	(B)		MCQ / SQ (Any Three out of Five)	03
		(i)	What is differentiated cell?	
		(ii)	What is lens placode?	
		(iii)	When atrial septal defect (ASD) is observed?	
		(iv)	Why neural crest is called fourth germ layer?	
		(v)	Write names of major divisions of embryonic brain.	
Q-4	(A)		Write the following	
		(i)	Write an account on types of regeneration.	07
		(ii)	What is allometric growth? Write a detailed account on analysis of allometric growth.	07
			OR	
		(i)	Discuss about regeneration in invertebrate.	07
		(ii)	Write about three different types of growth observed in multicellular animals.	07
	(B)		MCQ / SQ (Any Three out of Five)	03
		(i)	Write about regeneration power in fishes.	
		(ii)	What is the correlation between concentration of oxygen and regeneration?	
		(iii)	What are the two factors on which regeneration is dependent?	
		(iv)	Proliferation of myoblasts require _____ growth factor.	
		(v)	Define chalones.	

0503E1672   Candidate's Seat No : _____

M.Sc. (Sem.-3) Examination
501
Statistics

Time : 2-30 Hours]   March 2019   [Max. Marks : 70

1. (A) Answer the following:
   (i) State and prove necessary part of NP lemma for randomized test.   7
   (ii) Let X be a normal variate $N(\mu, 9)$. Obtain ump test to test H: $\mu=0$ versus K: $\mu > 0$.   7
   Obtain power function of the test.

OR

   (i) State and prove the theorem on UMP test for testing H: $\theta \leq \theta_0$ V/S K: $\theta > \theta_0$.   7
   (ii) Let X ~ exponential distribution with mean θ, $\theta > 0$. To test H: $\theta \leq \theta_0$ versus   7
   K: $\theta > \theta_0$, derive UMP test of size α and power function of the test based on a
   random sample of size n.

   (B) Attempt any four.   4
   (i)   Define non-randomized test
   (ii) Define size of the randomized test.
   (iii) Give an example of composite hypothesis.
   (iv) Define UMP test.
   (v)   State type-II error.
   (vi) Give an example of randomized test function.

2. (A) Answer the following:
   (i) State and prove the necessary and sufficient condition for all α-similar tests to have   7
   Neyman structure based on sufficient statistic T.
   (iii) Let $X_1, X_2, ..., X_n$ be a random sample from uniform $U(0, \theta)$ distribution. Obtain   7
   UMP test of size α to test H: $\theta \geq \theta_0$ versus K: $\theta < \theta_0$. Also obtain power function of
   the test.

OR

   (i) Let $\phi(x)$ be any unbiased test of level α for testing H: $\theta \in \Omega_H$ versus K: $\theta \in \Omega_K$. If   7
   power function is continuous in θ then show that $\phi(x)$ is α –similar on Λ.
   (ii) Let $X_1, X_2, ..., X_n$ be a random sample from exponential distribution with pdf   7

   $$f(x; \theta, \sigma) = \frac{1}{\sigma} \exp(-(x - \theta)/\sigma), \ x > \theta, \ \sigma > 0. \text{ To test H: } \theta = \theta_0 \text{ V/S K: } \theta \neq \theta_0$$

   Derive UMPU test of size α and power function of the test.

   (B) Attempt any four: 4
   (i) State MLR property.
   (ii) Define UMP test .
   (iii) To test the hypothesis H: $\theta \geq 10$ versus K: $\theta < 10$, where θ is the mean of exponential
   distribution, state UMP critical region based on a random sample of size 1.
   (iv) Suppose that $X_1, X_2, ..., X_n$ are iid $U(0, \theta)$, $\theta > 0$. This distribution possess MLR
   property in T(x) =

   (A) ΣX (B) $X_{(1)}$ (C) $X_{(n)}$ (D) $1 / \Sigma X$

1

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(v) State an example for which UMP test exist for testing two sided alternative hypothesis.

(vi) Define unbiased test.

3. (A) Answer the following:

  (i) Discuss likelihood ratio test.   7

  (ii) Let $X_1, X_2, ...,X_n$ be a random sample from binomial distribution with parameter   7
$p, 0 < p < 1$. Construct LRT to test H: $p \leq p_0$ versus K: $p > p_0$.

OR

  (i) Explain procedure of SPRT.   7

  (ii) Obtain SPRT for Bernoulli distribution to test simple versus simple hypothesis on   7
parameter of the distribution.

(B) Attempt any three.   3

  (i) State general form of the test statistic in LRT.

  (ii) State general rule of rejection of null hypothesis in LRT.

  (iii) State range of the stopping bounds in SPRT.

  (iv) State how ASN can be determined from the Wald's identity.

  (v) State approximate formula of OC function in SPRT.

4. (A) Answer the following:

  (i) Show that SPRT always terminate with probability one.   7

  (ii) Derive ASN function of the SPRT.   7

OR

  (i) Describe K-S test for two samples .   7

  (ii) Discuss the Kruskal -Wallis test.   7

(B) Attempt any three.   3

  (i) State an sample estimate of distribution function.

  (ii) Which one of the following is false?

    (a) K-S procedures are based on vertical deviations between the observed and expected cumulative distribution functions.

    (b) K-S Test is applicable only for grouped data.

    (c) The exact sampling distribution of test statistic D_n is known.

    (d) All K- S test statistics are distribution free.

  (iii) Define D_n.

  (iv) State application of Siegel-Tukey test.

  (v) State the linear rank statistic used in the Siegel-Tukey test.
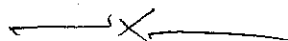
0503E1673   Candidate's Seat No : _____

M.Sc. (Sem.-3) Examination
501
Life Science

Time : 2-30 Hours]   March 2019   [Max. Marks : 70

Instructions:

All questions are compulsory.
Illustrate your answers with neat diagrams wherever necessary.

1 (A)   **Answer in Detail:**
i)   Discuss Cell mediated and Humoral immunity.   [07]
ii) Explain Alternative pathway. Add its significance.   [07]

OR

i)   Describe the properties of Cytokines. Add their significance.   [07]
ii) Describe the Primary Lymphoid organs.   [07]

1 (B)   **Answer in Short: (Any Three)**   [03]
i)   Mention the role of Thymus in immune system.
ii)   Enlist different types of Interferon.
iii) What is Paracrine signaling?
iv)   Discuss Redundancy property of Cytokines in brief.
v)   Explain: Tumor Necrosis Factor

2 (A)   **Answer in Detail:**
i)   Define HLA and discuss Class I of MHC.   [07]
ii) What is Antigen? Describe various types of Antigens.   [07]

OR

i)   What is Immunogen? Enlist their types and discuss IgD, IgE and IgM.   [07]
ii) What is Antibody Diversity? Discuss Light Chain Splicing in brief.   [07]

2 (B)   **Answer in Short: (Any Four)**   [04]
i)   Define: Endogenous antigen
ii)   What is meant by Clonal Selection?
iii) Name the regions of MHC Class I molecule.
iv)   Which antibody covers 5-8% of total Serum immunoglobulin?
v)   Define: Immunogen
vi)   Explain: Hapten

3 (A)   **Answer in Detail:**
i)   Explain the process of Monoclonal Antibody production in detail.   [07]
ii) Write a detailed note on DNA Vaccine. Add its clinical applications.   [07]

OR

i)   Explain the principle of ELISA and describe its clinical applications.   [07]
ii) Define Agglutination. Mention its clinical applications.   [07]

3 (B)   **Answer in Short: (Any Three)**   [03]
i)   Explain: ELISA
ii)   What do you mean by RAST?
iii) Discriminate Paratope and Epitope
iv)   Explain: MMR Vaccine
v)   Mention any two applications of Monoclonal Antibody.

4 (A)   **Answer in Detail:**

i)   Write a detailed note on Type I, II and III Hypersensitivity.   **[07]**

ii)   Describe Allogenic and Autograft transplantation.   **[07]**

OR

i)   Define Autoimmunity. Mention its types and describe autoimmune diseases.   **[07]**

ii)   Give a detailed account on: Hazards of Vaccine   **[07]**

4 (B)   **Answer in Short: (Any Four)**   **[04]**

i)   Explain Allogenic transplantation in brief.

ii)   Define: Peripheral Tolerance

iii)   Explain: Xenograft

iv)   What is type IV Hypersensitivity?

v)   Explain: Immunodeficiency

vi)   What is the role of Antihistamines?

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0503E1674

Candidate's Seat No :_____

M.Sc. (Sem.-3) Examination

501

Environmental Science ‹₊ ›₁ (o \d)

Time : 2-30 Hours]

March 2019

[Max. Marks : 70

Note: Draw the diagram where ever required.

a) Q.1 (A) Write a note on water pollution laws and standards. [14]

OR

a) Q.1 A (i) Discuss the different sources of water pollutants and their effects on environment. [07]

b) Q.1 A (ii) Explain: (i) Utilization of water (ii) Composition of waste water. [07]

Q.1 (B) Answer the following in one or two lines. (Any Four) [04]
   a) What is ground water?
   b) Give an example of surface water .
   c) Give an example of pollutant present in water.
   d) State an adverse impact of water pollutant in environment.
   e) In which year Water Act came in to existence?
   f) Give the characteristics of drinkable water.

Q.2 (A) How to determine TOC and DO in waste water? [14]

OR

Q.2 A (i) Elaborate on different methods of bacteriological measurements. [07]

Q.2 A (ii) Explain on sampling and preservation of waste water samples. [07]

Q.2 (B) Answer the following in one or two lines. (Any Four) [04]
   a) What is turbidity ?
   b) What is the permissible limit of BOD ?
   c) Which are the organic pollutant present in water ?
   d) Give acronym for COD.
   e) Define: Alkanity.
   f) State the impact on environment raised due to lower level of DO present in water.

Q.3 (A) Discuss the secondary wastewater treatment. [14]

OR

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Q.3 A (i) Give a brief idea on recovery of materials from process effluents. [07]

Q.3 A (ii) How the use of lagoons has proved to be very effective for the
treatment of domestic waste water ? [07]

Q.3 (B) Answer the following in one or two lines. (Any Three) [03]
   a) What is full form of RO?
   b) Define: Ion-exchange
   c) Enlist different methods used in primary treatment of water.
   d) What is discrete settling?
   e) Explain the term: Sludge.

Q.4 (A) Explain the processing unit of sugar industry with its Effluent Treatment Plant. [14]
                                    OR
Q.4 A (i) Elaborate on the processing unit of fertilizer industry. [07]
Q.4 A (ii) Describe the processing unit of dye industry with its effluent treatment plant [07]

Q.4 (B) Answer the following in one or two lines. (Any Three) [03]
   a) Give acronym for ETP.
   b) What is the organic content present in ETP of dairy industry?
   c) What is Bagasse?
   d) State the need for ETP.
   e) Draw a flow chart of ETP.

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0503E1674-3 Candidate's Seat No :_____

M.Sc. (Sem.-3) Examination

501

Environmental Science   New

Time : 2-30 Hours]   March 2019   [Max. Marks : 70

Note: Draw the diagram where ever required.

Q.1 (A) Explain Cleaner Bioprocess and sustainable development.   [14]

OR

Q.1 A (i) Write a note on Amended Liners and explain factors relevant to all

types of liners.   [07]

Q.1 A (ii) Describe various methods used for capturing fine particles.   [07]

Q.1 (B) Answer the following in one or two lines. (Any Four)   [04]

a) Define: Geo-membrane.

b) Which are the positive factors influencing the plant available mineral nitrogen ?

c) Explain the term: Leachate.

d) Define: Sustainable development.

e) What does 5 'R' stands for ?

f) Give acronym for CMA and CMC.

Q.2 (A) Give an account on rural and urban integrated waste recycling

system made by using duckweed.   [14]

OR

Q.2 A (i) Write a note on immobilization technique.   [07]

Q.2 A (ii) Explain vertical flow bed system.   [07]

Q.2 (B) Answer the following in one or two lines.(Any Four)   [04]

a) Enlist major chemical sources of nitrogenous waste.

b) What is Duckweed?

c) Name the treatments used to treat municipal sewage effluent.

d) What does sludge treatment bed comprises of ?

e) Which aquatic plants are employed in construction of wetland ?

f) What will be the source of dirty water having BOD between 300-3000 mg/L ?

Q.3 (A) Describe various microbial systems used for the bioremediation

of contaminated soil.   [14]

OR

Q.3 A (i) Justify: "Bioremediation as a clean technology".   [07]

Q.3 A (ii) What are the general strategies to increase bioavailability ?   [07]

1

Q.3 (B) Answer the following in one or two lines. (Any Three)   [03]
  a) Give acronym for BTEX.
  b) Explain the causes responsible for pollution of soil and groundwater.
  c) Name few organisms that can remove metal ions their surrounding environment.
  d) Enlist organic contaminants present in soil.
  e) Give examples of DNALPs.

Q.4 (A) Write a note on New bleaching process and Enzymatic bleaching.   [14]
                                OR
Q.4 A (i) Give an account on clean technology for a sustainable fish-processing industry. [07]
Q.4 A (ii) Explain the enzyme technology used to enhance extraction process
           of oil in Oil Agro Industry.   [07]

Q.4 (B) Answer the following in one or two lines. (Any Three)   [03]
  a) What is fish silage ?
  b) Give full form of ECF.
  c) Name the countries where processing of sugar from sugarcane is practiced.
  d) What is the use of POME ?
  e) State the main components of wood.

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0503E1675   Candidate's Seat No :_____

M.Sc. (Sem.-3) Examination
501
Bio-Technology (Integrated)
March 2019

Time : 2-30 Hours]   [Max. Marks : 70

Q-1 (A) Discuss structure and biological functions of Carotenoids and Vitamin B12   [14]
        OR
(A) (1) List important vitamins and consequences of its deficiency   [7]
    (2) Explain important terms used in toxicology and explain factors affecting toxic response [7]

(B) Answer in brief (Any Four)   [4]
    (1) Give biological functions of vitamin E
    (2) Name two sources of natural sources of fibres in food
    (3) Deficiency of which vitamin is common among vegetarians?
    (4) Define essential amino acids with example
    (5) Name vitamin useful for coagulation of blood
    (6) What is MLD for toxic substance?

Q-2 (A) Write an essay on Probiotic cultures and beneficial role played by it in health [14]
        OR
(A) (1) What are nutraceuticals? Explain its Classification and importance   [7]
    (2) Explain how omics technology helps developing nutritional food   [7]

(B) Answer in brief (Any Four)   [4]
    (1) What are Prebiotics?
    (2) Define Synbiotics.
    (3) Define Bioavailability
    (4) On what basis, food classified as a functional food or nutraceutical?
    (5) Name two important phytochemicals present in fruits and vegetables
    (6) Give two examples of medical foods

Q-3 (A) List nutritionally important edible mushrooms and technique for its large scale cultivation [14]
        OR
(A) (1) Define fermented food and explain production of any one Indian variety   [7]
    (2) Summarize process for production of wines   [7]

(B) Answer in brief (Any Three)   [3]
    (1) Name starter cultures used for production of yogurt
    (2) Which food preparations can be modified by protease treatment?
    (3) Name important nutrients in Cheese
    (4) What is range of alcohol content in Beer?
    (5) What is Sauerkraut?

Q-4 (A) Write detailed note on production of SCP   [14]
        OR
(A) (1) Discuss advantages and disadvantages of GM food   [7]
    (2) Discuss use and production of microbial flavouring agents and food additives [7]

(B) Answer in brief (Any Three)   [3]
    (1) Which authority approves M foods in India
    (2) Name two cultures used for production of edible oil
    (3) Name two most important staple food crops of the world
    (4) Give full name of FSSAI
    (5) What is use of baking soda in food preparation?

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0503E1676   Candidate's Seat No :_____

M.Sc. (Sem.-3) Examination

501

Clinical Research

Time : 2-30 Hours]   **March 2019**   [Max. Marks : 70

Que. 1 (A) Write the following

   (i) General Considerations for a BA/BE Study according to Brazilian Guidelines   07

   (ii) Define Bioanalytical Method Validation and Discuss Fundamental Parameters for Method Validation   07

OR

   (i) Protocol Design for a BA/BE Study according to ANVISA Guidelines   07

   (ii) Write a note on different study designs of a BA/BE Study   07

Que.1 (B) Answer the following (Any four)   04

   (i) Name the regulatory agency of Canada

   (ii) Define: Latin Square Design

   (iii)Define: Carry Over Effect

   (iv)Give BCS Classification

   (v) Name the current DCGI

   (vi)Define: Hatch-Waxman Act

Que. 2 (A) Write the following

   (i) US FDA Guidelines for BA/BE Studies   07

   (ii) DGFT   07

OR

   (i) e-CTD   07

   (ii) Day to Day Activities of a BA/BE Study in a CRO   07

Que.2 (B) Answer the following (Any four)   04

   (i) Define: Highly variable drugs

   (ii) Give full form of BCS.

   (iii) Define: SWOT Analysis

   (iv)Generics Drugs are Pharamceutical Alternative to Reference Drug. True/False?

