

Tribhuvan University, 2070

Bachelor Level / III Year / Sc. & Tech. Full Marks: 100

Computer Science (CS.332)

Time: 3 hrs.

Group "A" (Data Base Management System)

1. Long Answer Questions

Attempt any TWO Questions.

2×10=20

- 1.1 Explain the 3-schema architecture? How are these different schema layers related to the concepts of logical and physical data independence?
- 1.2 Differentiate between inner join and outer joins with examples.
- 1.3 Define database transaction and discuss the ACID properties of it. Draw a state diagram, and discuss the typical states that a transaction goes through during execution.

2. Problems:

Attempt any TWO Questions.

2×5=10

- 2.1. For a relational database with the following schemas:
employee (employee_ID, employee_name, address, salary)
work_in (employee_ID, comp_ID) company (comp_ID, comp_name, location)

Write SQL statement that will

- a. Print the name of all employees working in "Nepal Airlines" company located at "Kathmandu".
 - b. Print name and address of those employees who are working in a company named If Nepal Airlines" and whose salary is greater than 20,000.
 - c. Delete those employees whose address is null.
- 2.2. For an employee relation with following schema employee (ID, name, city, salary)

Write SQL statement that will

- a. Increase the salary of an employee having ID 10 by 15%.
 - b. Display average salary obtained by an employee.
 - c. Insert a new record in employee table.
 - d. Delete those records whose city is null.
- 2.3. Consider the following schemas of a relational database: employee (employee_ID, employeeet_name, gender, address,) company (company_ID, address, city) works_in (employee_ID, company_ID)
- Using the relational algebra answer the following queries:
- a. Print the name of the employees who are working in a company named as "Minisoft".
 - b. Print the name of the employees who are not working in any school.

- c. Print the name of the employees who are working in both the company named as "Macrosoft" and "Minisoft".

3. Short Answer Questions:

Attempt any EIGHT Questions.

8×2.5=20

- 3.1 What is normalization? State 2nd and 3rd normal form.
- 3.2 Describe serializability with example.
- 3.3 Explain the distinction among the terms primary key, secondary key, and super key?
- 3.4 What are the different types of integrity constraints, explain in brief?
- 3.5 Differentiate between dead lock and starvation?
- 3.6 Discuss the variable and fixed blocking?
- 3.7 Discuss the importance of Indexing and Hash functions.
- 3.8 What is concurrency control and why is it needed?
- 3.9 Explain the various types of database failure.
- 3.10 What is query-processing cost and how this cost can be reduced?

Group "B" (Object Oriented Programming in C++)

4. Long Answer Questions:

Attempt any TWO Questions.

2×10=20

- 4.1 What is virtual function and how it is different from pure virtual function? Describe a circumstance in which virtual functions would be appropriate.
- 4.2 What is the difference in lifetime and visibility between external, automatic and static objects? Explain with suitable example.
- 4.3 What is inheritance? How can inheritance reduce duplication of attributes and methods in different classes? Explain with example.

5. Problems:

Attempt any TWO Questions.

2×5=10

- 5.1 Create a class called 'Object', which includes a class method for returning the current number of objects in existence. The attribute which records this should be incremented each time a new object is instantiated. Include a class method which returns the name 'Object' when called.
- 5.2 Here are two class definitions. Using generalization put them into an appropriate classification hierarchy so that they both inherit from a common base class. Add appropriate methods.

```
class Book                                class Magazine
{
private:
    char title[30];
    char author[30];
    char publisher[30];
    char ISBN[20];
};
```


};

- 5.3. Create a C++ class for a 'StockItem' abstract data type. It should have the attributes of stock level (an integer) and unit price (a float). Define methods to return the values of these two attributes and to set them using parameters. And two more methods to allow stock receipts, and stock issues, updating the stock level as appropriate.

6. Short Answer Questions:

Attempt any EIGHT questions:

8×2.5=20

- 6.1 What is being hidden when we talk about information hiding?
- 6.2 What type of method is able to alter the state of an attribute?
- 6.3 What may be different for all objects in a class, and what remains the same?
- 6.4 What kind of object requires the destructor to be explicitly called by the 'delete' operator? Explain.
- 6.5 What is metaclass and what resides in the metaclass?
- 6.6 What do you mean by function overloading? When do we use function overloading?
- 6.7 What is aggregation? Explain properties of aggregation.
- 6.8 What kinds of objects might benefit from being able to use overloaded operators such as arithmetic operators?
- 6.9 What is an abstract class?
- 6.10 What does polymorphism mean in OOP?

Tribhuvan University, 2070

Bachelor Level / III Year / Sc. & Tech.

Full Marks: 100

Environment & Biodiversity (Bot.333)

Time: 3hrs.

New Course

Section "A"

Give explanatory answer to the following questions: (any TWO)

2×10=20

1. What are different categories of ecosystem services? Discuss ecosystem services provided by forests.
2. Why do you think that haphazard development activities lead to adverse environmental consequences? Give a critical analysis.
3. Outline various sustainable energy resources in Nepal. How are these resources superior to the conventional energy resources such as fossil fuel?

Write short notes on any FOUR of the following:

4×5=20

4. Environment Protection Act
5. Temperate deciduous forest
6. Causes of climate change
7. Biofuel
8. Participatory Technology Development (PTD) approach

9. EIA of hydropower projects

Give short answers for the following: (any FOUR)

4×2.5=10

10. Pesticide abuse

11. Urbanization in Nepal

12. Role of plants in air pollution monitoring

13. Effects of air pollution on plants.

14. Activities of ICIMOD

Section "B"

Give explanatory answer to the following questions: (any TWO)

2×10=20

15. What do you understand by agrobiodiversity? Discuss the contribution of agrobiodiversity in ensuring food security.

16. Discuss the participatory community approach for biodiversity conservation in Nepal with suitable examples.

17. Discuss with suitable examples, the role of plant resources in community development.

Write short notes on any FOUR of the following:

4×5=20

18. Oil yielding plants in Nepal

19. Convention on biological diversity

20. Cryopreservation

21. Protected area network

22. Ethnobotany and economics

23. Intellectual Property Rights

Give short answer for the following: (any FOUR)

4×2.5=10

24. Role of herbaria in biodiversity research

25. Effects of climate change in mountain biodiversity

26. Role of ecotourism in conservation

27. Climate change and species extinction

28. Environmental ethics

Old Course

Each question of Section A carries 10 marks, and questions of Section B & C carries 5 marks.

Attempt ALL the questions.

Section "A"

1. Define conservation and management of biodiversity. Discuss the state of biodiversity conservation in Nepal.

OR

What are the laws of energy? Discuss efficient use of energy giving examples.

2. What is ethnobotany? Highlight the role of ethnobotany in community development.

3. What are the natural resources? Discuss the use and management of water as a resource.

Section "B"

Draw well labelled diagrams of the followings:

[description not required]

4. Ecological pyramid of biomass
5. Flow chart to depict Carbon cycle
6. Map of Nepal showing Vegetation Zones
7. Food web

Section "C"

Explain the following in brief:

8. EIA (Environmental Impact Assessment)
9. EPA (Environmental Protection Act) of Nepal
10. Protected area
11. Botanical gardens
12. Medicinal plants of lowland
13. Air pollution in Nepal
14. Urbanization
15. Soil conservation
16. Ecotourism in Nepal
17. Species extinction

Tribhuvan University, 2070

Bachelor Level / III Year / Sc. & Tech.

Full Marks: 100

Engineering, Exploration and Environmental Geology and Remote Sensing and GIS (GEO. 333)

Time : 3 hrs

Attempt NINE questions, selecting THREE from each Group.

Group "A"

1. (a) Define a stress. Describe the uses of Mohr circle of stress in engineering geology.
(b) Explain how the Unified Soil Classification System (USCS) is used in the field.
2. (a) What are the engineering properties of rocks to be studied before implementing a construct projection? Discuss.
(b) How does the orientation of discontinuities play role in creating instability in a rock slope? Describe in brief with a suitable sketch.
3. (a) Define the hydraulic gradient. Explain the conditions of seepage pressure on a slope.
(b) Discuss the basic elements of GIS.
4. (a) Discuss the importance of remote sensing data in geology.

- (b) Discuss the concepts and use of vector and raster based GIS analysis.

Group "B"

5. (a) Describe the purpose of drilling. Explain in brief the major elements and types of drilling.
(b) Define reserve. Describe the methods of reserve estimation.
6. (a) Describe geological and geochemical prospecting methods.
(b) Why lighting and drainage are introduced in underground mining? Describe.
7. (a) Write short notes on :
(i) Dispersion haloes
(ii) Open cast and underground mining
8. (a) Define an aureole. Describe different types of aureole.
(b) Discuss the importance of dressing? Describe the possible beneficiation process in short.

Group "C"

9. (a) Describe briefly the fundamental concepts of environmental geology.
(b) Why landslide disaster occurs mainly in Monsoon season in Himalaya? Describe methods of landslide risk reduction in brief.
10. (a) Explain briefly the environmental impacts of flood hazards in Nepal.
(b) Discuss how surface water and ground water are polluted. Describe the preventive methods to control drinking water pollution in brief.
11. (a) What is an erosion? Describe factors affecting the soil erosion in Siwalik.
(b) Describe briefly the methods of minimizing the environmental degradation caused by the mineral resources sectors.
12. (a) What are seismic hazards and how Kathmandu City can be protected from seismic hazards?
(b) Describe acid rain and its causes in brief.

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Bachelor Level / III Year / Sc. & Tech.

Meteorology (MET 332)

Full Marks: 100

Time: 3 hrs.

Attempt any SIX questions where Q.No.1 and Q. No.6 are compulsory.

1. (a) Explain application and importance of hydrology in engineering field. [6+6]
1. (b) A drainage basin has the following data:
Area of the basin = 250 km²; Length of the main stream = 80 km; the perimeter of the basin = 260 km.
Determine the form factor, circulatory ratio, elongation ratio and the compactness coefficient for the basin. [6]

2. (a) Differentiate between a rain gauge and a totalizer. Explain the procedure to check the consistency of the rainfall data obtained from any station. [5+5]
2. (b) A hydro-electric plant is proposed at a site on a stream which has the following mean monthly discharge.

Month	J	F	M	A	M	J	J	A	S	O	N	D
Discharge (m ³ /s)	6.8	6.2	7.5	10.5	12.9	36.0	54.2	64.1	36.5	16.5	10.1	7.8

If the net head is 500 m, calculate the theoretical power potential of dependable Q65 discharge of the river. [6]

3. (a) Distinguish between infiltration and percolation? Derive an expression for Horton's infiltration equation. [5+5]
3. (b) Derive the estimation of PET by Penman equation. [6]
4. (a) What do you understand by a basin yield? Describe the possible factors affecting runoff. [2+8]
4. (b) Describe a method of separating base flow from a hydrograph. [6]
5. (a) Describe a technique of artificial ground water recharge. Explain briefly about ground water resource of Nepal. [4+6]
5. (b) Explain the optimum number of hydrometric stations. [6]
6. (a) What do you understand by a tracer technique? Describe the principle of discharge measurement by the tracer technique. [2+10]
6. (b) Discuss different methods that can be applied for interpolation and extrapolation of rating curve. [6]
7. (a) Describe formation and source of sediment in a river. Explain the factors affecting sediment yield. [2+2+6]
- (b) What do you understand by water quality? Explain domestic and industrial use of water quality. [2+4]
8. Write short notes on any FOUR of the following:
- Glacier mass balance
 - Snow survey
 - Snow metamorphism
 - Hydrological cycle
 - Flow duration curve
 - Ground water recharge [4+4+4+4]
9. (a) What is the snow surface albedo? Explain snow observation and measurement technique of glacier. [2+8]
9. (b) Calculate the net shortwave radiation on a dirty snow surface based on the given data. [6]

Time	Snow surface albedo	Incoming solar radiation (W/m ²)
10.00	0.12	455
11.00	0.18	540
12.00	0.23	630

13.00	0.26	645
14.00	0.28	620
15.00	0.31	515
16.00	0.34	325

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Bachelor Level/III Year/Sc.& Tech.

Full Marks: 100

Quantum Mechanics, Mathematical Physics (Pby.332)

Time: 3 hrs.

New Course

Attempt ALL the Questions.

1. Prove $\int_{-\infty}^{\infty} \psi_n^*(x) \psi_m^*(x) dx = 0$ for $m \neq n$ where $\psi_n(x)$ and $\psi_m(x)$ are the

Harmonic oscillator wave functions. Also plot and discuss $\psi_0(x)$, $\psi_1(x)$, $\psi_2(x)$ and $\psi_3(x)$. [6+3]

OR

What do you mean by divergence of a vector? Also, establish a physical meaning for the divergence of a vector by use of an illustration from hydrodynamics. [2+8]

2. Using the partial sum of a Fourier series show that

$$\lim_{p \rightarrow \infty} S_p(x) \rightarrow \frac{1}{2} [f(x+0) + f(x-0)] \quad [9]$$

Or

State and prove Parseval's formula. Hence use it to prove

$$\int_{-\infty}^{\infty} \phi^*(P_x) \phi(P_x) dP_x = 1 \text{ if } \int_{-\infty}^{\infty} \psi^*(x) \psi(x) dx = 1. \quad [2+3+4]$$

3. Solve the problem of rigid rotator to get its energy and wave function. Hence, discuss the degeneracy in quantum mechanics. [3+3+3]

OR

Describe the Davisson - Germer experiment and write down its significance and limitations. [5+4]

4. State and prove Ehrenfest's theorem. Also discuss its significance.

[1+3+2]

OR

Show that for a spherically symmetric potential the minimum of the energy of a quantum mechanical system increases with ℓ .

