TRIBHUVAN UNIVERSITY

2066

Bachelor Level / Science & Tech. /II Year **Full Marks : 100**

CHEMISTRY (CHEM=321) **Time : 3 hrs.**

Candidates are required to give their answers in their own words as for as practicable.
The figures in the margin indicate full marks.

Use separate answer-book for each group.

The Comprehensive Question of each group is compulsory.
Attempt EIGHT questions of Short Answer Questions of each group.

Group "A" (INORGANIC)

Comprehensive Question

1. What is meant by 'd' block element ? Discuss 'd' block element in the following respect with examples.
   (a) Variable oxid^{n} state (b) Complex compound - formation
   (c) Coloured compounds (d) Catalytic properties. [1+2+2+2+2]

   OR

   Describe how flourine is produced . What are the necessary precautions required ? Give the main uses of flourine? [4+3+2]

2. Short Answer Questions : 8×3=24
   2.1. What is meant by inert pair effect ? Explain it on the basis of gr III and gr IV element.
   2.2. How will you show that H_2O_2 act both as oxidising as will as reducing agent ?
   2.3. Describe one method of preparation of Marshal's acid and Carro's acid. Write its structure.
   2.4. Write the principle of 'Zone refining' process for refining metal.
   2.5. How is hydrazine prepared, mention its difficulties involved during preparation. Give its two reducing properties.
   2.6. Pπ-pπ back bonding occurs in halide of Boron but not in halides of I. Why ?
   2.7. Li+ has smallest ionic radius but ionic mobility in aqueous solution in the order $Cs^+ > Rb^+ > K^+ > Na^+ > Li^+$. Give the reason for this apparent anomaly.
   2.8. Outline the reaction of Ozone with Freon.
   2.9. Define following term with examples . (a) Secondary and primary valencies (b) EAN rule.
   2.10. What is Zeigler, Natta Catalyst ? Point out any one of its application .
   2.11. Explain the basic character of iodine with examples.

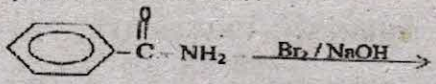
Group "B" (ORGANIC)

Comprehensive Question

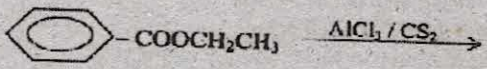
3. Give the mechanism of acid catalyzed and base promoted halogenation of ketone with suitable examples. Bromination in $CH_3CH_2COCH_3$ forms $CH_3CHBrCOCH_3$ in acid catalyzed reaction, where as it forms
   (a) Variable oxid^{n} state (b) Complex compound - formation
   (c) Coloured compounds (d) Catalytic properties. [1+2+2+2+2]

   OR

Predict the product with mechanism :

a. 

b. $R-C\equiv N \xrightarrow{OH^-}$

c. 

4. Short Answer Questions : 8×3=24

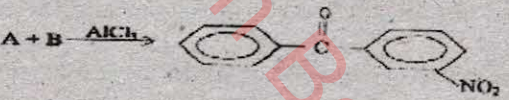
4.1. What are bicyclic compounds ? Write down the structure of bicyclo [4.40] dec-3-ene. How would you prepare the compound by Deils-Alder reaction ?

4.2. What are two possible chair conformations of methyl cyclohexane ? Which one of these two conformation is more stable ? Give reason for your answer.

4.3. Write the products for nitration of three isomeric of dibro-mobenzene (A,B and C) individually.

4.4. Show the effect of presence of $-CH^3$ group in an eletrophilic aromatic substitution.

4.5. Which of the following is aromatic ? Give reason.
a. Cyclopropene, cyclopropenyl cation, cyclopropenyl anion
b. Cyclopropentadiene, cyclopentadienyl cation, cyuclopentadienyl anion

4.6. 

4.7. Account for the fact that b enzaldehyde is less reactive than acetaldehyde in nuclephilic addition reaction. A compound, $C_5H_{10}O$, gives iodoform test and also give positive test with 2, 4 - dinitrophenylhydrazine . What is structure of this compound ? Give reason for your answer with possible reaction.

4.8. Outline the synthesis of ∝-methyl n-valeric acid (2-methyl pentanoic acid) from acetoacetic ester.

4.9. Arrange the isomers of salicylic acid on the basis of their acidity. Give reason for your answer.

4.10. Starting from toluene how would you synthesize ortho and para bromotoluenes.

4.11. Give reasons for the following :
a. C - O bond distance in phenol is shorter than that in methanol.
b. Melting point and boiling point of ortho nitrophenol is much lower than that of its meta and para isomer.