   (v) Dosing water quantity according to European Guidelines is _____ ml.

   (vi) Give full form of CDA

Que. 3 (A) Write the following

    (i) Discuss the statistical criteria acceptable by the different reg. bodies for the BABE studies.   07

    (ii) Elaborate specific regulatory requirements for the drugs with long half life, narrow therapeutic index and highly variable drug products   07

<div align="center">OR</div>

    (i) Give a tabular representation of the retention period of the samples for different reg. bodies.   07

    (ii) Discuss the need of measuring metabolites as per the different reg. bodies   07

    (B) Answer the following (Any three)   03

    (i) US FDA Form 482 stands for _____

    (ii) Give full form of PBD

    (iii) Define: Sensitivity

    (iv) Enlist 5 responsibilities of DCGI

    (v) Name the regulatory agency of India

Que. 4 (A) Write the following

    (i) Draw and discuss an organogram (Functional) of Clinical Research Organization involved in BABE activity   07

    (ii) Roles and Responsibilities of a Medical Writer in Clinical Research   07

<div align="center">OR</div>

    (iii) Clinical Research Department of a CRO   07

    (iv) Quality Assurance and Quality Control in CR   07

    (B) Answer the following (Any Three)   03

    (i) Define: Precision

    (ii) Give the importance of Washout Period

    (iii) Which study design requires less number of subjects, Parallel or Crossover? Why?

    (iv) Define: Phase 0 Trial

    (v) Define: Outlier

2/53 **0603E1681** Candidate's Seat No :___

M.Sc. (Sem.-3) Examination

502

Physics

Time : 2-30 Hours] March 2019 [Max. Marks : 70

Instructions : (1) Attempt all questions.
(2) All questions carry equal marks.
(3) Symbols and terminology have their usual meanings.
(4) Scientific calculator may be permitted.

Q-1(A) (i) Explain Picard's method of solving ordinary differential equation. Using 07
this method, solve $\frac{dy}{dx} = -xy$ with $x_0 = 0, y_0 = 1$ upto third
approximation.

(ii) Write merits and demerits of Adams-Bashforth Method. If $\frac{dy}{dx} = 2e^x y$, 07
y(0)=2, find y(4) using Adams predictor correction formula by
calculating y(1), y(2) and y(3) using Euler's modified formula.

OR

Q-1(A) (i) Write notes on Euler's and modified Euler's methods of solving the 07
ordinary differential equation. Point out their limitations.

(ii) Discuss Runge-Kutta method briefly of solving the ordinary differential 07
equation. Using Runge-Kutta method of 4th order, solve for y at x=1.2,
1.4 from $\frac{dy}{dx} = \frac{2xy+e^x}{x^2+xe^x}$ given $x_0 = 1, y_0 = 0$.

Q-1(B) Write any FOUR out of SIX 04
(i) What is single-step methods? Write its examples.
(ii) State limitations of Taylor's series method of solving the ordinary
differential equation.
(iii) Why Runge-Kutta method is better than Taylor's series method?
(iv) Define initial and boundary conditions for ordinary differential equation.
(v) Write formula of predictor-corrector method.
(vi) What do you mean by step-by-step methods?

Q-2 (A) (i) Solve the Poisson equation $u_{xx} + u_{yy} = -81xy$, 0<x<1, 0<y<1 given 07
that u(0,y)=0, u(x,0)=0, u(1,y)=100, u(x,1)=100 and h=1/3.

(ii) Solve the elliptic equation $u_{xx} + u_{yy} = 0$ for the following square mesh 07
with boundary values as shown.

0	300	600	300	0	0
500		u1 C	u2	u3	500
1000	A	u4	u5	u6 B	1000
500		u7	u8	u9	500
0					0
0	300	600	300	0	

OR

Q-2 (A) (i) Calculate the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$ subject to the conditions $u(x,0) =$ 07
$\sin \pi x$, $0 \le x \le 1$; u(0,t)=u(1,t)=0, using (a) Schmidt method, (b) Crank-

Nicolson method and (c) Du Fort-Frankel method. Carryout computations for two levels, taking h=1/3 and k=1/36.

(ii) Solve the equation $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2}$ satisfying the initial condition: **07**
$u(x, y, 0) = cos2\pi x\ cos2\pi y$, $0 \le x, y \le 1$ and conditions: $u(x, y, t) = 0$, $t > 0$ on the boundaries, using Alternating Direction Explicit (ADE) method with $h = \frac{1}{3}$ and $\alpha = \frac{1}{8}$. Calculate the results for one-time level.

Q-2(B) Write any FOUR out of SIX **04**

(i) Classify the equation: $x^2 u_{xx} + y^2 u_{yy} = xu_x - yu_y$.

(ii) What is limitation of Schmidt explicit formula?

(iii) How a general second order partial differential equation is classified?

(iv) What is the classification of the partial differential equation $f_{xx} + 2f_{xy} + f_{yy} = 0$?

(v) Why Crank-Nicholson's scheme is called an implicit scheme?

(vi) Write expression of standard 5-point formula of partial differential equations.

Q-3 (A) (i) What is voltage regulator? Discuss IC723 low and high voltage regulator **07**
with neat and clean circuit diagram.

(ii) Draw circuit diagram of first-order high pass filter using IC741 and **07**
obtain expressions for its gain and phase response.

OR

Q-3 (A) (i) Using IC741, discuss wide-band reject and narrow-band reject filter with **07**
proper circuit diagram.

(ii) Write short notes on foldback current limiter and external current boost **07**
transistor circuits using IC723 positive voltage regulator.

Q-3(B) Write any THREE out of FIVE **03**

(i) What is band pass filter? Classify it.

(ii) Which type of relationship of pn-junction diode is used by the logarithmic amplifier?

(iii) What do you mean by sample and hold circuits?

(iv) If centre frequency is 3 MHz and Q is 1000 then find the bandwidth of the band-pass filter.

(v) What is a universal filter?

Q-4 (A) (i) What is meant by pole and zero in pole-zero diagram? Examine and **07**
explain the pole-zero diagram of single tuned amplifier. Write use of it.

(ii) Draw and explain the pole-zero diagram for a stagger-tuned amplifier. **07**
Write advantages of increasing the number of stages in amplifier circuit.

OR

Q-4 (A) (i) Explain briefly PLL with its neat and clean block diagram and elucidate **07**
lock range and capture range from it.

(ii) Explain briefly shunt-peaked video amplifier with maximally flat gain **07**
response curve and time delay factor.

Q-4(B) Write any THREE out of FIVE **03**

(i) State uses of PLL in communication systems.

(ii) Define pulse duration with help of diagram.

(iii) What is a sag for pulse?

(iv) What do you mean by crossover frequencies?

(v) How inductively coupled circuit is employed in amplifier stage?

0603E1682   Candidate's Seat No :_____

M.Sc. (Sem.-3) Examination
502
Chemistry (Organic)
March 2019   [Max. Marks : 70

Time : 2-30 Hours]

Instructions: Figurs to the right indicate full marks of that question.

Q.1 (A)   Discuss third generation Cephalosporins. Give the synthesis of a Cephalosporin.   [14]
OR

Q.1 (A) (i) Explain broad spectrum antibiotics, Classify them on chemical structure   [7]
variation bases.

(ii) Write notes on structure variations in Tetracyclin. Give synthesis and uses of   [7]
Chloromphenicol.

Q.1 (B) Answer in short (Any four)   [4]
   (i) What is acid fast strains?
   (ii) How many chiral centre present in penicillin ?
   (iii) Give a structure of β- Lactum antibiotics.
   (iv) Define : Bectariocidal agents.
   (v) Give two name of narrow spectrum antibiotics.
   (vi) Give a structure of Bacitracin.

Q.2 (A)   What are hypnotics and sedatives ? Classify them and give synthsis of   [14]
Nickethemide.
OR

Q.2 (A) (i) Discuss intravenous general anaesthetics and Give synthesis of Procain.   [7]

(ii) Write notes on: Neurolaptics and give the synthesis of Thiopental.   [7]

Q.2 (B) Answer in short (Any four)   [4]
   (i) Define: Invivo and Invitro
   (ii) Give the structure of Lidocain
   (iii) Differentiate local and General anesthetics ?
   (iv) Give the structure of Pethidine.
   (v) Define : anti depressant agent.
   (vi) What is "Qinghaosu" ?

Q.3 (A)   Discuss moderm chemotherapy of malaria and give synthesis of Diltiazim.   [14]
OR

Q.3 (A) (i) Discuss structure activity relationship of 4- Amino quinolines and Chloroquin.   [7]

(ii) Give synthesis of: Ethionamide and Ethambutol .   [7]

Q.3 (B) Answer in short (Any four)   [3]
   (i) What is acid fast bacilli ?

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(ii) Give the structure of mefloquin.
(iii) Give use of Ziehl-Nelsen strain ?
(iv) What is bectariostatic agents ?
(v) Who is "The father of modern chemotherapy" ?

Q.4 (A)   Define and classify cardiovascular drugs. Give one example in each class. Give the   [14]
           synthesis of Atenolol.   OR

Q.4 (A) (i) Give classification of non mercurial diuretics and give synthesis of Chlorothiazide.   [7]
       (ii) Give synthesis of: Tolbutamide and Ethacrynic acid   [7]

Q.4 (B) Answer in short (Any three)   [3]
       (i) Define : Hypoglycemic condition
       (ii) Give the structure of glibenclamide.
       (iii) Give the structure and use of methyl dopa
       (iv) What is an arrhithmias ?
       (v) Give the structure of acetazolamide.

0603E1683

Candidate's Seat No : _____
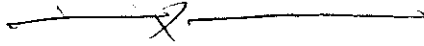
M.Sc. (Sem.-3) Examination
502
Chemistry (Analytical)
March 2019

Time : 2-30 Hours]

[Max. Marks : 70

Que. 1 (A) Discuss the various sources and detectors used in IR spectroscopy with neat and labelled diagram. **14**

OR

(A-i) Compare the monochromators used in IR and discuss their importance. **07**

(A-ii) Explain the mechanical model of stretching vibration in diatomic molecule. **07**

Que. 1 (B) Answer in one or two lines (any four out of six) **04**

(i) Name the different regions of IR with their range.

(ii) Name two hyphenated techniques to IR technique.

(iii) Give the characterization and types of bending vibration.

(iv) Give relation between frequency, wavelength and wave number.

(v) Define degree of freedom.

(vi) Give the name of interferometer used in FT-IR.

Que. 2 (A) Write short notes on (i) Resonance Raman spectroscopy and (ii) Remote Raman spectroscopy. **14**

OR

(A-i) Give the applications of Raman spectroscopy. **07**

(A-ii) Explain how the depolarization ratio is useful in determining the structure of molecules. **07**

Que. 2 (B) Answer in one or two lines (any four out of six) **04**

(i) Give the range of finger print region.

(ii) Give the full form of Nd: YAG laser source.

(iii) Name any two techniques related to Raman spectroscopy.

(iv) When Stokes lines are obtained in Raman spectroscopy?

(v) What is the use of LIDAR?

(vi) Give the limitations of Raman spectroscopy.

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Que. 3 (A) Discuss the theory of NMR by quantum description and instrumentation of **14** NMR spectroscopy.

OR

(A-i) Explain Spin-Lattice and Spin-Spin relaxation processes in NMR. **07**

(A-ii) How is high resolution spectra obtained in NMR spectroscopy? **07**

Que. 3 (B) Answer in one or two lines (any three out of five) **03**

   (i) What is the unit of chemical shift in NMR spectroscopy?

   (ii) Define Karplus relationship.

   (iii) Give the unit for coupling constant.

   (iv) Give two important applications of NMR spectroscopy

   (v) Give the importance of nuclear overhauser effect in short.

Que. 4 (A) Explain any one method for X-ray generation with suitable diagram. Enlist **14** various qualitative and quantitative applications of X-ray diffraction.

OR

(A-i) Write a note on types of detectors used in X-ray diffraction. **07**

(A-ii) Discuss the instrumentation of powder X-ray diffraction method. **07**

Que. 4 (B) Answer in one or two lines (any three out of five) **03**

   (i) What is White radiation or Background radiation?

   (ii) What is SWL in X-ray spectra?

   (iii) Differentiate between $K\alpha_1$ and $K\alpha_2$ spectral lines.

   (iv) Give two limitations of X-ray diffraction technique.

   (v) What is the function of CCD in X-ray diffraction?

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0603E1684   Candidate's Seat No :_____

M.Sc. (Sem.-3) Examination

502

Zoology

March 2019   [Max. Marks : 70

Time : 2-30 Hours]

NB: All questions are compulsory. Illustrate your answers with neat diagrams wherever necessary.

Q-1	(A)	Write the following		
		(i)	Give a brief account of ecological foot print.	07
		(ii)	Discuss solid waste management.	07
			OR	
		(i)	Briefly describe bioremediation.	07
		(ii)	Describe the various non-conventional sources of energy.	07
	(B)	MCQ / SQ (Any Four out of Six)		04
		(i)	What is ecological complexity?	
		(ii)	Define sustainable development?	
		(iii)	What is environmental impact assessment?	
		(iv)	What is the importance of conservation of natural resources?	
		(v)	Name the wildlife sanctuaries of Kutch.	
		(vi)	What is adaptive management?	
Q-2	(A)	Write the following		
		(i)	Briefly explain primary and secondary production.	07
		(ii)	Describe food chain, food web and ecological pyramid.	07
			OR	
		(i)	Give a brief description of the biogeographical zones of india.	07
		(ii)	Explain the patterns and theories of succession.	07
	(B)	MCQ / SQ (Any Four out of Six)		04
		(i)	What is realized niche?	
		(ii)	What is annual actual evapotranspiration?	
		(iii)	What is top-down control?	
		(iv)	What is compensation pint?	
		(v)	Define biome.	
		(vi)	What is Bergmann's rule?	
Q-3	(A)	Write the following		
		(i)	What is quadrat? Write quadrat sampling method in detail.	07
		(ii)	Write short note on population growth.	07
			OR	
		(i)	Discuss about population selection and life history strategies.	07
		(ii)	Write in detail about age structure.	07
	(B)	MCQ / SQ (Any Three out of Five)		03
		(i)	Write formula to find out abundance.	
		(ii)	Number of eggs or ova produced by an organism per year is known as _____.	
		(iii)	Cohort life table is also known as _____or _____ life table.	
		(iv)	Migration of fishes from sea water to fresh water is known as _____.	
		(v)	Give the names of three different types of clumped distribution.	
Q-4	(A)	Write the following		
		(i)	Explain mutualism with suitable examples.	07
		(ii)	Write short note on carbon cycle.	07
			OR	
		(i)	Explain interspecific and intraspecific competition with examples.	07
		(ii)	Give an account on environmental degradation and pollution.	07
	(B)	MCQ / SQ (Any Three out of Five)		03
		(i)	Where is phosphorous present in our body?	
		(ii)	What is phoresis? Explain with an example.	
		(iii)	Define carbon footprint.	
		(iv)	What is ammonification process.	
		(v)	Write general nature of interaction between two species in amensalism type of biotic interaction.	

0603E1685   Candidate's Seat No : _____

M.Sc. (Sem.-3) Examination
502
Mathematics

Time : 2-30 Hours]   March 2019   [Max. Marks : 70

Q. 1(A) Answer the following questions.   [14]

(1) If $G = <a>$ is a cyclic group of order n. Then prove that $G = <a^k>$ if and only if gcd(k,n)=1.

(2) State and prove Lagrange's theorem for finite groups.

OR

(1) Prove that a group cannot be expressed as a union of its two proper subgroups.

(2) Define the center of the group. Prove that the center of a group G is a subgroup of G.

(B) Attempt any Four.   [04]

(1) Prove or disprove: The group $(\mathbb{Q}, +)$ is cyclic.

(2) How many generators does the group $(\mathbb{Z}, +)$ have?

(3) Give an example of a non-Abelian group of order 8.

(4) Give an example of a group G that is Abelian but not cyclic.

(5) True or False: The Symmetric group S_n has a normal subgroup of index 2.

(6) True or False: The group U(16) is cyclic.

Q. 2(A) Answer the following questions.   [14]

(1) Prove that the group $Aut(\mathbb{Z}_n)$ is isomorphic to $U(n)$.

(2) Prove that A_n is a subgroup of the symmetric group S_n and $|A_n| = \frac{n!}{2}$.

OR

(1) State and prove Cayley's theorem.

(2) Show that every permutation of a finite set can be expressed as a cycle or as a product of disjoint cycles.

(B) Attempt any Four.   [04]

(1) List all the elements of $\mathbb{Z}_{40}$ that have order 10.

(2) Let a and b are elements of the group. If $|a| = 10, |b| = 21$, show that $<a> \cap <b> = \{e\}$.

(3) What is the order of the group $Aut(\mathbb{Z}_{12})$? Explain.

(4) Prove that any finite cyclic group of order k is isomorphic to $\mathbb{Z}_k$.

