

M.Sc. (Sem.-4) Examination

CHEI 507

Chemistry (Inorganic)

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

- Q. 1 (A-i) Discuss the IR spectra of NSF_3 . 07
- (A-ii) Why it is harder to observe the ESR spectra of 2nd and 3rd row transition series elements? 07
- OR
- (A-i) Explain IR spectra of SO_4 ion after coordination. 07
- (A-ii) Write a short note on Zero field splitting. 07
- Q. 1 (B) Answer in one or two lines (any four out of six) 04
- (i) What is Force Constant in IR spectroscopy?
- (ii) Convert 250 nm to cm^{-1} .
- (iii) What is the condition for a molecule to be IR active?
- (iv) What do you understand by anisotropic system in ESR spectroscopy.
- (v) ESR spectra of methyl radical will consist -----lines.
- (vi) Will ZnO exhibit ESR.
- Q. 2 (A-i) Short Note on FT-NMR 07
- (A-ii) Explain doppler effect with reference to Mossbauer spectroscopy. 07
- OR
- (A-i) Compare between working frequency of ESR and NMR. 07
- (A-ii) Write a short note on Isomer Shift in Mossbauer spectroscopy. 07
- Q. 2 (B) Answer in one or two lines (any four out of six) 04
- (i) Which isotope of Fluorine will exhibit NMR spectra.
- (ii) What are satellite peaks.
- (iii) Relate precessional frequency with magnetic moment of the nuclei.
- (iv) Which element other than Fe can be used to carry out Mossbauer spectroscopy.
- (v) What is recoil energy.
- (vi) What is the energy of emitted γ ray from ^{57}Fe in M.B.Spectroscopy.

- Q. 3 (A-i) Define the term 'Hapticity'. Classify the organometallic compounds on the basis of hapticity with suitable examples. 07
- (A-ii) Discuss in detail 'Hydroformylation'. 07
- OR
- (A-i) Write a note on 'Hydrogenation'. 07
- (A-ii) Discuss in detail Transition-metal butadiene complexes. 07
- Q. 3 (B) **Answer in one or two lines (any three out of five)** 03
- (i) Write the characteristics of Homogeneous catalysis.
- (ii) Write the structure of $\text{Co}_4(\text{CO})_{12}$.
- (iii) Give the dismutation reaction of alkenes.
- (iv) Give the reaction to prepare Sodium cyclopentadienide.
- (v) Give the mechanism for Hydrocyanation reaction.
- Q. 4 (A-i) Why some Lanthanide elements are coloured and some are colourless ? Explain with suitable examples. 07
- (A-ii) Write a note on cyclopentadienyl compounds of lanthanides. 07
- OR
- (A-i) Write a note on methods for the preparation of transuranic elements. 07
- (A-ii) Write a note on organometallic chemistry of the Actinides. 07
- Q. 4 (B) **Answer in one or two lines (any three out of five)** 03
- (i) Why La^{+3} is diamagnetic?
- (ii) Give the application of Americium.
- (iii) Due to which property the separation of lanthanides is possible with fractional crystallization?
- (iv) List out the name of elements in Actinides series.
- (v) Give the names of ores of Uranium.

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M.Sc. (Sem.-4) Examination

CHEA 507

Chemistry (Analytical)

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

- Q. 1 (A-i) Discuss in detail the process of collection and preservation of the biological samples. 07
- (A-ii) Describe the basic principle and different types of ELISA. 07
- OR**
- (A-i) Classify the composition of whole blood and state some common determinants of blood and serum samples with their method of analysis. 07
- (A-ii) What is the basic principle of immunoassay? Explain in detail the fundamentals of radioimmunoassay. 07
- Q. 1 (B) **Answer in one or two lines (any four out of six)** 04
- (i) Name five major immunoglobulins in human blood.
- (ii) Give the difference between Fab and Fc
- (iii) Mention the function of anticoagulant.
- (iv) What is Biuret reagent?
- (v) Define: Monoclonal antibody
- (vi) Name the dyes which are commonly used in fluorescence immunoassay.
- Q. 2 (A-i) Explain in detail pharmaceutical method development and method validation. 07
- (A-ii) Discuss the significance of pre-formulation and stability studies of drug substances. 07
- OR**
- (A-i) State the activities followed in modern pharmaceutical analysis and discuss in brief the degradation and impurity analysis of drug substances. 07
- (A-ii) Describe the role of discovery of new chemical entity and high throughput screening in drug discovery process. 07
- Q. 2 (B) **Answer in one or two lines (any four out of six)** 04
- (i) Comment on high-throughput screening (HTS).
- (ii) How is assay miniaturization helpful in drug discovery?
- (iii) What is the requirement of dissolution/bioavailability studies?
- (iv) What do you understand by new molecular entity (NME)?
- (v) What is combinatorial chemistry?
- (vi) Give the full name of IND.

- Q. 3 (A-i) State the salient features of regulatory considerations for clinical and regulatory aspects of drug discovery. 07
- (A-ii) Define ICH guidelines. Discuss the issues covered under ICH guidelines. 07
- OR**
- (A-i) Describe the significant features of regulatory compliance in modern pharmaceutical analysis. 07
- (A-ii) Explain regulated and non-regulated aspects in drug discovery development process. 07
- Q. 3 (B) **Answer in one or two lines (any three out of five)** 03
- (i) What is new drug application (NDA)?
- (ii) Which are the three copies of NDA that are to be submitted to USFDA?
- (iii) Give the full name of CMC & CTD.
- (iv) Name the six teams which are organized by USFDA for technical review process.
- (v) Name any three items to be submitted during NDA filing under form 356h.
- Q. 4 (A-i) What are the three essential components of bioanalytical methodology? Discuss each in detail. 07
- (A-ii) Define: Pharmacokinetic study of drug. Discuss various parameters of pharmacokinetic profile with a neat diagram. 07
- OR**
- (A-i) Explain the significance of Incurred Sample Reanalysis (ISR) test for subject samples in bioanalysis. 07
- (A-ii) Discuss in detail various bio-analytical method validation parameters as per USFDA guidelines. 07
- Q. 4 (B) **Answer in one or two lines (any three out of five)** 03
- (i) What is pharmacology?
- (ii) Define: Bioavailability
- (iii) What do you understand by pharmacodynamics?
- (iv) Comment on quantitation range.
- (v) Define: Dosage regimen.

M.Sc. (Sem.-4) Examination

CHEP 507

Chemistry (Physical)

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

Q. 1 (A-i) Discuss the nature of electrical double layer and explain the Helmholtz-Perrin theory of double layer. 07

(A-ii) Explain Guoy-Chapman theory and give its limitations. 07

OR

(A-i) Discuss relation between half wave potential and diffusion coefficients and Explain the effect of pH on polarogram. 07

(A-ii) Discuss determination of composition and the stability constant of complex by polarographic method. 07

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

(i) What is concentration polarization?

(ii) Define limiting current.

(iii) What is electrical double layer?

(iv) Define current density.

(v) What is half wave potential?

(vi) Mention any one application of polarography.

Q. 2 (A-i) Explain: (i) spin-spin coupling (ii) spin de-coupling (iii) coupling constant. 07

(A-ii) Discuss the terms: (i) Nuclear spin (ii) Nuclear resonance (iii) Shielding of magnetic nuclei. 07

OR

(A-i) Discuss principle and instrumental technique of ^{13}C NMR spectroscopy. 07

(A-ii) Discuss principles and applications of FT- NMR spectroscopy. 07

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

(i) Define Chemical shift.

(ii) Why ^{13}C shows NMR spectra?

(iii) Write any one application of FT-NMR spectroscopy.

(iv) Which solvent is used in NMR Spectroscopy?

(v) Write any one application of ^{13}C NMR spectroscopy.

(vi) What is spin de-coupling?

- Q. 3 (A-i) What is partition function? Derive an equation for vibrational partition function. 07
- (A-ii) Derive an equation for the equilibrium constant of an ideal gaseous mixture in terms of the partition function of the reactants and products. 07

OR

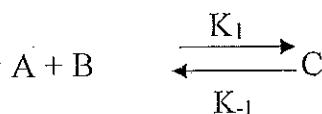
- (A-i) What is rotational constant? Derive an expression for rotational partition function for symmetrical diatomic molecule. 07
- (A-ii) Calculate the translational partition function for C₆H₆ (Mol. wt.=78.0 g/mole) in a volume of 1 m³ at 25^o C. (N_A=6.022x10²³ mol⁻¹, h=6.626x10⁻³⁴ J.s and k=1.38x10⁻²³ J.K⁻¹) 07

- Q. 3 (B) Answer in one or two lines (any three out of five) 03
- (i) What is degeneracy?
- (ii) Define zero point energy.
- (iii) What is symmetry number for NO and H₂ molecule?
- (iv) Define characteristic vibrational temperature.
- (v) What is the unit of partition function?

- Q. 4 (A-i) Name various methods for studying the fast reactions and discuss the pressure jump method. 07
- (A-ii) Discuss the stopped flow technique for studying the fast reactions. 07

OR

- (A-i) Write a note on flash photolysis and shock tubes. 07
- (A-ii) Derive an equation for relaxation time of one step reaction of the type 07



- Q. 4 (B) Answer in one or two lines (any three out of five) 03
- (i) Which flow method is the most popular?
- (ii) Write any two illustrations of fast reactions.
- (iii) Which method was pioneered by Norrish and Porter?
- (iv) What is relaxation time?
- (v) Who developed experimental techniques to study kinetics of fast reactions?

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M.Sc. (Sem.-4) Examination

GEL 507

Geology

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

1. (A) Describe Geophysical methods of groundwater exploration. 14
OR
- (A) (i) Hydrogeology of arid zones. 07
(ii) Radioisotopes in hydrogeological studies. 07
(B) Short Questions (Any four out of six) 04
(i) Define confined water.
(ii) What is juvenile water?
(iii) Write about Von Hisa's estimation.
(iv) Define isohyets.
(v) What is wetland?
(vi) How artesian system developed along a fault?
2. (A) Discuss water well technology in detail. 14
OR
- (A) (i) Darcy's law. 07
(ii) Water table contour maps. 07
(B) Short Questions (Any four out of six) 04
(i) What is recharge shaft?
(ii) Define stream channel modifications.
(iii) Define transmissivity.
(iv) State the types of hydrographs.
(v) Where salinity ingress is going on in Gujarat?
(vi) Define radial flow.
3. (A) Explain groundwater occurrence in sedimentary rocks. 14
OR
- (A) (i) Surface water resources management. 07
(ii) Over exploitation of groundwater. 07
(B) Short Questions (Any three out of five) 03
(i) Name the non-indurated sediments.
(ii) State the US standard for drinking water.
(iii) Why groundwater legislation is required?
(iv) State conjunctive use of groundwater.
(v) Give full form of GWRDC.
4. (A) Write explanatory note on levelling and contouring. 14
OR
- (A) (i) Gravitational method of prospecting. 07
(ii) How you can perform labelling for Saurashtra tour? 07
(B) Short Questions (Any three out of five) 03
(i) Define alidade.
(ii) State the scope of Applied Geology.
(iii) Mention the work of surveyor in surveying.
(iv) What is foliage? Give its importance.
(v) What is anomaly map?

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Candidate's Seat No : _____

M.Sc. (Sem.-4) Examination

STA 507

Statistics

Time : 2-30 Hours]

March 2019

[Max. Marks : 70

- (i) Discuss advantages and disadvantages of Input-Output Analysis. 07
(ii) Discuss Leontief's Open-sector model for Input-Output Analysis. 07

OR

- (i) Discuss Leontief's Closed-sector model for Input-Output Analysis. 07
(ii) In usual notations define Marginal propensity to consume and Marginal propensity to save. Derive relation between them. 07

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

- (i) What is the difference between Open-sector and Closed-sector model?
(ii) What is transaction matrix in Input-Output Analysis.
(iii) State the relation between MPC and MPS.
(iv) Write an application of Input-Output Analysis in real life.
(v) Write an assumption of Input-Output Analysis regarding technological coefficients.
(vi) What are technological coefficients with reference to Input-Output Analysis

Q-2(A) Write the following.

- (i) Explain the Multiplier when consumption function is linear as well as general. 07
(ii) Explain the concept of Accelerator in view of Input-Output Analysis. 07

OR

- (i) Discuss in brief Mahalanobis two Sector Model. 07
(ii) Discuss briefly Solow's growth model. 07

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

- (i) State the Consumption function.
(ii) State the Investment function.
(iii) Define Growth model.
(iv) What is the drawback of Harrod-Domar growth model.
(v) State an assumption of Mahalanobis four Sector Model.
(vi) Who extended Mahalanobis two Sector Model?

Q-3(A) Write the following.

- (i) Discuss Variate Difference method and show how the trend component of a time series is estimated using this method. When this method fails? 07
(ii) Explain the concept of random walk with drift and without drift. Why random walk is said to have an infinite memory? 07

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OR

- (i) Explain the concept of ARIMA (p, d, q). Write the estimation procedure of the ARIMA model. 07
- (ii) Explain the concept of "Unit Root Stochastic Process". Write different particular cases

of the time series $y_t = \beta_1 + \beta_2 t + \beta_3 y_{t-1} + u_t$ Where u_t is a white noise error term and t is time. 07

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

- (i) When intensity function takes high value?
(ii) Give an example of stationary process.
(iii) What is detrending?
(iv) Give an example of non-stationary process.
(v) When a time series is said to be integrated of order zero?