5. Find the covariant derivative of g_{ij} . [6]

OR

Does $AB = BC$ imply that $B = C$ for A , B and C three matrices?
Illustrate by means of an example. [1+5]

6. Prove that $(A + A^\dagger)$ is Hermitian for any A . [6]

OR

State and prove the uncertainty principle for wave packets. [2+4]

7. Answer ALL questions: [6×3=18]

(a) Given $\psi(x) = \frac{1+ix}{1+ix^2}$. Find its normalization constant.

(b) Plot ψ_{100} of H atom. Also explain it.

(c) Distinguish between group velocity and phase velocity with a suitable example.

(d) If α is a closed surface which encloses a volume τ , prove that $\oint \mathbf{r} \times d\vec{\sigma} = 0$.

(e) Find eigenvalues of $A = \begin{pmatrix} 3 & 1 \\ 2 & 2 \end{pmatrix}$.

(f) Show that $\text{div}(\vec{A})$ is a scalar.

8. Calculate the de Broglie wavelength of an electron accelerated through a p.d. of 200V. [6]

Consider a one-dimensional rectangular potential well defined by;

$$V(x) = \begin{cases} 0 & \text{for } x < 0 \\ -V_0 & \text{for } 0 < x < a \\ 0 & \text{for } a < x \end{cases}$$

such that $V_0 > 0$. Carry-out the calculation of ψ for a particle of positive total energy in above potential well and draw a graph of the transmission coefficient as a function of E . [5]

10. If \hat{H} and $\hat{\Pi}$ are parity operators and $V(x) = V(-x)$, prove that $[\hat{H}, \hat{\Pi}] = 0$ [5]

11. Prove that $J_n(-\xi) = J_n(\xi)$ for even n and $J_n(\xi) = -J_n(-\xi)$ for odd n . [5]

12. The error function is defined by

$$\text{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x e^{-t^2} dt.$$

Prove that $\text{erf}(x)$ is an odd function. [5]

13. Find Laplace transform of te^{kt} . [5]

Old course

Attempt All the questions

1. What do you mean by Polynomials? Solve Hermite differential equation using power series solution method. Find $H_0(x)$ and $H_2(x)$ and discuss it

OR

[10]

Define vector quantity and vector field and describe the laws of vector algebra. Find the projection of the vector $\vec{A} = \hat{i} - 2\hat{j} + \hat{k}$ on the vector $\vec{B} = 4\hat{i} - 4\hat{j} + 7\hat{k}$.

2. Set up Schrodinger equation for a quantum mechanical central force problem. What are the physical meaning of the angular solution of the equation?

OR [9]

Find the reflectance and transmittance of a particle in a one dimensional potential step,

$$V(x) = 0; x < 0$$

$$V(x) = V; x \geq 0.$$

Discuss the physical condition corresponding to the situations: (a) $E > V$ and (b) $E < V$, where E represents the energy of the incident quantum particles.

3. Find the energy eigenvalues of the harmonic oscillator and explain the physical meaning of zero-point energy.

OR [9]

Set up the wave equation for a vibrating string fixed at both ends and solve it. Obtain a relation for $J_{1/2}(x)$. What is its physical significance?

4. OR [6]

Find rank of the following tensor: (a) Velocity (b) Gradient of a scalar potential field.

5. Distinguish between phase velocity and group velocity. Show that for a non-relativistic free particle the phase velocity is half of the group velocity.

OR [6]

Find the probability for a wave function

$$\psi(x, t) = [Ae^{i\frac{Px}{\hbar}} + Be^{-i\frac{Px}{\hbar}}] e^{-i\frac{Pt}{2m\hbar}}$$

Also find probability current density and discuss it.

6. Find $[L^2, L_2]$. OR [6]

Find Fourier series expansion of

$$f(x) = 0 \text{ for } \pi \leq x \leq 0$$

$$= \sin x \text{ for } 0 < x < \pi.$$

7. Answer ALL questions: [6 × 3 = 18]

- Find the Laplace transform of e^{ax} .
- Explain physical meaning of a system described by Hamiltonian (H) and orbital angular momentum (L) as $[L, H] = 0$.
- Summarize the result and limitations of Davission - Germer experiment.
- Explain Kronecker delta.
- What do you mean by Hermitian conjugate?
- Give Stoke's theorem of vector analysis.

8. State and prove Ehrenfest theorem. [6]
9. Show that the ground state energy level of a particle in one-dimensional potential box with rigid walls is in agreement with the uncertainty principle. [6]
10. What ratio of $\frac{E}{V_0}$ is necessary for scattering from a one-dimensional step potential, so that transmission probability is 50%? [6]
11. Find the volume of the region bounded by the surface $y = x^2$, $x = y^2$ and the planes $z = 0$, $z = 3$.
12. Find the eigenvalue and eigenvectors of the matrix
- $$\begin{bmatrix} 4 & 3 \\ -1 & 2 \end{bmatrix}$$
- [6]
13. Find the inverse Laplace transform of $\frac{S}{4S^2 - 25}$ [6]

Tribhuvan University, 2070

Bachelor Level / III Year / Sc. & Tech.

Full Marks: 100

Medical Zoology & Applied Entomology (Zol.332)

Time: 3 hrs.

New Course

Group "A"

Attempt any TWO questions

2 × 12.5 = 25

- Write an account of life-history, mode of infection and pathogenicity of *Trichinella spiralis*.
- Give an account on ecology, morphology and control measures of *Anopheles*. Name the disease which is transmitted by *Anopheles*.
- Name various classes of immunoglobulins and describe structure and functions of IgG, IgA and IgM.

Group "B"

Attempt any TWO questions

2 × 12.5 = 25

- Mention habit, habitat, morphology, and short life cycle of paddy pest *Leptocorisa* sp.
- Give an account of the life history of silkworm and point out its economic importance.
- What are the various methods of pest management? Explain mechanical and biological control methods.

Group "C"

Attempt ALL questions

8 × 5 = 40

- Enumerate the general characters of Spirochetes.
- Explain the causes of auto-immune diseases.
- Give the morphology and economic importance of *Meloidogyne*.

10. Give the morphology of *Pediculus*.

OR

Define antibody. Give its functions.

11. Give the life cycle of pulse pest *Heliothis armigera*.

12. What are the histopathological changes of tissues in tumours?

OR

Briefly explain the process of insect preservation.

13. Mention the pathogenicity caused by *Toxoplasma gondii*.

14. Give an account on occurrence and prevention of the disease Cholera.

15. Write short notes on any TWO:

2×5=10

(a) Zoonotic diseases

(b) White ants

(c) Cirrhosis

Old Course

Attempt ALL questions from Group A & B and 12 questions from Group C.

Group "A"

(Medical Zoology)

2×10=20

Attempt any TWO questions.

1. Write an account of morphology, mode of infection, pathogenicity and life cycle of *Schistosoma haematobium*.
2. What is cirrhosis? What histopathological changes occur in liver in cirrhosis? Explain with reasons.
3. What do you mean by auto-immunity? Mention two immuno deficiency disorders with their causes. How T-cells respond to antigen.

Group "B"

(Entomology + Wild Life)

2×10=20

Attempt any TWO questions.

4. What do you mean by store grain pests? Write the zoological and common names of two store grain pests of Nepal. Describe the structure, life cycle, nature of damage and control of any one of them.
5. Define Integrated Pest Management. Explain the major cultural practices used in management of insect pests.
6. Explain endangered, vulnerable, rare and threatened animals with examples in reference to Nepal.

Group "C"

(Medial, Entomology and Wildlife)

12×5=60

Attempt ALL questions.

7. "*Heterorhabditis* is an important phyto-pathogenic nematode." Discuss.
8. What are vectors? Discuss the morphology and control measures of *Xenopsylla*.

9. Discuss the methods of collection of aquatic and soil insects.
10. Discuss the mode of infection and treatment against the disease caused by Trichinella.
11. Define antigen. Briefly explain the functions of B - cells, T - cells , and T - cytotoxic cells.
12. Describe the short term food grain storage method and mention its advantages.
13. Discuss why houseflies and sandflies are called important household pests.
14. Discuss the damages caused by Callasobrunchus chinesis and white ants.
15. Give the symptoms and control of Rabies.
16. Give the advantages and disadvantages of biological control.
17. Compare the fauna of Sagarmatha and Bardia National Parks of Nepal.
18. What is competition? Explain it in the light of population control in nature.

Tribhuvan University, 2070

Bachelor Level / III Year / Sc. & Tech.

Full Marks: 100

Medical and Environmental Microbiology (MB.333)

Time: 3 hrs.

Group "A"

5×10=50

(Long Answer Questions)

Attempt ALL FIVE questions.

1. Define immunity. Explain the structure and property of IgG with suitable diagram. [2+8]
2. Define infection. Describe the role of any two bacterial and the host factors responsible for human infection initiation. [2+8]
3. Describe general structure, pathogenesis and laboratory diagnosis of rabies virus. [10]
4. Define epidemiology. Explain mode of transmission of diseases. [2+8]
5. Define industrial effluent. Describe the process of sewage treatment with suitable flow diagram. [2+8]

Group "B"

5×7=35

(Short Answer Questions)

Attempt any FIVE questions.

6. Explain classification of parasites.
7. Explain in brief bacterial typing methods.
8. Explain in brief principle of agglutination tests.
9. Give laboratory diagnosis of Shigella species.

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Bachelor Level / III Year / Sc. & Tech.

Full Marks: 100

CHEMISTRY (CHEM.333)

Time: 3hrs.

Use separate answer-book for each group.

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

[New Course

GROUP "A" (INORGANIC)

Comprehensive Question

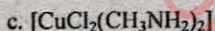
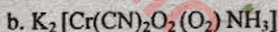
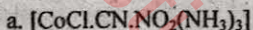
1. What are salient features of crystal field theory? Discuss splitting of d-orbitals in octahedral field according to crystal field theory. [6+3]

OR

What are metallocenes? Discuss the structure and bonding in ferrocene. [2+7]

2. Short Answer Questions 8×3=24

2.1 Name the following complexes by IUPAC system



2.2 Given an example of (a) Hydrate isomers (b) Ionization isomers (c) Optical isomers.

2.3 What is meant by lanthanide contraction? Give its two consequences.

2.4 Write three main postulates of valence bond theory.

2.5 What is the difference between inner orbital complex and outer orbital complex?

2.6 What are metal carbonyls? Give any two general methods of preparation of metal carbonyls.

2.7 Draw and explain the oxygen binding curves for haemoglobin and myoglobin.

2.8 What are ferredoxins and rubredoxins?

2.9 Explain 18 electron rule with an example of metal carbonyl compound.

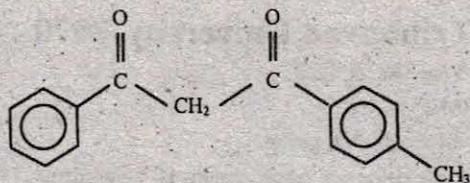
2.10 What are actinides? Why they show greater variation in oxidation number compared to the lanthanides? Explain.

2.11 Though neutral, CO occupies higher position in spectrochemical series. Explain.

Group "B" (ORGANIC)

Comprehensive Question

3. Define synthon and retron giving examples. How would you synthesize the following compound based on retrosynthetic analysis? [2+2+5]



OR

Give two general methods of preparation of amino acids with examples.

[4+5]

Write steps required for the synthesis of Leu-Ala from alanine and leucine.

4. Short Answer Questions 8×3=24
- 4.1. Write two methods of protection and deprotection of carbonyl functional group.
 - 4.2. What is the importance of Green Chemistry? Explain giving examples.
 - 4.3. Natural glucose is represented as D-(+)-glucose. What are the meaning of D - and (+)-symbols? Explain.
 - 4.4. Describe two properties of D - (+) - glucose that cannot be explained by open - chain structure.
 - 4.5. Write short notes on the following:
 - (a) Epimerisation
 - (b) Osazone formation of D-(+)-glucose.
 - 4.6. How are soaps prepared? What is the soap's cleansing mechanism?
 - 4.7. Show your acquaintance with the following
 - (a) Isoelectric point
 - (b) Electrophoresis
 - 4.8. On what basis Watson and Crick proposed the double helical structure of DNA? Why is double helical structure stable?
 - 4.9. Show your acquaintance with organic chemistry of vision.
 - 4.10. Describe Edman method of N - terminal analysis of peptides.
 - 4.11. Show your acquaintance with (a) Phosphoglycerides (b) Steroids.

GROUP "C" (PHYSICAL)

Comprehensive Question

5. Define entropy. Describe entropy change for isothermal and irreversible process in an isolated system. Calculate, process.
 2 moles of $\text{H}_2(\text{g})$ 298, 1 atm \rightarrow 2 moles of $\text{H}_2(\text{g})$ 298, 5 atm.