Group "C" (PHYSICAL)

Comprehensive Question [10]

5. What is a cyclic process ? Describe Carnot cycle for establishing maximum convertibility of heat into work.
In the efficiency of a Carnot engine is 20% and the temperature of sink is 300K. Calculate the temperature of source. [1+6+3]

OR

Describe the Hittorf's method of determinations of transport number. The speed ratio of silver and nitrate ions in an aqueous solution of silver nitrate is found to be 0.92. Calculate the transport number of Ag^+ and NO_3^- runs. (7+3)

6. Short Answer Questions : 8×3=24

6.1. State second law of thermodynamics. Explain the term entropy.
6.2. Derive the relation : dG = Vdp - SdT.
6.3. Show your familiarity with Fluorescence and Phosphorescence.
6.4. Calculate the frequency and wavelength of light corresponding to the energy 53 kcal $mole^{-1}$.
6.5. Give a brief account of pseudo first order reaction.
6.6. Discuss on the basis of collision theory the effect of temperature on the rate of reaction.
6.7. Show your acquaintance with the transition state theory.
6.8. At 25°C, the half life period of the decomposition of N^2O^5 is 5 hour and is independent of the initial concentration of N^2O^5 . Calculate the specific reaction rate and time requi9red for 90% decomposition.
6.9. Discuss the mechanism of heterogeneous catalysis with the help of a suitable example.
6.10. Enumerate the characteristics of a catalyst.
6.11. The specific conductance of a solution containing 1 gram of anhydrous $BaCl_2$ in 200 cm^3 of solution has been found to be 0.0058 S cm^{-1}. What are the molar conductance and equivalent conductance of the solution ? (At.wt. of Ba = 137 and Cl = 35.5).

Mathematical Analysis I (Math. 322) IV Paper, 2066

Time : 3 hour Full Marks : 75

Attempt ALL the questions.

Group "A" 5×7=35

1. Define supremum of a set S of real numbers. If $c > 0$ and if b is any real number, then prove that there exists a natural number n such that $nc > b$. Also prove that there exists a rational number between any two unequal real numbers. [1+3+3]
2. What do you mean by interior point and interior of a set S in $\Re$? Find interior of A = $\{x : 2 \leq x < 5\} \cup \{6\}$ and ZZ = {x : x is an integer.} Define open set in $\Re$ and prove that arbitrary union of open sets in $\Re$ is open. [2+2+3]

OR

Distinguish between limit points and adherent points of a set S in $\Re$. Find all limit points and adherent points of the set A = (1 , 2) $\cup$ {4 , 5}. Prove that a set S in $\Re$is closed iff it contains all its limit points. [2+1+4]

3. Define continuity of a function $f : \Re \to \Re$ at a point $c \in \Re$ and give an example. Prove that $f : \Re \to \Re$ is continuous on $\Re$ iff f^{-1} (S) is open in domain $\Re$ for every open set S in range $\Re$.
4. When is a bounded function f : [a, b] $\to \Re$ Riemann integrable on [a , b] ? What is Riemann's condition for integrability ? If a bounded function f : [a , b] $\to \Re$ is continuous on [a , b] , prove that f is Riemann integrable on [a , b]. [1+1+5]

OR

Let f: [a, b] $\to \Re$ be a bounded function. Define its upper and lower Riemann integrals on [a , b]. Also establish a relation between them. [3+4]

5. Define primitive of a function f : [a , b] $\to \Re$.
If g " [a , b] $\to \Re$ has continuous derivative g'(x) for all x $\in$ [a, b] and if A = g ([a , b]) and f : A $\to \Re$ is continuous on A , Prove that

$$\int_{g(a)}^{g(b)} f(t)dt = \int_{a}^{b} f[g(x)]g'(x)dx. \qquad [1+6]$$

Group "B" 10×4=40

6. When are two sets A and B called equivalent ? Prove that the set of all even positive integers is equivalent to the set of all positive integers. [1+3]
7. Prove that the set of all real numbers between 0 and 1 is not countable. [4]
8. Define convergence of a sequence $\{X_n\}$ of real numbers. Prove that the limit of a convergent sequence numbers. Prove that the limit of a convergent sequence of real numbers is unique. [1+3]
9. Define monotonically increasing and decreasing sequence of real numbers. If a sequence $\{X_n\}$ is monotonically decreasing (or non-increasing) and is bonded below, then prove that it is convergent and attains its greatest lower bound. [1+3]

OR

Define Cauchy sequence. Prove that every Cauchy sequence in $\Re$ is bounded. [1+3]

10. Prove that a necessary condition for convergent of an infinite series $\sum x_n$ is $\lim_{n\to\infty} x_n = 0$. Also, given an example to show that the above condition is not sufficient. [3+1]
11. Apply Cauchy criterion of convergence to determine the convergence of

$$1+\frac{1}{1!}+\frac{1}{2!}+\frac{1}{3!}+\ldots\ldots\ldots\ldots+\frac{1}{n!}+\ldots\ldots\ldots$$

OR

Prove that absolutely convergent series is convergent but not conversely.