Q-4 (A) Write the following.

- (i) Explain the terms: (i) Autocorrelation and (ii) Correlogram. Let

$$X_t = y \cos \theta t + z \sin \theta t$$

where y and z are two uncorrelated random variables each with mean zero and variance unity and $\theta \in (-\pi, \pi)$. Obtain γ_k and ρ_k . 07

- (ii) Distinguish between: Ordinary and stationary time series. In usual notations define auto covariance and auto correlation matrix. For n=3, show

that $\rho_i \leq 1, i=1,2$ and $-1 \leq \frac{\rho_2 - \rho_1^2}{1 - \rho_1^2} \leq 1$. 07

OR

- (i) Write a brief note on periodogram analysis. 07
- (ii) How would you test the significance of $R^2(\mu)$? 07

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

- (i) When a time series is called weak stationary?
(ii) Write name of any two methods to check the stationary of the given time series.
(iii) What is Buys-Ballot Table?
(iv) Write any two limitations of Box-Jenkins Model.
(v) Suggest name of any two approaches for economic forecasting based on time series data.



Que-1 (A) Explain in detail the process controls of physical parameters in bioprocess. [14]
(OR)

1. Explain growth and Monod kinetics of batch culture. [7]

2. Compare and Contrast: Batch and Continuous fermentors [7]

(B) Answer any Four of the following in brief [4]

1. Bubble column reactor cannot be used for medium.

2. Define Chemostat cultures.

3. Find Generation Time (minutes) for bacterial culture dividing 5 generations in 2 hours.

(a) 15 (b) 24 (c) 20 (d) 30

4. Write the Nernst equation.

5. Write the principle of Rotameter.

6. Microbial growth is the result of both cell division and change in cell size (True/False)

Que-2 (A) Explain theory of heat transfer and describe design for heat exchanger with diagram [14]
(OR)

1. Discuss theory applicable to gas absorption in liquid medium. [7]

2. Explain mass transfer coefficient for Oxygen during bioprocess. [7]

(B) Answer any Four of the following [4]

1. Heat transfer takes place as per

(a) Zeroth law of thermodynamics (b) First law of thermodynamics (c) Second law of thermodynamics (d) Kirchoff's law

2. Write the importance of $K_L a$ factor.

3. Gas absorption is the process of transferring solute component from liquid solvent to gas mixture (True/False)

4. Write the main function of fouling factor.

5. The unit of overall coefficient of heat transfer is

6. What is biofilm?

Que-3 (A) What is Scale-up process? Discuss different parameters used in scaling up process. [14]
(OR)

1. Explain process optimization and give its uses. [7]

2. Discuss modelling methods in a fed-batch fermentation process. [7]

(B) Answer any Three of the following in brief [3]

1. Select size (Litre) of general Pilot-scale bioreactor from the following fermentor volumes

(a) 100-1000 (b) 1000-10000 (c) 1-100 (d) <1

2. The most common structure for input-output models is

3. Bioreactor and Fermentor are same (True/False)

4. What is Reynolds number?

5. Name any two important parameters used in optimization process.

Que-4 (A) Discuss different cell disruption techniques used to extract intracellular products. [14]
(OR)

1. Describe use of affinity chromatography in recovery of products. [7]

2. Explain principle and design for large-scale liquid-liquid extraction unit. [7]

(B) Answer any Three of the following [3]

1. Tubular centrifuge has maximum rotating speed (RPM) of

(a) 15000-50000 (b) 50000-100000 (c) 100000-150000 (d) 150000-200000

2. What is crystallization?

3. List factors affecting rate of Sedimentation

4. Liquid portion remaining after precipitation of solid is called

5. Name material used to make membranes for ultrafiltration.

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Candidate's Seat No : _____

M.Sc. (Sem.-4) Examination

ELE 507

Electronics Science

March 2019

[Max. Marks : 70

Time : 2-30 Hours]

**Instruction : (1) Attempt all questions
(2) Symbols used have their usual meanings**

Q.1 (a) What are the steps required for the silicon wafer shaping? Give details of the procedure of silicon wafer polishing. [7]

(b) (i) Explain segregation coefficient and effective segregation coefficient. [4]

(ii) Segregation coefficient of oxygen in silicon is 0.25. Number of oxygen atoms per cm^3 in solid silicon ingots at 4% doping level is 1.3×10^{18} , find the concentration of oxygen in the crystal at a fraction solidification of 0.7 [3]

OR

Q.1 (a) What do you mean by metallurgical grade silicon ? Using necessary diagram, explain the preparation of electronic grade silicon ((EGS). [7]

(b) Obtain an expression of maximum pull rate for Si crystal growth. Discuss the Czochralski (CZ) crystal growth technique [7]

Q.1 (c) Answer the following : (any four) [4]

1. State the importance of Raynold's number in vapour phase epitaxy.
2. State limitations of float zone (FZ) crystal growth technique.
3. Draw the primary and secondary flats for *p*-type (111) Si wafer.
4. State the limitations of chemical-mechanical polishing of Si wafer.
5. State why carbon impurity preferentially occupy substitutional site in the grown Si crystal?
6. State the physical significance of pull rate in crystal growth process.

Q-2 (a) Why oxidation require in VLSI-IC Technology? Explain, "high-pressure Oxidation technology". [7]

(b) Discuss in detail, "Electron-Beam Lithography" in VLSI-IC Technology". [7]

OR

(a) What is wet chemical etching? Explain in detail following terms, [7]

(1) Si etching, (2) silicon nitride & poly-silicon etching.

(b) Discuss in detail, "The pattern transferring process in lithography". [7]

Q-2 (c) Answer the following : (any four) [4]

(1) why semiconductor wafers are pre-heated before inserting in the quartz tube hot wall for deposition of die-electric material?

(2) What is the difference between positive and negative photo-resist material?

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- (3) Why exposure wavelength greater than $0.5 \mu\text{m}$ is not suitable in lithography?
 (5) Which one is use as electron gun in electron-beam lithography?
 (i) single crystal lanthanum hexa-boried (LaB_6),
 (ii) Hexa-Methylene Di-Siloxane (HMDS),
 (iii) High-atomic number membrans (SiN_x),
 (iv) non of above.
 (6) Which one is called BOE- buffered oxide etching chemical solution?
 (i) HF, (ii) NH_4F , (iii) HNO_3 , (iv) H_3PO_4 .

- Q. 3 (a)** Distinguish between diffusion and ion implantation. Explain (i) ion stopping mechanism and (ii) channeling process in a typical ion implantation. [7]
(b) List the desired properties of metallization in IC technology. Discuss the process of electromigration with Al metallization. How can it be reduced? [7]

OR

- (a)** Explain the Fick's theory of diffusivity for constant surface concentration and state its significance in VLSI processes. [7]
(b) Explain the wire bonding process used in VLSI interconnects. [7]

- Q. 3 (c)** Answer the following : (any Three) [3]
 1. Give a schematic showing interstitial diffusion model in solids
 2. Draw any two VLSI package types.
 3. Why Al metal is most suitable for top metallization?
 4. Give a schematic of junction spiking mechanism in metallization process.
 5. Compare the surface and through-hole VLSI mounts.

- Q. 4 (a)** With the help of necessary diagrams discuss in detail, "GaAs-IC VLSI fabrication process". [7]
(b) Discuss in detail, 'Fabrication process of CMOS VLSI-IC Technology'. Explain the concept of twin-tube and doping material. [7]

OR

- (a)** Write short note about "Electrostatic Discharge Damage (EDD)". How to solve EDD? [7]
(b) Discuss the basic VLSI fabrication process of Bipolar NPN Transistor. Explain the concept of buried layer and gate material. [7]

- Q. 4 (c)** Answer the following : (any Three) [3]
 (1) What is call, "PAD OXIDE" in NMOS-IC fabrication?
 (2) What is the fundamental limit set the size of (transistor) device must not reduced than the 0.14 to $0.29 \mu\text{m}$? what happen when size of transistor is below than this limit?
 (3) What is difference between active base and extrinsic base?
 (4) How can we make ultra clean-water against different types of contaminations?
 (5) In Bipolar ICs fabrication, buried layer is heavily doped than the lightly doped n -epitaxial layer. In this case, why antimony or arsenic are preferred rather than phosphorus?

M.Sc. (Sem.-4) Examination

CHEP 507

Polymer Testing

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

Q.1 (A) Write the following.

- i Write the notes on importance of Standard and specification for polymers testing. 07
- ii Discuss in detail the various methods for specimen preparation. 07

OR

- i Explain the Conditioning and test atmospheres for polymer testing. 07
- ii Describe the basic concept to analysis the stress- strain curve for polymer material. 07

Q.1 (B) Any Four out of six (Answer in one or two lines only)

- i What is the role of Polymer Testing? 01
- ii Write the definition of Young modulus. 01
- iii Plot the strain- stress curve for Poly carbonate. 01
- iv Write the factors affect the specimen preparation. 01
- v DIN stands for 01
- vi Discuss the Elasticity and Plasticity. 01

Q.2 (A) Write the following.

- i Discuss tensile strength? What are the factors influence the tensile strength of plastic material? 07
- ii Explain in brief: Kelvin model for creep. 07

OR

- i Discuss the Abrasion Test and factor affecting the abrasion test results. 07
- ii Define Hardness. List various hardness test used for plastics material. 07

Q.2 (B) Any Four out of six (Answer in one or two lines only)

- i What do you mean by flexural strength? 01
- ii Why the notch is provided in specimen for impact test? 01
- iii Give the significance of shear test. 01
- iv The increase in moisture increases (Stress/strain). 01
- v What is the test method for charpy impact test? 01
- vi Explain the behavior of filler on tensile properties of Thermoplastics. 01

Q.3 (A) Write the following.

- i Discuss transition temperature and its significance. 07
- ii Give the testing method to evaluate vicat softening temperature as per ASTM. 07

OR

- i Define Heat Deflection Temperature. Explain how this test is carried out for plastics material along with its significance? 07
- ii Discuss in details Thermal Conductivity. 07

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- Q.3 (B) Any Three out of five (Answer in one or two lines only)**
- i Write the ASTM test method for Coefficient of expansion. 01
 - ii MFI of PVC determine by ASTM D 1238.- True or False 01
 - iii Give the importance of Mooney viscosity. 01
 - iv What is the test method for determine flammability? 01
 - v What is the significance of thermal stability test for polymers? 01
- Q.4 (A) Write the following.**
- i Explain ESCR test and its significance and factor affecting the test results. 07
 - ii Give detailed review on permeability. 07
- OR**
- i Describe the transparency and haze. 07
 - ii What is volume resistivity? Give the test procedure with significance in details. 07
- Q.4 (B) Any Three out of five(Answer in one or two lines only)**
- i What is Gloss clarity? 01
 - ii Give the significance of refractive index. 01
 - iii Which test method used for dielectric constant? 01
 - iv What is the importance of water absorption test? 01
 - v Explain the distance between electrodes in Arc resistance test of polymers. 01

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M.Sc. (Sem.-4) Examination

CHEI 508

Chemistry (Inorganic)

Time : 2-30 Hours]

March 2019

[Max. Marks : 70

- Q. 1 (A-i) Discuss the use of gas-separation membranes in chlorine processing. 07
- (A-ii) Describe the diaphragm cell process for the manufacture of caustic and chlorine. 07
- OR**
- (A-i) Describe the procedure for preparation of sodium hydroxide by electrolysis of brine. 07
- (A-ii) Write a note on preparation of sodium nitrate using salt and nitric acid. 07
- Q. 1 (B) **Answer in one or two lines (any four out of six)** 04
- (i) Name two control technologies in chlor-alkali industry?
- (ii) What is the role of electrostatic precipitator in chlor-alkali industry?
- (iii) State two enforcements as per BPCTCA for the Diaphragm cell technology?
- (iv) Give the domestic uses of chlorine.
- (v) How is the solid waste disposed in mercury cell process?
- (vi) Name the chief pollutants found in waste water from chloralkali industries.
- Q. 2 (A-i) Write a note on the role of TBT in marine pollution. 07
- (A-ii) Write a note on the salinity and ionic strength of sea water. 07
- OR**
- (A-i) Write notes on Marine Sulfur Cycle and Charlson Hypothesis. 07
- (A-ii) Explain 'bioremediation' for marine pollution. 07
- Q. 2 (B) **Answer in one or two lines (any four out of six)** 04
- (i) Give the full form of CDOM.
- (ii) Why is the iron concentration very low in sea water?
- (iii) How is the sea water different from the solution of a table salt?
- (iv) Name the parts that are checked by oil spill monitoring programme in sea water?
- (v) What is oceanic anoxia?
- (vi) What are humic substances?