(5) How many elements of order 2 are there in the group $\mathbb{Z}_{100} \oplus \mathbb{Z}_{400}$? Explain.

(6) True or False: The group $\mathbb{Z}_4 \oplus \mathbb{Z}_5$ is isomorphic to $\mathbb{Z}_{20}$.

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Q. 3(A) Answer the following questions. [14]

    (1) State and prove G/Z theorem.

    (2) State (only) the fundamental theorem of finite Abelian groups. Determine the isomorphic classes of Abelian group of order 50.

<div align="center">OR</div>

    (1) Prove that A_4 has no subgroup of order 6.

    (2) Define homomorphism. If ϕ is a homomorphism from group G to K, prove that $|\phi(g)|$ divides $|g|$.

  (B) Attempt any Three. [03]

    (1) Let ϕ be a group homomorphism. If $kernel\phi = \{e\}$, prove that ϕ is one-one.

    (2) Prove that the center of a group G is a normal subgroup of G.

    (3) Give a subgroup H of symmetric group S_3 such that is H not normal.

    (4) True or False: If G/H is Abelian then G is Abelian. Justify.

    (5) Define : Normalizer N(H) and Centralizer C(H) of a subgroup H.

Q. 4(A) Answer the following questions. [14]

    (1) State and prove Sylow's first theorem.

    (2) Define simple groups. State and prove non-simplicity test.

<div align="center">OR</div>

    (1) State and prove Sylow's third theorem.

    (2) Define simple groups. Prove that A_5 is simple.

  (B) Attempt any Three. [03]

    (1) By an example show that a group of order 10 need not be Abelian.

    (2) True or False: If $|G| = 81$, then its centre $Z(G)$ is non-trivial.

    (3) Prove that any group of prime order is simple.

    (4) Prove that there is no simple group of order 35.

    (5) Every non-Abelian group is simple. True or False?

0603E1686   Candidate's Seat No :_____

Time : 2-30 Hours]   [Max. Marks : 70

Instructions:
1. **All symbols carry their usual meanings.**
2. **Scientific calculators are allowed**

Q.1Ai). What is meant by poles and zeros of a transfer function of a control system?
The transfer function of a control system is given by

$$G(s) = (s+j) / (s+1)(s+3j)$$

Find out the poles and zeros of the system and represent on Pole-Zero plot. [7]

ii). Write a short note on Synchros. [7]

OR

Q.1Ai). List the advantages of analogous systems. Discuss Force-current analogy. [7]
ii). Write a descriptive note on Stepper motor. [7]

Q.1B). Answer the following (**Any Four**) [4]
i). List the two main requirements of a good control system.
ii). Give two examples of open loop control system.
iii). In Voltage –Force analogy, write the analogous of **spring constant K.**
iv). Write any two standard test signals and their Laplace transform.
v). What is servomotor ?
vi). State the difference between distributed and lumped type of system.

Q.2Ai). Compare the block diagram and Signal flow graph (SFG) method. What is Mason's gain equation? State the steps for solving SFG using this formula. [7]

ii). Derive the expressions of steady state error coefficient (e_{ss}) for type zero, and type one systems when the input given is a step function. [7]
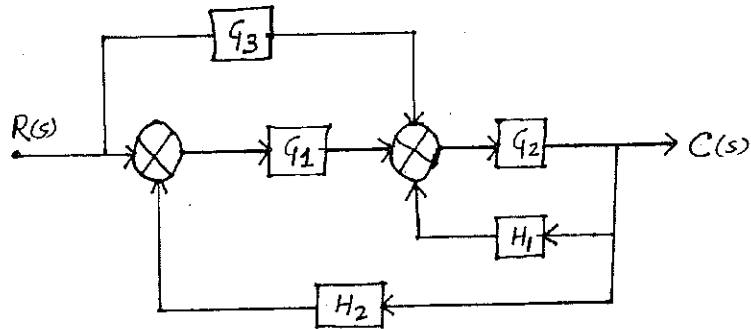
OR

Q.2Ai). Discuss time response of second order system which is subjected to unit impulse input for over-damped condition ($\xi > 1$). [7]
ii). Reduce the following block diagram to its canonical form and get its transfer function (indicating the rules as applied). [7]

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Q.2B). Answer the following (**Any three**) [3]
   i). State the rule for shifting the Take off point after the Block.
   ii). What is meant by "ORDER" of a system?
   iii). When damping ratio (ξ) is 1, the **Poles** are real. **TRUE OR FALSE.**
   iv). What is the value of Peak overshoot (**Mp**) for damping ratio ξ = 0
   v). What is meant by transient response and steady state response?

Q.3Ai). Write a program to read a series of 50 values, using a function find out average of highest and lowest values in the series, print result from main(). [7]
   ii). Distinguish between array, structure and union. Give separate examples for declaration and initialization of array, structure and union. With help of an example explain nested structure. [7]

OR

Q.3Ai). Write a program to read a string, call a function to change case of each alphabet in the string. [7]
   ii). Write a program to define a structure **book** with title, author, year of publication and cost as its members and read information about 1000 books. The program should print average cost of the books and details of all books authored by Balagurusamy. [7]

Q.3B). Attempt **any four** from the following [4]
   i). Distinguish between automatic variable and static variable.
   ii). By default a function returns _____ type value.
   iii). Write prototype of a function which has two float values as its arguments and returns a double value.
   iv). Correct the following prototype declarations
         float fun1(x, y);
         void fun2(int a, b, c);
   v). The _____ operator is used to link structure variable with its elements.
   vi). Give an example of nested structure.

Q.4Ai). Write a program to read a series of 50 values, using a function with pointer arguments find out average of all even values in the series. The function should make use of pointer increments. [7]

ii). Write a program to copy content of a user specified file into another user specified file. Program should check error in opening the files. [7]

OR

Q.4Ai). Write a program to read two numbers, call a function with pointer arguments to exchange the numbers. The program should print original values and exchanged values from main(). [7]

ii). Write a program to read 50 values, store all values between 1 and 100 in a file. Read content of the file, and then write odd and even numbers in two separate files. Program should check errors in opening all files. [7]

Q.4B). Attempt **any three** from the following [3]
i). What do you understand by a pointer variable?
ii). What happen when a pointer is incremented?
iii). In the following statement, **double** represents what?
double *x = &y;
iv). What is meant by the following statement?
fseek (fp, -2, 1);
v). Distinguish between the following functions
getw(), gets()

****

0603E1687   Candidate's Seat No : _____

M.Sc. (Sem.-3) Examination
502
Clinical Research

Time : 2-30 Hours]   March 2019   [Max. Marks : 70

Que. 1 (A) Write the following

    (i) Enlist different clinical data management steps and discuss in brief each of them   07

    (ii) Roles and Responsibilities and Code of Ethics for CDM Professional   07

<div align="center">OR</div>

    (i) Write a note on Clinical Data Entry   07

    (ii) Audit Trail   07

Que.1 (B) Answer the following (Any four)   04

    (i) Define: Biometrics

    (ii) Name the two parts of an ICF

    (iii) Define: Self Evident Correction

    (iv) Give full form of COSTART

    (v) Enlist 3 advantages of eCRF over paper CRF

    (vi) Give the difference between CRF and DCF.

Que. 2 (A) Write the following

    (i) Data Management: An Integral Part of a Clinical Trial.   07

    (ii) Discuss Features of a Standard CRF   07

<div align="center">OR</div>

    (i) Short Note: CDISC   07

    (ii) 21 CFR Part 11   07

Que.2 (B) Answer the following (Any four)   04

    (i) Define: Z test

    (ii) Enlist SOPs for Data Entry

    (iii) Subject Name is a required field in the header of a CRF. True/False?

    (iv) Define: Discrepancy

    (v) Enlist any 3 essential documents generated during the study.

    (vi) Give full form of ANOVA

P. T. O

1687-2

Module VIII Clinical Data Management & Biostatistics

Que. 3 (A) Write the following

 (i) Define Data Coding and discuss problems with coding the data   07

 (ii) Roles and Responsibilities of a Data Manager   07

<div align="center">OR</div>

 (i) Draw and discuss organogram of a Clinical Data Management Department   07

 (ii) Data Freezing   07

(B) Answer the following (Any three)   03

 (i) Explain: Duty Delegation Form

 (ii) Define: Variance

 (iii) Give full form of IVRS

 (iv) Define: eSource Data

 (v) Give the importance of Data Archival

Que. 4 (A) Write the following

 a) Based on the grouped data below find out mean, median and mode.   07

Time to travel to work	Frequency
1-10	08
11-20	14
21-30	12
31-40	09
41-50	07

 b) Enlist graphs used in Clinical Research and discuss each one of them in detail.   07

<div align="center">OR</div>

 c) Discuss in brief role of Biostatistician in Clinical Trial   07

 d) Find out standard deviation for following data   07

No. of Order	f
0-3	05
3-6	11
6-9	18
9-12	22
12-15	14
15-18	04
18-21	02

Module VIII Clinical Data Management & Biostatistics

(B) Answer the following (Any Three)   03

(i) Define: Heads up and Heads down Data Entry

(ii) Explain: "Expected but missing pages" with reference to data tacking

(iii) Give full form of OCR

(iv) A CRF is to be printed before a trial starts. True/False?

(v) Define: Edit Check

— X —

0703E1702 Candidate's Seat No :_____

M.Sc. (Sem.-3) Examination

503

Physics

Time : 2-30 Hours] **March 2019** [Max. Marks : 70

Instructions: (1) Attempt All Questions.

(2) Symbols and terminology have their usual meanings.

(3) Scientific calculator may be permitted.

Q.1(A)(i)	Draw circuit of 9 bit even parity generator and explain its working.	7
Q.1(A)(ii)	Draw circuit and explain working of decade counter. Also draw the waveforms.	7

OR

Q.1(A)(i)	Draw the circuit of astable multivibrator using IC 555 and explain the working.	7
Q.1(A)(ii)	Draw internal block diagram of IC 7495. Show how it can be used as all types of shift registers.	7
Q.1(B)	**Answer any 4 out of 6:**	4
1.	Give pin diagram of IC 555	
2.	How many flip flops are required to store a nibble?	
3.	Give full forms of EPROM & RAM	
4.	8 bit shift registers are there. Which type of shift register will require highest number of pins?	
5.	What is synchronous counter?	
6.	Give application of binary to hexadecimal converter.	

Q.2(A)(i)	Write a note on different types of displays.	7
Q.2(A)(ii)	With help of diagram explain the operation of R-2R DAC.	7

OR

Q.2(A)(i)	With circuit diagram explain operation of successive approximation ADC.	7
Q.2(A)(ii)	The analog input range is 0 to +2 volts. If step height of 4 mV is required; what is the minimum number of Digital Bits required for the convertor?	7
Q.2(B)	**Answer any 4 out of 6:**	4
1.	Find comparators required for 8 bit flash convertor ADC.	
2.	What is pull-up resistor?	
3.	What is resolution of 8 bit ADC having input range of 0 to +4 V?	
4.	Give numbers of two ICs used as 4 bit counters.	
5.	What is principle of working of LCD display?	

1

[P. T. O.]

6.   How can we produce LEDs emitting different colour light?

Q.3(A)(i)   Discuss (i) Microcomputers (ii) Workstations   7

Q.3(A)(ii)   Draw relevant schematics of 8085 Hardware Model, Programming   7
Model and Flag Register and discuss each one briefly

OR

Q.3(A)(i)   List the difference between Instruction and Instruction sets. Give   7
classification of 8085 instructions and discuss each categories.

Q.3(A)(ii)   What is a memory? Discuss memory classification.   7

    3

Q.3(B)   **Answer any 3 out of 5:**

1.   List four operations performed by the MPU

2.   Specify the function of data bus

3.   List four control signals commonly used by the 8085 MPU

4.   What is a buffer?

5.   Draw a schematic of tri state buffer with active low enable line

Q.4(A)(i)   Draw relevant schematics of the logic pin out and signals of the 8085   7
Microprocessor. Discuss Address bus, Multiplexed address/data bus,
Control and status signals, Power supply and clock frequency.

Q.4(A)(ii)   Draw schematic of Latching Low-order Address bus and discuss   7
demultiplexing of the bus AD_7-AD_0. The address of high order bus is
20H and low order bus is 05H.

OR

Q.4(A)(i)   Draw a Functional Block diagram of the 8085A Microprocessor.   7
Discuss the ALU, Timing and control unit, Instruction Register and
Decoder, Register Array.

Q.4(A)(ii)   Draw a logic diagrams and functional table of the 74LS245   7
bidirectional buffer. Discuss D flip-Flops as Latch and clocked.

    3

Q.4(B)   **Answer any 3 out of 5:**

1.   Explain the function of the ALE signal of the 8085 microprocessor

2.   Explain the function of the IO signals of the 8085 microprocessor

3.   Specify the crystal frequency required for an 8085 system to operate
at 1.5 MHz

4.   If the clock frequency is 3 MHz, how much time is required to
execute an instruction of 18 T states?

5.   CALL instruction is _____ byte/s instruction
****

0703E1703   Candidate's Seat No :_____

M.Sc. (Sem.-3) Examination
503
Chemistry (Inorganic)

Time : 2-30 Hours]   March 2019   [Max. Marks : 70

Que. 1 (A) Write a note on "Pharmacopoeia of India. And discuss about British   **14**
pharmacopoeia and British national formulary.

OR

(A-i) Define the term monograph. Discuss the contents of monograph in detail?   **07**

(A-ii) What are gastro-intestinal tract agents? Give a brief account of acidifying   **07**
agents and gastric antacids.

Que. 1 (B) **Answer in one or two lines (any four out of six)**   **04**

(i)   Why Bismuth compounds are used as GI agents?

(ii)   Give an example of combination antacid preparation.

(iii) Give an example of electrolytes used for replacement therapy.

(iv)   Which receptors govern gastric acid secretion?

(v)   What are acidifying agents?

(vi)   What do you mean by very slightly soluble?

Que. 2 (A) What are topical agents? Classify them and explain their mode of action   **14**
giving suitable examples.

OR

(A-i) What are expectorants? Classify them giving suitable examples and how do   **07**
they act?

(A-ii) What are respiratory stimulant? Give a brief account of inorganic   **07**
respiratory stimulants?

Que. 2 (B) **Answer in one or two lines (any four out of six)**   **04**

(i)   Give an example of astringent?

(ii)   What is the difference between zinc oxide and calamine?

(iii) Describe the word alum, used as an astringent?

(iv)   Give an example of Anti-dandruff agent?

(v)   What are emetic and anti-emetic drugs?

(vi) Give an example of Anti-tussive agents.

Que. 3 (A) Write a note on Metals used for diagnosis and chemotherapy.   **14**

OR

(A-i) Give a brief outline on Antibacterial agents.   **07**

(A-ii) Write a note on trace element Iron.   **07**

Que. 3 (B) Answer in one or two lines (any three out of five)   **03**

(i) Write the name of clinical candidates of Lanthanum carbonate.

(ii) Define the term Minerals.

(iii) Write the name of Cu chelator.

(iv) Write the mode of action of Gallium nitrate.

(v) What is AE?

Que. 4 (A) Write a note on Vanadium complexes.   **14**

OR

(A-i) Explain pyridine based NHCs and their metal complexes.   **07**

(A-ii) Discuss in detail Silver based antimicrobial agents.   **07**

Que. 4 (B) Answer in one or two lines (any three out of five)   **03**

(i) Write the full name of STZ

(ii) Give the use of radio isotopes of 105Rh and 111Ag.

(iii) What is the half-life of 111Ag?

(iv) Give the structure for BMOV.

(v) Give the full name of IMA.

———————————

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M.Sc. (Sem.-3) Examination

503

Chemistry (Organic)

Time : 2-30 Hours]   **March 2019**   [Max. Marks : 70

Instructions : (1) Figures to the right indicate Full Marks.

1 (a) Draw the schematic diagram of fypical double beam IR spectrometer and explain its woring   14
in brief. Write a note on various applications of UV-spectroscopy.

OR

(a)   (1)   Describe different shifts in UV₋psoctroscopy.   7
(2)   Calculate the M-max values for the following compounds :   7
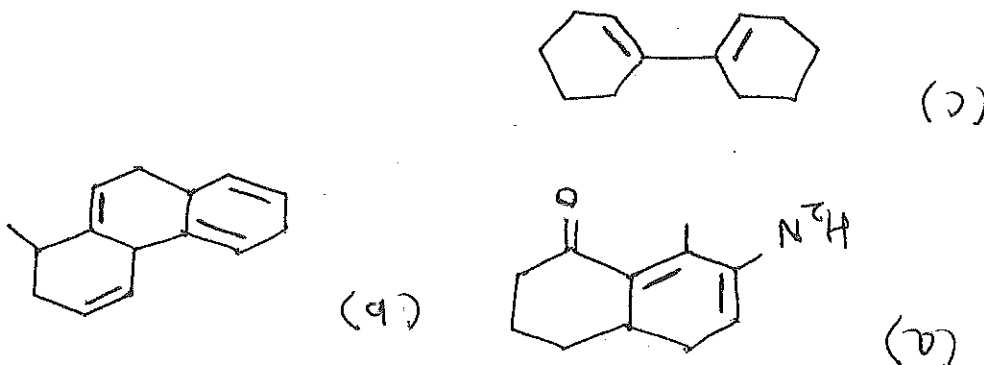
(b) Answer in one or two lines (any four out of six) :   4
(1)   Define Absorbance
(2)   Define Hyperchromic effect
(3)   En list the detectors used in UV-visible and IR-spectrophotometer
(4)   Why IR-spectra called band spectra?
(5)   How will you distinguish CH_3CONH_2 and $CH_3CH_2NH_2$?
(6)   What is the use of Nujol in IR-spectra?