12. Discuss the discontinuities of the function f : $\Re \to \Re$ given by f (x) = [x]. where [x] is the greatest integer less or equal to x. Defining jump of a function at a point, find the jumps of above function at its points of discontinuities.[2+2]

OR

Let f : [a , b] $\to \Re$ be continuous. If k i any real number between f(a) and f(b). then prove that there exists a point c $\in$ [a , b] such that f(c) = k. [4]

13. State Lagrange's mean value theorem for derivatives. Prove that , if f'(c = 0 for all c $\in$ [a , b], then f is constant on [a , b] [1+3]
14. State and prove L' Hospital's Rule. [1+3]

OR

Write the Taylor's polynomial of degree 5 about 0 for $f(x) = \frac{1}{1+x}$.
Also write an expression for the remainder. [3+1]

15. Prove that a monotonic function f on a closed interval [a,b] is Riemann integrable. [4]

Computer Science (CS.321)

Information System Design / Data Strucuture

Time : 3 hour Full Marks : 100

Group "A" (Information System Design)

1. Long Answer Questions :

Attempt any TWO Questions. **2×10=20**

1.1. What is a system development life cycle ? Draw the block diagram and explain in detail about feasibility study. Explain why operational feasibility is important in the context of Nepal.

1.2. Explain in detail about conceptual system design.

1.3. What is a data flow diagram ? Explain different levels with suitable example.

2. Short Answer Questions : **10×3=30**

2.1. Why planning is required in the information system design ?

2.2. What is the use of negative feedback ?

2.3. How the data dictionary can be used ?

2.4. Explain in brief about context diagram .

2.5. What are the internal IS standards ?

2.6. Explain in brief about prototyping and its applications.

2.7. What do you understand by post operation evaluation ?

2.8. What is a CASE tool ?

2.9. Explain the jobs of a system analyst.

2.10. What do you understand by cut-over in the detailed system design ?

3. Long Answer Questions :

Attempt any TWO Questions. 2×10=20

3.1. Describe searching in data structure. Compare the efficiency of three searching algorithms (sequential, binary and quick)

3.2. Explain why Greedy algorithm is popular in finding the shortest path in directed graph ? Explain with a suitable example.

3.3. What is recursion ? Explain with Tower-Of-Hanoi example. How recursive algorithm makes program effective ? Write the merits and demerits of recursion in programming.

4. Problems

Attempt any TWO Questions. **2×5=10**

4.1. Write C functions for push and pop operations in stack.

4.2. Write a C function to traverse a binary tree in pre order.

4.3. Write a program in C for heap sorting .

5. Short Answer Questions :

Attempt ALL the Questions. **8×2.5=20**

5.1. Differentiate between contiguous list and doubly linked list with suitable examples.

5.2. Explain binary search tree. Write the searching algorithm in search tree.

5.3. Explain hashing with suitable example.

5.4. Explain why linked list is called dynamic list ? Write the algorithm for inserting a new node before a node.

5.5. Explain the characteristics of Huffman algorithm and its application.

5.6. Write merits and demerits of recursive function over none of the above recursive function.
5.7. Write the steps involved in inserting a node in an AVL tree.
5.8. Discuss radix sort. How you rate this sorting from selection sort ?

Environmental Science (ENV.321)

Time : 3 hour Full Marks : 100

SECTION "A"

1. Attempt any THREE Questions. **3×10=30**

1.1. What are the major physico-chemical properties of water in lentic environment ? How does it differ from that of lotic environment ?

1.2. A quadrate sampler of the size 50cm ×50cm was used to collect the grasshoppers from the two sites of grass land ecosystem. The number of grasshoppers from each sampling unit was counted and following values were obtained.

Site A:	15	18	28	48	32	12	25	42	49	49	9	32	33	8			
Site B:	16	19	9	5	2	3	48	9	15	22	8	25	17	4	7	3	4

The null hypothesis (No) is that both samples come from the same population and therefore must have same mean. Using the t-test, write your opinion about the null hypothesis for grasshoppers of two sites of the grassland ecosystem.