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- Q. 3 (A-i) Write a short note on quantitative analysis without using a standard. 07
- (A-ii) Write a short note on JCPDS powder diffraction file and match procedure. 07

OR

- (A-i) Discuss X-ray diffraction and derived the equation ' $n\lambda = 2d\sin\theta$ '. 07
- (A-ii) Discuss in detail about generation of X-rays. 07
- Q. 3 (B) Answer in one or two lines (any three out of five) 03
- (i) Write a name of scientist who discovered X-ray.
- (ii) What is the disadvantage of film mounting technique?
- (iii) Define X-rays.
- (iv) List out the types of counter used in X-ray powder diffractometer.
- (v) On moving the specimen table through θ degree, the detector rotates 2θ degree, Why?

- Q. 4 (A-i) Explain the specificity and sensitivity of ESCA. 07
- (A-ii) Give an assessment of XPS for studying I₂ impregnation of carbon nanotubes. 07

OR

- (A-i) Explain the spin orbit splitting observed in XPS spectra of copper metal. 07
- (A-ii) Write a note on Z+1 approximation. 07
- Q. 4 (B) Answer in one or two lines (any three out of five) 03
- (i) For a ground-state neutral atom with 13 protons, write the stationary states of two core electrons using both spectroscopic and X-ray notation
- (ii) State the physical properties that are affected due to surface modification.
- (iii) Which technique is used to identify same element in different environments?
- (iv) What is Auger Emission?
- (v) Why is Helium not detectable by XPS?

X ————— X

M.Sc. (Sem.-4) Examination

CHEA 508

Chemistry (Analytical)

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

- Q. 1 (A-i) Describe various interferences encountered in flame atomic absorption spectrophotometric measurements. 07
- (A-ii) Mention the construction of hollow cathode lamp and explain its working mechanism in detail. 07
- OR**
- (A-i) Explain in detail working mechanism of total consumption and premixed chamber burners with schematic diagram. 07
- (A-ii) Discuss in brief types of methods used for the background correction in AAS. 07
- Q. 1 (B) **Answer in one or two lines (any four out of six)** 04
- (i) Mention limitations of AAS.
- (ii) What do you understand by nebulization?
- (iii) Give the difference between rich and lean flame.
- (iv) What is the significance of an ionization suppressor?
- (v) Define: Resonance line
- (vi) Write down any two applications of AAS.
- Q. 2 (A-i) Discuss non-flame emission techniques in brief. Write a short note on instrumentation of ICP-AES and working of ICP torch. 07
- (A-ii) Explain in detail different types of nebulizers used in ICP-AES. 07
- OR**
- (A-i) Discuss the basic, chemical and physical principles of ICP-AES. 07
- (A-ii) Write a brief note on spectrometers used in ICP-AES. 07
- Q. 2 (B) **Answer in one or two lines (any four out of six)** 04
- (i) Give two applications of ICP-AES.
- (ii) Name two complementary techniques of ICP-AES.
- (iii) What is a p-type and n-type semiconductor?
- (iv) How many emission lines can be obtained for transition elements in sequential spectrometer?
- (v) Define: Dark current
- (vi) Which gases are used in DCP (Direct Current Plasma), ICP (Inductively coupled Plasma) and MIP (Microwave Induced Plasma)?

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N326-2

- Q. 3 (A-i) Discuss various applications of AFS. 07
(A-ii) Explain the term accuracy and precision and describe the interferences in AFS. 07

OR

- (A-i) Describe various types of sources used in atomic fluorescence spectroscopy (AFS). 07
(A-ii) Explain the functioning of atom cell and discuss detection in AFS. 07
Q. 3 (B) Answer in one or two lines (any three out of five) 03
(i) Which elements are best determined with the help of AFS?
(ii) Write down any two limitations of AFS.
(iii) What is an electronic transition?
(iv) Name the spectral interferences observed in AFS.
(v) Give two points of difference between dispersive and non-dispersive instruments.

- Q. 4 (A-i) Explain in detail the X-Ray fluorescence process with the help of a diagram. 07
(A-ii) Write a brief note on various sources and detectors used in XRF. 07

OR

- (A-i) Discuss new developments in instrumentation in X-Ray Fluorescence (XRF) technology. 07
(A-ii) Describe different types of sample preparation approaches in XRF. 07
Q. 4 (B) Answer in one or two lines (any three out of five) 03
(i) How is EDXRF different from WDXRF?
(ii) Name some complementary techniques related to XRF.
(iii) State Bragg's Law.
(iv) Mention the attractive features of synchrotron radiation.
(v) Give full forms of XRMF and PIXE.

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M.Sc. (Sem.-4) Examination

CHEP 508

Chemistry (Physical)

March 2019

[Max. Marks : 70]

Time : 2-30 Hours]

- Q. 1 (A-i) Discuss the Fermi gas model of the atomic nucleus. 07
(A-ii) Write a note on isotopic dilution method and radiometric titrations. 07

OR

- (A-i) Write a note on liquid drop model of the atomic nucleus. 07
(A-ii) Discuss the uses of radio isotopes as tracers. 07
Q. 1 (B) Answer in one or two lines (any four out of six) 04
(i) Write magic numbers.
(ii) Give any one similarity between liquid drop and nucleus.
(iii) Why shell model is considered as single particle model?
(iv) What is evaporation reaction?
(v) What is fission reaction?
(vi) Give one example of spallation reaction.

- Q. 2 (A-i) Explain measurement techniques and applications in ESR spectroscopy. 07
(A-ii) Discuss Doppler shift and recoil energy in Mossbauer spectroscopy. 07

OR

- (A-i) Explain measurement techniques and applications of Mossbauer spectroscopy. 07
(A-ii) Discuss zero field splitting and Kramer's degeneracy in ESR spectroscopy. 07
Q. 2 (B) Answer in one or two lines (any four out of six) 04
(i) What is electronic spin in ESR spectroscopy?
(ii) What is Mossbauer effect?
(iii) Define degeneracy in ESR spectroscopy.
(iv) What is relative line width in Mossbauer spectroscopy?
(v) Explain Quadrupole interactions in Mossbauer spectroscopy.
(vi) What is hyperfine splitting in ESR spectroscopy?

- Q. 3 (A-i) Define critical constants. Derive an expression for equation of state for liquids. 07
- (A-ii) What is mesomorphism? Write a note on thermotropic liquid crystals. 07
- OR**
- (A-i) Discuss types of liquid crystals in detail. 07
- (A-ii) Discuss radial and molecular distribution function. 07
- Q. 3 (B) **Answer in one or two lines (any three out of five)** 03
- (i) What is super cooled liquid?
- (ii) What is ionic liquid?
- (iii) Define mesomorphic state of matter.
- (iv) What is anisotropy property?
- (v) Give difference between smectic and nematic mesophase.
- Q. 4 (A-i) What is Bose-Einstein statistics? Derive an expression for N indistinguishable particles. 07
- (A-ii) Write a note on Debye modification and give its limitations. 07
- OR**
- (A-i) Discuss Dulong-Petit's law in detail. 07
- (A-ii) Discuss the Einstein theory of heat capacity of solids in detail. 07
- Q. 4 (B) **Answer in one or two lines (any three out of five)** 03
- (i) Define heat capacity.
- (ii) What is the drawback of Einstein model?
- (iii) What is thermodynamic probability?
- (iv) Write one application of Bose-Einstein statistics to helium.
- (v) Which particles are considered as Bosons?

X ————— X

M.Sc. (Sem.-4) Examination

GEL 508

Geology

March 2019

[Max. Marks : 70]

Time : 2-30 Hours]

Q-1 (A) Describe landslides and excavations in mining industry with suitable examples from India. 14

OR

(A) (i) Principles and monitoring of terrain evaluation. 07

(ii) Design of buildings used in seismic zone -IV. 07

(B) Answer the following short questions. (Any four out of six) 04

(i) Give the characteristic properties of S- waves.

(ii) Name two localities from Gujarat which are included in seismic zone -III.

(iii) Define seismic technology.

(iv) What is relation between tunnel parallel to folding?

(v) Draw sketch map showing seismic areas of Gujarat.

(vi) Name two locations of granite and sandstone mine.

Q-2 (A) Explain engineering impact assessment of engineering project with case study of Bhakra Nagal dam site. 14

OR

(A) (i) Foundation stability, silting and seismotectonic factors. 07

(ii) Rockmass improvement techniques. 07

(B) Answer the following short questions. (Any four out of six) 04

(i) Name any two books on engineering geology.

(ii) What is logging?

(iii) Give three examples of major dams of India.

(iv) Name three principle types of foundation for building.

(v) Mention two types of supports.

(vi) Give two index property of the rock.

Q-3 (A) Describe oceanic circulation, wave, currents and trenches with suitable examples. 14

OR

(A) (i) Tectonic history of the oceans. 07

(ii) Geochronometry of deep - sea deposits. 07

(B) Answer the following short questions. (Any three out of five) 03

(i) Name any two books on marine geology.

(ii) Mention three ocean morphological features.

(iii) Give composition of the polymetallic nodules.

(iv) Name two oceans where cobalt rich crust is formed.

(v) Give two examples of canyons.

Q-4 (A) Explain data display programme and solve three adjacent faults have throws and dips as follows: (1) 10 m at 60° (2) 5 m at 65° (3) 12 m at 45°, draw the figure and calculate the total slip vector and total dip angle of block 1 relative to block 4. 14

OR

(A) (i) Mathematics and statistics as tools in geology. 07

(ii) Find the integral $\int_0^{\pi} (5\sin x + 4x^2 + \cos x) dx$ and $\int_0^{\pi} (\tan x + 4x^{1/2} + \cos x) dx$ also find derivative of $y = 3x^2 \sin x$ at $x = \pi$. 07

(B) Answer the following short questions. (Any three out of five) 03

(i) What is T-test?

(ii) Find the derivative of $y = 3x \sin(x)$.

(iii) Write Pythagoras formula for right-angle triangle.

(iv) Find the integration of $\tan(x)$.(v) Convert the angle $\frac{\pi}{12}$ from radian to degree.

M.Sc. (Sem.-4) Examination

STA 508

Statistics

Time : 2-30 Hours]

March 2019

[Max. Marks : 70

1. (A) Answer the following:

(i) For the general linear model $\underline{Y} = X\underline{\beta} + \underline{U}$, $\underline{U} \sim N(\underline{0}, \sigma^2 I_n)$. Obtain BLUE of $\underline{\beta}$. 07

Also obtain its variance.

(ii) What is auto correlation? Describe the consequences of auto correlation. 07

OR

(i) For the general linear model $\underline{Y} = X\underline{\beta} + \underline{U}$, $\underline{U} \sim N(\underline{0}, \sigma^2 I_n)$. Obtain MLE of $\underline{\beta}$. 07

Also obtain its distribution.

(ii) Write note on ridge regression estimator. 07

(B) Attempt any four. 04

(i) Which of the following two is GLM?

(1) $Y = \beta_1 + \beta_2 X_2^2 + \beta_3 X_3 + U$ (2) $Y = \beta_1 + \beta_2^2 X_2 + \beta_3 X_3 + U$

(ii) State the condition for homoscedasticity in GLM.

(iii) State the OLSE of σ^2 in GLM.

(iv) Define multicollinearity.

(v) State the effect of multicollinearity on R^2 .(vi) In GLM if $\rho(X'X) < k$, what will happen?

2. (A) Answer the following:

(i) Consider the model $Y_t = \beta_1 + \beta_2 X_t + U_t$, $t = 1, 2, \dots, n$ with $E(U_t) = 0$, 07 $E(U_t^2) = \sigma^2 X_t$, $E(U_t, U_s) = 0$ for $t \neq s$. Discuss the method of estimating the parameters of the model.

(ii) Discuss one situation that gives rise to heteroscedasticity. 07

OR

(i) Describe the Glejser test for detecting heteroscedasticity. What are the difficulties in using this test? 07

(ii) Describe consequences of auto correlation. 07

(B) Attempt any four. 04

(i) If a linear auto correlation with lag 4 is 0.36 then what will be the linear auto correlation with lag 2? 07

(ii) State Aitken's linear transformation for GLS model.

(iii) A graph of e_i^2 versus X_i exhibit some linear pattern, what will you conclude? 07

(iv) State the use of Goldfeld and Quandt test.

(v) State the range of Durbin-Watson test statistic.

(vi) State your conclusion in case of $d_L \leq d \leq d_U$.

3. (A) Answer the following:

(i) Discuss some salient features of dummy variables method. 07

(ii) Discuss how dummy variables method is used to deseasonalized the time series data. 07

OR

(i) Describe the method of dummy variables for pooling of cross section data. 07

(ii) Write note on piecewise linear regression. 07

N329-2

(B) Attempt any three.

03

- (i) For education level with four categories, how many dummy variables are used?
- (ii) When dummy variable is used?
- (iii) Define dummy variable.
- (iv) How do you use gender in GLM?
- (v) If 3 dummy variables are used for a variable with 3 categories in a GLM with intercept what will happen?

4. (A) Answer the following:

- (i) Show that OLS estimation to simultaneous equations system leads to biased estimator. 07
- (ii) Describe indirect least square method of estimation for simultaneous equations system. 07

OR

- (i) Discuss identification problem in simultaneous equations system. 07
- (ii) Write note on 2-SLS method for a system of simultaneous equations. 07

(B) Attempt any three.

