

ALL THE QUESTIONS PAPER EXAM 2069

Tribhuvan University, 2069

Bachelor Level / III Year /Science

Full Marks: 100

Research Methodology

Time: 3 hrs.

Attempt any TEN questions.

1. What do you understand by 'scientific research process'? Explain various steps involved in the scientific research process.
2. What is review of literature? Explain important aspects of review of literature.
3. What is research design? What consideration should be made to select appropriate research design?
4. Discuss the meaning of research problem. How are they stated? Also discuss the pitfalls of problem stating.
5. Distinguish between a questionnaire and a schedule. Describe different types of schedules, Also discuss the contents of schedules.
6. What is reliability? How is it measured? The reliability coefficient of a test is found as 0.65; mean score as 50 with standard deviation 5. Mr. A obtains a score of 40 on the test. What is his true score? Also compute 95% confidence interval for the true mean.
7. What is sampling? What are the steps to be followed in sampling. It has been estimated by cable companies that 60% of all households of Kathmandu Valley are wired to receive cable TV. You would like to test the claim with 5% error and 95% level of confidence. How large a sample would you require?
8. What is scale? Discuss different types of scale. Also discuss the method of constructing T - scale.
9. Write about the reference citing. Discuss different approaches used in quoting 'Journals', 'Books' and 'Articles'.

10. What is case study? What are its types? Write the sources of data in case study?
11. What is research proposal and what are the major steps in preparing research proposal?
12. What are the basic features of a thesis? Write down the basic steps followed in thesis writing? Also discuss the pitfalls in choosing topics of a thesis Work.

Tribhuvan University, 2069

Bachelor Level / III Year / Sc. & Tech.

Full Marks: 100

Meteorology (MET 331)

Time: 3 hrs.

New Course - Applied Meteorology

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 plant physiology and animal physiology. Why agriculture meteorology is important for plant physiology. [3+7]
2. Discuss briefly the basic process of photosynthesis. Give the chemical equation of photosynthesis and discuss the effect of temperature and carbon dioxide concentration on photosynthesis. [3+3+4]
3. Describe the role of soil moisture and wind on plant growth. [10]
4. What is agricultural climate? Which type of agricultural climate is important for apple and sugarcane product? [6+4]

Group B: Aviation Meteorology

5. What are the factors affecting horizontal visibility? Write its importance in aviation meteorology. [5+5]
6. Explain the importance of meteorological phenomena in aviation. Write briefly the meteorological aspects of ICAO. [6+4]
7. Write short notes on any TWO of the following:
 - a. Cautionary meteorological reports
 - b. Meteorological aspects of flight planning
 - c. PANSMET
 - d. Microburst [5+5]

Group C: Air Pollution Meteorology

8. What is air pollution? Describe the sulphur and nitrogen containing compounds in the air pollutants. [2+3+5]
9. What do you understand by pollution monitoring? Describe the effect of air pollutants on plants. [2+4+4]
10. Describe the effect of air pollutants on human beings, animals, plants and materials. [10]
11. Write short notes on any TWO of the following:
 - a. Ekman spiral
 - b. Turbulence of boundary layer
 - c. Atmospheric diffusion

d. Effective stack height [5+5]

Group D : Satellite and Radar Meteorology

12. Describe electromagnetic radiation. Explain the characteristic of atmosphere in radar meteorology. [3+7]
13. Explain the quantitative information from satellites sensor. Describe its physical principle and usefulness in meteorological research. [3+7]
14. What is jet stream? Describe the cloud features associated with jet streams in satellite imageries. [3+7]

Tribhuvan University, 2069

Bachelor Level / III Year / Science

Full Marks: 100

Meteorology (MET 332)

Time: 3 hrs.

New Course Applied Hydrology

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

- 1.(a) Explain importance and application of hydrology in engineering field. [5+5]
- 1.(b) A drainage basin has the following data:
Area of the basin = 200 km²; Length of the main stream = 75 km; the perimeter of the basin = 250 km.
Determine the form factor, circulatory ratio, elongation ratio and the compactness coefficient for the basin. [6]
- 2.(a) What is 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 | 6.5 | 6.0 | 7.3 | 7.3 | 10.1 | 12.6 | 35.4 | 50.5 | 60.5 | 38.8 | 17.0 | 10.4 | 7.9 |
- If the net head is 500 m, calculate the theoretical power potential of dependable Q_{65} discharge of the river. [6]
- 3.(a) What is infiltration? Derive an expression for Horton's infiltration equation. [4+6]
3. (b) Derive the estimation of PET by Penman equation. [6]
- 4.(a) What is basin yield? Describe the factor affecting runoff. [2+8]
- 4.(b) Describe base flow of hydrograph. Discuss the river system of Nepal. [2+4]
- 5.(a) Describe artificial ground water recharge. Explain the ground water resource of Nepal. [4+6]
5. (b) Explain the optimum number of hydrometric stations. [6]
- 6.(a) What is Tracer? Describe the sudden and constant injection method of discharge measurement. [2+4+4]
6. (b) Discuss different methods which can be applied for interpolation and extrapolation of rating curve. [3+3]
- 7.(a) Explain the factor affecting of sediment yield. Describe the source of sediment. [5+5]