The critical values of 't' Probability					
d.f.	0.10	0.05	0.02	0.01	0.001
25	1.71	2.06	2.49	2.79	3.73
26	1.71	2.06	2.48	2.78	3.71
27	1.70	2.05	2.47	2.77	3.69
28	1.70	2.05	2.47	2.76	3.67
29	1.70	2.05	2.46	2.76	3.66

1.3. Explain the various forms of precipitation and discuss how is precipitation data interpreted.

1.4. Explain the process of weathering and erosion. Discuss air and water as agents of geo-morphological processes.

Section "B"

2. Describe briefly any TEN Questions : **10×5=50**

2.1. Darey's law and its validity.
2.2. Radioactivity in atmosphere.
2.3. Causes and consequences of global warning.
2.4. Bulk properties of soil.
2.5. GIS for environmental monitoring .
2.6. Cation and anion exchange phenomenon.
2.7. Elements of agroclimatology.
2.8. Climate of Nepal.
2.9. Rock mass rating.
2.10. Autogenic and Allogenic process of lentic environment.
2.11. Fossil fuels.
2.12. Chemical composition of earth.

Section "C"

3. Attempt ALL the Questions : **10×2=20**

3.1. Formation and depletion of ozone layer
3.2. Deformation and failure

3.3. Rain and Drizzle
3.4. Mean and mode
3.5. Weather and climate
3.6. Aquifuse and Aquitord
3.7. Topographical map and Aerial photograph
3.8. Littoral ozone and profundal zone
3.9. Soil erosion and landslide
3.10. Primary and secondary air

Petrology, Historical Geology & Geology of Nepal and Adjacent Region (GEO.321)

Time : 3 hour Full Marks : 100

Attempt ALL the questions.

SECTION "A"

1.(a) How are igneous rocks classified ? Discuss in detail the IUGS classification system.
(b) Describe the solid solution . Discuss the process of crystallization of Albite-Anorthite system.

2.(a) What is meant by intrusive and extrusive igneous bodies ? Describe various structures of intrusive igneous bodies.
(b) Write short notes on any THREE of the following :
(i) Primary magma (ii) Carbonatite
(iii) Granite (iv) Block lava

3.(a) What do you understand by texture ? Describe briefly the textures of metamorphic rocks.
(b) Describe the relation of porphyroblasts with tectonism.

4.(a) Write short notes on any THREE of the following :
a. Hornfels b. Isograde
c. Polymetamorphism d. Preferred orientation

5.(a) What is diagenesis ? Discuss the characteristics of terrigenous deposits.
(b) Describe tectures, structures and mineral composition of limestones ? Also give their classification.

OR

Write short notes on any THREE of the following :
a. Depositional basins b. Conglomerates
c. Evaporite d. Lithification

Group "B"

6.(a) What is the main composition of atmosphere ? Discuss the development of atmosphere.
(b) Describe the aspects of paleogeographic map. Discuss how it is prepared.

7.(a) Describe the tectonic history of Devonian Period.
(b) Write short notes on the following:
i) Methods of determination of relative and absolute age
ii) Physical criterias for correlation

8.(a) What is paleotectonic reconstruction ? Describe the tectonic elements of continents.
(b) What is geological time scale ? Draw the geological time scale with major events during each period.

OR

(a) How can life and sediment bionomical zone be recognized ?
(b) What is phylogeny ? Write down its importance in correlation.

Group "C"

9.(a) Discuss in brief the geology of Eastern Nepal.
(b) Describe in brief the geology of the Tethys Zone with special reference to Manang area.

10.(a) Discuss the role of geological works done by J Stocklin and K.D. Bhattarai (1977) in Central Nepal.

OR

Write short notes on :
i) Stratigarphy of the Tansen area
ii) MCT and MBT
iii) Stratigraphy of the Siwaliks

Statistics II Paper (Stat. 321)

Time : 3 hour Full Marks : 100

Attempt ALL the questions.

1. **(Compulsory) Attempt any SIX questions.** **5×6=30**

a. What is truncation of distribution ? Give examples of the situations when truncated distribution arises.

b. Suppose that has pdf;

$$f(x) = 2x, 0 < x < 1$$
$$= 0, \text{elsewhere}$$

Find the pdf of $y = 3x + 1$.

c. If X and Y are two independent random variables such that $E(x) = \lambda_1, V(x) = \sigma_1^2$ and $E(y) = \lambda_2, V(y) = \sigma_2^2$, then prove that

$$V(xy) = \sigma_1^2\sigma_2^2 + \lambda_1^2\sigma_2^2 + \lambda_2^2\sigma_1^2$$

d. State central limit theorem . State how this distribution is deduced from Chebyshev's theorem.

e. Describe the principle of M.I.C. and state its properties.

f. Find the mean and variance of chi-square distribution.

g. Explain Median test and when it is used.