03

- (i) Define endogenous variable.
- (ii) Define exogenous variable.
- (iii) Define structural equation.
- (iv) Define reduced form equation.
- (v) State the drawback of 2-SLS estimator.

X ——— X

M.Sc. (Sem.-4) Examination

BTI 508

Biotechnology (Integrated)

Time : 2-30 Hours]

March 2019

[Max. Marks : 70

BTI-508 Environmental Biotechnology

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Que-1 (A) Describe biological production of Hydrogen explaining environmental sustainability of Hydrogen as fuel. [14]

OR

1. Compare sustainability of renewable and non-renewable sources of energy. [7]
 2. Explain the procedure and importance of process for desulphurization of coal. [7]
- (B) Answer any Four of the following in brief [4]
1. Name process of thermal decomposition of materials at elevated temperature in absence of O₂
 2. List components of syngas.
 3. List chemical constituents of Biodiesel
 4. What is trans-esterification?
 5. Which type of wastes can be used for biogas production?
 6. In microbial fuel cell the source of electron for generation of current is (A) Mediator (B) Bacteria (C) Salt bridge (D) Nutrients

Que-2 (A) Discuss different strategies used for bioremediation of soil and water contaminants. [14]

OR

1. Explain the process and applications of phytoremediation. [7]
 2. What are oil spills? How they can be remediated using bacterial biosurfactants? [7]
- (B) Answer any Four of the following in brief [4]
1. Which of the following formulation was developed by TERI-ONCG to clean oil spills? (A) Oilclean (B) Oilzapper (C) Oildegrade (D) Cleansite
 2. Give example of Co-metabolisms.
 3. Name green plant usable for remediation of water contaminants (A) Water hyacinth (B) Lotus (C) Puzzle-grass (D) White-water lily
 4. Give meaning of Xenobiotic
 5. Write one difference between *in-situ* and *ex-situ* bioremediation.
 6. How disposal of detergents in water bodies is harmful to environment?

Que-3 (A) Describe types and characteristics of wastes. [14]

OR

1. Explain functions of effluent treatment plants. [7]
 2. Differentiate between landfills and composting. [7]
- (B) Answer any Three of the following in brief [3]
1. Which of the nutrient plays dominant role in causing eutrophication?
 2. Name content of biomedical waste.
 3. The methods Not used in waste water treatment includes (A) Composting (B) Trickling filters (C) Landfills (D) Filtration
 4. What are advantages of Common ETP.
 5. Draw design diagram of Inhoff tank

Que-4 (A) Discuss the scope and objectives of environmental audit. [14]

OR

1. Describe the procedure for environmental clearance to a project. [7]
 2. Why assessment is necessary to validate impact of any project involving environment? [7]
- (B) Answer any Three of the following [3]
1. Which ministry controls for Environment Impact Assessment?
 2. What is SIA?
 3. Prevention of large-scale loss of biological integrity, focusing both on ecology and human health is known as (A) Biosafety (B) Social risk assessment (C) Social impact assessment (D) Environmental assessment
 4. Identifying and managing the social impacts of an industrial projects is known as social assessment (True/False)
 5. What is main objective of risk assessment?

Instructions:

1. All symbols carry usual meanings. 2. Total Marks : 70
3. Attempt all questions. 4. Scientific calculators are allowed

Q1(A)(i) How is the stability of a system checked using Routh's stability criteria?

A unity feedback control system has

$$G(s) = \frac{k}{(s+4)^3}$$

Using Routh's stability criterion, determine range of k for system's stability. [7]

(ii) What is "Root Locus"? State its importance.

The open loop transfer function of a unity feedback system is

$$G(s) = \frac{5s}{(s+1)(s+2)(s+3)}$$
 [7]

Find Out the following:

- (i) No of Loci and loci ending at infinity
(ii) No of asymptotes and their angles

OR

(i) The transfer function of a second order system is given by [7]

$$T(s) = \frac{4}{s^2 + 2s + 4}$$

Find Out the following frequency domain specifications:

- (i) Damping Ratio (ξ) (ii) Natural frequency (ω_n)
(iii) Resonance frequency (ω_r) (iv) Response peak (M_r)

(ii) (a) Using Hurwitz criterion, examine the stability of a system having characteristic equation given by:

$$s^2 + 2s + 1 = 0$$
 [3]

(b) For a unity feedback system with

$$G(s) = \frac{k}{s(s+2+2j)(s+2-2j)}$$
 [4]

Find Out:

- (i) Number of poles & zeros
(ii) Angle of departure of root locus from complex poles.

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

- (i) What is the effect of adding poles in the transfer function of a system?
- (ii) The open loop transfer function of a unity feedback system is
 $G(s) = k \cdot (s + 2 - j) / (s + 1 - j)$
Find out where the root locus begins and ends.
- (iii) Write two advantages of Routh's stability criterion.
- (iv) Draw the location of poles for marginally stable system in s plane?
- (v) State Hurwitz's stability criteria.
- (vi) State two advantages of Frequency domain analysis

2(A) (i) With necessary diagrams explain the following terms: [7]
(a) Gain Crossover frequency (b) Phase Crossover frequency
(c) Gain Margin (d) Phase Margin

(ii) Discuss the steps followed to draw a Bode plot.
For a standard factor as a Zero at origin (derivative factor), draw Bode plot. [7]

OR

(i) For a unity feedback control system
$$G(s).H(s) = \frac{10(s+1)}{s(1+5s)}$$
 [7]

Write the above equation in Bode form and Find out:

- (i) All standard factors present
- (ii) Draw Magnitude Vs Log ω curve

(ii) List various types of control actions. Describe Proportional-Integral (P-I) controller. [7]

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

- (i) A decade is a frequency band from f_1 to f_2 where $f_2/f_1 = \text{-----}$.
- (ii) For a system if GM is infinity and PM is positive then it is stable. TRUE or FALSE.
- (iii) State two advantages of Bode Plot.
- (iv) Draw Phase versus log ω plot for Bode gain (K_1).
- (v) Draw a + 20dB/decade line passing through $\omega=1$, 10dB
- (vi) If Gain Crossover frequency is less than Phase Crossover frequency then the system is stable. TRUE or FALSE.

Q3(A)(i) With block diagram and voltage waveforms explain RC firing circuit. [7]

(ii) Draw waveforms during SCR turn-off & explain turn-off characteristic in detail. [7]

OR

(i) What is meant by Rating of a thyristor? Explain different ratings of thyristor in brief. [7]

(ii) What is pulse transformer? How can it be used in triggering circuits? [7]

N331-3

(B) Answer the following (Any Three) [3]

- (i) The drawback of A.C. gate triggering is that a separate _____ is required to step down the a.c. supply.
- (ii) Simultaneous triggering is also called independent or _____ firing method.
- (iii) Sequential Triggering is also referred to as _____ triggering method.
- (iv) String efficiency can never be equal to _____.
- (v) The PUT is also referred to as a complementary _____.

Q4(A) (i) Explain integral cycle triggering with waveforms and circuit. [7]

(ii) Explain single-phase half-wave controlled rectifier with inductive load. [7]

OR

(i) Explain symmetrical configuration half controlled bridge rectifier with resistive load in detail. [7]

(ii) Explain flyback SMPS with transformer isolation & feed-forward SMPS with output filter. [7]

(B) Answer the following (Any Three) [3]

- (i) Those converters which work on principle of natural commutation are called _____ commuted converters.
- (ii) In single-phase half-wave controlled rectifier with resistive load, average load current $I_d =$ _____.
- (iii) Heating loads are suitable for _____ cycle control.
- (iv) The overall size of the SMPS is a function of _____.
- (v) UPS provide an interrupted free supply of power to the _____ load.

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2003N331-4

Candidate's Seat No : _____

M.Sc. (Sem.-4) (New) Examination

ELE 508

Electronics Science

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

Date:

Instructions:

1. All symbols carry usual meanings.
2. Total Marks : 70
3. Attempt all questions.
4. Scientific calculators are allowed

Q1(A)(i) How is the stability of a system checked using Routh's stability criteria?

A unity feedback control system has

$$G(s) = \frac{k}{(s+4)^3}$$

Using Routh's stability criterion, determine range of k for system's stability. [7]

(ii) What is "Root Locus"? State its importance.

The open loop transfer function of a unity feedback system is

$$G(s) = \frac{5s}{(s+1)(s+2)(s+3)}$$
 [7]

Find Out the following:

- (1) No of Loci and loci ending at infinity
- (2) No of asymptotes and their angles

OR

(i) The transfer function of a second order system is given by [7]

$$T(s) = \frac{4}{s^2 + 2s + 4}$$

Find Out the following frequency domain specifications:

- (1) Damping Ratio (ξ)
- (2) Natural frequency (ω_n)
- (3) Resonance frequency (ω_r)
- (4) Response peak (M_r)

(ii) (a) Using Hurwitz criterion, examine the stability of a system having characteristic equation given by:

$$s^2 + 2s + 1 = 0$$
 [3]

(b) For a unity feedback system with

$$G(s) = \frac{k}{s(s+2+2j)(s+2-2j)}$$
 [4]

Find Out:

- (1) Number of poles & zeros
- (2) Angle of departure of root locus from complex poles.

- B. Answer the following (Any Four)** [4]
- (i) What is the effect of adding poles in the transfer function of a system?
 - (ii) The open loop transfer function of a unity feedback system is

$$G(s) = k. (s + 2 - j) / (s + 1 - j)$$
 Find out where the root locus begins and ends.
 - (iii) Write two advantages of Routh's stability criterion.
 - (iv) Draw the location of poles for marginally stable system in s plane?
 - (v) State Hurwitz 's stability criteria.
 - (vi) State two advantages of Frequency domain analysis

- 2(A)(i) With necessary diagrams explain the following terms:** [7]
- (a) Gain Crossover frequency
 - (b) Phase Crossover frequency
 - (c) Gain Margin
 - (d) Phase Margin
- (ii) Discuss the steps followed to draw a Bode plot.** [7]
 For a standard factor as a **Zero at origin (derivative factor)**, draw Bode plot.

OR

- (i) For a unity feedback control system**
- $$G(s).H(s) = \frac{10 (s+1)}{s (1 + 5s)}$$
- [7]
- Write the above equation in Bode form and Find out:
- (a) All standard factors present
 - (b) Draw Magnitude Vs Log ω curve
- (ii) (a) Describe Proportional-Integral (P-I) controller.** [3]
- (b) State the advantages of Polar Plots for frequency response analysis?** [4]
 Draw the polar plot for first order Zero Factor.

- B. Answer the following (Any Four)** [4]
- (i) A decade is a frequency band from f_1 to f_2 where $f_2 / f_1 = \text{-----}$.
 - (ii) For a system if GM is infinity and PM is positive then it is stable. **TRUE or FALSE.**
 - (iii) State two advantages of Bode Plot.
 - (iv) Draw Phase versus log ω plot for Bode gain (K_1).
 - (v) Draw a + 20dB/decade line passing through $\omega=1$, 10dB
 - (vi) If Gain Crossover frequency is less than Phase Crossover frequency then the system is stable. **TRUE or FALSE.**

- Q3(A)(i) With block diagram and voltage waveforms explain RC firing circuit .** [7]
- (ii) Draw waveforms during SCR turn-off & explain turn-off characteristic in detail.** [7]

OR

- (i) What is meant by Rating of a thyristor? Explain different ratings of thyristor in brief.** [7]
- (ii) What is pulse transformer? How can it be used in triggering circuits?** [7]

(B) Answer the following (Any Three) [3]

- (i) The drawback of A.C. gate triggering is that a separate _____ is required to step down the a.c. supply.
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- (iii) Sequential Triggering is also referred to as _____ triggering method.
- (iv) String efficiency can never be equal to _____.
- (v) The PUT is also referred to as a complementary _____.

Q4(A) (i) Explain integral cycle triggering with waveforms and circuit. [7]

(ii) Explain single-phase half-wave controlled rectifier with inductive load. [7]

OR

(i) Explain symmetrical configuration half controlled bridge rectifier with resistive load in detail. [7]

(ii) Explain flyback SMPS with transformer isolation & feed-forward SMPS with output filter. [7]

(B) Answer the following (Any Three) [3]

- (i) Those converters which work on principle of natural commutation are called _____ commuted converters.
- (ii) In single-phase half-wave controlled rectifier with resistive load, average load current $I_d =$ _____.
- (iii) Heating loads are suitable for _____ cycle control.
- (iv) The overall size of the SMPS is a function of _____.
- (v) UPS provide an interrupted free supply of power to the _____ load.