OR

Describe the properties and significance of ΔG . Calculate ΔG and ΔS for the process.



[5+5]

6. Short Answer Questions 8×3=24
- 6.1 Describe Clausius - Clapeyron equation.

- 6.2 Calculate entropy change when one mole of an ideal gas expands isothermally and reversibly from a pressure of 10 atm to 27°C.
- 6.3 Derive entropy of mixing of an ideal gas.
- 6.4 Calculate the equilibrium constant (K_p) for the reaction.

$$\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$$
 is 1.64×10^{-4} atm at 400°C and heat of ΔH is -105185.8J at 500°C.
- 6.5 Write a concise note on transition state theory.
- 6.6 How crystal structure is ascertained by Bragg's equation.
- 6.7 Describe the effect of temperature on the rate of reaction.
- 6.8 Describe Schottky and Frenkel defects in a crystal.
- 6.9 What are chain reactions? Describe various steps evolved
- 6.10 What is zero point energy? What is its significance?
- 6.11. The microwave spectrum of HCL consists of a series of e spaced lines separated by 6.62×10^{11} HZ. Calculate bond length of HCL.

Old Course

GROUP "A" (INORGANIC)

Comprehensive Question

1. Apply crystal field theory and valence bond theory to explain the nature of bonding in $[\text{Co}(\text{NH}_3)_6]^{3+}$ and $[\text{CoF}_6]^{3-}$. [9]

OR

What is meant by organometallic compound? What are the broad classes of organometallic compounds? Give the characteristic features of these organometallic compounds. Suggest any three methods to be used for the preparation of organometallic compound. [1+2+3+3]

2. Short Answer Questions 8×3=24
 - 2.1 Square planar complexes does not exhibit optical isomerism. Explain.
 - 2.2 What is meant by chelate effect?
 - 2.3 What is meant by trans-effect? How this concept can be utilized to synthesize the desired geometric isomer in square planar complexes?
 - 2.4 What is meant by inert and labile complexes? Give example.
 - 2.5 Why is it difficult to separate the lanthanides from a mixture? Discuss any one method used for the separation of lanthanides.
 - 2.6 What is 18 electron rule? Why is that simple carbonyls of Re, Co etc. are polynuclear?
 - 2.7 Point out the difference in the nature of iron atom in the oxygenated and deoxygenated haemoglobin.
 - 2.8 What are Ferredoxins? Point out their role in biological systems.
 - 2.9 Why is $\text{Ti}(\text{bipy})(\text{CH}_3)_4$ more thermally stable than $\text{Ti}(\text{CH}_3)_4$? Explain.
 - 2.10 Write the bridge and non bridge structure for $\text{Mn}_2(\text{CO})_{10}$. Point out any one method by which the structures can be differentiated.

- 2.11 What are metallocenes? Give any two methods for the preparation of any metallocene of your choice.

Group "B" (ORGANIC)

Comprehensive Question

3. Write three general reactions shown by amino acids.

What is peptide bond? What is its geometry? Write steps leading to synthesis of Val-Gly from glycine and valine. [3+2+4]

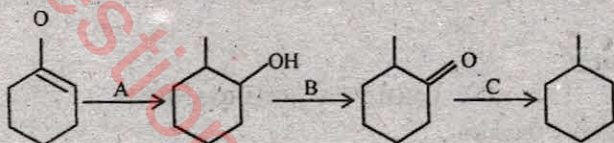
OR

What is bio-organic chemistry? Write mechanism of biological oxidation of ethanol to acetaldehyde and also explain how this mechanism was determined. Show your acquaintance with organic chemistry of vision with pertinent chemical equations. [1+5+3]

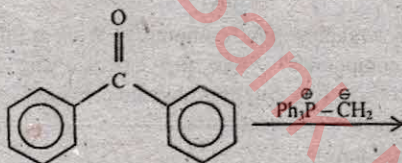
4. Short Answer Questions

8×3=24

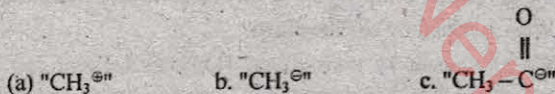
- 4.1 What are A, B and C?



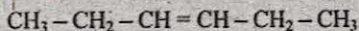
- 4.2 Predict the product and also write mechanism of the following reaction



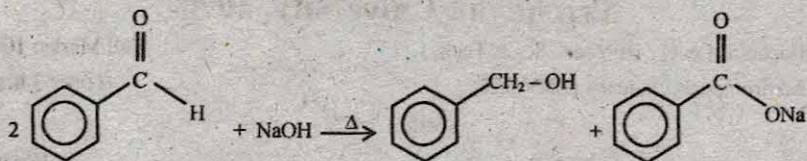
- 4.3 What are synthetic equivalent of the following synthons?



- 4.4 Propose a synthesis of the following compounds based on retrosynthetic analysis.



- 4.5 Write two methods of protection / deprotection of ketone functional group.
- 4.6 Show your acquaintance with (a) unsaturated fats and (b) steroids.
- 4.7 Write the structure of DNA.
- 4.8 What is genetic code? What is its importance?
- 4.9 What is Perkin reaction? Write its mechanism.
- 4.10 Write mechanism of the following reaction



4.11. Write the reaction involved in the hydrolysis of fats.

GROUP "C" (PHYSICAL)

Comprehensive Question

5. Derive clapeyron equation and clapeyron equation for vaporisation equilibrium.

Water boils at 373°K at 1 atm. At what temperature will it boil when atmosphere pressure becomes 528 mm Hg? [5+5]

OR

Distinguish between consecutive and parallel reaction. What is the influence of temperature on the rate of reaction and how activation energy of a chemical reaction can be determined?

At NTP, 2.8 liters of oxygen and 19.6 liters of hydrogen were mixed, calculate the increase in entropy of mixing. [6+4]

6. Short Answer Questions

8×3=24

6.1. How enthalpy and entropy are related? How does Gibb's free energy vary with temperature and pressure?

6.2. Calculate the temperature at which water vapour exists in equilibrium with liquid water at 1 atm provided the enthalpy and entropy of vaporization of water are 40.6 KJ mol⁻¹ and 108.8 Jmol⁻¹ K⁻¹, respectively.

6.3. Discuss the collision theory of unimolecular reaction.

6.4. The frequency factor and activation energy for a reaction are 4 × 10¹³ sec⁻¹ and 98.6 KJ mol⁻¹ respectively.

If the reaction is of first order, at what temperature will its half life period be 10 minutes?

6.5. Distinguish between Frenkel and Schottky defects.

6.6. What are chain reactions? Discuss the different steps involved with suitable example.

6.7. Discuss the importance of Frank-Condon principle.

6.8. State the third law of thermodynamics with its application.

6.9. Derive Bragg's equation and also mention its importance.

6.10. How does a molecule give rise to rotation, vibration and electronic spectra?

6.11. What are Raman spectra?

Tribhuvan University, 2070

Bachelor Level / III Year / Sc. & Tech.

Full Marks: 100

Environmental Science (ENV.332)

Time: 3 hrs.

Section "A"

1. Attempt any THREE questions. 3×10=30
- 1.1 What are biological resources? Describe briefly about the importance of biological resources.
 - 1.2 What is the current situation of world's food production? Discuss on the human nutrition and health problems associated with food resources in the world.
 - 1.3 Describe briefly about the availability of natural resources in mountains.
 - 1.4 Describe about the land capability and land use in Nepal. What are the major land reform policies and practices of Nepal? Discuss.

Section "B"

2. Describe briefly any TEN Questions: 10×5=50
- 2.1 Role of environmental education for sustainable development
 - 2.2 Human population distribution in Nepal
 - 2.3 New sources of water
 - 2.4 Commercial sector energy consumption in Nepal
 - 2.5 Travel cost method
 - 2.6 Provisions of Environment Protection Act, 1996 in Nepal
 - 2.7 Surface mining
 - 2.8 Renewable energy consumption in Nepal
 - 2.9 Components of a hydropower plant
 - 2.10 Environmental benefits of organic farming
 - 2.11 International organisations for environmental conservation in Nepal
 - 2.12 Human population projections of world

Section "C"

3. Attempt ALL the Questions. 10×2=20
- Differentiate between:
- 3.1 Species and ecosystem diversity
 - 3.2 Metallic and non-metallic minerals
 - 3.3 High - throughput and low - throughput economics
 - 3.4 Subsistence and intensive agriculture
 - 3.5 First and second order of landforms
 - 3.6 Tourism and ecotourism
 - 3.7 Local and biological extinction
 - 3.8 GDP and GPI
 - 3.9 Logistic and exponential growth

Tribhuvan University, 2070

Bachelor Level /III Year/Hum. + Sc. & Tech.

Full Marks: 75

Mechanics (Math.334)

Time: 3 hrs.

Attempt ALL the questions.

Group "A"

3×10=30

1. What are the catenary and a uniform catenary? Obtain the equations of the uniform catenary in intrinsic form and hence obtain its equation in Cartesian form. [2+8]
2. Define simple harmonic motion. Show that the period of oscillation of the SHM is independent of the amplitude. Also prove that if a particle describes a circle with constant angular velocity, the foot of perpendicular from it on any diameter executes SHM. [1+6+3]

OR

A particle moves in a straight line under an attraction towards a fixed point on the line varying inversely as the square of the distance from the fixed point. Discuss the nature of the motion. If the law of attraction be inverse distance show that the time of descent is a $\sqrt{\frac{\pi}{2\mu}}$. [6+4]

3. If the moments and products of inertia about all axes through centre of gravity of a body are given, then find those about all parallel axes. Hence determine the M.I. of a solid sphere about a tangent. [6+4]

Group "B"

9×5=45

4. Forces P, Q, R act along the lines $x = 0$, $y = 0$ and $x \cos \alpha - y \sin \alpha = p$, axes being rectangular. Find the magnitude of the resultant and equation of its line of action.

OR

[5]

A beam whose centre of gravity divides it into two portions, a and b, is placed inside the a smooth sphere; show that if θ be the inclination of the horizon in the position of equilibrium and 2α be the angle subtended by the beam at the centre of the sphere then $\tan \theta = \left(\frac{b-a}{b+a}\right) \tan \alpha$. [5]

5. Enumerate the forces which may be omitted informing the equation of virtual work. [5]
6. Using intrinsic equation of catenary, obtain the equations (i) $y = c \sin \psi$ (ii) $y^2 = s^2 + c^2$, with usual notations.

OR

[5]

A given length, $2s$, of a uniform chain has to be hung between two points at the same level and the tension has not to exceed the weight of length b of the chain. Show that the greatest span is $\sqrt{b^2 - s^2} \log \left(\frac{b+s}{b-s}\right)$.

7. Find the C. G. of the area bounded by the parabola $y^2 = 4ax$, the axis of x and the latus rectum. [5]
8. In a S.H.M. of amplitude a and period T , prove that $\int_0^T v^2 dt = \frac{2\pi^2 a^2}{T}$ [5]
9. A particle moves along a circle $r = 2a \cos \theta$ in such a way that its acceleration towards the origin is always zero.
Prove that $\frac{d^2\theta}{dt^2} = -2 \cot \theta \cdot \dot{\theta}^2$ [5]

OR

- Prove that the tangential and normal acceleration of a particle describing a plane curve be constant throughout the motion, the angle ψ through which the direction of motion turns in time T is given by $\psi = A \log(1 + Bt)$. [5]
10. A particle slides down the outside of a smooth vertical circle starting from rest at the highest point. Find the velocity and reaction at any point of the circle. [5]
11. Define central force and central orbit. If the orbit is a cardioid $r = a(1 + \cos\theta)$, find the law of forces. [5]
12. Determine the M.I. of truncated cone about its axis, a, b being radii of ends. [5]

Tribhuvan University, 2070

Bachelor Level / III Year / Hum. + Sc. & Tech.

Full Marks: 75

Mathematical Statistics (Math.336)

Time: 3 hrs.

Attempt ALL the questions.

Group "A"

3×10=30,

1. Define standard deviation. Explain why standard deviation is considered as the most suitable measure of the dispersion.
Find the mean and standard deviation of the natural numbers, the frequency of each being unity, under what circumstances would you use A.M., G.M., H.M. the most suitable to describe the measure of central tendencies of a distribution. [1+3+2+4]

OR

Distinguish between central moment and raw moment of a distribution. Establish the relation

$$\mu_r = \mu_r^1 - r c_1 \mu_1^1 \mu_{r-1}^1 + r c_2 \mu_2^1 \mu_{r-2}^1 - r c_3 \mu_3^1 + \dots + (-1)^r \mu_1^r$$

The first three moments of a distribution about the value 2 are 1, 16 and -40, show that the mean is 3, the variance 15. [2+3+5]

2. Define Karl Pearson's correlation coefficient between two variable x and y . Prove that the correlation coefficient between two variable is independent of the change of origin and scale.