2 (a) Define : chemical shift and describe the factor affecting to it. Predict the structure mass 88   14
whose PMR data is given below :
(1)   A triplet (1.23 δ) 3H
(2)   A singlet (1.97 δ) 3H
(3)   A quartet (4.06 δ) 2H

OR

(1)   Discuss HETCOR spectroscopy with suitable example. Show how it differ from cosy.
(2)   Explain the spin system AB, AMX and ABX with suitable example.

P - T O'

(b) Answer in one or two lines (any four out of six) : 4

(1) What is spin-spin splitting.

(2) Define : Coupling constant (J)

(3) What is meant by induced magnetic field.

(4) Give the relative decreasing order of d values for 3^0, 2^0, 1^0 prptons of alkanes as compared to CH_4 hydrogens.

(5) What do you know about magmetically non-equivalent protons?

(6) In case of -OH and -NH resonances broad signals are oberved Why?

3 (a) What is off-resonance decoupling in ^{13}(-NMR, HOW is ^{13}(-NMR is different from ^{1}H-NMR Describe some important feature of the mass-spectra of amines with example. 14

OR

(1) Explain DEPT spectram in ^{13}C-NMR with example.

(2) Give fragmentation of aliphatic and aromatic acids.

(b) Answer in one or two lines (any three out of five) : 3

(1) What is the natural abundance of ^{13}CNMR?

(2) Why ^{13}C-NMR spectra are more difficalt to resord compared to ^{1}H-NMR spectra?

(3) What do you know about M^+ and M^+ ion?

(4) What is Mclafferty rearrangement?

(5) What do you mean by base peak?

4 (a) An organic compound with m.f. $C_{10}H_{12}O_2$ exhibits the following spectral data. 14

UV : Λ max 263 nm 410E

IR : 2832, 1712, 1632, 1598, 1550, 1355, 1328, 1237, 1105, 732, 694 cm^1

^{1}HNMR : ɣ1.12 (d, 6H), 3.46(M, 1H) 7.21 (S, 5H)

^{13}C NMR : δ 15.1, 27.2, 124.9, 128.2, 135.6, 149.3, 173

Deduce the structure of the compound with suitable explaination, and give the fragmentation of resultant structure.

OR

(1) An organic compound with MW 135 ehibits the following spectral data. Inentufy the compound

UV : Λ max 273 nm

IR : 3410, 2829, 1698, 1642, 1578, 1237, 737, 698 cm^1

^{1}HNMR : 81.6 (S, 1H), 2.26(S, 3H), 6.98 (S, 5H)

^{13}C NMR : δ 28.0, 126.0, 128.1, 130.2, 207.5, 130.5

(2) Identify the compound on the basis of spectral data. Show the reasoning for the conclusion arrived at

UV : 243 nm, 280 nm

IR : 3300, 3000+, 3000, 1670, 1650, 1510 cm^{-1}

NMR : 1.3(3H), 2.1(3H), 4.0(2H), 6.8, 7.6(1H), 7.3d(4H)

CMR : 14.8, 24.2, 63.7, 114.7, 122.0, 131.0, 155.8 168.5

MS : M+ 179, 137, 43, 27 and 29, 108/109
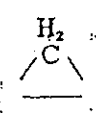
(b)   Answer in one or two lines (any three out of five) :   3

(1)   A compound with molecular formula C7H5OCl3 shows a three proten singlet at δ(3.9) and two one proton doublets (7=8Hz) at δ 6.76 and 7.3. Identify the compound.

(2)   Predict the number of signals and their multiplicities for the PMR spectrum of p-Nitrotoluene.

(3)   Deduce the structure of the organic compound m.f. C_9H_{10}, δ 7.30 (m, 5H) 5.34(d, 1H) 5.05(M, 1H) 2.11(d, 3H)

(4)   An organic compound with m.f. C_8H_{18} shows the following characterstic absorption bonds :

2925 cm⁻¹, 1465 cm⁻¹, 1380 cm⁻¹ and 720 cm⁻¹

Determine the structure of the compound.

(5)   Determine the structure of the compound whose m/e values in the mass spectrum are 100, 85, 71, 57, 43 (base), 41, 29 and 27.

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35M390-5

COMMON FRAGMENTS LOST

Molecular Ion Minus	Fragment Lost Inference structure
1	H·
2	2H·
15	CH_3·
16	O ($ArNO_2$, amine oxides, sulfoxides); · NH_2 (carboxamides, sulfonamides)
17	HO·
18	H_2O (alcohols, aldehydes, ketones)
19	F·
20	HF
26	$CH \equiv CH$, · $CH \equiv N$
27	$CH_2 = CH$·, $HC \equiv N$ (aromatic, nitriles, nitrogen heterocycles)
28	$CH_2=CH_2$, ·, CO, (quinones) (HCN+H)
29	CH_3, CH_3·; (ethyle ketones, $ArCH_2CH_2CH_3$), · CHO
30	NH_2CH_2·, CH_2O ($ArOCH_3$), NO ($ArNO_2$), C_2H_6
31	·OCH_3(methyl esters), · CH_2OH, CH_3NH_2
32	CH_3OH, S
33	HS · (thiols), (·CH_3 and H_2O)
34	H_2S (thiols)
35	Cl·
36	HCl, $2H_2O$
37	H_2Cl (or HCl + H)
38	C_3H_2, C_2N, F_2
39	C_3H_3, HC_2N
40	$CH_3C \equiv CH$
41	$CH_2 = CHCH_2$·
42	$CH_2 = CHCH_3$, $CH_2 = C = O$, $H_2C\overset{H_2C}{\diagup}\diagdown$ CH_2, NCO, $NCNH_2$
43	C_3H_7 · (propyl ketones, $ArCH_2$–C_2H_5), $CH_3\overset{O}{\overset{\|}{C}}$ · (methyl ketones, $CH_3\overset{O}{\overset{\|}{C}}G$, where G= various functional groups), $CH_2 = CH$–O· (CH · and $CH_2 = CH_2$), HCNO
44	$CH_2 = CHOH$, CO_2 (esters, anhydrides) N_2O, $CONH_2$, $NHCH_2CH_3$
45	CH_3CHOH, CH_3CH_2O (ethyl esters), CO_2H, ·$CH_2CH_2NH_2$
46	(H_2O and $CH_2 = CH_2$), CH_3CH_2OH, · NO_2 ($ArNO_2$)
47	CH_3S·
48	CH_3SH, SO(sulfoxides), O_3
49	·CH_2Cl
51	·CHF_2

35M390-6

52 C_4H_4, C_7N_2
53 C_4H_5
54 $CH_2 = CH - CH = CH_2$
55 $CH_2 = CHCHCH_3$
56 $CH_2 - CHCH_2CH_3$, $CH_3CH = CHCH_3$, 2CO
57 C_4H_9 (butyl ketones), C_3H_5CO (ethyl ketones, $EtC=OG$, G = various structural units)
58 NCS, $(NO + CO)$, CH_3COCH_3, C_4H_{10}

Chemical Shifts for Carbon Atoms in Carbon - 13 Nuclear Magnetic Resonance Spectra

Type of Carbon Atom	δ^*	Type of Carbon Atom	δ^*
RCH_2CH_3	13–16	$RCH = CH_2$	115–120
RCH_2CH_3	16–25	$RCH = CH_2$	125–140
R_3CH	25–38	$RC \equiv N$	117–125
$CH_3\overset{O}{\overset{\|}{C}}R$	~30	ArH	125–150
$CH_2\overset{O}{\overset{\|}{C}}OR$	~20	$R\overset{O}{\overset{\|}{C}}OR'$	170–175
RCH_2Cl	40–45	$R\overset{O}{\overset{\|}{C}}OH$	177–185
RCH_2Br	28–35	$R\overset{O}{\overset{\|}{C}}H$	190–200
RCH_2NH_2	37–45	$R\overset{O}{\overset{\|}{C}}R'$	205–220
RCH_2OH	50–64		
$RC \equiv CH$	67–70		
$RC \equiv CH$	74–85		

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SELECTED SPECTRAL DATA
Characteristic Infrared Absorption Frequencies

Bond Type	Stretching, cm^{-1}	Bending, cm^{-3}
C-H alkanes	2960-2850 (s)	1470-1350 (s)
C-H alkenes	3080-3020 (m)	1000-675 (s)
C-H aromatic	3100-3000 (v)	870-675 (y)
C-H aldehyde	2900, 2700 (m, 2 bands)	
C-H alkyne	3300 (s)	
C≡C alkyne	2260-2100 (v)	
C≡N nitrile	2260-2220 (v)	
C=C alkene	1680-1620 (v)	
C=C aromatic	1600-1450 (v)	
C=O ketone	1725-1705 (s)	
C=O aldehyde	1740-1720 (s)	
C=O α,β-unsaturated ketone	1685-1665 (s)	
C=O aryl ketone	1700-1680 (s)	
C=O ester	1750-1735 (s)	
C=O acid	1725-1700 (s)	
C=O amide	1690-1650 (s)	
O-H alcohols (not hydrogen bonded)	3650-3590 (v)	
O-H alcohols (hydrogen bonded)	3600-3200 (s, broad)	1620-1590 (v)
O-H acids	3000-2500 (s, broad)	1655-1510 (s)
N-H amines	3500-3300 (m)	
N-H amides	3500-3350 (m)	
C-O alcohols, ethers, esters	1300-1000 (s)	
C-N amines, alkyl	1220-1020 (w)	
C-N amines, aromatic	1360-1250 (s)	
NO$_2$ nitro	1560-1515 (s)	
	1385-1345 (s)	

s = strong absorption
m = medium absorption
w = weak absorption
v = variable absorption

Typical chemical shifts for Types of Hydrogen Atoms
Seen in Proton Magnetic Resonance Spectra

Type of Hydrogen Atom	δ*	Type of Hydrogen Atom	δ*
RCH$_3$	0.9	R$_2$C=CH$_2$	5.0
RCH$_2$R acyclic	1.3	RCH = CR$_2$	5.3
acyclic	1.5	ArH	7.3
R$_3$CH	1.5-2.0	O ‖ RCH	9.7
R$_2$C=C CH$_3$ | R'	1.8	RNH$_2$	1-3
O ‖ RCCH$_3$	2.0-2.3	ArNH$_2$	3-5
ArCH$_3$	2.3	O ‖ RCNHR	5-9
RC≡CH	2.5	ROH	1-5
RNHCH$_3$	2-3	ArOH	4-7
RCH$_2$X (X = Cl, Br, I)	3.5	O ‖ RCOH	10-13
ROCH$_3$, O ‖ RCOCH$_3$	3.8		

WOODWARD RULES FOR CONJUGATED DIENE ABSORPTION

$\pi \rightarrow \pi^*$ Transitions

Acyclic diene or heteroannular diene (transoid)	214	nm
Homoannular diene (cisoid)	253	nm
Increment for each:		
Double bond extending conjugation	30	nm
If double bond conjugation is cis	40	nm
Exocyclic double bond	05	nm
Increment for each substituents:		
Alkyl group or ring residue (R)	05	nm
Chlorine (Cl) or Bromine (Br)	05	nm
Alcohol (OH) or Alkoxy (OR)	06	nm
Ester (OCOR)	00	nm
Amine (NR₂)	60	nm
Thioether (SR)	30	nm

✓ WOODWARD RULES FOR αβ - UNSATURATED ALDEHYDES AND KETONES ABSORPTION

$\pi \rightarrow \pi^*$ Transitions

$$\overset{\delta}{|}\ \overset{\gamma}{|}\ \overset{\beta}{|}\ \overset{\alpha}{|}\ Z \qquad Z = H \quad \text{aldehyde} \quad Z = R \text{ ketone}$$
$$-C=C-C=C-C=O \quad Z = OH, -OR : acid, ester$$
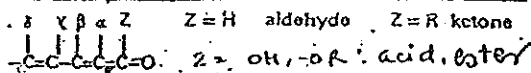
Acid, ester	193	
αβ – Unsaturated aldehyde	208	nm
αβ – Unsaturated acyclic or six carbon ring ketone	215	nm
αβ – Unsaturated five carbon ring ketone	202	nm
Increment for each:		
Double bond extending conjugation	30	nm
If double bond conjugation is cis	40	nm
Exocyclic double bond	05	nm
Increment for each substituents:			
Alkyl group or ring residue (R)	α	10	nm
	β	12	nm
	γ, δ	18	nm
Chlorine (Cl)	α	15	nm
	β, χ, δ	12	nm
Bromine (Br)	α	25	nm
	β	30	nm
	γ, δ	25	nm
Alcohol (OH)	α	35	nm
	β	30	nm
	γ	30	nm
	δ	50	nm
Alkoxy (OR)	α	35	nm
	β	30	nm
	γ	17	nm
	δ	31	nm
Ester (OCOR)	α, β, γ, δ	06	nm
Amine (NH₂, NHR, NR₂)	β	95	nm
Thioether (SR)	β	85	nm

8

0703E1705   Candidate's Seat No :_____

2 /23

M.Sc. (Sem.-3) Examination
503
Chemistry (Analytical)
March 2019

Time : 2-30 Hours]   [Max. Marks : 70

Que. 1 (A) Discuss the importance of electro-capillarity and impedance measurements.   **14**

OR

(A-i) Discuss the measurements of voltage when zero and finite current flow through the circuit of an electrochemical cell.   **07**

(A-ii) Explain the Stern's model for the formation of electrical double layer.   **07**

Que. 1 (B) **Answer in one or two lines (any four out of six)**   **04**

(i) How faradic and non- faradic current are different from each other?

(ii) Explain the different terms of Tafel's equation.

(iii) Define current density.

(iv) Give the importance of Nernst equation.

(v) Define a diffusion controlled system.

(vi) Define faradic admittance?

Que. 2 (A) Explain the square wave voltammetric and AC polarographic techniques with suitable diagrams.   **14**

OR

(A-i) Discuss the working principle of differential pulse polarography.   **07**

(A-ii) Discuss the technique "stripping analysis" and give its importance.   **07**

Que. 2 (B) **Answer in one or two lines (any four out of six)**   **04**

(i) Name the property being measured in amperometric titration.

(ii) Give the voltage pattern of cyclic voltammetry.

(iii) Give the relationship between faradaic current and time.

(iv) Which technique is used to study the reversibility of a redox reaction?

(v) Name two modified AC polarographic techniques.

(vi) Give the detection limit of normal pulse polarography.

(P. T. O)

Que. 3 (A) Why electro-deposition at controlled potential is selective and electro-deposition at constant potential and constant current is non-selective? **14**

<center>OR</center>

(A-i) Discuss the three factors which increase the applied potential needed for electrolysis. **07**

(A-ii) Explain in brief the electro-deposition at constant current, constant potential and controlled potential. **07**

Que. 3 (B) Answer in one or two lines (any three out of five) **03**

(i) What is the preferred shape of cathode?

(ii) Give the difference between coulometric method and electrodeposition.

(iii) Give the relation between activity and ionic strength.

(iv) Define an electrolytic cell?

(v) Write down the different components for an electrochemical cell used for electrodeposition.

Que. 4 (A) Describe the various potentiometric biosensors linked with pH, NH_3, CO_2, Ag_2S and I_2. **14**

<center>OR</center>

(A-i) Explain in brief conductometric sensors and biosensors. **07**

(A-ii) Explain the determination of Glucose and Lactate using amperometric biosensors. **07**

Que. 4 (B) Answer in one or two lines (any three out of five) **03**

(i) Give various types of sensors.

(ii) Draw a neat and labeled diagram of Clark Oxygen Electrode.

(iii) What are potentiometric sensors based on?

(iv) Give the full form of NAD and IGFET.

(v) Draw a neat and labeled diagram of Glass electrode.

0703E1706   Candidate's Seat No : _____

M.Sc. (Sem.-3) Examination
503
Mathematics (Old)
March 2019

Time : 2-30 Hours]   [Max. Marks : 70

1. (A) (i) Find $\partial_x w$ and $\partial_y w$ in terms of the partial   [7]
            derivatives $\partial_1 f$, $\partial_2 f$ and $\partial_3 f$, where
            $w = \arctan[f(2x-y, y, 2)]$.

   (ii) Find the extreme values of   [7]
         $f(x,y) = 2x^2 - 2x - 3y^2$ on the set
         $\{(x,y) : x^2 + y^2 \le 1\}$.