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M.Sc. (Sem.-4) Examination

CHEP 508

Polymer Science

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

- Q-1(A) Write The Following
- (i) Enumerate and explain in brief various structural features responsible for building heat resistance in polymers. 07
- (ii) Explain the preparation and structural properties of poly sulphons used as a fire resistant material? 07
- Or
- (i) Which Heterocyclic polymers are used as high temperature resistance compound? Explain in detail. 07
- (ii) Give short note on: PEEK as high temperature polymers. 07
- Q-1(B) Any Four Out Of Six 04
1. Describe what a smart material is.
 2. What are the properties that make aromatic fibers good material for fire-resistant materials?
 3. Since PVC has a much higher LOI than PC, why is it not employed to make fire retardant fabric?
 4. Why are there a number of fluorine-containing polymers employed in coating industries?
 5. Give three principal stages for burning of polymers.
 6. Why brominated compound are not used as fire resistance additives?
- Q-2(A) Write The Following
- (i) Define the term Liquid crystallinity? Explain why some polymer show LC behavior while others not? Give examples of liquid crystal polymers. 07
- (ii) Write notes on: (i) Polypyrrole (ii) Piezoelectric polymers 07
- Or
- (i) Describe the nonlinear optical polymers and their applications. 07
- (ii) Why Polyacetylene is conducting polymer? Give its applications 07
- Q-2(B) Any Four Out Of Six 04
1. Which of the following would you expect might become electrically conductive if doped? PE, PVC, PS, poly-p-phenylene, and PPV.
 2. What advantages might conductive carbon nanotubes have over polyacetylene?
 3. Describe briefly how doping works.
 4. Give full name of PVDF and its application.
 5. What do you meant by photo conducting polymers?
 6. Define Dielectric property of polymer.

N332 - 2

- Q-3(A) Write The Following
- (i) Describe the classification of Ionomers? Give use of Ionomers used in medical field. 07
 - (ii) What are Ion exchange resins? Give their applications in industries. 07
- Or
- (i) Write note on: Polyelectrolytes and its applications. 07
 - (ii) What are Nafion and Flemion? Give their applications. 07
- Q-3(B) Any Three Out Of Five 03
1. What is hydrophilicity?
 2. Give relation between Swelling and Cross linking density.
 3. Which polymer is used in Li-ion battery?
 4. Give example of natural ionomers.
 5. What is Zeolite?
- Q-4(A) Write The Following
- (i) What are biomaterials? Give their characteristics. List their applications. 07
 - (ii) What is polymer gel? Give its classification and application. 07
- Or
- (i) Describe polymeric binders for rocket propellants. 07
 - (ii) What is Polymer concrete? Enlist its applications. 07
- Q-4(B) Any Three Out Of Five 03
1. What is the advantage of a conductive polymer over a copper wire?
 2. Which is more expensive: Portland cement or polymer concrete? And Why?
 3. Which polymers are used in electrical and electronic industries?
 4. Give benefit of specialty polymer.
 5. PTFE is Polar. True/False

X ————— X

M.Sc. (Sem.-4) Examination

CHEI 509

Chemistry (Inorganic)

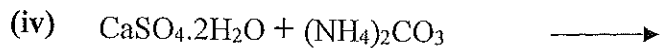
March 2019

[Max. Marks : 70]

Time : 2-30 Hours]

- Que. 1 (A-i) What are Nanomaterials and give their synthetic classification. 07
 (A-ii) Explain the effect of different reducing and stabilizing agent on size of gold nanoparticles. 07
- OR
- (A-i) Write short note on nano-catalysts and nano-adsorbents. 07
 (A-ii) Explain the phenomenon of Surface Plasmon Resonance and its applications in sensing. 07
- Que. 1 (B) **Answer in one or two lines (any four out of six)** 04
- (i) What is oxidation state of silver nanoparticles?
 (ii) Give one example for stabilizing as well as reducing agent of gold nanoparticles.
 (iii) Which one is nanomaterials: atom and DNA and why?
 (iv) Which type of interaction occurs in Analytes and nanosensor?
 (v) What is the size range of nanomaterials (Å°)?
 (vi) Define magnetic nanoparticles.
- Que. 2 (A-i) What is smart material, Explain their different types. 07
 (A-ii) Define piezoelectric materials. Give its application with examples. 07
- OR
- (A-i) Explain the shape memory alloy (SMA) and magnetostrictive materials with examples. 07
 (A-ii) Explain self-healing gel and pH sensitive polymer with example. 07
- Que. 2 (B) **Answer in one or two lines (any four out of six)** 04
- (i) Quartz is example of which smart materials?
 (ii) Give one example for rheological polymer.
 (iii) Which one is smart material: BaTiO_3 and titanium.
 (iv) Which type of polymer occurs in thermoresponsive material?
 (v) Name the polymer which response the pH?
 (vi) Define block copolymer.
- Que. 3 (A-i) Discuss the applications of chemical fertilizers. 07
 (A-ii) Write a note on Azetobactor. 07
- OR
- (A-i) What is the full name of PSB? Write a note on it. 07
 (A-ii) Write a note on NPK fertilizers. 07
- Que. 3 (B) **Answer in one or two lines (any four out of six)** 03
- (i) Write the main consideration for the designing commercial process for urea.
 (ii) Write the chemical formula for DAP.
 (iii) Write the reactions for the manufacturing of urea.

N 356-2



(v) Give the name of symbiotic micro-organisms.

- Que. 4 (A-i) Discuss the processes used to remove sulfur from fuels. 07
(A-ii) Give an account of radionuclides in aquatic environment. 07

OR

(A-i) Describe the methods for removal of solids from industrial waste water. 07

(A-ii) Explain the electro-dialytic method used for removal of ionic materials. 07

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

(i) Define the biomarkers of water pollution.

(ii) Which chemicals are used for oxidation of iron and manganese from industrial waste water?

(iii) Write the source and significance of fluoride in water.

(iv) Give the name and biochemical effect of any one heavy metal present in water.

(v) Which natural processes leading to the formation of carbon monoxide?

— X —

M.Sc. (Sem.-4) Examination

CHEA 509

Chemistry (Analytical)

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

- Q. 1 (A-i) What are the fundamental differences between HPLC and UHPLC? Explain in brief. 07
- (A-ii) Describe pharmaceutical application of UHPLC. 07
- OR
- (A-i) Discuss basic principle and instrumentation of SFC. 07
- (A-ii) How SFC caters to the limitations of GC and HPLC for analysis of non-volatile compounds? Discuss in detail. 07
- Q. 1 (B) **Answer in one or two lines (any four out of six)** 04
- (i) Why higher injection volumes are not allowed in UHPLC?
- (ii) Why smaller particle size columns are used in UHPLC?
- (iii) What will be the affect on density and viscosity of CO₂ supercritical fluid compared to CO₂ gas and CO₂ liquid?
- (iv) Give any two applications of SFC.
- (v) SFC is a form of normal phase chromatography. True or False
- (vi) Why SFC is more environmental friendly than HPLC?
- Q. 2 (A-i) Explain the fundamentals of atmospheric pressure chemical ionization (APCI) and atmospheric pressure photo ionization (APPI) in detail. 07
- (A-ii) Describe the role of mass spectrometry for the analysis of biomolecules. 07
- OR
- (A-i) Write a brief note on tandem mass spectrometry. 07
- (A-ii) Discuss in detail ion cyclotron resonance and Fourier transform mass spectrometry. 07
- Q. 2 (B) **Answer in one or two lines (any four out of six)** 04
- (i) Name the two steps which are involved in the working mechanism of MALDI.
- (ii) What is transmission ratio in mass analyzer?
- (iii) Which mass analyzer works on the principle of trajectory stability for the separation of ions?
- (iv) Name any two matrix compounds which are used in MALDI.
- (v) What is the basic principle of mass analyzer?
- (vi) Write down the applications of MALDI.

P.T.O.

- Q. 3 (A-i) Describe available modes for the efficient transfer of components from HPLC system to NMR for spectral measurements. 07
- (A-ii) Give the comparison of some important features of HPLC-UV/DAD, LC-MS and LC-NMR. 07

OR

- (A-i) Explain in detail the application of LC-NMR and LC-MS. 07
- (A-ii) Discuss different ways to increase the sensitivity of HPLC-NMR technique. 07
- Q. 3 (B) Answer in one or two lines (any three out of five) 03
- (i) What do you understand by "online column trapping"?
- (ii) What was the limitation of early 1970s LC-NMS/MS system?
- (iii) Name any three functional groups that are NMR silent but can be monitored using MS spectrometer.
- (iv) How the time required for data acquisition in NMR spectrometer can be minimized?
- (v) Give the full form of "WET" and its significance in LC-NMR analysis.

- Q. 4 (A-i) Write a brief note on fundamental aspects of Interface in ICP-MS. 07
- (A-ii) Discuss the sources of interferences observed in ICP-MS, and ways to minimize them. 07

OR

- (A-i) Give a comparative evaluation of some important features of ICP-MS with other atomic spectroscopic techniques. 07
- (A-ii) Discuss the application of ICP-MS in the determination of toxic and essential elements in food samples. 07
- Q. 4 (B) Answer in one or two lines (any three out of five) 03
- (i) Comment on the position of plasma torch in ICP-MS and ICP-AES.
- (ii) What is the role of interface in ICP-MS and where it is positioned in ICP-MS?
- (iii) Why is it necessary to maintain zero potential plasma in ICP-MS?
- (iv) Define: Secondary ionization
- (v) What is *Debye length*?

—X—

M.Sc. (Sem.-4) Examination
CHEP 509

Chemistry (Physical)

March 2019

[Max. Marks : 70

Time : 2-30 Hours]

- Q. 1 (A-i) Explain the principle and applications of differential scanning calorimetry. 07
(A-ii) Discuss transmitted and reflected light microscopy in detail. 07

OR

- (A-i) Explain the principle and instrumentation of scanning electron microscopy. 07
(A-ii) Discuss the principle and instrumentation of X-ray technique for the characterization of polymers. 07

- Q. 1 (B) **Answer in one or two lines (any four out of six)** 04
(i) What is bright field illumination?
(ii) What is the principle of differential thermal analysis for polymer characterization?
(iii) What is phase constant microscopy?
(iv) Which property is measured in DTA?
(v) Define polarized light microscopy.
(vi) Write any one application of X-ray technique for polymer characterization.

- Q. 2 (A-i) Discuss calendaring and die casting in polymer processing. 07
(A-ii) Explain compression and injection moulding in polymer processing. 07

OR

- (A-i) Explain foaming process in polymer processing. 07
(A-ii) Discuss wet and dry spinning in polymer processing. 07

- Q. 2 (B) **Answer in one or two lines (any four out of six)** 04
(i) What is slush moulding in rotational casting process?
(ii) Define elastomers.
(iii) Give two illustrations of natural fibre.
(iv) What is reinforcing in polymer processing technique?
(v) Which polymer processing technique is used to produce hollow balls of doll heads?
(vi) What is compounding?

- Q. 3 (A-i) Explain modification of polymers through copolymerization. 07
(A-ii) Discuss the physical and chemical modifications of polymers. 07

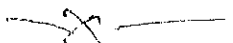
OR

- (A-i) Explain polymer blending in detail. 07
(A-ii) Discuss the given reactions using suitable examples. (i) Halogenation (ii) Nitration (iii) Sulphonation. 07
- Q. 3 (B) Answer in one or two lines (any three out of five) 03
(i) What are post reactions in polymer modifications?
(ii) What is chemical modification?
(iii) Which type of polymers can be hydrolysed in the presence of acids and alkalies?
(iv) What is cross-linking?
(v) Why bromination of polymer is more selective than chlorination?

- Q. 4 (A-i) Explain conducting polymers in detail. 07
(A-ii) Discuss thermally stable polymers in detail. 07

OR

- (A-i) Discuss the polymers for medical applications by giving suitable examples. 07
(A-ii) What are biodegradable polymers? Give synthesis and uses of any two biodegradable polymers. 07
- Q. 4 (B) Answer in one or two lines (any three out of five) 03
(i) What is block polymer?
(ii) Define Plastics.
(iii) What is graft polymer?
(iv) Define flame retardant polymer.
(v) What is the full form of PHBV?



M.Sc. (Sem.-4) Examination

GEL 509

Geology

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

1. Explain: (A) Ash fall, ash flow, lahar deposits and lithic, vitric and crystal tuffs. (14)
- OR
- (A) (i) Composition of sedimentary rocks. (07)
(ii) Classification of conglomerates. (07)
- (B) Write brief answers (any four out of six): (04)
- (1). Give names of textures as per shape of grains.
 - (2). Name limestones as per Folks' classification.
 - (3). Define lava tube.
 - (4). Define roundness.
 - (5). What is diamictite?
 - (6). Define lapilli.
2. Write notes: (A) Erosional and depositional sedimentary structure. (14)
- OR
- (A) (i) Sedimentary facies. (07)
(ii) Shallow water clastic deposits. (07)
- (B) Write short answer (any four out of six): (04)
- (1). Define waves and tides.
 - (2). Provide names of post-depositional sedimentary structures.
 - (3). What is lacustrine deposit.
 - (4). Draw diagrams of mud crack and rain print.
 - (5). Draw a diagram of Bouma sequence.
 - (6). Define aeolian deposit.
3. Describe: (A) Sedimentary diagenesis and differentiation. (14)
- OR
- (A) (i) Shallow sub-tidal cementation in carbonate diagenesis. (07)
(ii) Sedimentary cycles, rhythms and cyclothems. (07)
- (B) Write in short (any three out of five): (03)
- (1). Give names of two marine palaeoenvironments.
 - (2). Define stylolite.
 - (3). In which way sedimentary structures are recorded?
 - (4). Define correlative conformity.
 - (5). Define Low-stand System Tract (LST).
4. Discuss: (A) Sedimentary signature of foreland basin and basins formed at intra-plate settings. (14)
- OR
- (A) (i) Signature of climate on sedimentation. (07)
(ii) Plate tectonics concepts in sedimentation. (07)
- (B) Write in brief (any three out of five): (03)
- (1). Define flysch.
 - (2). Name type of rocks originated on a stable coast line.
 - (3). Mention effects of elevation on sedimentation.
 - (4). Define autogeosyncline.
 - (5). Define miogeosyncline.