Group "A"

Attempt any FOUR questions. **4×7=28**

2. Find the mean and variance of Truncated Poisson distribution. Show that Poisson distribution truncated at origin does not satisfy the additive property.

3. Let X~N(0,1) and Y~N(0,1) be independent random variables . Find the distribution of $\frac{x}{y}$ and name the distribution.

4. Two unbiased dice are thrown. If X is the sun of the numbers showing up, prove that $p[|x-7| \geq 3] \leq \frac{35}{54}$. Compare this with the actual probability.

5. Write notes on probability density function, distribution function and their properties in case of two variables X and Y.

6. Explain the concept of convergence in probability.

Let X~N(0.1,4.41) and a random sample of 900 members is drawn from the normal population . Find the probability that the sample mean will be negative.

Group "B"

Attempt any SIX questions. 6×7=42

7. Define t-distribution. Show that square of t-variate with n df is distributed as F-distribution with 1 and n df.
8. Let $x_1, x_2, \ldots\ldots\ldots\ldots x_n$ be a random sample of large size drawn from an exponential population with pdf given by

$$f(x,\theta) = \frac{1}{\theta} e^{-x/\theta}; 0 < x < \infty; \theta > 0$$

Construct 95% confidence interval for θ for the large sample.

9. For the 2×2 table

a	b
c	d

gives. prove that chi-square test of independence

$$x^2 = \frac{N(ad-bc)^2}{(a+c)(b+d)(a+b)(c+d)}, N = a+b+c+d$$

10. Show that sample variance is an unbiased estimate of population variance in the case of SRSWOR.
11. The weights (in lb) at birth of 15 babies born in a maternity hospital are given below.

6.2	7.6	7.1	6.9	7.5	5.7	4.6	6.8
7.6	7.8	8.1	5.0	5.8	8.9	8.5	

Test the randomness of the 15 babies at 5% level of significance.

12. Ten individuals are chosen at random from a normal population and their heights are found to be 63, 63, 66 , 67, 68, 69, 70 , 70 , 71 , 71 inches . Test if the sample belongs to the population whose mean heights is 66 inches. [Given $t_{5\%} = 2.62$ for 9 df.]
13. What are the criteria for good estimators ? Explain.

Zoology (Chordata, Cell & Tissue Biology)(Zol. 321)

Time : 3 hrs. Full Marks : 100

Attempt any TWO questions from each Group A & B . Group C is compulsory.

Group "A"

1. Describe the external features of Petromyzon. What are the points of difference between Petromyzon and Myxine ? Mention. [15]
2. Write an account of air-sacs in Columba Liva . Give importance of air-sacs in this animal. [15]
3. Describe the structure of brain in Uromastix and compare it with that of frog. [15]

Group "B"

4. How vertebrate heart begins its beating ? Explain the process of conduction and regulation of beats. [15]
5. What are enzymes ? Discuss the types and structure of enzymes and co-enzymes in animals. [15]

6. Discuss the structure of mammalian pituitary gland. Why is it often called master gland ? Explain. [15]
7. Enumerate the characteristics of Metatheria.
8. Write an account of ampulla of Lorenzini in dog-fish.
9. Classify Ambystoma and Rhacophorus and give their ecological notes.
10. What is Bhor effect ? Explain.
11. Describe the roles of vitamins in animals.
12. Discuss the histological structure of mammalian liver.
13. Explain the roles of hormones produced by the adrenal gland.
14. Write the replication process of DNA in short.

Ecology, Physiology, Cytology and Genetics, Embryology and Anatomy (Bot. 321)

Time : 3 hrs. Full Marks : 100

Attempt any TWO questions from each Group A & B . Group C is compulsory.