                        OR

   (i) Find and classify the critical points of the   [7]
        function $f(x,y) = xy(8 - 2x - 4y)$.

   (ii) Find the Taylor polynomial of order 4   [7]
         based at $a = (0,0)$ of the function
         $f(x,y) = y\cos(x+y)$.

   (B) Do any four.   [4]

   (i) Find the directional derivative of the function
        $f(x,y) = xy^2 + \sin\pi xy$ at the point $(-2,1)$ in
        the direction $\left(\frac{4}{5}, \frac{3}{5}\right)$.

   (ii) Compute $\frac{\partial y}{\partial x}$ where y is determined as a
         function of x and z by the equation
         $x + y^3 + z^2 = 3xyz$.

   (iii) Calculate $\partial_x \partial_y f$ where $f(x,y) = xy^2 + \sin\pi xy$.

   (iv) Find the second order Taylor polynomial of
         $f(x,y) = e^{x+y^2}$ about $(x,y) = (0,0)$.

   (v) Let $(u,v) = f(x,y,z) = (xyz - 4y, 3y^2 - xyz)$.
        Compute $Df(x,y,z)$.

   (vi) Find the tangent plane to the surface in
         $\mathbb{R}^3$ described by the equation $z = 2x^2 - 3y^2$
         at the point $a = (0,0,0)$.

                                              (P.T.O)

2. (A) (i) Investigate the possibility of solving the [7]
equations $\begin{cases} yz + 2xz - 3xy = 0 \\ xyz + y - z = 0 \end{cases}$,

for two of the variables as functions of the
third near the point $(x, y, z) = (2, 2, 2)$.

(ii) Let S be the circle formed by intersecting [7]
the plane $x + y = 2$ with the sphere $x^2 + y^2 + z^2 = 4$.
Find a parametrization of S. Find parametric
equations for the tangent line to S at the
point $(1, 1, \sqrt{2})$.

OR

(i) Find a parametrization for the hyperboloid [7]
$x^2 + y^2 - z^2 = 1$.

(ii) Let $(u, v) = f(x, y) = (e^x \cos 2y, e^x \sin 2y)$. [7]
Compute the Jacobian $\det(Df)$. Draw a
sketch of the images of some of the lines
$x = $ constant and $y = $ constant in the
u-v plane. Find a formula for a local inverse of f.

(B) Do any four.: [4]

(i) Draw a sketch of $S = \{(x, y) : \frac{x^2}{2^2} + \frac{y^2}{3^2} = 1\}$.

(ii) Draw a sketch of $S = \{(x, y) : y^2 - x^2 = 1\}$.

(iii) Draw a sketch of $S = \{(x, y) : x^2 + y^2 - 2x + 2y + 1 = 0\}$.

(iv) Draw a sketch of $S = \{(x, y, z) \in \mathbb{R}^3 : x^2 + y^2 = 4\}$.

(v) Find a parametric equation of the line which
is the intersection of the plane $2x - z = 0$
and the plane $4x - y = 0$.

(vi) Give the parametrization of the unit sphere
by spherical coordinates. (Do not prove).

3. (A) (i) Find the volume of the region in $\mathbb{R}^3$ above the   [7]
triangle T in the xy-plane with vertices
$(0,0)$, $(1,0)$ and $(0,1)$ and below the surface
$z = xy + x^2$.

(ii) Find the centroid of the portion of the ball   [7]
$x^2 + y^2 + z^2 \leq 4$ lying in the first octant,
$(x, y, z \geq 0)$.

OR

(i) Find the volume of the ellipsoid   [7]
$(x - 2y)^2 + (x + 2y - z)^2 + x^2 \leq 1$.

(ii) Find the centroid of the tetrahedron   [7]
bounded by the co-ordinate planes and
the plane $4x + 5y + 6z = 60$.

(B) Do any three.   [3]

(i) Find the area of the parallelogram with
vertices $(0,0)$, $(2,3)$, $(1,4)$, $(3,7)$.

(ii) Evaluate $\int_0^1 \int_1^3 x^2 \, dy \, dx$.

(iii) Write down (without proof) the 4-dimensional
volume of the ball $x^2 + y^2 + z^2 + w^2 \leq 2^2$.

(iv) Let $S = \{ (x,y) : x + y < 2, x^2 + y^2 \leq 4 \}$.
Find $\chi_S(-1, 1)$. (χ_S is the characteristic
function of S).

(v) Let $S \subseteq \mathbb{R}^3$, $S = [1,3] \times [-1, 0] \times [1,4]$.
Find the 3-dimensional volume of S.

$(P.T.O)$

E1706-4

4. (A) (i) Find $\int_C y\,dx + x\,dy$, where C is the portion [7]
of the curve $y = x^3$ from $(0,0)$ to $(1,1)$.

(ii) Evaluate the surface integral [7]

$$\iint_S F \cdot n\,dA \quad \text{where}$$

$F(x,y,z) = x^2 i + y^2 j + z^2 k$, and S
is the surface of the cube $0 \le x, y, z \le 4$.

OR

(i) Evaluate $\int_{\partial S} 3x^2 \sin y^2\,dx + 2x^3 y \cos y^2\,dy$, [7]

where S is any regular region with piecewise
smooth boundary.

(ii) Find the centroid of the upper hemisphere [7]
of the unit sphere $x^2 + y^2 + z^2 = 1$.

(B) Do any three. [3]

(i) Find the arc length of the parametrized
curve $g(t) = (\cos t, \sin t, 3t), 0 \le t \le 2\pi$.

(ii) State Green's theorem.

(iii) Write down (without proof) the area of
the torus obtained by revolving the circle
$(x-4)^2 + z^2 = 1$ in the xz-plane about
the z-axis.

(iv) State the Divergence theorem.

(v) Compute the curl of the vector field
$F(x,y,z) = xy i + yz j + zx k$.

M.Sc. (Sem.-3) Examination
503
Statistics

Time : 2-30 Hours]   **March 2019**   [Max. Marks : 70

Q-1(A) Write the following.

(i) Define Multivariate normal distribution. Obtain its characteristic function. If $\underline{x} \sim N_p(\underline{\mu}, \Sigma)$ and C:mxp be any arbitrary matrix then obtain the distribution of $C\underline{x}$.   07

(ii) Let $\underline{x} \sim N_p(\underline{\mu}, \Sigma)$ and partition $\underline{x}$, $\underline{\mu}$ and Σ as follows:

$$\underline{x} = \begin{bmatrix} \underline{x}_1 \\ \underline{x}_2 \end{bmatrix} \begin{matrix} r \\ s \end{matrix}, \quad \underline{\mu} = \begin{bmatrix} \underline{\mu}_1 \\ \underline{\mu}_2 \end{bmatrix} \begin{matrix} r \\ s \end{matrix} \quad \text{and} \quad \Sigma = \begin{bmatrix} \Sigma_{11} & \Sigma_{12} \\ \Sigma_{12} & \Sigma_{22} \end{bmatrix} \begin{matrix} r \\ s \end{matrix}, \quad r + s = p$$

Show that $\underline{x}_1 - \Sigma_{12}\Sigma_{22}^{-1}\underline{x}_2$ and $\underline{x}_2$ are independently distributed. Also, obtain the conditional distribution of $\underline{x}_1$ given $\underline{x}_2 = x_2$.   07

OR

(i) Define Partial Correlation coefficient for p variables. In usual notation obtain the expression in terms of elements of $\Sigma^{-1} = (\sigma^{ij})$ for it.   07

(ii) Define canonical correlation coefficients and canonical variates. In usual notation Show that the canonical correlations are solution of the determinant equation

$$\begin{vmatrix} -\lambda\Sigma_{11} & \Sigma_{12} \\ \Sigma_{12} & -\lambda\Sigma_{22} \end{vmatrix} = 0 .$$
   07

Q-1(B) Answer the following questions. (Any four)   04

(i) Write any two applications of multivariate normal distribution in real field.

(ii) If $\underline{x}_1$, $\underline{x}_2$,........., $\underline{x}_n$ be a random sample of n independent observation from $N_p(\underline{\mu}, \Sigma)$ Population then write MLE's of μ and Σ.

(iii) If $\underline{x}_1$ and $\underline{x}_2$ are independent $N_p(\underline{\mu}_r, \Sigma_r)$; r = 1, 2 then write the distribution of $\underline{x}_1 - \underline{x}_2$.

(iv) If joint probability density function of (x, y) is $\frac{1}{2\pi}\exp\left[\frac{-1}{2}\{(x-1)^2 + (y-2)^2\}\right]$ then write the values of $\mu_x, \mu_y, \sigma_x, \sigma_y$ and ρ_{xy}.

(v) If the marginal distribution of each x_i is normal, this does not necessarily imply that the Joint distribution of $(x_1, x_2,..., x_p)$ is p-variate normal. State whether this statement is true of false. Justify your answer. (true)

(P.T.O)

(vi) If $\underline{x} \sim N_p(\underline{\mu}, \Sigma)$ then how many distinct parameters has to be estimated?

Q-2 (A) Write the following.

    (i) In usual notations obtain pdf of Wishart matrix V when $\mu = 0$ and $\Sigma = I$.   07

    (ii) State important properties of Wishart distribution.   07

<div align="center">OR</div>

    (i) Obtain null distribution of sample correlation coefficient r. Write E(r) and Var(r). 07

    (ii) Obtain MLE's of $\underline{\mu}$ and Σ for p-variate normal distribution.   07

Q-2 (B) Answer the following questions. (Any four)   04

    (i) Define Multiple correlation coefficient $R_{1.23...p}$.

    (ii) Write application of Multiple correlation coefficient $R_{1.23...p}$.

    (iii) Write any two applications of Wishart distribution.

    (iv) State the reproductive property of Wishart distribution.

    (v) If $\underline{x}_1, \underline{x}_2$ are two independent observations from $N_2(0, \Sigma)$ population with $\Sigma = \begin{pmatrix} 1 & 2 \\ 2 & 11 \end{pmatrix}$, then write the value of $E(\underline{x}_1\underline{x}_1' + \underline{x}_2\underline{x}_2')$.

    (vi) Let $\underline{X}_1, \underline{X}_2, ..., \underline{X}_{20}$ be a random sample of size n=20 from a $N_9(\underline{\mu}, \Sigma)$ population. Specify the distribution of (n-1)S.

Q-3 (A) Write the following.
(i) Define Hoteling's T^2 statistic. Show that Hoteling's T^2 is used to test the hypothesis $H_0 : \underline{\mu} = \underline{0}$ against $H_1 : \underline{\mu} \neq \underline{0}$ when $\underline{x} \sim N_p(\mu, \Sigma)$.   07

(ii) Discuss the problem of testing equality of two mean vectors from multivariate normal populations with unknown but equal covariance matrices.   07

<div align="center">OR</div>

(i) Define principal components. If $\Sigma = \begin{pmatrix} 1 & \rho \\ \rho & 1 \end{pmatrix}$, where $\rho > 0$, then find the principal components associated with matrix Σ and find the percentage of total variance explained by the first principal component. 07

(ii) Define sample Mahalanobis distance D^2. Write the relation between Hotelling's T^2 and D^2. Hence, obtain the distribution of D^2. 07

Q-3 (B) Answer the following questions. (Any three) 03

    (i) Write the distribution of T^2 under $H_0 : \underline{\mu} = \underline{0}$.

    (ii) Write any two applications of Hoteling's T^2 statistic.

    (iii) Write any two applications of principal components.

    (iv) "Principal components obtained from covariance matrix and correlation matrix are not same". State whether this statement is true or false? Justify your answer.

    (v) Define the correlation coefficient between principal component Y_i and the variable X_k.

Q-4 (A) Write the following.

(i) Obtain the estimated minimum ECM rule for classifying an object $\underline{X}_0$ when $\Sigma_1 = \Sigma_2$. 07

(ii) Define error of misclassification. Obtain probabilities of errors of misclassification for the classification rule you obtained in terms of the Mahalanobis distance Δ^2. 07

OR

(i) Explain orthogonal factor model with K common factors. Give principal component solution of the factor model. 07

(ii) Obtain null distribution of sample correlation coefficient matrix $R = (r_{ij})$. 07

Q-4 (B) Answer the following questions. (Any three) 03

    (i) Define Fisher's Linear Discriminant function.

    (ii) If $f_1(x_0) = 0.3$ and $f_2(x_0) = 0.4$, $C(2/1) = 5$ and $C(1/2) = 10$ units and prior probabilities are $p_1 = 0.6$ and $p_2 = 0.4$, then classify x_0 in one of the two populations π_1 and π_2.

    (iii) What is the aim of factor analysis?

    (iv) Define communalities in terms of factor analysis.

    (v) When MANOVA is preferred to ANOVA?

0703E1708   Candidate's Seat No :_____

M.Sc. (Sem.-3) Examination
503
Life Science

Time : 2-30 Hours]   **March 2019**   [Max. Marks : 70

Instructions:

All questions are compulsory.
Illustrate your answers with neat diagrams wherever necessary.

1 (A) **Answer in Detail:**

i) Explain Mean and Mode with examples. [07]

ii) A certain stimulus administered to each of 12 patients resulted in the following [07] changes in blood pressure:

6, 2, 8, -2, 3, 0, -4, 1, 5, 0, 7, 9.

Can it be concluded that the stimulus will in general be accompanied by an increase in blood pressure? (Given for 11 d.f., t0.05 = 2.20).

OR

i) Explain One-Way ANOVA in detail. [07]

ii) Discuss the test of Significance and importance of degree of freedom and [07] probability.

1 (B) **Answer in Short: (Any Three)** [03]

i) Explain: Standard Error

ii) Define: Regression

iii) Explain: Alternative Hypothesis

iv) Define: Level of Significance.

v) What is meant by Correlation?

2 (A) **Answer in Detail:**

i) Explain meaning and significance of Research. [07]

ii) Describe the tools and techniques involved in Secondary structure prediction. [07]

OR

i) Write Research Proposal of your Dissertation work. [07]

ii) Give a detailed account on: Ramchandran Plot [07]

2 (B) **Answer in Short: (Any Four)** [04]

i) Explain: Null Hypothesis

ii) What do you mean by 'Analytical Research'?

iii) What is Bibliography?

iv) State the full form of PDB.

v) Explain: NCBI

vi) Name any two Biological Databases.

3 (A) **Answer in Detail:**

i) Explain principle and construction of Phase contrast Microscope. Add its [07] applications.

ii) Describe the principle and technique of Transmission Electron Microscope. Add [07] its applications.

OR

i) Discuss the instrument and technique of Epi-fluorescence Microscopy. Mention [07] its applications.

ii) Give an account on "Construction of Bright Field Microscope". Mention its [07] applications in biological sciences.

3 (B)   **Answer in Short: (Any Three)**   [03]

i) Define and derive Resolution in Microscope.

ii) Explain the Role of Vernier Scale used for specimen Holder in Stage of Microscope.

iii) Enlist the Types of Eye pieces used in Light Microscope.

iv) Define Refraction pattern in Magnetic Lens.

v) Discuss the role of Paraboloid Lens in Dark Field Condenser.

4 (A)   **Answer in Detail:**

i) Discuss the Principle and Instrumentation of FACS.   [07]

ii) Explain role of Flow Cytometer in various Cytological Characterizations.   [07]

OR

i) Write the workflow for Cytotoxicity assay.   [07]

ii) Describe the Matrix Assisted Laser Desorption and Ionization Mass Spectroscopy.   [07]

4 (B)   **Answer in Short: (Any Four)**   [04]

i) Discuss the principle of Laminar Viscous Drag

ii) Define Stream in Air breaks up and ink-jet Graphic Technique.

iii) Name two Animal models for Cancer.

iv) Define: LD_{50}

v) Explain: QSAR

vi) What is Pressure Pulse theory?