Calculate the rank correlation coefficient between x and y .

x:	3	5	8	4	7	10	2	1	6	9		
y:	6	4	9	8	1	2	3	10	5	7		[1+4+5]

3. What are mutually exclusive events? Give an experimental definition of probability. What do you mean by a sample space? If A, B, C be not three mutually exclusive event prove that $P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(C \cap A) + P(A \cap B \cap C)$. [1+1+1+7]

Group "B"

9×5=45

4. Draw both less than and more than ogives from the following data and hence find the median mark.

Marks :	10-20	20-30	30-40	40-50	50-60	60-70	
No. of students:	5	7	12	18	15	3	[4+1]

5. Show that in a discrete series if deviation are small compared with mean m so that $\left(\frac{x}{m}\right)^3$ and higher powers of $\left(\frac{x}{m}\right)$ are neglected $G = m \left(1 - \frac{\sigma^2}{2m^2}\right)$ where m is the A.M. and σ is the s.d. of the series. [5]

6. Find the mean deviation from the mean and standard deviation of the A.P.
 $a, a + d, a + 2d, \dots, a + nd$. [2+3]

In the two sets of variables x and y with 50 observation each, the following data were observed.

$$\bar{x} = 10, \sigma_x = 3, \bar{y} = 6, \sigma_y = 2, r = 0.3$$

Find the regression equation of y on x . [5]

7. If X is a random variable and a, b are constants
 Prove that (i) $E(aX + b) = aE(X) + b$
 (ii) $\text{var}(aX + b) = a^2 \text{var} X$. [5]

8. Verify that the function $f(x)$ is a d.f and derive that p.d.f.

$$\begin{aligned} f(x) &= 0 && \text{for } x < 0 \\ &= x^2 && \text{for } 0 \leq x \leq \frac{1}{2} \\ &= 1 - 3(1-x)^2 && \text{for } \frac{1}{2} \leq x < 1 \\ &= 1 && \text{for } x \geq 1 \end{aligned}$$
 [5]

9. What is Poisson distribution? Find the mean of the Poisson distribution

OR

If the mean and variance of a binomial distribution are 4 and $\frac{4}{3}$ respectively.

Find $P(X \geq 1)$. [5]

10. Fit an equation of the form $y = a + bx + cx^2$ to the following data : [4+1]

X :	3	4	2	1	5
Y :	33	39	28	25	28

11. The probability that a man aged 70 years will die within a year is 0.01125, what is the probability that of such mean

(i) nobody will die.

(ii) 1 person will die.

[1+2+2]

12. Show that the mean and variance of the geometric distribution

$$p(x) = pq^x \quad x = 0, 1, 2, \dots \text{ are } \frac{p}{q} \text{ and } \frac{q}{p^2}$$

Or

Describe briefly t-test and f-test [5]

Tribhuvan University, 2070

Bachelor Level /III Year/Sc. & Tech.+Hum.

Full Marks:75

Linear Programming (Math.335)

Time: 3 hrs.

Attempt ALL the questions.

Group "A"

3×10=30

1. A company produces two types of models M_1 and M_2 . Each M_1 model requires 4 hours of grinding and 2 hours of polishing where each M_2 requires 2 hours of grinding and 5 hours of polishing. The company has 2 grinders and 3 polishers. Each grinder works for 40 hours a week and each polisher works for 60 hours a week. Profit on an M_1 model is Rs.3.00 and on M_2 model is Rs.4.00; whatever is produced in a week is sold in the market. How should the company allocate its production capacity to two types of models so that it may make the maximum profit in a week? Formulate this problem as a linear programming problem and hence solve graphically. [10]

2. Prove that the value of a game with pay off $\begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix}$, without any saddle point, is $\frac{a_{11}a_{22} - a_{12}a_{21}}{(a_{11} + a_{22}) - (a_{12} + a_{21})}$ and hence find the solution to the game $\begin{pmatrix} 2 & 5 \\ 4 & -1 \end{pmatrix}$. [6+4]

3. Give mathematical formulation of transportation problem. Show that the condition $\sum a_i = \sum b_j$ (i.e. total supply = total demand) is both necessary and sufficient for the existence of the feasible solution of an $m \times n$ transportation problem. Do you agree the solution of the T.P. never unbounded? Justify your answer. [2+5+2]

OR

What is an unbalanced transportation problem? Solve the following cost minimizing transportation problem. [1+9]

		Destinations				
		D_1	D_2	D_3	D_4	
Sources	S_1	25	17	25	20	40
	S_2	15	10	18	15	30
	S_3	16	20	8	10	60
		40	40	50	10	
		Requirements				

4. By using simplex algorithm, show that the LPP

$$\text{Max } Z = -x_1 + x_2$$

Subject to the constraints

$$x_1 - x_2 \geq -1$$

$$-x_1 + 2x_2 \leq 4;$$

$$x_1 \geq 0, x_2 \geq 0$$

admits of an alternative optimal solution. [5]

5. Find the dual of the following primal problem:

$$\text{Min } Z = 3x_1 - 2x_2$$

Subject to the constraints

$$2x_1 + x_2 \leq 1$$

$$-x_1 + 3x_2 \geq 4; x_1 \geq 0, x_2 \geq 0$$

Also verify that the dual is primal. [5]

6. If the objective function on an LPP assumes its optimal value at more than one extreme point, then prove that it takes on the same value for every convex combination of those particular points. [5]

OR

Solve the following assignment problem:

	I	II	III	IV
A	12	18	22	26
B	12	7	11	13
C	4	9	13	16

7. Solve the travelling salesman problem given by the following data:
- $C_{12} = 4$
- ,
- $C_{13} = 7$
- ,
- $C_{14} = 3$
- ,
- $C_{15} = 4$
- ,
- $C_{23} = 6$
- ,
- $C_{24} = 3$
- ,
- $C_{25} = 4$
- ,
- $C_{34} = 7$
- ,
- $C_{35} = 5$
- ,
- $C_{45} = 7$
- where
- $C_{ij} = C_{ji}$
- and there is no route between cities
- i
- and
- j
- (i.e.
- $C_{ij} = \infty$
-). [5]

8. Find the minimal value of

$$f(x, y, z) = x^2 + y^2 + z^2 \text{ when } x + y + z = 3, x, y, z \geq 0. [5]$$

9. Find the best strategy for each player from the following rectangular game [5]

	Player B				
Player A	(	2	3	11)
	(	7	5	2)

OR

Use dominance principle to solve the following 3×3 game

		B			
A	(	2	3	$\frac{1}{2}$)
	(	$\frac{3}{2}$	2	0)
	(	$\frac{1}{2}$	1	1)

10. Use Kuhn - Tucker condition to solve the following non-linear programming problem:

$$\text{Max } Z = 36x - 4x^2 + 16y - 2y^2$$

Subject to the constraints

$$2x + y \leq 10, \quad x, y \geq 0. \quad [5]$$

11. Solve the difference equation

$$y_x = y_{x-1} + y_{x-2}, \quad x \geq 2 \text{ given that } y_0 = 1 \text{ and } y_1 = 1 \quad [5]$$

OR

Express the polynomial $3x^3 + 2x^2 - 2x + 5$ in fractional notation taking difference interval 1 (unity) and hence find the first difference of the function. [3+2]

12. Define hyperplane in \mathbb{R}^n . Prove that the hyperplane is a convex set. [1+4]

Tribhuvan University, 2070

Bachelor Level/III Year/Sc. & Tech.+ Hum.

Full Marks: 75

Algebra II. (Math.333)

Time:3hrs.

Attempt ALL the questions.

Group "A"

5×7=35

1. Let V be a finite dimensional vector space with a positive definite scalar product. Let W be subspace of V and let $\{W_1, W_2, \dots, W_n\}$ be an orthogonal basis of W . If $W \neq V$, prove that there exist elements $W_{m+1}, W_{m+2}, \dots, W_n$ of V such that $\{w_1, w_2, \dots, w_n\}$ is an orthogonal basis of V . Find an orthonormal basis for the subspace of \mathbb{R}^3 generated by the vectors $(1, 3, -1)$ and $(2, 1, 1)$. [5+2]
2. Let V be a finite dimensional vector space over the complex number of dimension ≥ 1 and let $T: V \rightarrow V$ be a linear map. Let P be its characteristic polynomial, prove that $P(T) = 0$.

OR

[7]

Let V be a finite dimensional vector space over the complex numbers with positive definite hermitian product and let $\dim V \geq 1$. Let $A: V \rightarrow V$ be a unitary operator. Prove that there exists an orthogonal basis of V consisting of eigenvectors of A .

3. Define homomorphism of groups and illustrate it with a non-trivial example. Let G be a finite group such that $G = AB$ where A is normal subgroup of G and B a subgroup of G . Show that if $\frac{G}{A} \cong B$ then $A \cap B = \{e\}$. [2+5]

OR

Let G be a finite abelian group and p divides $0(G)$, where p is a prime number, prove that there exists an element $a \neq e$ in G such that $a^p = e$. [7]

4. Define Euclidean ring with example. Let R be a Euclidean ring, prove that every element in R is either a unit in R or can be written as the product of a finite number of prime elements of R . [1+1+5]
5. If L is a finite extension of K and if K is a finite extension of F , then prove that L is a finite extension of F . Moreover $[L:F] = [L:K][K:F]$. [7]

Group "B"

10×4=40

6. Let $L: \mathbb{R}^3 \rightarrow \mathbb{R}^3$ be a linear map defined by $L(x, y, z) = (x - y, x + z, x + y + 3z)$ show that L is invertible. [4]
7. Let $V = \mathbb{R}^3$ be a vector space. If two bases $\beta = \{(1, 1, 0), (-1, 1, 1), (0, 1, 2)\}$ and $\beta' = \{(2, 1, 1), (0, 0, 1), (-1, 1, 1)\}$, then find $M_{\beta'}^{\beta}(\text{id})$. [4]
8. Let V be the vector space of functions generated by the two functions $f(t) = t$ and $g(t) = t^2$ with scalar product $\langle f, g \rangle = \int_0^1 f(t)g(t) dt$. Find an orthonormal basis for V . [4]

Or

- Define dual basis. Find the dual basis of $\{(1, 2), (-1, 3)\}$ of \mathbb{R}^2 . [1+4]
9. Let f be the bilinear form on \mathbb{R}^2 over \mathbb{R} defined by $f((x_1, y_1), (x_2, y_2)) = x_1y_1 + x_2y_2$. Find the matrix of f in the order basis $\{(1, 1), (0, 1)\}$ or \mathbb{R}^2 . [4]

OR

- Let V be a finite dimensional vector space over the complex numbers with a fixed positive definite hermitian form $\langle \cdot, \cdot \rangle$. If T is an operator such that $\langle Tv, v \rangle = 0$ for all $v \in V$, then prove that $T = 0$.
10. Let V a vector space over the field K and λ is an eigenvalue of an operator $T: V \rightarrow V$. Let V_{λ} be the set of all eigenvectors of T associated with eigenvalue λ . Show that V_{λ} is a subspace of V . [4]
11. Define fan basis. Let $\{u_1, u_2, \dots, u_n\}$ be a fan basis for a linear map $T: V \rightarrow V$, prove that the matrix associated with T relative to this basis is an upper triangular matrix. [1+3]
12. If $I(G)$ is the set of all inner automorphism of the set of all automorphism $A(G)$ of a group G , then prove that $I(G)$ is a normal subgroup of $A(G)$. [4]

OR

- What is normalizer of an element of a group? Prove that $N(a)$, $a \in G$, is a subgroup of a group G . [1+3]
13. Suppose G is the internal direct product of N_1, N_2, \dots, N_3 , prove that for $i \neq j$, $N_i \cap N_j = \{e\}$ if $a \in N_i$, $b \in N_j$ then $ab = ba$. [4]
14. If J_p , the ring of integers mod p , is a field, then prove that p is a prime number. [4]

Or

If the primitive polynomial $f(x)$ can be factored as the product of two polynomials having rational coefficients, then prove that it can be factored as the product of two polynomials having integer coefficients.

15. Define algebraic element of degree n over a field F . Prove that the elements in K which is algebraic over F form a subfield of K . [1+3]

Tribhuvan University 2070

Bachelor Level/III Year/Sc. & Tech.+Hum.

Full Marks:75

Advanced Calculus VI Paper (332)

Time: 3 hrs.

Attempt ALL the questions.

Group "A"

5×7=35

1. What is exact differential equation of first order?

Show that $(x^3 - x) \frac{d^3y}{dx^3} - (8x^2 - 3) \frac{d^2y}{dx^2} + 14x \frac{dy}{dx} + 4y = \frac{2}{x^3}$ is exact. Find the first and second integral. [1+2+2+2]

Or

By the method of variation of parameters, solve the differential equation $\frac{d^2y}{dx^2} + (1 - \cot x) \frac{dy}{dx} - y \cot x = \sin^2 x$. [7]

2. Define curvature and torsion for a curve at a point on the space curve. Hence state and prove Serret - Frenet formula. [2+5]

Or

Prove that $[t' t'' t'''] = k^3 (k\tau' - k'\tau) = k^5 \frac{d}{ds} \left(\frac{\tau}{k} \right)$; the symbols have their usual meanings. [7]

3. When a function is analytic at a point? Write the Cauchy - Riemann equations in Cartesian and polar form. Find X such that the function $f(z) = r^2 \cos 2\theta + ir^2 \sin 2\theta$ is analytic. [1+2+4]

4. State Green's theorem and use it to evaluate $\oint (2x - y + 4) dx + (5y + 36 - 6) dy$ around a circle of radius 4 units with centre at origin. [1+6]

5. Define trigonometric series. State, when it becomes Fourier series. If a function is such that

$$-\frac{1}{2}, -\pi < x < 0$$

$$f(x) = \frac{1}{2}, 0 < x < \pi$$

then show that Fourier coefficients for $f(x)$ is $a_n = 0$, $b_n = 0$ or $\frac{2}{n\pi}$ according as n is even or odd.