M.Sc. (Sem.-4) Examination

STA 509

Statistics

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

Note: Attempt all questions.

Q.1(A)(i) Explain: (a) Prevention costs (b) External failure costs. [7]

(ii) Explain natural tolerance limits and specification limits. [7]

OR

(i) Discuss dimensions of quality. [7]

(ii) Explain the concept of six-sigma. [7]

(B) Answer any four [4]

(i) Define quality.

(ii) The theory behind control charts stipulates that if a point on the control chart falls outside the plus or minus 3 standard deviations control limits, we are 99.7% sure that the process has changed.

(a) True (b) False

(iii) The ----- is the statistical foundation of control charts for variables.

(a) Poisson distribution (b) Binomial distribution

(c) central limit theorem (d) none of the above

(iv) Assignable variations may be due to

(a) variations in raw materials (b) limitations of the process

(c) limitations in the skills of the operator (d) all of the above.

(v) Define average run length (ARL).

(vi) Who of the following individuals was credited for making the distinction between common and special causes of variation?

(a) Juran (b) Deming (c) Shewhart (d) none of the above.

P.T.O

N 360-2

- Q.2(A) (i) Explain the tabular cusum for monitoring the process mean. [7]
(ii) Explain the moving average control chart and compare it with other control charts. [7]

OR

- (i) Explain the cumulative sum control chart for monitoring process variability. [7]
(ii) Explain the exponentially weighted moving-average control chart. [7]
(B) Answer any four [4]
(i) Which of these is a correct statement for cusum status charts?
(a) A plot between the C_i^+ or C_i^- and the sample number
(b) A plot between the C_i^+ or C_i^- and the sample mean
(c) A plot between the C_i^+ or C_i^- and the sample variance
(d) A plot between the C_i^+ or C_i^- and the sample standard deviation
(ii) What of these can be used as the decision interval for the tabular cusum charts?
(a) 2σ (b) 1σ (c) 5σ (d) 4σ
(iii) Shewhart control chart is used to detect small process shifts.
(a) True (b) False
(iv) What do you understand by rational subgroups?
(v) Give one disadvantage of V-mask procedure.
(vi) Process capability ratio cannot be zero.
(a) True (b) False

- Q.3 (A) (i) What do you understand by process capability analysis? How it is helpful in quality improvement program. [7]
(ii) Explain ChSP-1 plan. Discuss OC curve related to this plan. [7]

OR

- (i) Discuss confidence intervals on process capability ratios. [7]
(ii) Discuss CSP-1 plan. [7]
(B) Answer any three [3]
(i) PCR =-----.
(ii) PCR_K measures potential capability in the process.
(a) True (b) False
(iii) PCR_{km} is given by
(a) $\frac{LSL - USL}{6}$ (b) $\frac{USL - LSL}{\tau}$ (c) $\frac{USL - LSL}{6\tau}$ (d) none of the above.
(iv) Continuous-sampling plans are rectifying inspection plans, in that the quality of the product is improved by the partial screening.
(a) True (b) False
(v) Skip-lot sampling plans should be used only when the quality of the submitted product is good as demonstrated by the vendor's quality history.
(a) True (b) False

N 360-3

Q.4 (A) (i) Discuss how Taguchi's philosophy is helpful in the quality improvement process of any organization. [7]

(ii) Explain how 2^3 factorial design is useful in process development and improvement. [7]

OR

(i) Explain how statistical process control methods and experimental design are interrelated for the improvement and optimization of process. [7]

(ii) Explain 2^{k-p} fractional factorial design with an example. [7]

(B) Answer any three [3]

(i) What do you understand by contrast?

(ii) When there are several factors of interest in an experiment, a -----design should be used.

(iii) What do you mean by main effect in factorial design?

(iv) What do you mean by noise factors?

(v) A $\frac{1}{8}$ fraction is called a 2^{k-4} fractional factorial design.

(a) True (b) False

R.T.O

M.Sc. (Sem.-4) Examination

BTI 509

Biotechnology

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

BTI-509 Immunology in Health

Que-1 (A) Describe the process of antigen presentation and processing citing role of T-cell. [14]

OR

1. Write note on Immunosuppression. [7]
2. Differentiate between T-cell and B-cell response. [7]

(B) Answer any Four of the following in brief [4]

1. Give one example of tumour antigen.
2. Name two autoimmune disease
3. T-cell complex is responsible for graft rejection (True/False)
4. Give one example of allograft.
5. Which immune cell(s) are involved in cell-mediated immune response?
6. Name a neuromuscular disease linked to immune response

Que-2 (A) Explain the structure of MHC class I and II. Write their functions in antigen presentation. [14]

OR

1. Explain the properties and therapeutic potential of cytokines. [7]
2. Elucidate the activation process of CD8+ T-cells with diagram. [7]

(B) Answer any Four of the following in brief [4]

1. β 2-microglobulin is responsible for expression of MHC-I on cell membrane (True/False)
2. Which cells receives antigen presented by MHC molecule?
3. What is the name of MHC in human?
4. Name the genes which encode MHC Class-II in humans.
5. Name the region of MHC that has binding site for CD4+ T cell co-receptor ?
6. What is HLA?

Que-3 (A) Describe genetic basis of antibody diversity and class switching. [14]

OR

1. Explain somatic cell fusion with reference to production of monoclonal antibody. [7]
2. Explain structure of immunoglobulin with labelled diagram. [7]

(B) Answer any Three of the following in brief [3]

1. Generation of antibody diversity is an example of recombination.
2. Which cells are damaged by HIV?
3. What is function of HGPRT?
4. IgM can cross human placenta (True/False)
5. List defensive components present in Tears

Que-4 (A) Describe the use of lactic acid bacteria as live vaccines. [14]

OR

1. Describe the therapeutic uses of monoclonal antibody. [7]
2. Write an explanatory note on recombinant vaccines. [7]

(B) Answer any Three of the following in brief [3]

1. Part of antigen which attached to antibody is known as receptor (True/False)
2. name Diseases and Discoverer for first ever vaccine
3. A vaccine can be made up of
(A) antigenic protein (B) Weakened pathogen (C) Live attenuated pathogen (D) All of these
4. What is epitope?
5. Name any two vaccines given under universal immunization programme.

Fiber Optics and its applications (Old Syllabus)

- 1 (A) Write the following
- (i) What are the meridional rays? Obtain an expression for the Numerical aperture of an optical fiber for meridional rays drawing necessary figure. 07
- (ii) What are the skew rays? Obtain an expression for the Numerical aperture of an optical fiber for skew rays. 07

OR

- (i) Explain the following: 07
1. Rayleigh scattering losses
 2. Meï scattering losses.
- (ii) What is the dispersion? Explain material dispersion, and obtain an expression for material dispersion parameter M. 07
- (B) Answer the following (Any Four out of Six): 04
- 1 What is the Evanescent field?
 - 2 According to Maxwell's equations $\nabla \times E = \underline{\hspace{2cm}}$ and $\nabla \times H = \underline{\hspace{2cm}}$
 - 3 What is intermodal dispersion in optical fibers?
 - 4 An optical fiber has Numerical Aperture of 0.4. The acceptance angle for skew rays, for $n_0 = 1$, and $\gamma = 50^\circ$, is
 - 5 An optical fiber has Numerical Aperture of 0.4. The acceptance angle for meridional rays, for $n_0 = 1$, is
 - 6 The general expression for index variation $n(r)$ inside the core and in cladding is

- 2 (A) Write the following
- (i) Explain the double crucible method of fiber drawing. 07
- (ii) Explain the possible types of misalignments that may occur when jointing optical fibers. 07

OR

- (i) What is a fiber coupler? Discuss different types of fiber couplers and their functions. 07
- (ii) What are splices? Discuss different types of mechanical splicing techniques. 07
- (B) Answer the following (Any Four out of Six) 04
- 1 Draw the schematic diagram of stratified melt process for producing glass clad rods or preforms.
 - 2 What is the main difference between fiber splices and connectors?
 - 3 What is the full form of OVPO technique?
 - 4 For no overlapping of light pulse in optical fiber link, the digital bit rate B_T must be less than
 - 5 Full form of PCVD technique is
 - 6 Draw the schematic diagram for (only) deposition in case of MCVD

method.

N 362 - 2

- 3 (A) Write the following:
- (i) Explain measurement of Dispersion in frequency domain with necessary block diagram. 07
 - (ii) In detail explain operation of Optical Time Domain Reflectometer. What are its advantages? 07

OR

- (i) Give details of Optical Return Loss measurement with help of block diagram. 07
- (ii) Explain measurement of Numerical Aperture of optical fiber with necessary block diagram. 07

- (B) Answer the following (Any Three out of Five) 03
- 1 How are mode filters made?
 - 2 How do you differentiate between NEAR FIELD & FAR FIELD measurements?
 - 3 Why is optical feedback more important for LASER source?
 - 4 Why do you need light to pass through a kilometer long fiber before making any measurements?
 - 5 The velocity of signal in CORE is ----- compared to its velocity in CLADDING in optical fiber.

- 4 (A) Write the following:
- (i) Draw and explain operation of a drive circuit for LED source in IM/DD optical fiber communication system. 07
 - (ii) Draw block diagram of polarization diversity FSK heterodyne receiver using one bit delayed demodulation and explain role of few important blocks. 07

OR

- (i) Draw and explain operation of a drive circuit for LASER source in optical fiber communication system. 07
- (ii) Draw block diagram of generalized coherent optical fiber system. Explain what is homodyne and heterodyne system. 07

- (B) Answer the following (Any Three out of Five) 03
- 1 Name two techniques for polarization control.
 - 2 List two difficulties in establishing coherent communication.
 - 3 What is the role of local oscillator in coherent communication?
 - 4 What is main advantage of LED source compared to LASER?
 - 5 What is main advantage of digital fiber optical fiber compared to analog communication?

N 362-3

ELE-509

Fiber Optics and its applications (New Syllabus)

- 1 (A) Write the following
- (i) What are the meridional rays? Obtain an expression for the Numerical aperture of an optical fiber for meridional rays drawing necessary figure. 07
 - (ii) What are the skew rays? Obtain an expression for the Numerical aperture of an optical fiber for skew rays. 07
- OR**
- (i) Explain the following: 07
 - 1. Phase and group velocity
 - 2. Goos-Haenchen shift.
 - (ii) Discuss the transmission in multimode step index fibers, and mode volume M_s . 07
- (B) Answer the following (Any Four out of Six): 04
- 1 What is the Evanescent field?
 - 2 According to Maxwell's equations $\nabla \times E = \underline{\hspace{2cm}}$ and $\nabla \times H = \underline{\hspace{2cm}}$
 - 3 For an optical fiber having core and cladding refractive indices 1.5 and 1.45, respectively, the critical angle is
 - 4 An optical fiber has Numerical Aperture of 0.4. The acceptance angle for skew rays, for $n_0 = 1$, and $\gamma = 50^\circ$, is
 - 5 An optical fiber has Numerical Aperture of 0.4. The acceptance angle for meridional rays, for $n_0 = 1$, is
 - 6 The general expression for index variation $n(r)$ inside the core and in cladding is
- 2 (A) Write the following
- (i) What is the dispersion? Explain material dispersion, and obtain an expression for material dispersion parameter M. 07
 - (ii) Explain the possible types of misalignments that may occur when jointing optical fibers. 07
- OR**
- (i) What is a fiber coupler? Discuss different types of fiber couplers and their functions. 07
 - (ii) What are splices? Discuss different types of mechanical splicing techniques. 07
- (B) Answer the following (Any Four out of Six) 04
- 1 What is intermodal dispersion in optical fibers?
 - 2 For a multimode step index optical fiber, $\sigma_s = 29.9 \text{ ns km}^{-1}$, and $\sigma_m = 12.5 \text{ ns km}^{-1}$. What is the total rms pulse broadening per kilometer?
 - 3 What is intramodal dispersion in optical fibers?
 - 4 For no overlapping of light pulse in optical fiber link, the digital bit rate B_T must be less than

P.T.O

N 362-4

- 5 How can we reduce potential macrobending losses in optical fibers?
- 6 The mean optical power launched into 1 km length of fiber is $200 \mu\text{W}$, and mean optical power at the fiber output is $5 \mu\text{W}$. The signal attenuation is
- 3 (A) Write the following:
- (i) Explain with diagram outside vapour-phase oxidation process. (OVPO). Name other techniques used for preparing optical fibers. 07
- (ii) In detail explain operation of Optical Time Domain Reflectometer. What are its advantages? 07
- OR**
- (i) Give details of Optical Return Loss measurement with help of block diagram. 07
- (ii) Explain why high purity glass is required for making optical fibers. Draw figure and describe radio frequency induction furnace used for high purity melting. 07
- (B) Answer the following (Any Three out of Five) 03
- 1 How are mode filters made?
 - 2 How do you differentiate between NEAR FIELD & FAR FIELD measurements?
 - 3 Why is optical feedback more important for LASER source?
 - 4 Why do you need light to pass through a kilometer long fiber before making any measurements?
 - 5 The velocity of signal in CORE is ----- compared to its velocity in CLADDING in optical fiber.
- 4 (A) Write the following:
- (i) Draw and explain operation of a drive circuit for LED source in IM/DD optical fiber communication system. 07
- (ii) Draw block diagram of polarization diversity FSK heterodyne receiver using one bit delayed demodulation and explain role of few important blocks. 07
- OR**
- (i) Draw and explain operation of a drive circuit for LASER source in optical fiber communication system. 07
- (ii) Draw block diagram of generalized coherent optical fiber system. Explain what is homodyne and heterodyne system. 07
- (B) Answer the following (Any Three out of Five) 03
- 1 Name two techniques for polarization control.
 - 2 List two difficulties in establishing coherent communication.
 - 3 What is the role of local oscillator in coherent communication?
 - 4 What is main advantage of LED source compared to LASER?
 - 5 What is main advantage of digital fiber optical fiber compared to analog communication?