SECTION "A" (ECOLOGY)

1. Describe the role of protected areas for bio-diversity conservation in Nepal.
OR [10]
What is succession ? Describe it with an example of hydrosere.
2. Give an account of carbon cycle in nature. How carbon dioxide contribute for global warming ? [5]
3. Give various adaptive features of xerophytic plants. [5]
4. Write brief note on environmental problems of Nepal. [5]

SECTION "B" (PLANT PHYSIOLOGY)

5. Describe the mechanism of light dependent processes of photosynthesis .
OR [10]
Describe the mechanism of Anaerobic respiration.
6. What is dormancy ? Describe its role on plant survival. [5]
7. Give the function of Cytokinins. [5]
8. Describe in short, how light affect in morphology of plant. [5]
9. What are macro and micronutrients ? [5]

SECTION "C" (CYTOLOGY & GENETICS)

10. State the law of independent assortment with suitable example.
OR [10]
Describe the various types of mutations caused by changes in chromosome.
11. What is breeding ? Describe the importance of breeding in Agriculture. [5]
12. Distinguish between DNA and RNA. [5]
13. Describe the structure of chromosome at metaphase stage. [5]

SECTION "D" (EMBRYOLOGY)

14. What is microspore ? Describe the development of microsporangium in angiosperm. [5]
15. What is palynology ? Write short account on scope of palynology. [5]

SECTION "E" (ANATOMY)

16. What is anomalous secondary growth ? Write how secondary growth occurs in Bignonia stem. [5]
17. What is meristems ? Write the differences found in various types of meristems. [5]

Meteorology II Paper (MET 321 / 322)

Time : 3 hrs. Full Marks : 100

Attempt SIXTEEN questions including Q.No. 1 and Q. No. 2 which are compulsory.

1. a. Explain briefly the following types of flows of a liquid system: steady , uniform, laminar, incompressible, and rotational.

1. b. Derive and explain Bernoulli's equation and also discuss the assumptions underlying the development of this equation. [5+10]

2. What is continuity equation ? Derive the continuity equation for three dimensional flow of fluid. [3+12]

3. Explain why monsoon rainfall in Nepal is relatively higher in the east that west and also explain why winter air temperature is higher over west than east Nepal. [5]

4. Give necessary conditions for the formation of tropical cyclone and explain why they do not form close to the equator. [5]

5. What are different meteorological factors affecting agriculture ? Discuss the role of rainfall and temperature. [5]

6. What is photosynthesis ? Explain the importance of this process in the plant growth and development . [5]

7. What is intertropical convergence zone, why thunderstorms are developed over these zones ? [5]

8. Explain the life cycle of a thunder cell with suitable diagrams. [5]

9. Sketch a diagram explaining the global distributions of wind during both summer and winter. [5]

10. Write short notes on easterly and westerly waves in the tropics. [5]

11. Explain circulation, vorticity, divergence and deformation. [5]

12. With the help of an expression for stream function, find out resultant and components of velocity at a point denoted by $x = 6$ and $y = 9$. [5]

13. Explain why cyclone and anticyclone are respectively associated with bad and good weather. [5]

14. Write down the atmosphere variables that are analysed on the surface and upper air charts. [5]

15. Write in short about weather and plant diseases. [5]

16. What is greenhouse effect ? What is its impact on the agriculture ? [2+3]

17. Define the velocity potential function. That is the relationship between stream function and velocity potential function ? [1+4]

18. Explain the vertical thermal distribution of the atmosphere with a neat diagram. [3+2]

19. What is cloud ? Is there any different between cloud and fog ? Write down the names of different fog formation. [1+2+2]

20. Explain the following types of flows of liquid system in brief.

(a) steady (b) uniform (c) incompressible
(d) laminar (e) rotational [1+1+1+1+1]

Microbial , Biochemistry and Biotechnology (MB. 321)

Time : 3 hrs. Full Marks : 100

Attempt ALL the questions .

Group "A"

1. Describe the process of transcription in genetic expression in prokaryotic system. [15]
2. Describe scope hazards of biotechnology. [15]

OR

Classify lipids. Deseribe lipid metabolism in brief. [5+10]

Group "B"

3. Describe different techniques used in mushroom culture. [10]
4. Explain the synthesis of DNA. [10]

OR

Define enzyme and point out the advantages of using microbial enzymes.[10]

Group "C" 10×5=50

5. Draw a well labelled diagram of a fermenter used in submerged slate fermentation.
6. Explain in brief the process of powder milk production.
7. Point out the differences between RNA and DNA.
8. Point out the major steps involved in gene manipulation.
9. Explain in brief cheese production process.
10. Write short notes on biofertilizer.
11. Explain water as the solvent for life.
12. Classify the proteins.
13. Describe in brief Beer production process.
14. Write short notes on fluid - mosaic model of cell membrane.

Physics II Paper (Phy. 321)

(Optics, Atomic & Nuclear Physics , Electronics)

Time : 3 hrs. Full Marks : 100

Attempt ALL the questions .