E 1709

0703E1709

Candidate's Seat No : _____

M.Sc. (Sem.-3) Examination

503

Environmental Science

Time : 2-30 Hours]

March 2019

[Max. Marks : 70

Q.1 A   Discuss the Environment Protection Policy of India.   14
or

Write short notes on following:

Q. 1 A (i) Global Warming is Global warning   07

Q. 1 A (ii) Contemporary Pollution Problems in India   07

Q. 1 B Answer Any Two out of four: 04

1   Environmental protection and improvement were explicitly incorporated into the constitution by the _____ by inserting article 48-A and 51-A(g) in"Directive principles of state policy" and Fundamental Duties" respectively
A)52nd Amendment act,1985
B)35th Amendment act, 1974
C)42nd Amendment act, 1976
D)45th Amendment act, 1980

2   16 September is celebrated every year as the international Day for preservation of the Ozonelayer because it commemorates the dates of singing of _____ on substance that deplete the Ozone Layer
A)   Geneva Convention
B)   Marrakesh Convention
C)   Kyoto Protocol
D)   Montreal Protocol

3 Silence area comprise an area of not less than _____ meters around hospitals, educational institutions and courts as per the Noise Pollution (Regulation and Control) Rules, 2000
A) 50
B) 100
C) 200
D) 250

Q.2 A Discuss Salient features of The Air (Pollution & Prevention) Act, 1981.   14

C.P. T.O)

or

Write short notes on following:

Q. 2 A (i) Provisions relating to 'Hazardous Process' under the Factories Act, 1948

07

Q. 2 A (ii) Sustainable Development   07

Q. 2 B Answer Any Two out of four: 04

1. The prohibition and restrictions on location of industries and carrying on of activities and processed in different areas under EP act is prescribed under
    A) Section 16 of the Act
    B) Section 11 of the Act
    C) Rule 5 of the Rules
    D) Schedule IV of the Rules

2. Which sections defines "environment" under the EP Act?
    A) Section 2(c)
    B) Section 2(b)
    C) Section 2(a)
    D) Not Defined

3   Under the constitution of India which of the following articles are releting to environment protection.

    A) Article 21
    B) Article 48
    C) Article 48 A (g)
    D) Article 25

Q.3 A – Explain the Doctrine of Absolute Liability in India.   14
or

Write short notes on following:
Q. 3 A (i) Functions of Central Pollution Control Board   07

Q. 3A (ii) Sample taking method under The Water (Pollution & Prevention) Act, 1981.

07

Q. 3 B Answer Any Two out of four: 04

1. Under the Air act, 1981 which body is empowered to set standard for ambient air quality?

    A) Ministry of Home Affairs
    B) CPCB
    C) Ministry of Forest and Environment

E 1709-3

D) State Ministry of Home Affairs

2. . Which provision conforms upon the State Board set up under Air Act,1981, the power of entry and inspection to determine that rules are complied with?

A) Section 12
B) Section 18
C) Section 19
D) Section 24

3   Which of the following is not the principle of International Environmental Law?

A) Public trust doctrine
B) Precautionary Principle
C) Doctrine of Estoppel
D) Polluter pays Principle

Q.4 A. Discuss Provisions relating to Environment Protection under the Constitution of India.   14

or

Q. 4 A (i) 42nd Amendment of Constitution relating to environment.   07

Q. 4 A (ii) Polluter pays principle   07

Q. 4 B Answer Any Two out of four: 04

1   The central pollution control board (CRPB) is authorized to take into matters of environmental pollution. Where is this authority derived from?
A)Environmental (protection) Act, 1986
B)Water (prevention and Control of Pollution) act, 1974
C)National green tribunal act, 2010
D)National environment tribunals act, 1995

2   In which case did the court hold the doctrine of public trust to be part of the law land, after looking into ancient Roman Empire and modern English law?
A)M C Mehta v. Kamalnath, (1997) 1 SCC 1997
B)Majrasingh v. Indian oil corpn. AIR 1999 J&K 81
C)S.I.V Industries Ltd v. T N Pollution Control board (19960 2 MLJ 51)
D)T. Damodar Rao v. Municipal Corpn. Of Hyderabad, AIR 1987 Ap 171

3   Sample taking method under the Water Act is under section ----

A) Section 15
B) Section 10
C) Section 11
D) Section 20

0703E1710   Candidate's Seat No : _____

M.Sc. (Sem.-3) Examination
503
Bio-Medical Technology
March 2019

Time : 2-30 Hours]   [Max. Marks : 70

NB: All questions are compulsory.
         Illustrate your answers with neat diagrams wherever necessary

1. (A).   **Answer the following:**
    (i)   Briefly explain the process of folliculogenesis.   7
    (ii)   Discuss menstrual cycle and explain the endocrine control.   7
                                OR
    (i)   Describe spermatogenesis and the hormonal regulation involved.   7
    (ii)   Explain the ultrastucture of head and mid-piece region of the sperm cell.   7

1. (B)   **Give Short Answers (ANY FOUR- 1 mark each):**   4
    a.   Explain briefly: Amenorrhoea
    b.   What is spermeogenesis?
    c.   What is the importance of Leydig cell?
    d.   What is meant by follicular atresia?
    e.   Explain: Capacitation of sperm.

2. (A).   **Answer the following:**
    (i)   Write an account on: Radiation therapy.   7
    (ii)   Write a note on: X-Rays and their applications.   7
                                OR
    (i)   Describe the principle and procedure for ECIL Assays.   7
    (ii)   Discuss the principle and advantage of Sandwich ELISA.   7

2. (B)   **Give Short Answers (ANY FOUR):**   4
    a.   What is meant by brachytherapy?
    b.   Explain the importance of a Radioreceptor assay.
    c.   State the applications of ELISA assays.
    d.   Mention two isotopes used for radiation diagnostics.
    e.   What is a PET scan?

3. (A). **Answer the following:**
    (i)   What is the role of Y chromosome and Y-specific genes in sex determination?   7
    (ii)   Explain the development of external genitalia in detail.   7
                                OR
    (i)   Write a note on sperm preparative techniques.   7
    (ii)   Discuss: MART.   7

3. (B).   **Give Short Answers (ANY THREE- 1 mark each):**   3
    a.   What are the indications for an IVF?
    b.   Briefly explain: GIFT
    c.   Explain: Testicular feminization syndrome
    d.   State the significance of: SRY.

4. (A).   **Answer the following:**
    (i)   Describe surgical methods for male contraception   7
    (ii)   Discuss briefly anatomical causes for male infertility.   7
                                        OR
    (i)   Describe endocrine and lifestyle factors causing infertility in female.   7
    (ii)   Write a note on: Contraceptive pills   7

4. (B).   **Give Short Answers (ANY THREE- 1 mark each):**   3
    a.   Explain briefly: Varicocele
    b.   Distinguish between: Primary and secondary infertility.
    c.   Explain briefly: Barrier methods for Contraception
    d.   Mention Iatrogenic causes for male infertility.

E|7|6 -3

M. Sc. Semester – III [NEW COURSE]
COURSE: BMT 503 (REPRODUCTIVE TECHNOLOGIES & RADIATION DIAGNOSTICS)

Time: 2-30 hours   Total Marks: 70

NB: All questions are compulsory.
          Illustrate your answers with neat diagrams wherever necessary

1. (A).   **Answer the following:**
    (i)   Describe the ultrastructural details of spermatozoa.   7
    (ii)   Explain Capacitation and acrosome reaction.   7
                                    OR
    (i)   Describe the phases of the menstrual cycle and explain its regulation.   -7
    (ii)   Explain the process of ovulation and discuss its endocrine control.   7

1. (B)   **Give Short Answers (ANY FOUR- 1 mark each):**   4
    a.   What is amenorrhoea?
    b.   Write the functions of Sertoli cell.
    c.   Briefly describe: Corpus luteum.
    d.   Explain in brief: Etiology of PCOS
    e.   Name two biochemical components of semen.

2. (A).   **Answer the following:**
    (i)   Explain giving details: PET scan.   7
    (ii)   Write a note on: Properties and types of X-rays.   7
                                    OR
    (i)   Describe the principle and procedure for IRMA.   7
    (ii)   Discuss the principle and method of Competitive ELISA.   7

2. (B)   **Give Short Answers (ANY FOUR):**   4
    a.   What is brachytherapy?
    b.   Explain briefly: CAT scan
    c.   State applications of ECIL Assays.
    d.   What is the specific feature of an MRI?
    e.   Explain: advantages of ELISA.

3. (A). **Answer the following:**
    (i)   Discuss the steps for IVF.   7
    (ii)   Describe the process for cryopreservation of gametes.   7
                                    OR
    (i)   Write a note on Ovarian hyperstimulation and oocyte pick-up for IVF.   7
    (ii)   Describe various Assisted Reproductive technologies.   7

3. (B).   **Give Short Answers (ANY THREE- 1 mark each):**   3
    a.   What are the main side effects of IVF?
    b.   Briefly explain: Vitrification.
    c.   Explain: SUZI
    d.   Describe the main components of a micromanipulator.
    e.   What are the advantages of ICSI?

4. (A).   **Answer the following:**
   (i)   Describe various non-surgical contraceptive techniques in the female.   7
   (ii)   Discuss endocrine and environmental factors resulting in infertility.   7
                           OR
   (i)   Write a note on vasectomy, vasoculsion and vasoligation.   7
   (ii)   Explain various testis anomalies leading to infertility.   7

4. (B).   **Give Short Answers (ANY THREE- 1 mark each):**   3
   a.   Explain briefly: Unexplained infertility
   b.   Mention surgical methods for female contraception
   c.   Briefly explain: Immunological factors associated with infertility.
   d.   State two tests for sperm function.

0703E1711   Candidate's Seat No : _____

M.Sc. (Sem.-3) Examination
503
Bio-Technology (Integrated)
Time : 2-30 Hours]   **March 2019**   [Max. Marks : 70

Q-1 (A) Explain molecular mechanism of enzyme catalysis and enzyme kinetics .   14
                              OR
A(I) Explain metalloproteins and their biological significance   07
 (II) Describe multienzyme system with example of pyruvate dehydrogenase complex.   07
(B) Answer any four.   04
   1.   Which are the different types of reversible inhibition of an enzyme?
   2.   Which are the five key aminopeptidases?
   3.   Coenzyme-A is derived from _____ vitamin and its deficiency causes _____.
   4.   Define the term an allosteric enzyme.
   5.   Which are methods of enzyme regulation?
   6.   Ribozymes participate in a variety of RNA processing reactions which includes_____.

Q-2 (A) What is enzyme engineering? Describe classical methods in protein engineering.   14
                              OR
A(I) Explain: Genetically engineered insulin .   07
 (II) Describe immobilized enzymes and methods of immobilization.   07
Q-2 (B) Answer any four.   04
   1.   What is asymmetric catalysis?
   2.   Why enzymes are less active in organic solvents then in waters ?
   3.   What is endonuclease?
   4.   What is vector? Give any two examples.
   5.   Define the term biosensor.
   6.   Name the instrument used for separation of DNA fragments.

Q-3 (A) What are biofertilizers? Explain plant growth promoting and biocontrol microbes.   14
                              OR
A(I) Explain in detail on siderophore production.   07
 (II) Describe microbial production of biosurfactant and their importance.   07
(B) Answer any three   03
   1.   Which are indirect mechanisms of biocontrol microbes?
   2.   What is mineralization?
   3.   Give two names of microorganisms producing the respective polysachharides.
   4.   Why intracellular enzymes are more difficult to isolate?
   5.   What are the applications of amylase enzymes?

Q-4 (A) Explain in detail: Mineral resources and depletion of natural resources.   14
                              OR
A(I) Describe microbial leaching of metals.   07
 (II) Explain: microbial enhanced recovery of oil.   07
(B) Answer any three.   03
   1.   Define: extremophiles.
   2.   What is biofilms?
   3.   What is biotransformation of drugs?
   4.   Which are the renewable sources of energy?
   5.   What is biomethanation?

0703E1712

Candidate's Seat No :_____

M.Sc. (Sem.-3) Examination

503

Clinical Research

Time : 2-30 Hours]

March 2019

[Max. Marks : 70

Que. 1 (A) (i) Write a note on European Union PV guideline   07

(ii) Write a note on WHO-ART   07

OR

(i) Write a note on ICH-E2D   07

(ii) Write a note on UMC   07

Que. 1 (B) MCQs (Any Four out of Six)   4

1. Define: SUSAR

2. Define : Signal

3. Write a full form of EEA-EFTA _____

4. Define: International Birth Date

5. Define: Vigisearch

6. Explain The Hierarchy In MeDRA?

Que. 2 (A) (i) Write a note on PSUR   07

(ii) Short Note: MedDRA   07

OR

(i) Audit in Pharmacovigilance   07

(ii) Expedited reporting requirement as per Australian Pharmacovigilance

Guideline   07

Que. 2 (B) MCQs (Any Four out of Six)   4

1. Define: Vigimed

2. Write a full form of PADER_____

3. Differentiate between Expected Adverse Events & Unexpected Adverse Events

4. What is ASPR-MHRA?

5. When do you consider an event to be serious?

6. Define SAE

Module IX Pharmacovigilance & Post Marketing Surveillance

Que. 3 (A) (i) Write a note on ICH-E2A   07

    (ii) Explain Risk Management Plan   07

        OR

    (i) Discuss case series development as per Good Pharmacovigilance

     Practice   07

    (ii) Write a note on Pharmacovigilance Centers in India   07

Que.3 (B) MCQs (Any Three out of Five)   03

 1. Name some data elements in ICSR?

 2. What is the minimum criterion required for a valid case?

 3. What do you mean by causality?

 4. Full form: PDUFA_____

 5. What Are Data Assessments In Pharmacovigilance?

Que. 4 (A) (i) Write a note on NPP   07

    (ii) Write a note on ICH-E2CR2   07

        OR

    (i) Write a note on General Principles of PBRER   07

    (ii) Describe content and structure of MedRA   07

Que.4 (B) MCQs (Any Three out of Five)   03

 1. Define Pharmacovigilance

 2. Write Full form of SUSAR.

 3. Mention the types of Pharmacovigilance

 4. Name The Regulatory Bodies In USA, UK, Japan And India?

 5. What Is Volume 9a?

_____

1. *All symbols carry their usual meanings.*
2. *Scientific calculators are allowed*

Q.1Ai). Discuss how ionosphere affects wave propagation. Derive an expression for refractive index of ionosphere. **[7]**

ii). Describe in detail about uplink power budgeting in case of geostationary satellites. **[7]**

OR

Q.1Ai). Derive an expression for field strength at a distance in case of space wave (tropospheric wave) propagation. **[7]**

ii). Describe in detail about station keeping and attitude control in the context of satellite communication. **[7]**

Q.1B). Attempt any four questions from the following **[4]**

i) What is meant by plasma angular frequency?

ii) Which ionospheric layer has highest critical frequency?

iii) What do you understand by skip distance?

iv) Frequencies near to 22 GHz are not used for satellite communication, why?

v). What is the major limitation of LEO orbits for satellite communication?

vi). What is the major advantage of Ka band for satellite communication compared to other bands.

Q.2Ai). Briefly describe the following in context of satellite communication
   a). Polarization discrimination   b). Multiple access methods **[7]**

ii). Discuss the merits and demerits of optical fiber communication in comparison with satellite communication. Derive an expression for numerical aperture of an optical fiber. Mention its significances. **[7]**

OR

P. T. O

Q.2Ai). What is meant by index profile of a fiber? Based on index profiles how fibers are classified? Mention their merits and demerits. **[7]**

ii). What do you understand by dispersion in optical fibers? Why is it significant? Mention major types of dispersions in optical fibers and explain any one in detail. **[7]**

Q.2B). Attempt **any three** from the following **[3]**

i). Which is the fundamental mode of propagation in optical fibers?

ii). What is the major advantage of single mode fiber?

iii). What are the two major frequency ranges used optical fiber communication?

iv). What is the advantage of PIN diode over PN diode?

v). At lower bit rates, the distance between source and transmitter in optical fiber communication is decided by loss, but at high bit rates the distance is decided by _____.

Q.3Ai). Define amplitude modulation. Derive the expression of instantaneous voltage for amplitude modulated wave. Define amplitude modulation index (m_a). **[7]**

ii). Draw and discuss the circuit of Foster Seeley detector. **[7]**

OR

Q.3Ai). What is Angle modulation and its different types? Explain generation of FM wave using JFET reactance modulator. **[7]**

ii). Describe the generation of Single sideband suppressed carrier (SSBSC) modulation using **Third method.** **[7]**

Q.3B). Answer the following **(Any Four)** **[4]**

i). Write two points to state the need for modulation.

ii). Is amplitude modulation index (m_a) independent of modulating signal frequency?

iii). State two advantages of SSB modulation.

iv). What is the bandwidth of amplitude modulated wave with modulating signal frequency (f_m) = 10kHz.

v). Ratio detector offers Amplitude limiting. **TRUE or FALSE.**

vi). Is Frequency Modulation a Constant Bandwidth system?

Q.4Ai). Describe Phase shift keying (PSK) in detail. Draw its frequency spectrum and find out its bandwidth requirement? **[7]**

ii). What is meant by bit timing recovery? Discuss **Early - Late** gate circuit for bit timing recovery? **[7]**

OR

Q.4Ai). What is meant by probability of bit error in baseband transmission system?
Draw the circuit of matched filter for rectangular pulses and explain its working.

[7]

ii). Define pulse code modulation? How is signal to quantization noise ratio $(S/N)_q$ related to number of quantized levels (L)?
A telephone signal with a cut off frequency of 3 kHz is digitized into 6 bit samples. Calculate Signal to noise $[(S/N)_q]$ ratio in dB.

[7]

Q.4B). Answer the following **(Any three)** [3]
  i). What is meant by Asynchronous type of transmission?
  ii). Is MSK a special type of CPFSK?
  iii). What is the value of Figure of merit (α) in case of ASK system.
  iv). What is aliasing effect?
  v). The bit error probability is _____ in **UNI POLAR** waveform.