Group "B"

10×4=40

6. Define osculating plane and determine its equation. [4]
7. Solve: $\frac{d^2y}{dx^2} + \frac{dy}{dx} + \left(\frac{dy}{dx}\right)^3 = 0$ [4]
8. Solve: $\frac{d^2y}{dx^2} + 4x \frac{dy}{dx} + 4x^2y = 0$ by removing the first derivatives. [4]
9. Form a PDE by eliminating f from $z = y^2 + 2f\left(\frac{1}{x} + \log y\right)$. [4]
10. Find P.I. of $s + p - q = z + xy$. [4]
11. Solve: $p^2x + q^2y = z$ by Charpit's method. [4]

Or

- Solve $z(qs - pt) = pq^2$ by Monge's method. [4]
12. Prove that $u = x^2 - y^2$, $v = \frac{y}{x^2 + y^2}$ both satisfy Laplace's equation. Find the harmonic conjugate of $v = \arg z$ [2+2]
13. If $\vec{F} = r^2\vec{r}$ show that \vec{F} is conservative field and scalar potential is $\phi = \frac{r^4}{4} + \text{constant}$. [4]
- Evaluate $\iint_S \vec{F} \cdot \vec{n} \, ds$ where $\vec{F} = y^2z^2\vec{i} + z^2x^2\vec{j} + x^2y^2\vec{j} + x^2y^2\vec{k}$ and S is the surface of sphere $x^2 + y^2 + z^2 = 1$ about xy -plane.
14. Find the real and imaginary parts of e^z and $\cosh z$. [4]

Or

- Define limit and continuity of a complex valued function. Discuss the limit of $\frac{|z|}{z}$ at $z = 0$.
15. Show that $\cos mx$ and $\cos nx$ are orthogonal on any interval of length 2π , provided $m^2 \neq n^2$. Write down the complex form of Fourier series and the formulas for its coefficients. [4]

Or

Define periodicity of a function. Develop the Fourier series for $f(x) = |x|$, $-\pi \leq x \leq \pi$.

Tribhuvan University, 2070

Bachelor Level/III Year/Sc. & Tech. + Humanities

Full Marks: 100

Applied Statistics (Stat332)

Time: 3hrs.

Group "A"

1. (Compulsory) Attempt any SIX questions. 6×5=30
- a. Explain control charts in statistical quality control.
- b. Discuss the method of least square in determining the trend values of a time series.

- Define index number. Describe Laspeyre's and Paasche's price index numbers.
- What is meant by deflating the index number? Write down the formula to compute real -wage and real wage index number.
- What do you understand by national income? What are its basic components?
- Describe UN's Sex-Age adjusted birth rate.
- Prove that the time period for a population to double varies inversely to $\log(1 + r)$ where r is the population growth rate. Derive the relationship between them.
- Define mean length of generation and net reproduction rate. Derive the relation between them.

Group "B"

Attempt any FIVE questions.

5×7=35

- Define vital statistics. What are the various cases of vital statistics for a country?
- Explain various measures of fertility in common use. How does total fertility rate differ from gross reproduction rate?
- Prove the relationship

$$P_x = \frac{e_x}{1 + e_{x+1}}$$

where notations have usual meanings.

- Fill in the blanks which are marked with a query in the following life table and explain the meaning of symbols at the heads of the column.

Age	ℓ_x	d_x	p_x	q_x	L_x	T_x	e_x^0	m_x
20	762227	?	?	?	?	?	27296632	?
21	758580	-	-	-	-	-	?	-

- Which population model is often used for short period population projection? State the reason. Also derive the model.
- Explain the difference between crude death rate and standardized death rate. Given below is the data regarding deaths in two districts. On the basis of given data, calculate the standardized rates.

Age	Population	No. of deaths	Population	No. of deaths	Age distribution of a standard 1000
0-10	2000	50	1000	20	206
10-55	7000	75	3000	30	583
55 and over	1000	25	2000	40	211

Attempt any FIVE questions.

- Describe the single sampling plan. Obtain operating characteristic (OC) and Acceptance Quality Level (AQL) curve for this plan. Distinguish between producer's and consumer's risk.
- What is a time series? Name the various components of time series and illustrate them with suitable examples. What purpose is served by time series analysis?
- What do you mean by seasonal index in analysis of time series? What are the methods of computing seasonal indices? Appliance centre sells a variety of electronic equipments and home appliances. For the last four years the following quarterly sales (in lakh Rs.) were recorded.

Year	Quarters			
	Q ₁	Q ₂	Q ₃	Q ₄
2011	5.3	4.1	6.8	6.7
2012	4.8	3.8	5.6	6.8
2013	4.3	3.8	5.7	6.0
2014	5.6	4.6	6.4	5.9

Determine seasonal indices for each of the four quarters by simple average method.

- Explain briefly how Fisher's ideal index number is constructed. Justify its being called ideal.
- What is cost of living index number? An enquiry into the budget of the middle class families in Kathmandu gave the following information:

Price in	Expenses on				
	Food 35%	Rent 15%	Clothing 20%	Fuel 10%	Miscellaneous 20%
2013	1500	600	1250	400	850
2014	1740	750	1325	550	1000

What changes in the cost of living figure of 2014 have taken place as compared to 2013?

- What do you mean by official statistics? Discuss industrial and agriculture statistics available in Nepal.

Tribhuvan University, 2070

Bachelor Level / III Year / Sc. & Tech.

Full Marks: 100

Earth Hazard Control - Optional Paper

Time: 3 hrs.

Attempt any FIVE Questions from each Group.

Group "A"

- What types of geological hazard do you expect to occur in the metamorphic belt of the Lesser Himalayan and Higher Himalayan regions?

- Define hazard and risk. Describe the attributing factors for hazard rating of soil.
- Explain the failure mechanism of rock slope.
- Define soil and describe briefly the Unified Soil Classification System.
- What do you understand by landslide? Describe the main triggers of landslide.
- What is an earthquake? Is the Himalayan region seismically active? Discuss.

Group "B"

- What do you understand by erosion? Discuss various types of erosion.
- Discuss the phenomenon of glacial lake outburst flood (GLOF). Add a note on the prevention and mitigation measures for GLOF.
- What is debris flow? Describe how an assessment of debris flow is done?
- Discuss the global warming and its impact in Nepal.
- What is vegetation structure? Describe its functions on slope protection. Add a note on importance of ethno-botanical plants.
- Write short notes on any TWO:
 - Topographical maps
 - Acid rain
 - Construction of gabion walls

Tribhuvan University, 2070

Bachelor Level / III Year / Science & Tech.

Full Marks: 100

Bio-Statistics (Electives)

Time: 3hrs.

Attempt any TEN Questions where Q.No. 12 is compulsory.

- Define biostatistics. Distinguish between categorical and non categorical data with illustration. What are the rules adopted in categorization?
- A reconnaissance study of radioactive materials was conducted in Alaska to call attention to anomalous concentrations of uranium in plutonic rocks. The amounts of uranium, in 14 locations under the Darby mountains are:
7.92, 10.29, 19.89, 17.73, 10.36, 13.50, 8.81, 6.18, 7.02, 11.71 and 8.33.
Find (a) Mean (b) Variance (c) Median (d) Interquartile range.
- Explain the term 'positive class' and 'ultimate class' frequencies in association of attributes. 1600 candidates appeared for a competitive examination, 422 were successful. 256 had attended a coaching class and of these 150 came out successful. Using Yule's coefficient of association estimate the utility of the coaching class.
- A farmer collected the following data, which show crop yields for various amounts of fertilizer used.

Fertilizer (kg/100 sq. ft)	0	4	8	10	15	18	20	25
Yield (bushels)	6	7	10	13	17	18	22	23

- Calculate correlation coefficient between fertilizer used and crop yield.

- b. Find the regression line for these data.
- c. Estimate the crop yield when fertilizer used is 16kg/100 sq.ft.
5. What is a probability? Define empirical approach of probability. A survey asked a group of 350 people whether or not they were doing daily exercise. The responses by sex and physical activity are as table given below:

	Female	Male	Total
Daily exercise	61	50	111
Not daily exercise	112	127	239
Total	173	177	350

A person is randomly selected.

- a. What is the probability that this person does daily exercise?
- b. What is the probability that the person does daily exercise given that the person is male?
6. Under what conditions binomial distribution tends to Poisson distribution? Suppose it is known that a new treatment is successful in curing a muscular para in 80% of the cases. If it is tried on 10 patients, find the probability that (i) exactly five will be cured (ii) at least one will be cured.
7. What are the parameters of normal distribution? What information is provided by these parameters? Suppose the number of particular type of bacteria in samples of 1 millilitre (ml) of drinking water tend to be approximately normally distributed with a mean of 85 and a standard deviation of 9. What is the probability that a given - ml sample will contain more than 100 bacteria?
8. What is an estimator? How does an estimator differ from estimation? The time to blossom a sample of 21 plants has mean 39 days and standard deviation 5.1 days. Calculate a 95% confidence interval of the mean time to blossom.
9. Define type I and type II error in testing of hypothesis. A random variable has a normal probability distribution with mean μ and standard deviation 3. The null hypothesis $\mu = 20$ to be tested against the alternative hypothesis $\mu > 20$ using a sample of size 25. It is decided that the null hypothesis will be rejected if the sample mean is greater than 21.4. Calculate the probability of making type I error.
10. Given two samples: 3, 5, 4 and 5, 9, 7
- a. Calculate (i) pooled sample variance (ii) the t-value when $\mu_1 = \mu_2$.
- b. Test $H_0: \mu_1 = \mu_2$ against $H_1: \mu_1 < \mu_2$, with $\alpha = 0.05$.
11. The following table records the observed number of births at a hospital in four consecutive quarterly periods:

Quarters	Jan. - Mar.	Apr. - Jun.	Jul. - Sep.	Oct. - Dec.
Number of births	110	57	53	80

It is conjectured that twice as many babies are born during the Jan. Mar. quarter than are born in any other three quarters.

At $\alpha = 0.10$, test if these data strongly contradict the stated conjecture.

12. Define gene and genotype frequency. What does constancy of gene frequency mean? State and prove Hardy - Weinberg equilibrium theorem in the light of constancy of gene.

Tribhuvan University, 2070

Bachelor Level / III Year / Sc. & Tech.

Full Marks: 100

Elective English

Time: 3 hrs.

Attempt ALL the questions.

1. State the main idea of "The Library Card." [10]
2. Summarize the plot of "Chandalika" in two paragraphs. [10]
3. Circle the correct choice in the following sentences: [5]
 - a. If I were a toad, I'd eat/ate flies.
 - b. I will make her read/to read a story.
 - c. If I had known, I would have help/helped her.
 - d. Last year he went/would go to Chitwan.
 - e. He is married with/to a nurse.
4. Apply four reading levels (retelling, interpreting, criticizing, and assimilating) to "Stopping by Woods on a Snowy Evening" Or "The Wretched Stone." [15]
5. Write a paragraph on your grandma. [5]
6. Anuradha Chaudhary warns us: if we fail to take decisive action, if we fail to bring about fundamental changes in our ways of thinking and doing politics, we just might sink and drown. Why does the author warn her readers in such a harsh manner? Give reasons for your answer. ("How Sane are We?") [10]
7. Write a short essay in about 200 words on "the negative effects of television on children's attitude and behaviors". [10]
8. Match the following words with their definitions: [6]

(a) copyright	i. a desire
(b) monitor	ii. too much
(c) grasping	iii. relating to practical affairs
(d) pragmatic	iv. the exclusive legal right to an artistic work
(e) urge	vi. fully understanding
(f) excessive	vi. check for particular purpose
9. Write a four paragraph essay comparing and contrasting on being an obese (overweight) or slim. [14]
10. Write a paragraph (in about 100 words) on Poverty.
11. Write a newspaper article on "Advertising and Lies" or "Air Pollution Today." [10]

Tribhuvan University, 2070

Bachelor Level /III Year/ Science & Tech. + Hum.
Sample Surveys and Design of Experiments (Stat.331)

Full Marks: 100

Time: 3 hrs.

Group "A"

1. (Compulsory) Attempt any SIX questions. 6×5=30
- Discuss the basic assumptions used in analysis of variance technique. State Cochran theorem.
 - What is the aim of design of experiment? Name the basic principles of experimental design, also give name of three basic design of experiments.
 - How can the sum of squares of analysis of variance of Latin square design of order K be calculated? Is 2×2 Latin square design possible? Why?
 - Discuss the advantages and disadvantages of sampling over complete enumeration.
 - Explain sampling and non sampling errors in a sample survey.
 - Explain the difference between ratio and regression method of estimation.
 - Show that in simple random sampling without replacement the probability of selecting a specified unit of the population at any given draw is equal to the probability of selecting it at first draw.