1. What is diffraction ? Discuss the phenomenon of diffraction at a straight edge and determine the wavelength of light used.

OR [10]

Derive an expression for the determination of wavelength of given Monochromatic source by using Fresnel's biprism with an appropriate diagram. Also explain the precautions to be taken in performing the experiment .

2. How is the total angular momentum quantum number of the electron calculated ? Derive an expression for Lande's splitting factor and explain the anomalous Zeeman effect.

OR [9]

What are characteristic X-rays and how are they produced ? What is Moseley's law ? Write down the importance of this law.

3. Explain current gain in common base, common emitter and common collector configurations. Hence establish the relationship between α and β for both dc and ac where α and β have their usual meanings.

OR [9]

What is positive feed back ? Deduce Barkhausen condition for oscillation. Draw the circuit diagram of a Hartley oscillator and explain its operation.

4. What is a quarter wave plate ? Explain with appropriate theory how circularly and elliptically polarized wave can be obtained.

OR [6]

What is Nicol's prism ? Explain how it is used to produce and analyze plane polarized light.

5. What is mass defect ? How is it related to the binding energy of nucleus ? Explain the significance of binding energy to understand the nuclear stability

OR [6]

What is a nuclear defector ? Discuss the working principle of a bubble chamber.

6. State and explain Thevnin's theorem.

OR [6]

What do you mean by exclusive or function ? Write down Boolean equation for the same and implement it using two - input NAND.

7. Answer in brief : [6×3=18]
   a. Explain, what happens when white light is used instead of monochromatic light in producing Newtons' ring.
   b. If a grating plate can resolve two sodium D_1 and D_2 lines in the first order. Explain what will happen if half part of grating is covered with opaque object.
   c. Explain the process of pair production.
   d. State and explain Pauli exclusion principle.
   e. Explain why Zener diode is called voltage reference diode.
   f. Differentiate between bipolar and field effect transistor.
8. A mixture of two wave lengths of light 5000A and 5200A are incident normally on a plane transmission grating having 600 lines / mm. A lenses is used to observe the separation on a screen. Calculate the separation of the two lines in the first order. [6]
9. Calculate the magnifying and resolving power of a laboratory microscope using following data:

   numerical aperture (NA) = 0.12

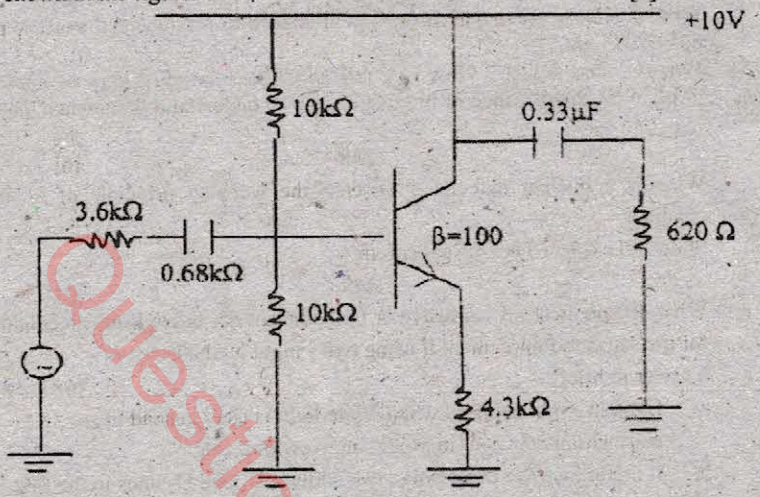
   wavelength $\lambda = 6\times10^{-7}$m

   distance of cross - wire from the objective = 0.15m

   focal length of objective = focal length of eyepiece = 0.025m [6]
10. NaCl has its principal planes spaced at 2.8 A . If the wavelength of X-ray used is 0.979 A. Calculate the angles for first and second order Bragg's reflection. [6]
11. One gram of a radioactive substance disintegrate at the rate of 3.7×10^{10} disintegration per second . If atomic weight of the substance is 226. Calculate the mean life. [6]
12. a. Convert 18 and 25 to binary number.

b. Add 1010 to 11001 and write the result in decimal number. [6]

13. Calculate the cutoff frequencies of the input and output lead network as shown in the figure. [6]



Algebra I (Math. 321) III Paper

Time : 3 hrs. Full Marks : 75

Attempt ALL the questions .