M.Sc. (Sem.-4) Examination

CHEP 509

Polymer Science

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

- 1.A. Write the following
- i Write a brief note Hydrolysis of synthetic biodegradable polymers. 14
- ii Discuss in brief about enzyme mechanism and give few examples of enzymes. 07
- OR
- i Define Enzymes? Write the physical factors affecting the activity of enzymes. 07
- ii Explain in brief about the chemical degradation of biodegradable polymers 07
- 1.B MCQ (Any four out of six)
- i Define biopolymers 04
- ii Write different types of degradation of polymers. 01
- iii Give any two enzymes families name that responsible for degradation. 01
- iv Biodegradable polymers do not need to be land-filled, they will re-enter normal geo-chemical cycles over time. Say True or False 01
- v Structure of PLA 01
- vi Plasticizer used for Starch is 01
- 2.A Write the following
- i Explain in brief about different methods of solvent extraction in biosynthesis. 14
- ii Write briefly about the crystals structure and morphology of Bio-polyesters. 07
- OR
- i Give a brief on Starch based biodegradable polymer with an example 07
- ii Write in brief about the soil burial test. 07
- 2.B MCQ (Any four out of six)
- i Which of the following is not required for the biodegradation process? 04
- a) Micro-organism b) Environment conditions 01
- c) Adhesives d) Substrate
- ii Write the steps involved in biodegradable recycling 01
- iii Give any three different tests for biodegradation assessment. 01
- iv Biodegradable polymer prepared from glycine and aminocapric acid is 01
- a)Nylon b)PHBV c) Buna - N d) None of these
- v Write the machinery used for compounding of Biopolymers 01
- vi Which of the following is not an example of natural biodegradable polymer? 01
- a) Collagen b) Polyvinyl alcohol c) Lignin d) Natural rubber
- 3.A Write the following
- i Discuss in detail about the recycling problems of biodegradable polymers. 14
- ii Explain in brief about polyethylene/starch film recycling process. 07
- OR
- i Discuss in brief conventional recycling of plastics with its recycling codes. 07
- ii Write the advantage and disadvantage of recycling of biodegradable polymers. 07
- 3.B MCQ (Any three out of five)
- i Select the incorrect statement from the following option: 03
- a) Biodegradable polymers are not suitable candidates in the recycling of 01

	commingled plastics	
	b) Biodegradable polymers are very expensive	
	c) Biodegradable polymers are an attractive option for addressing the solid waste and marine pollution	
	d) Biodegradable polymers are easily available	
ii	Define Thermoplastics Starch.	01
iii	Write the additives used for Biopolymers	01
iv	Write the full form of PBAT	01
v	Define biodegradable	01
4.A	Write the following	14
i	Discuss briefly on petri-dish screen Test Method	07
ii	Write a note on different Standards and Test methods available for biodegradable polymers.	07
	OR	
i	Explain in brief about environmental chamber method	07
ii	Give a brief note on criteria used in the evaluation of biodegradable polymers.	07
4.B	MCQ (Any three out of five)	03
i	Define biodegradability.	01
ii	Biodegradation will be more for:	
	a) More molecular weights and high crystallinity	
	b) Low molecular weights and high crystallinity	01
	c) More molecular weights and less crystallinity	
	d) Low molecular weights and less crystallinity	
iii	Write the Structure of polyesters polymer.	01
iv	Write different standards used for biodegradation	01
v	Write the Structure of starch.	01

— X —

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2303N390

Candidate's Seat No : _____

M.Sc. (Sem.-4) Examination

510

Chemistry (Inorganic/Organic/Analytical)

Time : 2-30 Hours]

March 2019

[Max. Marks : 70

- Q. 1 (A-i) Describe the criteria for selecting a method for analysis. 07
(A-ii) Explain the methods for separation of species from matrix. 07
- OR**
- (A-i) Discuss the statistical view of analytical procedures for their evaluation. 07
(A-ii) Explain in detail the various steps required for sampling. 07
- Q. 1 (B) **Answer in one or two lines (any four out of six)** 04
(i) Define: EIA
(ii) What is TLV?
(iii) Comment on repeatability.
(iv) Define: Statistics
(v) What do you understand by sample?
(vi) What is a random error?
- Q. 2 (A-i) Describe the sampling of airborne solids. 07
(A-ii) Discuss the gas chromatography method for determination of aromatic hydrocarbons in exhaust, petrol and air. 07
- OR**
- (A-i) Write a brief note on the techniques used for examination of airborne solids. 07
(A-ii) Explain in detail chemical methods for determining oxides of nitrogen in the atmosphere. 07
- Q. 2 (B) **Answer in one or two lines (any four out of six)** 04
(i) How will you identify transparent crystalline particles?
(ii) Write down one feature of liquid absorption system.
(iii) Which tubes are used for reactive gases in liquid absorption system?
(iv) Enlist the sources of H₂S and SO₂ in the atmosphere.
(v) Define PIT₅₀.
(vi) What is the source of lead in urban air?

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- Q. 3 (A-i) Define DO and BOD. Describe the process for determination of DO and BOD in waste water. 07
- (A-ii) Discuss in detail the determination of trace organics in water sample. 07
- OR**
- (A-i) Give an account of Ion-selective electrodes for the analysis of water. 07
- (A-ii) Explain in detail the determination of heavy metals in water sample. 07
- Q. 3 (B) **Answer in one or two lines (any three out of five)** 03
- (i) Give the full form of TISAB.
- (ii) What is ASV?
- (iii) State the advantages of DME.
- (iv) Give an example of biocidal reagent.
- (v) State the full name of CDTA.
- Q. 4 (A-i) Write a brief note on the spectroscopic techniques for soil analysis. 07
- (A-ii) Describe sample preparation and dissolution for plants analysis. 07
- OR**
- (A-i) Explain the need for plant analysis with respect to nutrient and metals. 07
- (A-ii) Discuss the analysis of plant tissue for any two among B, CO and S in plant tissue. 07
- Q. 4 (B) **Answer in one or two lines (any three out of five)** 03
- (i) Why KCl solution is used to extract available nitrogen from soils?
- (ii) Give size range for soil particles.
- (iii) What is the basis of Kjeldahl method?
- (iv) Give an example of suitable extractant for soil.
- (v) State any one example of suitable acid mixture for dissolution of soil or rocks.

—X—

- Q. 1 (A-i) Explain the role of crown ethers in phase transfer catalysis. 07
- (A-ii) Discuss the structural factors affecting the distribution of anions between aqueous and organic phases on PTC. 07
- OR**
- (A-i) Discuss mechanism of solid-liquid phase and liquid-liquid phase transfer catalysis. 07
- (A-ii) Explain the types of phase transfer catalysis. 07
- Q. 1 (B) **Answer in one or two lines (any four out of six)** 04
- (i) What is crown ether?
- (ii) Give examples of solid-liquid phase transfer catalysis.
- (iii) Name two agents used in phase transfer catalysis.
- (iv) Name of any two quaternary ammonium salt of PTC.
- (v) Give examples of liquid-liquid phase transfer catalysis.
- (vi) Mention the symbolic representation of phosphonium salt.
- Q. 2 (A-i) Discuss how dehydro halogenation and oxidation is carried out using phase transfer catalytic process. 07
- (A-ii) Explain phase transfer catalysis processes for alkylation and cylation. 07
- OR**
- (A-i) Give the advantages of phase transfer catalysis in industrial applications. 07
- (A-ii) Discuss the phase transfer catalytic processes for oxidation of benzoin. 07
- Q. 2 (B) **Answer in one or two lines (any four out of six)** 04
- (i) Write any one advantage of PTC in industrial applications.
- (ii) Write any one general feature of catalysis.
- (iii) Define homogeneous catalysis.
- (iv) What is role of aldol condensation in PTC?
- (v) What is catalysis process?
- (vi) What is role of PTC in Williamson ether synthesis?

- Q. 3 (A-i) Discuss the classification of nanomaterials and discuss the preparation and characterization of carbon nanotubes. 07
- (A-ii) Describe the role of the size, shape and surface area of nanoparticles in catalysis. 07

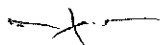
OR

- (A-i) Explain the basic instrumentation of XRD and mention its applications in the characterization of nanomaterials. 07
- (A-ii) Explain the TEM technique to determine the size, shape and surface area of nanoparticles in catalysis. 07
- Q. 3 (B) **Answer in one or two lines (any three out of five)** 03
- (i) Write any one limitation of AFM.
- (ii) Which theory is an extension of Langmuir theory?
- (iii) How surface area of nanoparticle affects the catalytic process?
- (iv) Which properties of nanomaterials are different from the bulk material?
- (v) Write any two methods for the preparation of nanomaterials.

- Q. 4 (A-i) Write a note on nanomaterials in medicinal field. 07
- (A-ii) Describe the uses of nanocatalyst in treatment of waste water and for protection of environment. 07

OR

- (A-i) Discuss the applications of nanocatalyst in synthesis of fine chemicals. 07
- (A-ii) Discuss the applications of nanocatalyst in drug delivery and solar cells. 07
- Q. 4 (B) **Answer in one or two lines (any three out of five)** 03
- (i) Write any one advantage of nanocatalyst in synthesis of fine chemicals.
- (ii) Mention any one application of nanocatalysis in medicine.
- (iii) Why nanoparticles are used as nanocatalysts?
- (iv) What is the cantilever made up of?
- (v) What is the application of nanocatalysis for environmental safety?



M.Sc. (Sem.-4) Examination

510

Geology

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

1. (A) Describe calculation of average grade. 14
OR
 (A) (i) Sublevel stopping and sublevel caving methods of mining. 07
 (ii) Exploration and exploitation phases of mining. 07
 (B) Short Questions (Any four out of six) 04
 (i) Define tunnel and face.
 (ii) What is ore chute?
 (iii) Define burden.
 (iv) Define berm and ramp.
 (v) Name the mining software.
 (vi) Define stripping ratio.
2. (A) Discuss catastrophic hazards. 14
OR
 (A) (i) Environmental implications of an earthquakes. 07
 (ii) Environmental implications of an avalanche. 07
 (B) Short Questions (Any four out of six) 04
 (i) What are non-renewable earth resources?
 (ii) Give examples of renewable resources.
 (iii) Define biodiversity.
 (iv) How geology is applied to urban planning?
 (v) Define environment legislation.
 (vi) State one waste disposal problem.
3. (A) Write a detailed note on elements of logging. 14
OR
 (A) (i) Kerogen and its types. 07
 (ii) Oilfield fluid occurrence. 07
 (B) Short Questions (Any three out of five) 03
 (i) What is primary migration of oil?
 (ii) Define facies analysis.
 (iii) Name the oil fields of Gujarat.
 (iv) What is mud-filtrate invasion?
 (v) Name the oil bearing basins of the world.
4. (A) Write a critical note on proximate and ultimate analyses of coal. 14
OR
 (A) (i) Carbonisation of coal. 07
 (ii) Coal prospecting. 07
 (B) Short Questions (Any three out of five) 03
 (i) State the full form of G.I.P.C.L.
 (ii) Name the coal fields of Madhya Pradesh.
 (iii) State the nuclear power stations of India.
 (iv) State the application of coal petrology in HC exploration.
 (v) What is maturation of coal?

M.Sc. (Sem.-4) Examination

STA 510

Statistics

Time : 2-30 Hours]

March 2019

[Max. Marks : 100

Instruction : (1) Figures to right indicates full marks.
 (2) All questions is compulsory.