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$E1734-4$

GUJARAT UNIVERSITY
M.Sc (Physics) Semester-III Examination
OLD SYLLABUS

PHY-504 : Electronic Communication-I

Maximum Marks : 70   **Time: 2hrs 30 mts.**

Instructions:
1.   All symbols carry their usual meanings.
2.   Scientific calculators are allowed

Q.1Ai). Sketch the lumped representation of a typical transmission line. What is meant by propagation constant in case of transmission line? Considering a cascaded T-network, derive expressions for it.   **[7]**

ii). Explain the terms reflection coefficient and standing wave ratio for transmission lines? Obtain a relation between them. What should be ideal values of reflection coefficient and standing ratio when the line is (i) short circuited (ii) open circuited (iii) terminated in its characteristic impedance?   **[7]**

OR

Q.1Ai). What is a Smith chart? With help of diagram explain its major features.   **[7]**

ii). Discuss how ionosphere affect wave propagation. Derive an expression for refractive index of ionosphere.   **[7]**

Q.1B). Attempt **any four** from the following   **[4]**
   i).   What are the advantages of coaxial line compared to two-wire line?
   ii). Write the expression for voltage as a function of distance in case of a transmission line terminated in its characteristic impedance.
   iii). What is the value of normalized impedance at the center of the Smith chart?
   iv). Mention any one application of quarter wave lines.
   v).   What is the importance of critical frequency in short wave communication?
   vi). What is meant by plasma angular frequency?

Q2Ai). Derive an expression for field strength at a distance in case of space wave (tropospheric wave) propagation.   **[7]**

ii). Describe in detail about uplink power budgeting in case of geostationary satellites.   **[7]**

OR

Q.2Ai). Describe in detail about station keeping and attitude control in the context of satellite communication. **[7]**

ii). What is meant by multiple accessing in connection with satellite communication? Mention different techniques used for multiple accessing. Describe any on method in detail. **[7]**

Q.2B). Attempt **any three** questions from the following **[3]**

i). What is the inclination of the INSAT satellite?

ii). Frequencies near to 22 GHz are not used for satellite communication, why?

iii). What is Effective Isotropic Radiative Power (EIRP)?

iv). What is the major disadvantage of Ka band for satellite communication compared to other bands.

v). What is the major limitation of LEO orbits for satellite communication?

Q.3Ai). Define amplitude modulation. Derive the expression of instantaneous voltage for amplitude modulated wave. Define amplitude modulation index (m_a). **[7]**

ii). Draw and discuss the circuit of Foster Seeley detector. **[7]**

OR

Q.3Ai). Define pulse code modulation? How is signal to quantization noise ratio $(S/N)_q$ related to number of quantized levels (L)?
A telephone signal with a cut off frequency of 3 kHz is digitized into 6 bit Samples. Calculate Signal to noise $[(S/N)_q]$ ratio in dB. **[7]**

(ii) Describe the generation of Single sideband suppressed carrier (SSBSC) modulation using **Third method.** **[7]**

Q3B). Answer the following (**Any Four**) **[4]**

i). Write two points to state the need for modulation.

ii). Is amplitude modulation index (m_a) independent of modulating signal frequency?

iii). State two advantages of SSB modulation.

iv). What is the bandwidth of amplitude modulated wave with modulating signal frequency (f_m) = 10kHz.

v). Ratio detector offers Amplitude limiting. **TRUE or FALSE.**

vi). What is aliasing effect?

Q.4Ai). Describe Phase shift keying (PSK) in detail. Draw its frequency spectrum and find out its bandwidth requirement? **[7]**

ii). What is meant by bit timing recovery? Discuss **Early - Late** gate circuit for bit timing recovery? **[7]**

OR

$P. T. O$

Q.4Ai). What is meant by probability of bit error in baseband transmission system? Draw circuit of matched filter for rectangular pulses and explain its working. What is Effective Isotropic Radiative Power (EIRP)? [7]

ii). Name any two types of carrier recovery circuits. Draw and discuss **Squaring Loop** method for carrier recovery. [7]

Q.4B). Answer the following (**Any three**) [3]
i). What is meant by Asynchronous type of transmission?
ii). Is MSK a special type of CPFSK?
iii). What is the value of Figure of merit (α) in case of ASK system.
iv). Are ASK and OOK same type of systems?
v). The bit error probability is _____ in **UNI POLAR** waveform.

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0803E1735   Candidate's Seat No :_____

M.Sc. (Sem.-3) Examination

504

Chemistry (Industrial Chemistry)

Time : 2-30 Hours]   March 2019   [Max. Marks : 70

Que. 1 (A)   Write brief note on fire & their safety, and hazardous chemicals &   **14**
their safety. Discuss the importance of "GLP" & "GMP" in industry.

OR

(A-i)   What is patent? Discuss its importance in R&D.   **07**

(A-ii)   Write a note on batch versus continuous process.   **07**

Que. 1 (B)   **Answer in one or two lines (any four out of six)**   **04**

(i)   Give any two safety precaution for handling of H_2SO_4.

(ii)   What are biological hazards?

(iii)   Give importance of Nitrogen gas during fire.

(iv)   What are carcinogens? Give their two examples.

(v)   How to protect yourself when working in a chemistry lab?

(vi)   How to avoid fire when handling organic solvents in lab?

Que. 2 (A)   Give various methods of chlorination (at least five reactions). Write   **14**
factors affecting on nitration reaction.

OR

(A-i)   Discuss amination by metal catalysed reduction and ammonolysis (three   **07**
reactions for each).

(A-ii)   Give reactions for sulfonation on Naphthalene for preparation various   **07**
suflonated products.

Que. 2 (B)   **Answer in one or two lines (any Three out of Five)**   **03**

(i)   Which major product forms from bromo benzene and propyl
bromide via Wurtz reaction?

(ii)   How to remove excess nitric acid from the mother liquor (H_2SO_4
containing solution) to purify H_2SO_4?

(iii)   Which product will be formed when Naphthalene 2-sulphonic acid is
treated with NaOH?

(iv)   Which products will be formed when Benzene is treated at 40 °C
and 80 °C when treated with nitrating mixture respectively?

(v)   Discuss the catalytic effect of Uv and $FeCl_3$ on chlorination of
toluene.

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Que. 3 (A) Discuss use of catalyst and prevention or minimization of hazardous 14
product as green chemistry aspects. What is Ionic liquid? Discuss
Grignard reaction on the basis of green chemistry aspects.

OR

(A-i) Discuss Michael and Wurtz reaction on the basis of green chemistry. 07

(A-ii) Discuss Diels-Alder and Witting-Horner reaction on the basis of green 07
chemistry.

Que. 3 (B) **Answer in one or two lines (any Three out of Five)** 03

(i) What is Green chemistry?

(ii) Can use Ionic liquid as a solvent?

(iii) What are N-alkylation and O-alkylation?

(iv) What is solid phase reaction?

(v) What is neat reaction?

Que. 4 (A) Write a note on Filtration and Distillation. 14

OR

(A-i) Write a note on insecticides. 07

(A-ii) Write a note on fungicides. 07

Que. 4 (B) **Answer in one or two lines (any four out of six)** 04

(i) Define agrochemicals.

(ii) Difference between unit process and unit operation.

(iii) What is extraction?

(iv) What is fractional distillation?

(v) Define absorption and adsorption.

(vi) How will you separate Aniline from mixture of Aniline – Benzoic
acid by chemical treatment?

M.Sc. (Sem.-3) Examination

504

Chemistry (Modern Separation Techniques)

Time : 2-30 Hours]   March 2019   [Max. Marks : 70

Q. 1   **(A)**   Discuss in detail the principle, instrumentation, separation   **14** mechanism and applications of high-performance liquid chromatography.

<p align="center">OR</p>

(A-i)   Write a short note ion-chromatography.   **07**

(A-ii)   Explain in brief the principle and working of chiral and affinity   **07** chromatography.

Q. 1   **(B)**   **Answer in one or two lines (Any four out of six)**   **04**

(i)   What is preparative chromatography?

(ii)   Molecular or longitudinal diffusion in liquids is slow and can be neglected.-True or False.

(iii)   What is the difference between isocratic and gradient elution?

(iv)   What type of columns provides faster separation in liquid chromatography?

(v)   State the basic principle of gel permeation chromatography.

(vi)   How temperature affects HPLC separations?

Q. 2   **(A)**   State the principle and types of gas chromatography (GC).   **14** Discuss working mechanism of various types of columns and detectors used in GC.

<p align="center">OR</p>

(A-i)   What is the function of mass analyzers in GC-MS? – Explain any   **07** two types of mass analyzers in short.

(A-ii)   Write a brief note on headspace GC.   **07**

Q. 2   **(B)**   **Answer in one or two lines (Any four out of six)**   **04**

(i)   Electron impact (EI) is known as a hard ionization technique-Comment.

(ii)   Name three types of pyrolyzers used in pyrolysis GC.

(iii)   What is PTV?

(iv)   State the fundamental differences between split and splitless injectors.

(v)   Mention any two applications of GC.

(vi)   What is the difference between chemical ionization (CI) and electrospray ionization (ESI)?

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Q. 3 **(A)** Explain in detail the basic separation mechanism in 14 polyacrylamide gel electrophoresis and capillary zone electrophoresis.

OR

(A-i) How electrophoresis can be utilized for the separation of neutral 07 molecules with the aid of micelle formation?

(A-ii) Write a short note on capillary electro-chromatography and 07 capillary gel electrophoresis.

Q. 3 **(B)** Answer in one or two lines (Any three out of five) 03

(i) Compare the basic characteristics of HPLC with those of capillary zone electrophoresis.

(ii) Write down the utility of ampholyte in isoelectric focusing.

(iii) Give a graphical representation of a laminar flow and a plug like electro-osmotic flow.

(iv) Write the equations used to calculate the amount of analyte for hydrodynamic and electrokinetic injections in capillary electrophoresis.

(v) What is the basic principle of electrophoresis?

Q. 4 **(A)** Explain the hydrostatic and hydrodynamic equilibrium 14 mechanism and criteria to select two phase solvent system in counter current chromatography.

OR

(A-i) Discuss the instrumentation of ice chromatography and explain 07 its separation mechanism by suitable example.

(A-ii) Give a detail account on the use of water in super heated water 07 chromatography and state its application.

Q. 4 **(B)** Answer in one or two lines (Any three out of five) 03

(i) Name any two applications of flash chromatography.

(ii) What is the limitation of glass nebulizer to produce ice-water particle?

(iii) Give the temperature range of super heated water chromatographic column.

(iv) Which pump is used in flash chromatography for isocratic and gradient separation?

(v) Mention any two criteria to select stationary phase in counter current chromatography.

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0803E1737

Candidate's Seat No : _____

M.Sc. (Sem.-3) Examination
504 Mathematics (Old/New)
(Math. Prog.)

Time : 2-30 Hours]   **March 2019**   [Max. Marks : 70

Q.1 (a)   14
  (i)   Maximize $z = 3x_1 + 5x_2$

           Subject to $x_1 - 2x_2 \leq 6$, $x_1 \leq 10$, $x_2 \geq 1$ and $x_1, x_2 \geq 0$.

  (ii)   Find integer solution to maximize $z = 2x_1 + 20x_2 - 10x_3$

           Subject to $2x_1 + 20x_2 + 4x_3 \leq 15$, $6x_1 + 20x_2 + 4x_3 = 20$ and $x_1, x_2, x_3 \geq 0$ are
           integers.

OR

(b)   14
  (i)   Maximize $z = 2x_1 + 2x_2 + x_3$

           Subject to $2x_1 + 5x_2 + x_3 = 12$, $3x_1 + 4x_2 = 11$ and $x_2, x_3 \geq 0$, x_1 is unrestricted.

  (ii)   Write the dual problem of the following primal problem.

           Minimize $z = x_1 + 2x_2$

           Subject to $2x_1 + 4x_2 \leq 160$, $x_1 - x_2 = 30$, $x_1 \geq 10$ and $x_1, x_2 \geq 0$.

(c)   Attempt any **FOUR**   04
  (i)   In Big-M method, _____ basic feasible solution is obtained by assigning
           ___ value to the original value.
  (ii)   If any value in x_B – column of final simplex table is negative, then the solution is
           _____ .
  (iii)   The value of the dual variable
           a. represents worth of each additional units of the resource.
           b. can be obtained by examining z_j - row of primal optimal simplex table.
           c. can be obtained by examining $c_j - z_j$ – row of primal optimal simplex
               table.
           d. all of the above.
  (iv)   The right-hand side constant of a constraint in a primal problem appears in the
           corresponding dual as
           a. a coefficient in the objective function.
           b. a right-hand side constant of a constraint.
           c. an input – output coefficient.
           d. solution of dual problem.
  (v)   In a Branch and Bound minimization tree, the lower bounds on objective function
           value
           a. do not decrease in value.
           b. do not increase in value.
           c. remains constant.
           d. cannot be said.
  (vi)   A non-integer variable is chosen in the optimal simplex table of the integer

                                                                                          1

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programming problem to
    a. leave the basis.
    b. enter the basis.
    c. to construct a Gomory cut.
    d. none of the above.

Q.2 (a)   14

(i)   Determine an initial basic feasible solution of the transportation problem by LCM.

		Destination				
		P	Q	R	S	Supply
Source	A	11	13	17	14	250
	B	16	18	14	10	300
	C	21	24	13	10	400
	Demand	200	225	275	250	

(ii)   Find optimal assignment schedule.

	A	B	C	D	E
P	9	11	15	10	11
Q	12	9	M	10	9
R	M	11	14	11	7
S	14	8	12	7	8

OR

(b) (i)   Determine a transportation schedule to minimize the cost of following 14 transportation problem.

		Destination			
		L	M	N	Supply
Source	A	8	5	6	120
	B	15	10	12	80
	C	3	9	10	80
	Demand	150	80	50	

(ii)   A marketing manager has five salesmen and five sales districts. On the basis of capabilities of the salesmen and the nature of the districts, the manager estimates that the sales per month (in hundred rupees) for each salesman in each district would be as follows.

	A	B	C	D	E
1	32	38	40	28	40
2	40	24	28	21	36
3	41	27	33	30	37
4	22	38	41	36	36
5	29	33	40	35	39

Find the assignment of salesmen to districts that will maximize the sales.

(c)   Attempt any **FOUR**   04

(i)   In the assignment problem, the number of allocations in each row and column are
   a. equal.
   b. zero.
   c. one.
   d. none of the above.

(ii)   The assignment problem
   a. requires that only one activity be assigned to each resource.
   b. is a special case of transportation problem.
   c. can be used to maximize resources.
   d. all of the above.

(iii)   An optimal solution of an assignment problem can be obtained only if
   a. each row and column have only one zero element.
   b. Each row and column have at least one zero element.
   c. the data is arranged into square matrix.
   d. all of the above.

(iv)   The dummy source or destination in transportation problem is added to
   a. satisfy rim conditions.
   b. prevent solution from becoming degenerate.
   c. ensure that total cost does not exceed a limit.
   d. none of the above.

(v)   The occurrence of degeneracy while solving a transportation problem means that
   a. total supply equals that total demand.
   b. the solution so obtained is not feasible.
   c. the few allocations become negative.
   d. none of the above.

(vi)   An alternative optimal solution to a minimization transportation problem exist whenever opportunity cost corresponding to unused route of transportation is
   a. positive and greater than zero.
   b. positive with atleast one equal to zero.
   c. negative with atleast one equal to zero.
   d. all zero.

Q.3 (a)   14
(i)   Derive (only) Kuhn-Tucker conditions to
   Minimize $z = x_1^2 + x_2^2 + x_3^2$
   Subject to $2x_1 + x_2 \leq 5$, $x_1 + x_2 \leq 2$, $0 \leq x_1 \leq 1$, $0 \leq x_2 \leq 2$ and $x_3 \geq 0$.

(ii)   Linearize following quadratic programming problem by Wolfe's method.
   Maximize $z = 12x + 21y + 2xy - 2x^2 - 2y^2$
   Subject to $y \leq 8$, $x + y \leq 10$ and $x, y \geq 0$.

OR

(b)   Using Beale's method   14
   Maximize $z = 2x_1 x_2 - 5x_1 - 13x_2 + 3x_2^2 - 10$
   Subject to $x_1 + x_2 \leq 1$, $4x_1 + x_2 \geq 2$ and $x_1, x_2 \geq 0$.

(c)   Attempt any **Three**   03

(i)   What is meant by quadratic programming?

(ii)   A function is said to attain its maximum value at a point $x = a$ if

       a. $f(a) = f(a+h)$.

       b. $f(a) > f(a+h)$.

       c. $f(a) < f(a+h)$.

       d. $f(a) = 0$.

(iii)   Hessian matrix is positive definite if all its leading principal minors of order

       a. 1×1 are positive.

       b. 1×1 are scalers.

       c. 2×2 are positive.

       d. 2×2 are scalers.

(iv)   The point of inflexion occurs at $x = a$ provided

       a. $f''(a) = 0$ for n odd.

       b. $f''(a) \neq 0$ for n odd.

       c. $f''(a) > 0$ for n odd.

       d. $f''(a) < 0$ for n odd.