Group " A" 5×7=35

1. Let $\phi : G \to G'$ be a homomorphism between two groups G and G'. Define kernel of ϕ, K_ϕ. Show that ϕ is homomorphism if and only if $K_\phi = \{e\}$, where e is the identity element of G. Let N be a normal subgroup of G and $f : G \to \frac{G}{N}$ is defined by $f(x) = xN$ for all $x \in G$, prove that f is a group homomorphism of G onto $\frac{G}{N}$ and $K_f = N$ [1+3+3]

2. Define an integral domain . Give an example of a ring which is not an integral domain. Prove that a finite integral domain is a field. Show that the set of residue classes modulo 5 is a field. [1+4+2]

3. What do you mean by 'consistent ' for a system of linear equation ? Show that a system of linear non-homogeneous equation is consistent if the rank of the coefficient matrix is equal to that of the augmented matrix. [1+6]

4. What do you understand by linear transformation ? Let V be a finite dimensional and $T : V \to W$ be a linear transformation, prove that dim V = dim (Ker T) + dim(Im T) . Also verify this equality from the basis (1,0,0), (0,1,0), (0,0,1) of $\Re^3$. [1+4+2]

OR

When a linear transformation is said to be non-singular ? Let V and W be vector spaces over the same field F and assume that dimV = dimW. If L : V→ W is a linear transformation then prove the following are equivalent :

i) L is invertible,

ii) L is one - one and onto,

iii) L is non - singular. [1+6]

5. Define a term a polynomial of degree n over R. When a polynomial is said to be complete polynomial ? Solve $x^4 - 2x^2 + 8x - 3 = 0$ by Descrarte's method. [1+1+5]

OR

Find the condition that the cubic equation $ax^3 + 3bx^2 + 3cx + d = 0$ should have its roots in geometrical progression. Solve the equation $27x^3 + 42x^2 - 28x - 8 = 0$, whose roots are in geometrical progression. [3+4]

Group "B" [10×4=40

6. Define relation and a function. When is a relation in a set an equivalence relation ? Determine whether the relation $\geq$ is or is not an equivalence relation for the set of real numbers. [1+1+2]

7. When two matrices are conformable for multiplication ? Get A, B, C are matrices of order m×n, n×p and n×p respectively. Show that A(B+C) = AB+AC. [1+3]

OR

Show that

$$\begin{vmatrix} a^2 & a^2-(b-c)^2 & bc \\ b^2 & b^2-(c-a)^2 & ca \\ c^2 & c^2-(a-b)^2 & ab \end{vmatrix} = (b-c)(c-a)(a-b)(a+b+c)(a^2+b^2+c^2)$$

8. Reduce the matrix $A = \begin{bmatrix} 2 & 1 & -3 \\ 2 & 1 & 4 \\ 1 & 2 & 1 \end{bmatrix}$ to Echelon form.

Hence find its rank. [3+1]

9. Define a subgroup with examples. If H is any subgroup of group G and h ∈ H, Prove that hH = H = Hh. [1+3]

OR

What do you mean by coset of a subgroup of a group ? Calculate the left coset of $S = \{(1), (12)\} \subset S_3$ generated by (12), (13), (23). [1+3]

10. What do you understand by an ideal of a ring R ? If $f : R \to R'$ is a ring homomorphism, prove that the kernel K_f of f is an ideal of R.

11. How do you define norm of a vector $\Re^n$? If P and Q are two vectors of $\Re^n$, prove that $\|P+Q\| \leq \|P\| + \|Q\|$.
Verify this in equality for P = (1 , 2) , Q = (-2 , 3). [1+2+1]

12. Define direct sum of two vector substance of a vector space.
Let V be a vector space over a find F and U and W be its subspaces.

If U + W = V and $U \cap W = \{0\}$, Prove that V is the direct sum of U and W. [1+3]

OR

What do you mean by a linearly dependent of vectors ? Prove that the set of non- zero vectors $u_1, u_2, \ldots\ldots, u_n$, $n \geq 2$ of a vectors space V over a field F is linearly dependent if and only if at least one of them can be written as a linear combination of the other. [1+3]

13. Let $T : \Re^2 \to \Re$ be the linear transformation for which T(1,2) =3 and T(0,3) = 2. Find T (5 , 3). [4]
14. Solve $3x^3 - 4x^2 + x + 88 = 0$ if one of the roots is $2 + i\sqrt{7}$. [4]
15. By Cardon's method . Solve $x^3 - 21x - 344 = 0$

OR

Solve, by using Ferrari's method, the equation
$x^4 - 2x^3 - 5x^2 + 10x - 3 = 0$ [4]