- 1 (a) Answer the following :
- (i) What is ment by "Biological Assays"? Discuss direct assays. 7
- (ii) State objectives of biological assays and discuss indirect assays. 7
- OR**
- (i) What is ment by "Quantal Response Assays"? Discuss profit analysis. 7
- (ii) Discuss Logit analysis. 7
- (b) Answer any four : 4
- (i) State Fieller's theorem.
- (ii) What is ment by minimum effective Dose?
- (iii) Define median effective Dose.
- (iv) How do you interpret ED_{90} ?
- (v) What is the meaning of standard preparation?
- (vi) What is ment by test preparation?
- 2 (a) Answer the following :
- (i) Discuss Phase I, Phase II, Phase III and Phase IV clinical trials in brief. 7
- (ii) Why are clinical trials needed? Discuss study protocol in detail. 7
- OR**
- (i) Discuss multi center trials. 7
- (ii) Define "Study population" and recruitment of participants. 7
- (b) Answer any four : 4
- (i) State the ethics of clinical trials.
- (ii) Explain large sample clinical trials.
- (iii) What is ment by "Withdrawal studies"?
- (iv) Define "Placebos".
- (v) What is ment by Vn blinded trials?
- (vi) Explain "Randomized control studies".

[P.T.O.]

2303N393-2

- 3 (a) Answer the following :
- (i) Discuss role of factorial designs in clinical trials. 7
 - (ii) Explain importance of cross over designs and group allocations designs in clinical trials. 7

OR

- (i) Discuss fixed allocation randomization with respect to clinical trials. 7
 - (ii) Discuss adaptive randomization with respect to clinical trials. 7
- (b) Answer any three :
- (i) What is ment by "Double Blind Trials"?
 - (ii) Explain "End points".
 - (iii) State the limitations of "Single Blinded Trials".
 - (iv) Define odd ratio.
 - (v) What is relative risk?

- 4 (a) Answer the following :
- (i) Discuss various methods of sample size determination in brief. 7
 - (ii) Explain "Survival Analysis". 7

OR

- (i) Discuss data collection and quality control with respect to clinical trials. 7
 - (ii) Discuss reporting and interpreting of results in clinical trials. 7
- (b) Answer any three :
- (i) State uses of baseline data.
 - (ii) What is "Past study Follow-Up"?
 - (iii) What is objective of Meta analysis in clinical trials?
 - (iv) What is interim analysis?
 - (v) State the importance of sample size determination in clinical trials.
-

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 (i) What are different types of data acquisition configurations describe in detail? 7
- (ii) Draw diagram and explain operation of a digitally controlled variable gain amplifier. 7
- OR
- Q-1 (i) Give pin diagram of MAX RS-232. Give the features of RS 232 interface. 7
- (ii) With help of diagrams of cable & connectors explain the details of USB interfacing system. 7
- Q-1 (b) Attempt any FOUR. 04
- 1 Give working principle of opto isolator.
 - 2 Why is variable gain amplifier required in a DAQ system?
 - 3 What is the role of transformer in the interfacing systems?
 - 4 In a variable gain amplifier using OPAMP, if $R = 100k\Omega$ and $RF = 1 \text{ mega ohms}$. Calculate its gain.
 - 5 If highest frequency in signal is 4 KHz; what should be the minimum sampling rate?
 - 6 Give output window profile on RS 232.
- Q-2 (i) Draw block diagram of SCPI generalized instrument model. Write a command to measure AC voltage in the range 0-2 V with a resolution of 0.1 Volts. 7
- (ii) Give in detail how bus expanders are used in GPIB system? 7
- OR
- Q-2 (i) Give in detail how bus extenders are used in GPIB system? 7
- (ii) Discuss in detail IEEE 488 system, Give examples to perform simple operations. 7
- Q-2 (b) Attempt any FOUR. 04
- 1 GPIB is a parallel interfacing system. TRUE/FALSE ?
 - 2 A GPIB connector has ----- Pins.
a) 9 b) 16 C) 24 D) 40
 - 3 What is maximum number of devices in GPIB system?
 - 4 What is range of addresses in GPIB system?
 - 5 GPIB compatible instruments of same specifications but from different manufacturers can be interchanged in a system. TRUE/FALSE?
 - 6 In GPIB ----- is not a handshake line.
a) ATN b) NDAC C) NRFD D) DAV

- N 394-2
- Q-3 (i) Write in the brief, "The moving target indicator (MTI) radar" 7
- (ii) Explain in detail, "geostationary orbit of satellite". What is the meaning of, "station keeping". 7
- Q-3 (i) Discuss in detail, "FMCW radar". 7
- (ii) What is multiple accessing? Discuss in detail FDMA or TDMA. 7
- Q-3 (b) Attempt any THREE 03
- 1 What is the "limits of visibility" in satellite communication?
- 2 What is the meaning of apogee and perigee?
- 3 What is maximum unambiguous range?
- 4 The Doppler frequency is maximum, when angle made by *target trajectory line to line joining between radar and target* is
- (a) $\Theta = 3\pi/2$, (c) $\Theta = \pi$,
- (b) $\Theta = 0$, (d) $\Theta = \pi/2$.
- 5 State, "Kepler's second law".
- Q-4 (i) Discuss in detail: (i) Co-channel interference, (ii) Adjacent-channel interference. 7
- (ii) Explain GSM communication and how it's services provided to user's? 7
- OR
- Q-4 (i) Discuss in detail, "Roaming and Handoff process". 7
- (ii) Explain in detail, "First Generation analog cellular telephone and AMPS frequency allocation". 7
- Q-4 (b) Attempt any THREE 03
- 1 What is the size of microcell in cellular communication?
- 2 What is frequency reuse?
- 3 What is sectoring?
- 4 What is the work difference between HLR and VLR?
- 5 What is full form of, (I) MTSO , (ii) PSTN.

=====BEST OF LUCK=====

V394-3

Time: 2-30 hours

Total 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 (i) What are different types of data acquisition configurations describe in detail? 7
- (ii) Draw diagram and explain operation of a digitally controlled variable gain amplifier. 7
- OR
- Q-1 (i) Draw block diagram of SCPI generalized instrument model. Write a command to measure AC voltage in the range 0-2 V with a resolution of 0.1 Volts. 7
- (ii) Give in detail how bus expanders are used in GPIB system? 7
- Q-1 (b) Attempt any FOUR. 04
- 1 A GPIB connector has ----- Pins.
9 b) 16 C) 24 D) 40
 - 2 In GPIB ----- is not a handshake line.
ATN b) NDAC C) NRFD D) DAV
 - 3 What is maximum number of devices in GPIB system?
 - 4 In a variable gain amplifier using OPAMP, if $R = 100k\Omega$ and $R_F = 1 \text{ mega ohms}$. Calculate its gain.
 - 5 If highest frequency in signal is 4 KHz; what should be the minimum sampling rate?
 - 6 GPIB is a parallel interfacing system. TRUE/FALSE ?
- Q-2 (i) Draw structure of IEEE 1394 cable. With diagram explain the IEEE 1394 system.. 7
- (ii) Give a comparison between RS 232, RS 485 and RS 422. 7
- OR
- Q-2 (i) Give pin diagram of MAX RS-232. Give the features of RS 232 interface. 7
- (ii) Discuss in detail different error checking methods. 7
- Q-2 (b) Attempt any FOUR. 04
- 1 What is maximum number of USB devices that can be attached to a pc?
 - 2 Give output window profile on RS 232.
 - 3 PC serial port is i Synchronous, ii Asynchronous, iii both synchronous and asynchronous iv none of above.
 - 4 Give diagram of USB cable.
 - 5 Give diagram of USB connectors.
 - 6 I²C bus is SERIAL INTERFACE. TRUE/FALSE?

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- N 394-4
- Q-3 (i) Write in the brief, "The moving target indicator (MTI) radar" 7
- (ii) Explain in detail, "geostationary orbit of satellite". What is the meaning of, "station keeping". 7
- Q-3 (i) Discuss in detail, "FMCW radar". 7
- (ii) What is multiple accessing? Discuss in detail FDMA or TDMA. 7
- Q-3 (b) Attempt any THREE 03
- 1 What is the "limits of visibility" in satellite communication?
- 2 What is the meaning of apogee and perigee?
- 3 What is maximum unambiguous range?
- 4 The Doppler frequency is maximum, when angle made by *target trajectory line to line joining between radar and target* is
- (a) $\Theta = 3\pi/2$, (c) $\Theta = \pi$,
- (b) $\Theta = 0$, (d) $\Theta = \pi/2$.
- 5 State, "Kepler's second law".
- Q-4 (i) Discuss in detail: (i) Co-channel interference, (ii) Adjacent-channel interference. 7
- (ii) Explain GSM communication and how it's services provided to user's? 7
- OR
- Q-4 (i) Discuss in detail, "Roaming and Handoff process". 7
- (ii) Explain in detail, "First Generation analog cellular telephone and AMPS frequency allocation". 7
- Q-4 (b) Attempt any THREE 03
- 1 What is the size of microcell in cellular communication?
- 2 What is frequency reuse?
- 3 What is sectoring?
- 4 What is the work difference between HLR and VLR?
- 5 What is full form of, (I) MTSO, (ii) PSTN.

=====BEST OF LUCK=====

M.Sc. (Sem.-IV) (Old) Examination

MAT 511 EA

Mathematics

March 2019

Time : 2-30 Hours]

[Max. Marks : 70

Instruction : Figures to right indicates full marks.

- 1 (a) (i) Compute the second fundamental form of the elliptic paraboloid $\sigma(u, v) = (u, v, u^2 + v^2)$. 7
- (ii) Compute the normal curvature of the circle $r(t) = (\cos t, \sin t, 1)$ on the elliptic paraboloid $\sigma(u, v) = (u, v, u^2 + v^2)$. 7

OR

- (a) (i) Calculate the principal curvatures of the helicoid $\sigma(u, v) = (v \cos u, v \sin u, u)$. 7
- (ii) State Euler's theorem. (Do not prove.) 7
- (b) Answer any four : 4
- (i) Define an asymptotic curve Y on a surface S
- (ii) Define a line of curvature C on a surface S
- (iii) Define an elliptic point
- (iv) Define an umbilical point
- (v) True or False? There are hyperbolic points on a torus (Do not prove.)
- (vi) True or False? Every point of a sphere is an umbilical point (Do not prove.)

- 2 (a) (i) Calculate the Gaussian curvature of the surface $\sigma(u, v) = (u + v, u - v, uv)$ at the point $(2, 0, 1)$. 7
- (ii) Define $z(u, v) = 3\sigma(u, v)$. Show that the Gaussian curvature at each point of the surface patch $z(u, v)$ is $\frac{1}{9}$ times that of the corresponding point $\sigma(u, v)$.

OR

- (a) (i) Calculate the Gaussian curvature at each point of the surface $z = f(x, y)$, where f is a smooth function. 7
- (ii) Describe the image under the Gauss map of the cylinder $\sigma(u, v) = (\cos v, \sin v, u)$. 7
- (b) Do any four : 4
- (i) Define the Gaussian curvature in terms of the principal curvatures.
- (ii) Define the mean curvature in terms of the principal curvatures.
- (iii) Give (without proof) the Gaussian curvature of a plane.
- (iv) Give (without proof) the Gaussian curvature of a sphere of radius 2.
- (v) True or False? There is a surface whose Gaussian curvature at each point is $K = -1$. (Do not prove.)
- (vi) True or False? If S is a compact surface, there is a point of S at which the Gaussian curvature K is greater than zero. (Do not prove.)

2503N430-2

- 3 (a) (i) Write down (without proof) the geodesic equations. Show that an isometry between two surfaces takes the geodesics of one surface to the geodesics of the other. 7
- (a) (ii) Describe (without proof) the geodesics on a sphere. Describe (without proof) the geodesics on a plane. 7

OR

- (i) State (without proof) Clairaut's theorem describing geodesics on a surface of revolution 7
- (ii) Describe the geodesics on the circular cylinder $x^2 + y^2 = 1$. 3
- (b) Do any three :
- (i) True or False? Meridians on a surface of revolution are geodesics. (Do not prove)
- (ii) True or False? Parallels on a surface of revolution are geodesics. (Do not prove)
- (iii) True or False? There is a unique geodesic through any given point of a surface in any given direction (Do not prove)
- (iv) What is the length of the shortest path between the points $(0, 0, 1)$ and $(0, 1, 0)$ on the unit sphere?
- (v) Define a geodesic on a surface S .

- 4 (a) (i) State Gauss' Theorema. Show that there is no isometry between (any part of) a sphere and (any part of) a plane. 7
- (ii) State (without proof) the Gauss-Bonnet theorem for a compact surface S . Find the Euler number of a sphere.

OR

- (a) (i) Describe (without proof) a compact surface whose Gaussian curvature is constant. Name a compact surface whose Gaussian curvature is not a constant. 7
- (ii) Find the multiplicity at the origin of the smooth vector field in the plane. 7
- $V(x, y) = (x, y)$.
- (b) Do any three : 3
- (i) If the first fundamental form is $du^2 + G dv^2$, give a formula for the Gaussian curvature K . (Do not prove)
- (ii) Is there an isometry between two spheres of different radii?
- (iii) Draw a vector field on a torus, with no stationary points.
- (iv) Give (without proof) a smooth vector field $V(x, y)$ in the plane with the origin as a stationary point of multiplicity 2.
- (v) Let $f(x, y) = x^2 + y^2$. Show that $(0, 0)$ is a critical point.