Group "B"

Attempt any FIVE questions. 5×7=35

- Explain how you would compare the efficiency of randomized block design over the completely randomized design.
- A dietician who specializes in weight control has three different diets she recommends. As an experiment she randomly selected 15 patients and then assigned to each diet. After three months the following weight losses, in kg, were noted. At 5 percent significance level, can she conclude that there is difference in the mean amount of weight loss among three diets?

Diet A	Diet B	Diet C
3	3	4
4	4	5
2	4	6
2	3	5
1	2	6

- What is meant by factorial experiment? What effects are measured in factorial experiment?
- Give the layout of Greco-Latin square design and describe the procedure of the analysis of data in this design.
- Explain the techniques of confounding in design of experiments. What are the advantages of confounding?

7. What do you mean by Analysis of Covariance? Write down the mathematical model for one way classification in covariance analysis.

Group "C"

Attempt any FIVE questions.

5×7=35

8. Explain the different steps used in conducting a sample survey.
9. A population consists of numbers 1, 3, 5, 7 and 9. Enumerate all possible samples of size two which can be drawn from the population without replacement. Show that sampling distribution of sample means is equal to the population mean. Also obtain its variance.
10. Show that $V(\bar{y}_{st})$ is minimum for fixed total size of the sample (n) if $n_i = N_i S_i$. The notations have their usual meanings.
11. What do you understand by systematic sampling? Discuss its advantages and disadvantages.
12. Describe probability proportional to size (PPS). Explain how PPS samples are drawn?
13. Obtain the variance of ratio estimate in simple random sampling and compare its efficiency with regression method of estimation.

Tribhuvan University, 2070

Bachelor Level /Sc. & tech.+ Huma./III Year

Full Marks: 75

Mathematical Analysis (Math.331)

Time: 3 hrs.

Attempt ALL the questions.

Group "A"

5×7=35

1. Define uniform convergence of a sequence of functions. State and prove Cauchy's condition of uniform convergence for a sequence. [1+6]
2. Define the improper integral of the first kind with an example.

Evaluate $\int_1^{\infty} \frac{dx}{x^p}$. Prove that if $0 \leq f$ is integrable over $[a, t]$ for all $t > a$ and

for $p > 1$, $\lim_{x \rightarrow \infty} x^p f(x) = L$, then $\int_a^{\infty} f(x) dx$ converges. [2+1+4]

Or

Assume that

- (i) f is integrable over $[a, t]$ for all $t \geq a$ and $\exists M > 0, \forall t \geq a$

$$\left| \int_a^t f(x) dx \right| \leq M,$$

(ii) $g(x)$ monotonically decreasing to 0 as x tends to ∞ , then prove that $\int_a^{\infty} f(x)g(x) dx$ exists. Also show that $\int_{-\infty}^{\infty} \frac{dx}{x^4+4}$ converges. [5+2]

3. Prove that in Euclidean space \mathbb{R}^k , every Cauchy sequence is convergent. Discuss the convergence of a real sequence (a_n) such that $|a_{n+2} - 2a_{n+1}| \leq \frac{1}{2}|a_{n+1} - a_n|$ for all $n > 1$. [5+2]

4. Define a function of bounded variation on $[a, b]$. Show that the function f defined by

$$f(x) \begin{cases} x^2 \sin\left(\frac{1}{x}\right) & \text{if } x \neq 0 \\ 0 & \text{if } x = 0 \end{cases}$$

is bounded variation on $[0, 1]$. Also prove that if f and g are each of bounded variation on $[a, b]$ then so is their sum and $V_{f+g} \leq V_f + V_g$. [1+2+4]

5. Let f, α be defined and bounded on $[a, b]$. What is a Riemann - Stieltjes sum of f with respect to α when f is said to be integral with respect to α ? And what is the Riemann - Stieltjes integral of f with respect to α ? Prove that if f is integrable with respect to α , then it satisfies Riemann's condition with respect to α on $[a, b]$. [3+4]

OR

Let $f \in R(\alpha)$ on $[a, b]$ and assume that α has a continuous derivative α' on $[a, b]$. Prove that the Riemann integral

$$\int_a^b f(x) \alpha'(x) dx \text{ exists and } \int_a^b f(x) d\alpha(x) = \int_a^b f(x) \alpha'(x) dx \quad [7]$$

Group "B"

10×4=40

6. Define point wise convergence of a sequence of function on a set. Prove that $\{x^n\}_{n=1}^{\infty}$ converges point wise but not uniformly on $[0, 1]$. [1+3]

7. Prove that a finite union of closed sets in \mathbb{R}^n is closed in \mathbb{R}^n . Prove or disprove that any union of closed sets in \mathbb{R}^n is closed in \mathbb{R}^n . [2+2]

OR

What is open set in \mathbb{R}^n ? Show that an open n ball is an open set in \mathbb{R}^n . [1+3]

8. Define an open covering of a set. Prove that a closed subset of a compact metric space is compact in the metric space. [1+3]

9. Define isolated point. Prove that every function is continuous at an isolated point. [1+3]

OR

Let $f: S \rightarrow T$ be a function where S and T are two sets. If $X \subseteq S$ and $Y \subseteq T$, then prove that

(i) $X = f^{-1}(Y) \Rightarrow f(X) \subseteq Y$ (ii) $Y = f(X) \Rightarrow X \subseteq f^{-1}(Y)$. [2+2]

10. Let S be a subset of \mathbb{R}^n . If $f : S \rightarrow \mathbb{R}^n$ is differentiable at c , then prove that f is continuous at c . [4]
11. Investigate the convergence or divergence of the integral $\int_0^1 \frac{dx}{\sqrt{x}}$. [4]
12. Define total variation of a function on $[a, b]$. Prove that $V_f(a, b) = 0$ if and only if f is constant function on $[a, b]$. [1+3]

OR

Prove or disprove that the reciprocal of a function of bounded variation on $[a, b]$ is of bounded variation on $[a, b]$. [4]

13. Evaluate $\int_{\pi}^{2\pi} \sin x \, d(\cos x)$ by changing into Riemann integral. [4]
14. Show that the Second Mean Value Theorem for Riemann integral does not hold on $[-1, 1]$ for $f(x) = g(x) = x^2$. [4]
15. If $\{a_n\}$ has a finite limit superior \cup , then show that it is unique. [4]

OR

Define subseries of a series. If $\sum a_n$ converges absolutely, then prove that every subseries $\sum b_n$ also converges absolutely, moreover. [1+3]

$$\left| \sum_{n=1}^{\infty} b_n \right| \leq \sum_{n=1}^{\infty} |b_n| \leq \sum_{n=1}^{\infty} |a_n|$$

Tribhuvan University, 2070

Bachelor Level / III Year. / Sc. & Tech.

Full Marks: 100

Agricultural & Food Microbiology (MB.331)

Time: 3 hrs.

Group "A"

(Long Answer Questions)

5×10=50

Attempt ALL FIVE questions.

1. Define soil and describe its composition. Mention major characteristics of soil cyanobacteria. [2+4+4]
2. Define biofertilizer. Describe sole of mycorrhiza as a biofertilizer. [2+8]
3. Define biopesticides. Describe microbiology of viral biopesticides taking one example. [2+8]
4. Differentiate between intrinsic and extrinsic parameters. [10]
5. Describe microbiology of canned foods spoilage. [10]

Group "B"

(Short Answer Questions)

5×7=35

Attempt any FIVE questions.

6. Explain in brief on food preservation.
7. Explain in brief on national food regulatory system.
8. Differentiate between food borne infections and intoxications.

9. Explain in short role of microorganisms -in degradation pesticides.
10. Explain in brief the role of bacterial enzymatic degradation of cellulose in agricultural waste.
11. Write down in brief on methanogenic microorganisms.

Group "C"

5×3=15

Attempt any FIVE questions.

12. Very Short Answer Questions.
 - a. Define xenobiotics
 - b. Clostridium food poisoning
 - c. Application of lactic acid bacteria in dairy
 - d. Define safe food handling
 - e. SCP
 - f. Biogas production

Tribhuvan University, 2070

Bachelor Level / III Year / Sc. & Tech.

Full Marks: 100

Stratigraphy and Sedimentology, Palaeontology and Economic Geology

(GEO.331)

Time: 3 hrs.

Attempt NINE questions, selecting THREE from each Group.

GROUP "A"

1. (a) Describe the methods of establishing the biostratigraphy? Radiometric dating for the age determination of the Siwalik rocks is not suitable, why?
(b) Explain the methods of establishing the lithostratigraphy. Describe the International Code for stratigraphy.
2. (a) Describe the different methods, uses and limitations of radiometric dating.
(b) Define the spiral flow of a meandering river and explain the characteristics of vertical sequence of meandering river system.
3. (a) Define estuary and explain, in brief, the hydrologic characteristics in estuaries.
(b) What are the properties of sedimentary deposits found in transgressive storm-dominated shelf?
4. Describe short notes on (any two):
 - (a) Fluid flow
 - (b) Bouma turbidite sequence
 - (c) Depositional processes in eolian desert system

GROUP "B"

5. (a) Explain the evolutionary trends of class Cephalopod of phylum Mollusca.
(b) Explain the importance and uses of the fossils in geosciences.

6. (a) Define functional morphology? Describe the methods of studying functional morphology.
- (b) Describe the morphology and geological distribution of the class Regularia of the phylum Echinodermata with neat diagram.
7. (a) Mention the trend in the evolution of vertebrates through time.
- (b) Describe briefly the Phylum Brachiopod with a neat sketch. Is it possible to establish the biostratigraphy in the Tibetan - Tethys Himalaya? Justify your answer.
8. (a) Describe the evolutionary trend of the modern Elephant.
- (b) Explain the fossils of the Gondwana age in Tansen area, central Nepal.

GROUP "C"

9. (a) List the forms of mineral bodies. Define and describe isometric ore bodies.
- (b) How economic types of iron deposits are formed? Add a note on uses of iron.
10. (a) What are economic mineral deposits? Describe the process of late magmatic concentration.
- (b) Describe the sources of hydrothermal solutions. Explain briefly the solution cavity filling deposit.
11. (a) Give the ore minerals, tenor and uses of lead. Explain the economic and genetic types of lead deposits.
- (b) What is mineral zoning? Describe in brief the mechanism of formation of contact metasomatic deposits.
12. (a) What do you mean by texture? Describe the texture of sedimentary ores.
- (b) Write short notes on:
 - (i) Gossan
 - (ii) Ore shoots

Tribhuvan University, 2070

Bachelor Level / III Year / Sc. & Tech.

Full Marks: 100

Environmental Science (ENV.331)

Time: 3 hrs.

Section "A"

1. Attempt any THREE questions. 3×10=30
 - 1.1. Describe the impacts of primary and secondary air pollution on human beings. Discuss briefly about the natural process of pollutants removal.
 - 1.2. What are the sources of water pollution? Illustrate the methods of secondary treatment of wastewater.
 - 1.3. Describe EIA process of Nepal. List out the importance of stakeholders' consultation while conducting EIA for developmental projects.

- 1.4. Define hazard. Explain briefly on glacial lake outburst flood and the suitable mitigation measures that can be adopted for minimizing the effects of such floods.

Section "B"

2. Describe briefly any TEN Questions: 10×5=50
- 2.1 Soil conservation techniques
 - 2.2 Selection of disposal sites
 - 2.3 Control of noise pollution
 - 2.4 Fate of toxicants in food chain
 - 2.5 Radioactive waste management
 - 2.6 Role of bioengineering in slope stabilization
 - 2.7 Urbanization in developed countries
 - 2.8 Effect of pesticides in ecosystems
 - 2.9 Scoping
 - 2.10. Environmental problems from economic point of view
 - 2.11. Soil profile development
 - 2.12. Ecological footprint

Section "C"

3. Attempt ALL the Questions. 10×2=20
- Differentiate between:
- 3.1 Brown and grey air smog
 - 3.2 Primary and tertiary wastewater treatment
 - 3.3 Sheet and gully erosion
 - 3.4 Reuse and recycling of solid waste
 - 3.5 Alpha and beta radiation
 - 3.6 Carcinogens and mutagens
 - 3.7 Rotational and translational slide
 - 3.8 Acute and chronic effects
 - 3.9 Primary and secondary effects of earthquake
 - 3.10 Persistent and non-persistent pollutants

Tribhuvan University, 2070

Bachelor Level / III Year / Sc. & Tech.

Full Marks: 100

CHEMISTRY (CHEM.331)

Time: 3 hrs.

New Course

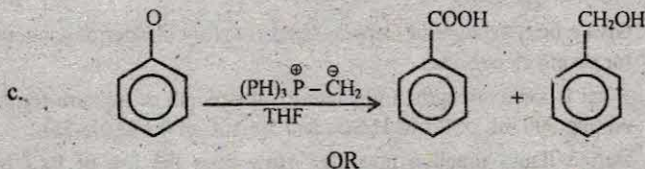
Use separate answer-book for each group.