Q.4 (a)   14

(i)   Use dynamic programming to

      Maximize $z = x_1^2 + 2x_2^2 + 4x_3$

      Subject to $x_1 + 2x_2 + x_3 \leq 8$ and $x_1, x_2, x_3 \geq 0$.

(ii)   Maximize $z = \dfrac{x_1 + 2x_2 + x_3 + 4}{2x_1 + 4x_3 + 7}$

      Subject to $x_1 + x_2 \leq 6$, $2x_2 + x_3 \leq 2$ and $x_1, x_2, x_3 \geq 0$.

OR

(b)   14

(i)   A company has five salesmen who have to be allocated to four marketing zones. The profit from each zone depends upon the number of salesmen working in that zone. The expected profits for different number of salesmen in different zones, as estimated from the past records, are given in the following table. Using Bellman's Principle, determine the optimal allocation policy.

No. of Salesmen	Marketing Zones		
	1·	2	3
0	45	30	35
1	58	45	45
2	70	60	52
3	82	70	64
4	93	79	72
5	101	90	82

(ii)   Maximize $z = \dfrac{3x + 5y}{x + 2y + 9}$

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Subject to $2x+3y \leq 12$, $x+y \leq 4$ and $x, y \geq 0$ by denominator method.

(c) Attempt any **Three**   03

(i) A state in a dynamic programming problem represents
   a. various conditions of the decision process at a stage.
   b. status of the system at a particular stage.
   c. possible effects that the current decision has on future course of action.
   d. all of the above.

(ii) The return function in a dynamic programming problem depends on
   a. stages.
   b. states.
   c. alternatives.
   d. all of the above.

(iii) State necessary condition for a fractional programming problem to have an initial basic feasible solution.

(iv) Give an example of a non-linear fractional problem.

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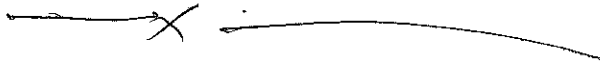
M.Sc. (Sem.-3) Examination

504

Statistics

Time : 2-30 Hours]   **March 2019**   [Max. Marks : 70

Note: Attempt all questions.

Q.1 (A)

(i) What are the different types of inventory in industries? Why is it important to control inventory? [07]

(ii) Derive a single period probabilistic inventory model with instantaneous and continuous demand and no set-up cost. [07]

OR

(i) What is inventory management? Briefly explain the major decisions concerning inventory. [07]

(ii) Derive the rule that gives the optimum order quantity for a single period probabilistic inventory system for which the holding cost and shortage cost are proportional to time and quantity. Assume that the demand is discrete. [07]

(B) Answer any four [04]

(i) Define inventory.

(ii) Define lead time.

(iii) One of the important reasons for carrying inventory is to
(a) improve customer service   (b) get quantity discounts
(c) maintain operational capability   (d) all of the above.

(iv) Define holding cost.

(v) Operating decisions in an inventory system are concerned with
(a) order quantity   (b) reorder level   (c) customer service level   (d) all of the above.

(vi) Define set-up cost.

Q.2 (A)

(i) What are the situations which makes the replacement of items necessary? [07]

(ii) At time zero, all items in a system are new. Each item has a probability p of failing immediately before the end of the first month of life, and a probability $q = 1 - p$ of failing immediately before the end of the second month (i.e. all items fail by the end of the second month). If all items are replaced as they fail, then show that the expected number of failures $f(x)$ at the end of month x is given by:

$$f(x) = \frac{N}{1+q}\left\{1 - (-q)^{x+1}\right\}$$

where N is the number of items in the system. [07]

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OR

(i) Discuss individual and group replacement policy. [07]

(ii) Discuss staffing problem with example. [07]

(B) Answer any four [04]
  (i) Define progressive failure.
  (ii) Define retrogressive failure.
  (iii)The problem of replacement is felt when job performing units fail
      (a) suddenly (b) gradually (c) both (a) and (b) (d) (a) but not (b).
  (iv) As the life of an item increases, its operational efficiency also deteriorates. This results in decrease in the resale value.
      (a)True   (b) False.
  (v) The group replacement policy is suitable for identical low cost items which are likely to
      (a)fail over a period of time   (b) fail suddenly
      (c) fail completely and suddenly   (d) none of the above.
  (vi) What do you understand by present worth factor?

Q.3 (A)

  (i) Discuss matrix solution method in network analysis. [07]

  (ii) Discuss application areas of PERT/CPM techniques. [07]

OR

  (i) How does PERT provide for uncertainty in activity time estimates? What is the rationale for using Beta probability distribution? [07]

  (ii) Discuss time – cost trade – off procedure of a project. [07]

(B) Answer any three [03]
  (i) The objective of network analysis is to
      (a) minimize total project duration
      (b) minimize total project cost
      (c) minimize production delays, interruption and conflicts
      (d) all of the above.
  (ii) If an activity has zero slack, it implies that
      (a) it lies on the critical path   (b) it is a dummy activity
      (c) the project is progressing well   (d) none of the above.
  (iii) Network models have advantage in terms of project
      (a)planning   (b) scheduling   (c) controlling   (d) all of the above.
  (iv) Define independent float.
  (v) In time cost -trade-off function analysis
      (a) cost decreases linearly as time increases   (b) cost at normal time is zero
      (c) cost increases linearly as time increases   (d) none of the above.

Q. 4 (A)

    (i) Explain Lagrangian method for solving a non-linear programming.   [07]

    (ii) Explain Wolfe's method for solving a quadratic programming problem.   [07]

<center>OR</center>

    (i) Discuss simulation of inventory problems with example.   [07]

    (ii) Discuss the role of computers in simulation.   [07]

(B) Answer any three   [03]
    (i) What is non-linear programming?
    (ii) Define separable programming.
    (iii) Define simulation.
    (iv) Which of the following is not the special purpose simulation language.
        (a)BASIC   (b) GPSS   (c) GASP   (d) SIMSCRIPT
    (v) As simulation is not an analytical model, therefore, the result of simulation must be viewed as
        (a)unrealistic (b) exact (c) approximation (d) simplified.

<center>***</center>

0803E1739   Candidate's Seat No :_____

M.Sc. (Sem.-3) Examination
504 EC
Life Science

Time : 2-30 Hours]   March 2019   [Max. Marks : 70

Instructions:

All questions are compulsory.
Illustrate your answers with neat diagrams wherever necessary.

1 (A)   **Answer in Detail:**
   i)   Explain the Molecular Mechanism of Prokaryotic DNA replication.   [07]
   ii) Write an account on Nucleosome and Solenoid structure.   [07]

OR
   i)   Discuss Initiation, Regulation and Progression of Chromosome replication.   [07]
   ii) Discuss Post-transcriptional Modification in detail.   [07]

1 (B)   **Answer in Short: (Any Three)**   [03]
   i)   Define oriR and ARSs.
   ii) Discuss the role of PCNA.
   iii) What is Chromatin?
   iv) Give name of Arginine rich Histone proteins.
   v)   Enlist the components of Transcriptional Initiation Complex.

2 (A)   **Answer in Detail:**
   i)   Compare and contrast Gene Cloning and Polymerase Chain Reaction.   [07]
   ii) Discuss key steps of Isolation of DNA from cells.   [07]

OR
   i)   Write a short essay on Restriction Endonucleases and their key role in Genetic   [07]
        Engineering.
   ii) Write a note on Criteria for effective Gene Therapy.   [07]

2 (B)   **Answer in Short: (Any Four)**   [04]
   i)   What is an Episome? What is its significance for Gene Cloning?
   ii) Where is the cos site located in Lambda phage? Why is it significant?
   iii) What is Microinjection and Electroporation?
   iv) Write importance of Phenol-Chloroform solution in DNA isolation method.
   v)   How to determine Purity of RNA?
   vi) What is Gain of Function Mutation?

3 (A)   **Answer in Detail:**
   i)   Describe the equipment set up in Cell Culture Laboratory.   [07]
   ii) Write a note on: Cryopreservation   [07]

OR
   i)   Explain Cell Culture Contaminations and ways for effective elimination.   [07]
   ii) Describe the components of typical Culture Media for Animal Cell Culture.   [07]

3 (B)   **Answer in Short: (Any Three)**   [03]
   i)   Define Confluency and Passage
   ii) Explain: Cell Viability Assay
   iii) State components of Cryoprotectants.
   iv) Give full forms of RPMI and DMEM.
   v)   Define: IC_{50}

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4 (A)   **Answer in Detail:**

   i) Describe various techniques used for Stem Cell Characterization.   [07]

   ii) Give a detailed account on Entrapment and Cross-linking in Enzyme Immobilization.   [07]

<div align="center"><i>OR</i></div>

   i) Discuss different methods of Cell Lysis.   [07]

   ii) What is Fractional Precipitation? Explain its role in Enzyme Purification.   [07]

4 (B)   **Answer in Short: (Any Four)**   [04]

   i) Enlist characteristic features of Stem Cells.

   ii) Differentiate Pluripotent and Multipotent Stem Cells.

   iii) Mention any two markers of Hematopoetic Stem Cells.

   iv) Define: iPSC

   v) Name the Cation used for Enzyme Purification.

   vi) Mention the role of Gluteraldehyde in Enzyme Immobilization.

0803E1740   Candidate's Seat No :_____

M.Sc. (Sem.-3) Examination
504
Environmental Science
March 2019

Time : 2-30 Hours]   [Max. Marks : 70

Note: Draw the diagram where ever required.

Q.1 (A) Explain the steps to carry EIA in detail   [14]

OR

Q.1 A (i) Write a note on salient features of EIA.   [07]

Q.1 A (ii) What are the impacts of various project activities on certain human aspects.   [07]

Q.1 (B) Answer the following in one or two lines. (Any **Four**)   [04]
   a) Define: Scoping.
   b) What is cumulative impact in EIA ?
   c) Explain the term: mitigation.
   d) Enlist resources of water.
   e) Give acronym for TOR and IEE.
   f) State the role of Environmental Audit in EIA.

Q.2 (A) Describe the environmental impacts on soil and groundwater due
        to road construction project.   [14]

OR

Q.2 A (i) Explain the scoping baseline of transport.   [07]

Q.2 A (ii Discuss typical mitigation measures that should be adopted to various
          water related issues.   [07]

Q.2 (B) Answer the following in one or two lines.(Any **Four**)   [04]
   a) Give acronym for BOD.
   b) Explain the term: Soil composition.
   c) State the examples of point sources of pollutant in water.
   d) What is water quality ?
   e) Define: suspended sediments.
   f) What is seismicity?

Q.3 (A) Describe the concept of Environmental Risk Assessment in detail.   [14]

OR

Q.3 A (i) Write a note on hazard identification.   [07]

Q.3 A (ii) Give salient features of ERA and EIA.   [07]

P. T. O

Q.3 (B) Answer the following in one or two lines. (**Any Three**)   [03]
    a) Give acronym for EcoRA.
    b) Enlist four steps of risk evaluation.
    c) What is risk management ?
    d) Define: hazard.
    e) Explain the term : Risk Assessment.

Q.4 (A) Write a note on GIS in Screening, Scoping and Baseline Studies.   [14]
                         OR
Q.4 A (i) What is GIS? Discuss the basic concepts and Techniques used in GIS.   [07]
Q.4 A (ii) Explain the concept of environmental remote sensing.   [07]

Q.4 (B) Answer the following in one or two lines. (**Any Three**)   [03]
    a) What is the use of RADAR ?
    b) Give full form of ISRO.
    c) What is the use of GIS ?
    d) State the use of remote sensing in fresh water body studies.
    e) Name four satellites currently providing daily coverage of the earth's surface
       using synthetic aperture radar(SAR) sensors.

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0803E1741

Candidate's Seat No : _____

M.Sc. (Sem.-3) Examination

504

Bio-Medical Technology (old)

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

Total Marks. 70

NB: All questions are compulsory. Illustrate your answers with neat diagrams wherever necessary.				
Q-1	(A)		Write the following	
		(i)	Write an account on DNA replication.	07
		(ii)	Write a short note on transcription.	07
			OR	
		(i)	What are the different DNA repair mechanisms? Discuss any one.	07
		(ii)	Describe the effects of mutation on phenotype.	07
	(B)		MCQ / SQ (Any Four out of Six)	04
		(i)	What is translation?	
		(ii)	What is nucleotide?	
		(iii)	Give full form of EDTA.	
		(iv)	What is Maxam & Gilberts method?	
		(v)	What are nonsense mutations?	
		(vi)	U.V. rays affect the DNA by causing formation of _____.	
Q-2	(A)		Write the following	
		(i)	Write a note on solenoid structure.	07
		(ii)	Describe the properties of heterochromatin.	07
			OR	
		(i)	What are the optimum conditions required for tissue culture?	07
		(ii)	Write a detailed account on Human Genome Project.	07
	(B)		MCQ / SQ (Any Four out of Six)	04
		(i)	Give an example of functional heterochromatin.	
		(ii)	X inactivation center present on _____ chromosome.	
		(iii)	Give full form of SCE.	
		(iv)	Define monolayer cultures.	
		(v)	What are stem cells?	
		(vi)	What are organ cultures?	
Q-3	(A)		Write the following	
		(i)	What are the invasive techniques used in Prenatal diagnosis? Briefly write on them.	07
		(ii)	Discuss the different noninvasive techniques used in prenatal diagnosis.	07
			OR	
		(i)	Write an answer on chromosomal euploidy.	07
		(ii)	Describe in detail: Translocations and inversions in chromosomes.	07
	(B)		MCQ / SQ (Any Three out of Five)	03
		(i)	_____ & _____ are examples of diseases with sex-linked inheritance.	
		(ii)	Define epistasis?	
		(iii)	What are multiple alleles?	
		(iv)	What are inborn errors of metabolism?	
		(v)	Give two examples of trisomy disorder in humans.	
Q-4	(A)		Write the following	
		(i)	Write an account on Western blotting technique.	07
		(ii)	Describe DNA foot printing technique in detail.	07
			OR	
		(i)	Describe the technique of PCR.	07
		(ii)	Write an account on FISH technique.	07
	(B)		MCQ / SQ (Any Three out of Five)	03
		(i)	Give any two applications of flow cytometry.	
		(ii)	Give full form of RFLP.	
		(iii)	Who discovered DNA finger printing technique?	
		(iv)	Define oncogenes.	
		(v)	What is the advantage of M-FISH?	

0803E1741 – 2   Candidate's Seat No : _____

M.Sc. (Sem.-3) Examination
504
Bio-Medical Technology (New)

Time : 2-30 Hours]   March 2019   [Max. Marks : 70

NB: All questions are compulsory. Illustrate your answers with neat diagrams wherever necessary.

Q-1	(A)		Write the following	07
		(i)	Write an account on translation.	07
		(ii)	Write a note on solenoid structure.	
			OR	
		(i)	Write a note on Spontaneous mutations.	07
		(ii)	Name the different DNA repair mechanisms. Discuss any one in detail.	07
	(B)		MCQ / SQ (Any Four out of Six)	04
		(i)	What is transcription?	
		(ii)	Give structural characteristics of acrocentric chromosome.	
		(iii)	What is intron?	
		(iv)	What is a mutagen?	
		(v)	What is di-deoxy base?	
		(vi)	What are frame shift mutations?	
Q-2	(A)		Write the following	07
		(i)	Write in detail about properties of heterochromatin.	07
		(ii)	Give an account on G-banding technique and its applications.	
			OR	
		(i)	Discuss the optimum conditions for tissue culture.	07
		(ii)	Describe the methods used for isolation of cells in tissue culture.	07
	(B)		MCQ / SQ (Any Four out of Six)	04
		(i)	Barr body is an example of _____ heterochromatin.	
		(ii)	What is the full form of SCD.	
		(iii)	Give examples of constitutive heterochromatin.	
		(iv)	When was Human Genome Project completed?	
		(v)	What is organ culture?	
		(vi)	Define suspension culture.	
Q-3	(A)		Write the following	
		(i)	Describe different structural aberrations of chromosomes.	07
		(ii)	What is numerical chromosomal aberration in chromosomes? Discuss.	07
			OR	
		(i)	What are the noninvasive techniques used in prenatal diagnosis? Discuss.	07
		(ii)	Explain Amniocentesis.	07
	(B)		MCQ / SQ (Any Three out of Five)	03
		(i)	Define co-dominance.	
		(ii)	Define Mendel's Law of dominance.	
		(iii)	Define oncogene.	
		(iv)	What is Down syndrome?	
		(v)	What is epistasis?	
Q-4	(A)		Write the following	
		(i)	Give detail account on protein blotting technique.	07
		(ii)	Discuss about criteria for effective gene therapy.	07
			OR	
		(i)	Describe the technique of PCR.	07
		(ii)	Discuss the FISH technique giving it's applications.	07
	(B)		MCQ / SQ (Any Three out of Five)	03
		(i)	What is gain of function mutation?	
		(ii)	The blotting technique used for DNA is known as _____.	
		(iii)	Define oncogene.	
		(iv)	What is M-FISH?	
		(v)	What are random primers?	