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

GROUP "A" (INORGANIC)

Comprehensive Question

1. What are silicates? Draw six different types of silicate. Give their formula and uses of one example of each type.



What do you mean by term "reaction mechanism"? Giving examples, show how reaction mechanism can be determined by the following evidences (a) isolation of an intermediate (b) detection of an intermediate and (c) stereochemical evidence. [1.5+2.5+2.5+2.5]

4. Short Answer Questions

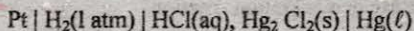
8×3=24

- 4.1 Give a method of benzyne preparation. Write the structure of benzyne.
- 4.2 Give reasons for the fact that tertiary carbonium ions are the most stable.
- 4.3 Write three applications of NMR spectroscopy.
- 4.4 What type of structural information is obtained from IR spectroscopy? Explain giving examples.
- 4.5 Five membered heterocycles such as furan and pyrrole are aromatic compounds. Give reason why are they aromatic.
- 4.6 In which position in five membered heterocycles such as furan and pyrrole, electrophilic substitution reaction occurs and why? Explain.
- 4.7 One example of nucleophilic substitution reaction on pyridine is called the "Chichibabin reaction". Show your acquaintance with this reaction with mechanism.
- 4.8 Define aromaticity and anti-aromaticity. Give one example of each.
- 4.9 Write the structures of singlet and triplet carbenes.
- 4.10 Why does benzene give a sharp NMR singlet resonance peak for its, aromatic protons? Explain.
- 4.11 Show the difference between classical and non-classical carbonium ions giving examples.

GROUP "C" (PHYSICAL)

Comprehensive Question

5. What are concentration cells? Derive the expression for the emf of a concentration cell with transference for the cell:



the standard emf of cell is found to be 0.26699V at 293K and 0.26690 at 303K. Calculate the values of ΔG , ΔS and ΔH at 298K. [1+5+4]

OR

What is phase rule? Define the terms involved in phase rule. Explain the salient features of the phase diagram for Ag - Pb system. [1+3+6]

6. Short Answer Questions

8×3=24

- 6.1 Give a brief account of Debye - Huckel theory of interionic interaction for strong electrolytes.
- 6.2 What is ionic strength? Calculate ionic strength of mixture formed by mixing 500 mL of 0.1 M H_2SO_4 and 500 mL of 0.1 M Na_2SO_4 .
- 6.3 Define liquid junction potential. How does the use of KCl in salt bridge minimize the junction potential?
- 6.4 Define the terms (a) polarization (b) overvoltage.
- 6.5 Explain the nature of phase diagram for nicotine-water system.
- 6.6 Write BET equation and define the terms involved in it.
- 6.7 Explain the fact that $MgCl_2$ is a better coagulant than KCl for As_2S_3 Sol.
- 6.8 What are gels? Distinguish between elastic and non-elastic gel.
- 6.9 State Henry's law. Why does bubbles of gas come out during opening a carbonated cold drink bottle?
- 6.10 Explain the viscosity measurement method for determination of molecular mass of macromolecules.
- 6.11 Explain the principle involved in steam distillation.

Old Course

GROUP "A" (INORGANIC)

Comprehensive Question

1. Write any one method for the preparation of diborane (B_2H_6). Why is it termed as an electron deficient compound?

Point out the unusual feature about the bonding of this compound.

[2+1+6]

OR

- (a) What are the factors to be considered for the utility of a non aqueous solvent? [3]
- (b) Give reactions that take place in liquid ammonia as a solvent under the following heading [2+2+2]
 - (i) Solvolysis reaction
 - (ii) Precipitation reaction
 - (iii) Acid-Base neutralization reaction

2. Short Answer Questions

8×3=24

- 2.1 What is meant by Chemical Oxygen Demand?
- 2.2 What is meant by NO_x ? Mention the factors that contributes as a source of NO_x .
- 2.3 Is CN^- a pseudohalide ion? If so cite its properties to justify it as a pseudo halide.
- 2.4 What are silicones? Give some important applications of silicones.

- 2.5 What are silicates? Show the structure of two different types of silicates.
- 2.6 How is the first Xenon compound prepared? Explain the strategy employed in the preparation.
- 2.7 What are chemical fertilizers? Write any one method each for the preparation of nitrogen fertilizer and phosphorus fertilizer.
- 2.8 What are hydrides? Why is that interstitial hydrides common in transition elements?
- 2.9 Discuss any one transition metal catalysed model system which will absorb nitrogen to generate ammonia.
- 2.10 What is isotope effect? Give two examples of isotope effect in the case of hydrogen.
- 2.11 How is S_4N_4 prepared? Draw its structure.

GROUP "B" (ORGANIC)

Comprehensive Question

3. Give an account of structure, preparation and reactions of carbocations.

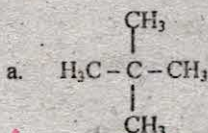
OR

[9]

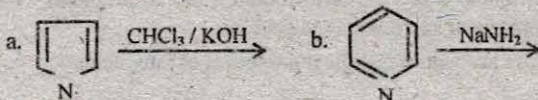
Establish the open-chain (aldohexose) structure of D-(+)-glucose.

4. Short Answer Questions 8×3=24

- 4.1 What are thermodynamic and kinetic requirements of a reaction? Explain.
- 4.2 How does isotope labelling help to determine mechanism of a reaction? Explain with an example.
- 4.3 Write two methods of generation of carbenes.
- 4.4 How many $^1\text{H-NMR}$ signals (including multiplicities) are expected from the following compounds?



- 4.5 Write two major applications of mass spectrometry.
- 4.6 Give the mechanism of mutarotation of D-(+)-glucose.
- 4.7 Give two methods of preparation of pyrrole.
- 4.8 Pyridine undergoes electrophilic substitution at 3-position. Explain why this reaction occurs at 3-position.
- 4.9 What is non-classical carbonium ion? Explain giving example.
- 4.10 Complete the following reactions.

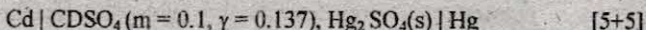


4.11 Define aromaticity and anti-aromaticity giving examples.

GROUP "C (PHYSICAL)

Comprehensive Question

5. Explain the various types of reversible electrode. Write cell-reactions and calculate the emf of following cell.



OR

Discuss the Langmuir theory of adsorption. Derive an expression for Langmuir unimolecular adsorption isotherm. What is the importance and limitation of the theory? [3+4+3]

6. Short Answer Questions 8×3=24

- 6.1 Define the terms: Adsorption and absorption, illustrating with suitable examples.
- 6.2 For the cell: $\text{Cd} | \text{CdCl}_2 | \text{AgCl}(s) | \text{Ag}$, the emf of cell is + 0.676V and temperature coefficient is $-6.5 \times 10^{-4} \text{ V. deg}^{-1}$. Calculate the value of ΔG and ΔS at 298K.
- 6.3 Draw the phase diagram of Bismuth - Cadmium system.
- 6.4 The mixture of alcohol and water cannot be separated by fractional distillation. Explain.
- 6.5 Explain the osmometric method for the determination of molecular mass of macromolecules.
- 6.6 Calculate ionic strength of mixture formed by mixing 200 mL of 0.1 M CaCl_2 solution and 300 mL of 0.2 M HCl solution.
- 6.7 What are emulsions and gels?
- 6.8 What is electrophoresis? How does this phenomenon provide the information about the sign of charge on particles?
- 6.9 Give a brief account of Debye Huckel theory.
- 6.10 What are concentration cells? Give an example.
- 6.11 Discuss the principle involved in solvent extraction.

Tribhuvan University, 2070

Bachelor Level / III Year / Sc. & Tech.

Full Marks: 100

Plant Bio-chemistry and Plant Bio-technology (Bot.331)

Time: 3 hrs.

New Course

Attempt All Questions.

Section "A" (Plant Bio-Chemistry)

Give explanatory answers to the followings (any TWO) [2×10=20]

1. Describe different types of carbohydrates found in plants. Write down structural formula of sucrose and glucose.
2. Give a concise account of chemical properties of fatty acids.

3. Describe DNA model as suggested by Watson and Crick. Write its chemical structure.

Write short notes on followings: (any FOUR)

[4×5=20]

4. Describe the structure of ribosomes and its role in protein synthesis.
5. Write down the structural formula of anthocyanins.
6. Describe fat soluble and water soluble vitamins.
7. What do you understand by the Dipole structure of water molecule?
8. Describe the factors that influence the enzyme activities.
9. Write the chemical structure of chlorophyll b.

Give short answer of the following: (any FOUR)

10. Give any two properties of enzyme.
11. Differentiate between saturated and unsaturated sugar.
12. Differentiate between starch and cellulose.
13. Essential and non-essential amino acids.
14. Name any two kinds of lipid.

Section "B" (Plant Bio-Technology)

Give explanatory answers to the followings (any TWO)

[2×10=20]

15. Describe the procedure of micropropagation from meristem.
16. What is biological nitrogen fixation? Describe nitrogen fixation by symbiotic organisms.
17. Describe the scope of biotechnology in agriculture.
18. Write short notes on the followings: (any FOUR)

[4×5=20]

19. Write the composition of any two types of media.
20. What are the plain growth - regulators? Describe the role of auxins in plant tissue culture.
21. What are haploid plants? Explain their significance.
22. Mention different steps in tissue culture.
23. What do you understand by totipotency? Discuss.
24. Define genetic engineering. How can it be useful for the improvement of crop plants?

Give short answer of the followings: (any FOUR)

[4×2.5=10]

25. What is cell culture?
26. What is mycorrhiza? List its types.
27. Role of blue green algae in maintaining soil fertility and crop productivity.
28. Write notes on Frankia.
29. What is cryopreservation? Mention any two cryoprotectors.

Old Course

Attempt ALL Questions.

Section "A" (Plant Bio-Chemistry)

1. Give a general account of classification of carbohydrates giving examples of each kind. Mention the biological significance of different types of carbohydrates. [10]

OR

- Differentiate between phospholipids and glycolipids. Give a concise account of properties and biological significance of lipids.
2. Define holoenzyme. What are the different components of a holoenzyme? Describe. How do enzymes catalyze biological reactions? [10]
3. What do you mean by primary and secondary structures of a protein? Describe with suitable diagrams. [5]
4. What are nucleic acids? What is their biological role? [5]
5. Why is water an ideal solvent for biological systems? Explain briefly. [5]
6. Define buffers. How do they work? [5]
7. What are vitamins? What is their biological role? [5]
8. Give the structural formula of any one plant pigment and mention its role in plants. [5]

Section "B" (Plant Bio-Technology)

9. How is aseptic culture condition maintained in tissue culture laboratory? Explain. [10]

OR

- What do you mean by somatic hybrids? How are they obtained in the
10. Describe the role of blue green algae in agriculture. [5]
11. What do you mean by genetically modified plants? What is their significance in agriculture? Describe briefly. [5]
12. Give a concise account of advantages and disadvantages of somaclonal variations. [5]
13. How are haploid plants generated? What is their significance in crop improvement? [5]
15. Differentiate between embryogenesis and organogenesis. [5]
16. Describe the role of biotechnology in biodiversity conservation. [5]
17. Write short notes on;
- Cellular totipotency
 - Application of meristem culture

Tribhuvan University, 2070

Bachelor Level / III Year / Sc. & Tech.

Full Marks: 100

Ecology, Wildlife & Fishery (Zol.331)

Time: 3 hrs:

New Course

Group "A"

Attempt any TWO questions

2×12.5=25

1. Write a brief essay on Wildlife Conservation.
2. What is ecosystem? Discuss about the abiotic and biotic components of terrestrial ecosystem.
3. Biomass based energy is the most common renewable energy resources in Nepal. Justify.

Group "B"

Attempt any TWO questions

2×12.5=25

4. Describe the diseases caused by internal parasites, bacteria and virus in fishes.
5. What is aquaculture? Give an account of Tilapia culture practiced in Nepal.
6. Describe the preparation and maintenance of an aquarium.

Group "C"

Attempt ALL questions

8×5=40

7. What are luminescent organs? Describe their types in fishes.
8. Explain the faunal diversity of oriental region.

OR

Write the faunal characteristics of Ethiopian region.

9. Discuss the effect of pH on productivity of fishes.
10. Give the distribution and morphology of *Tor putitora*.
11. Discuss briefly the social behaviour of mammals.
12. Give a brief account on different types of scales in fishes.

OR

Give an account of larvivorous fishes found in Nepal.

13. Give a brief account on noise pollution.
14. Discuss about the importance of EIA in Nepal.
15. Write short notes on any TWO :2×5=10

(a) Planktons

(b) Mountain faunas of Nepal

(c) Exotic fishes

Old Course

Attempt any TWO questions each from Group A & B and 12 from Group C.

Group "A"

2×10=20

1. Describe the development of chick upto the formation of germinal layers.

2. Define ecosystem. What are the components of ecosystem and describe common practice of ecosystem management.
3. Discuss briefly evidences in favour of evolution.

Group "B"

2×10=20

4. Describe diagnostic characters and distribution of Dipnoi.
5. Explain how fish ponds are constructed and prepared for fish culture.
6. Discuss the role of different abiotic factors in fish culture.

Group "C"

12×5=60

7. Give an account of human population and its impact on eco-degradation.
8. Describe briefly exotic fishes in Nepal.
9. Differentiate between ctenoid and cycloid scales.
10. Discuss various effects of noise pollution on human health.
11. How aquarium is set and maintained? Outline its steps.
12. Explain the faunal diversity of oriental region.
13. What are the causes and effects of green house effects and acid rains?
14. Differentiate learning behaviour form innate behaviour in general.
15. Describe different types of animal eggs.
16. What do you understand by natality and mortality?
17. Give an account of fish diseases.
18. Explain energy flow in an ecosystem.

Tribhuvan University, 2070

Bachelor Level / III Year / Sc. & Tech.

Full Marks: 100

Solid State Physics, Nuclear Physics, Mechanics (Phy.331)

Time: 3 hrs.

New Course

Attempt ALL the Questions.

1. Explain Fermi energy and the density of states. Hence discuss the occupancy of electrons in the neighbourhood of Fermi level.

Or

[10]

Discuss the basis on which Einstein model of specific heat of a lattice is obtained. Hence derive expression for the specific heat of a solid. How is this result different from those of Dulong - Petit and Debye results?

2. What is basic difference between Galilean and Lorentz transformations? Obtain relation for time dilation. Give an example to explain this concept of time dilation.

[9]

Or

State and explain D' Alembert's principle. Hence derive Lagrange's equation of motion.

3. Explain the classification of elementary particles and discuss the quark model with an example of its interaction with Leptons.

Or

[9]

Discuss the shell model of nucleus and explain how it is used to assign the values of nuclear level

4. Outline the salient features of a superconductor. [6]

Or

What do you mean by reciprocal lattice? Obtain reciprocal lattice of a simple cubic lattice.

5. Describe with theory the motion of a symmetrical top. [6]

OR

Show that the generalized moment conjugate to cyclic coordinates are conserved.

6. Describe the basic theory and essential components of a fission chain reactor. [6]

OR

Explain the problem of ground state of deuteron and discuss its significance.

7. Answer All the questions: [6×3=18]

- Explain the meaning of relaxation time in free electron theory.
- What do you mean by mobility of a carrier in semi-conductor?
- Explain what is meant by the term 'Q' value of a nuclear reaction.
- How is the nuclear chain reaction utilized in fission reaction? Explain.
- How is the centre of mass system different from laboratory system?
- What do you mean by Coriolis effect?

8. The resistivity of silver at 273 K is 1.6×10^{-8} ohm - m. Estimate the electronic thermal conductivity of silver at the same temperature. [6]

9. NaCl has its principal planes spaced at 2.82 Å. The first order Bragg's reflection is located at 10° . Find the angle for the second order reflection. [6]

10. What is the angular velocity of earth rotation on its axis so that a man standing on the surface of the earth at 45° latitude has zero weight? [6]

11. The binding energies per nucleon for deuteron (${}^2\text{H}^2$) and helium (${}^4\text{He}^4$) are 1.1 KeV and 7 MeV respectively. What would be the energy released when two deuterons fuse to form a helium nucleus. [6]

12. A particle of mass m is projected with an initial velocity u or an angle θ with horizontal. Write the Lagrangian for the particle. [6]

13. Find the speed at which the mass of an electron is 1.5 times of its rest mass and calculate its momentum. [6]

Old Course

Attempt ALL the Questions.

1. Obtain an expression for the lattice heat capacity of a solid on the basis of Debye's model. Also discuss its significance.

OR

[10]

Obtain an expression for density of states of free electrons at Fermi level. Hence discuss the occupancy of electrons in the neighbourhood of the Fermi level.

2. Develop the theory of ground state deuteron problem and discuss the significance of the results in nuclear physics. [9]
OR
- How are elementary particles classified? Explain the conservation laws in particle physics.
3. Set up Euler's equations of motion for a rigid body. Hence discuss the torque free motion of a symmetrical rigid body. [9]
OR
- Obtain an expression for the Rutherford scattering cross section for the scattering produced by a repulsive inverse square law force.
4. Describe different types of bonding in crystalline solids. [6]
OR
- Show that fee lattice is the reciprocal of the bc lattice.
5. Set up the Lagrangian for a simple pendulum and obtain the equation describing its motion. [6]
OR
- Show that the generalized moment conjugate to cyclic coordinates are conserved.
6. Describe the principle of power generation by a nuclear reactor. [6]
OR
- Write and discuss the significance of carbon-nitrogen cycle.
7. Answer All the questions: [6×3=18]
- What is meant by length contraction?
 - State Keyler's law of planetary motion.
 - Explain the hall effect
 - Explain Meissner effect in a super-conductor.
 - What is the role of parity in nuclear physics?
 - What do you mean by quark model?
8. The average energy required to create a vacancy in a metal is 0.5eV. Calculate the ratio of vacancies in the metal at 600K and 3 00K. [6]
9. The first order and second order Bragg's reflection of a crystal are 10° and 20° respectively. Find the separation of principal planes. [6]
10. A city requires 10 megawatts of electrical power on the average. If this power is to be supplied by a nuclear reactor of efficiency 60% using ${}_{92}\text{U}^{235}$ as a nuclear fuel, calculate the amount of fuel required for 4 hours of its operation, assuming that the energy released per fusion of ${}_{92}\text{U}^{235}$ nuclide is 200 MeV. [6]
- M. Calculate the mass, momentum and total energy of a protein moving with a speed of 0.5C. [6]

12. A particle describes a conic $r = \frac{p}{(1 + \epsilon \cos \theta)}$ whose p and ϵ are constants. Show that the force $f \propto \frac{1}{r^2}$. [6]
13. A particle of rest mass 10^{-6} kg moving with velocity $3 \times 10^7 \text{MS}^{-1}$ collides with another particle of mass 10^{-6} kg at rest, after which the particle coalesce. Calculate the velocity of the composite particle and its relativistic mass.

Tribhuvan University, 2070

Bachelor Level / III Year / Sc. & Tech.

Full Marks: 100

Meteorology (MET 331)

Time: 3 hrs.

Attempt any Three questions from Group A, Two from Group B, Three from group C and Two from Group D.

Group A: Agriculture Meteorology

1. Define agriculture meteorology and discuss why meteorology is important for agricultural development with reference to Nepal. [3+7]
2. Define plant physiology and animal physiology. Why agriculture meteorology is important for plant physiology. [4+6]
3. Explain in details the seed germination process and write down the general conditions for seed germination. [6+4]
4. What is micro-climate? What types of climates are suitable for orange and apple products? [2+4+4]

Group B: Aviation Meteorology

5. Explain the importance of meteorological phenomena in aviation. Write briefly the meteorological aspects of flight planning. [5+5]
6. Explain how meteorologists can contribute to air safety. What are the roles and responsibilities of WMO and ICAO? [4+6]
7. Write short notes on any TWO of the following:
 - a. Weather radars
 - b. Surface and slant visibility
 - c. CAT
 - d. Aerodromes

Group C: Air Pollution Meteorology

8. What do you understand by air pollution? What are the possible measures to mitigate air pollution? [3+7]
9. Explain possible sources of air pollution in Kathmandu valley. Suggest some practical ways to mitigate air pollution in the valley. [5+5]
10. What do you understand by aerosols? Describe nitrogen and carbon containing compounds in the air pollutants. [4+6]
11. Write short notes on any TWO of the following:
 - a. Atmospheric diffusion

- b. Pollutant monitoring
- c. Effective stack height
- d. Greenhouse gases

[5+5]

Group D: Satellite and Radar Meteorology

- 12. What is electromagnetic radiation? Explain the characteristic of atmosphere in radar meteorology. [2+8]
- 13. Give a brief note for each satellite images (e.g. visible, IR, microwave etc). Explain some techniques of image interpretation. [5+5]
- 14. What is remote sensing? Describe the importance of remote sensing technology in meteorological research. P+8]

Tribhuvan University, 2070

Bachelor Level / III Year / Sc. & Tech.

Full Marks: 100

Computer Science (CS.331)

Time: 3hrs.

Group "A" (Simulation and Modeling)

Long Answers Questions

- 1. Attempt any TWO Questions. 2x10=20
 - 1.1 Why do you perform the analysis of simulation output? Explain how do you use the simulation run statistics in the analysis of simulation output?
 - 1.2 What do you mean by physical models? Explain physical models with examples.
 - 1.3 Consider a machine tool in a manufacturing shop which is turning out parts at the rate of one every 20 minutes. As they are finished, the parts go to an inspector, who takes 8± minutes to examine each one and rejects 20% of the parts. Represents the above problem by block diagram in GPSS and write the GPSS code to inspect 2000 parts.

Short Answers Questions

- 2. Attempt any FIVE Questions. 5x2=10
 - 2.1 State and explain the properties of random numbers.
 - 2.2 Explain the terms validation and verification that are used in simulation models.
 - 2.3 Explain the three most common queuing disciplines that are used to describe congestion.
 - 2.4 Explain system, objects, attributes, and activities with suitable examples.
 - 2.5 Differentiate between continuous and discrete system with suitable examples.
 - 2.6 Explain in brief about dynamic mathematical model.
 - 2.7 How an economical system can be simulated? Explain suitable example.

Group "B" (Numerical Methods)

3. Attempt any SIX Questions. 6×5=30

- 3.1 Estimate a real root of $e^{-x} - x^2 - x = 0$ using bisection method correct up to two decimal places.
- 3.2 Use Lagrange's interpolation polynomial to find the value of $f(x)$ at $x = 0$ for following function:

X	-1	-2	2	4
f(x)	-1	-9	11	69

- 3.3 Find the real root of $4x^3 - 3x - 7 = 0$ by Newton-Raphson method. Approximate the required initial value.
- 3.4 Explain the Euler's method for the solution of ordinary differential equation.
- 3.5 Solve $AX = B$ for the following matrix using Gauss Jordan Method.

$$A = \begin{bmatrix} 2 & -2 & 0 & 0 \\ -1 & 2 & -3 & 0 \\ 0 & -2 & 2 & -4 \\ 0 & 0 & 1 & -1 \end{bmatrix} \quad \text{and } B = \begin{bmatrix} 5 \\ 6 \\ 7 \\ 8 \end{bmatrix}$$

- 3.6 Using Jacobi iteration method, solve the following equations: $3.15x - 1.96y + 3.85z = 12.95$; $2.13x + 5.12y - 2.89z = -8.61$ and $5.92x + 3.05y + 2.15z = 6.88$.
- 3.7 Derive Newton's divided difference interpolation formula.
- 3.8 Explain in brief about trial and error method for the solution of nonlinear algebraic equation.

Group "C" (Computer Graphics)

Long Answers Questions 2x10=20

4. Attempt any TWO Questions.
- 4.1 Explain about DDA line drawing algorithm.
- 4.2 Explain about Mid-point circle drawing algorithm. How can you modify it for ellipse drawing?

Short Answers Questions

5. Attempt any FIVE Questions. 5×4=20
- 5.1 Consider two different raster systems with resolutions of 640 by 480 and 1280 by 1024. What size frame buffer (in MB) is needed for each of those systems to store 12 bits per pixel? How much storage is required for each system if 24 bits per pixel to be stored.
- 5.2 Explain about light pen and its drawbacks.
- 5.3 Describe architecture of raster scan display system in brief.
- 5.4 Describe any two of the rigid-body transformations.
- 5.5 What is the difference between computer graphics and image processing? List some applications of image processing.
- 5.6 Explain about RGB colour model used in graphics.
- 5.7 What do you understand by world to viewing point transformation?

University, 2071

Bachelor Level / III Year / Sc. & Tech.
Environmental Science (ENV.331)

Full Marks: 100
Time: 3 hrs.

Section "A"

1. Attempt any THREE questions. 3×10=30
- 1.1. Describe the effects of primary and secondary air pollutants on human beings. Write down the necessity of air quality standards and legislations to control these pollutants.
 - 1.2. What are water pollutants? Explain the important chemical parameters to be determined for the aquatic ecosystems that are contaminated with sewage.
 - 1.3. Describe IEE approval process in Nepal. List out the importance of conducting IEE for developmental projects.
 - 1.4. Define and classify mass movement. Describe briefly on the major mass movement hazards of Himalayan regions.

Section "B"

2. Describe briefly any TEN Questions: 10×5=50
- 2.1. Consequences of soil erosion
 - 2.2. Selection of disposal site for solid waste management
 - 2.3. Sources and control of noise
 - 2.4. Cumulative toxicity
 - 2.5. Radioactive fallout
 - 2.6. Bioengineering practices
 - 2.6. Urbanization in developed countries
 - 2.8. Indices of toxicity
 - 2.9. Importance of Scoping in EIA
 - 2.10. Environmental problems from economic point of view
 - 2.11. GLOF
 - 2.12. Pattern of urban growth in Nepal

Section "C"

3. Attempt ALL the Questions. 10×2=20
- Differentiate between:
- 3.1. Primary and secondary air pollutants
 - 3.2. Alkalinity and hardness in water
 - 3.3. Rill and gulley erosion
 - 3.4. Sanitary and secure landfills
 - 3.5. Genetic and somatic effects of radiation
 - 3.6. Acute and chronic toxicity
 - 3.7. Debris flow and rock fall
 - 3.8. Fumigants and external insecticides