7. (b) Describe the water quality. Explain the domestic and industrial use of water quality. [2+4]
8. Write short notes on any FOUR of the following:
- Hydrological cycle
 - Flow duration curve
 - Glacier mass balance
 - Areal extent of snow cover
 - Time of concentration
 - Snow survey [4+4+4+4]

9. (a) What are the properties of snow? Explain the snow observation and measurement technique of glacier. [4+6]

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 (Wm^{-2})
10.00	0.18	400
11.00	0.20	500
12.00	0.22	614
13.00	0.23	650
14.00	0.25	630
15.00	0.30	530
16.00	0.32	350

10. (a) How does a glacial lake form? What are the causes of glacial lake outburst flood? [4+6]

10. (b) Calculate the actual vapour pressure of air at a glacier surface at different conditions of air temperature and relative humidity. [6]

Air Temperature ($^{\circ}C$)	Relative humidity (%)
12	40
14	50
16	60
18	65
19	90
20	100

Tribhuvan University, 2069

Bachelor Level / III Year Science

Full Marks: 100

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

Time: 3 hrs.

New Course

Attempt ALL the Questions.

1. Explain the Michelson-Morley experiment and discuss its conclusions. How are the 'negative' results explained by Einstein? Explain the relativity of simultaneity. [10]

OR

What difficulties are introduced by constraints in the solution of mechanical problems? Explain how are these resolved in case of holonomic constraints. Discuss the D'Alembert's principle and hence derive the Lagrange's equation of motion.

2. Discuss the Debye model of the lattice heat capacity and hence explain the Debye T^3 law. [9]

OR

Explain the term 'Density of States'. Develop an expression for the density of states for electrons in metals.

3. Explain the liquid drop model of nucleus. Discuss the significance of various terms in the binding energy formula. [9]

OR

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

4. What are intrinsic and extrinsic semiconductors? Explain how does the conductivity of an intrinsic semiconductor varies with change in temperature. [6]

OR

What is Meissner effect? Distinguish type I. and type II superconductors.

5. Explain the torque free motion of a symmetrical top. [6]

OR

What is differential scattering cross-section? Obtain an expression for the Rutherford scattering.

8. Explain "energy balance" of nuclear reactions with an example. [6]

OR

Discuss the energy spectrum of primary cosmic rays.

7. Answer All the questions: [6x3=18]

- Explain Miller indices and draw (001) and (100) planes of a cubic crystal.
 - Explain dislocations and crystal growth.
 - Discuss how the Foucault's pendulum can predict the earth's rotation.
 - Explain the problem of central force field with an example.
 - What is a "chain reaction?" Give an example.
 - How the binding energy curve helps identifying nuclides appropriate for fusion and fission reactions?
8. The first order Bragg reflections for two different specimens are located at 10° and 16° respectively. What is the ratio of spacing of their parallel planes? [6]
9. Calculate the free electron density of copper if its Fermi energy is 7.0 eV. [6]
10. Calculate the mass, momentum and kinetic energy of a particle of rest mass m_0 moving with a speed of 0.7 C. [6]
11. The mean distance of Mars from the Sun is 1.5 times that of the earth. Calculate the time of revolution of Mars about the sun. [6]
12. The binding energy per nucleon for ${}_1\text{H}^2$ and ${}_2\text{He}^4$ are 1.11 MeV and 7.07 MeV respectively. Calculate the energy release when two deuterons fuse to form a helium nucleus. [6]

13. Estimate the rate at which ${}_{92}\text{U}^{235}$ will be consumed by a reactor, operating at an output of 100 kW. [6]

Tribhuvan University, 2069

Bachelor Level / III Year Science

Full Marks: 100

Quantum Mechanics, Mathematical Physics (Phy.332)

Time: 3 hrs.

New Course

Attempt ALL the Questions.

1. Explain the significance of de Broglie wave. How does the Davisson and Germer's experiment supports the concept of the wave? Explain.

OR

[10]

Explain how the wave function plays role to illustrate and solve the potential barrier problem.

2. Develop the partial differential equation for hydrogen atom problem in spherical polar system and separate it into radial and angular parts.

OR

[9]

Describe the solution of Bessel's differential equation and hence find $J_{1/2}(X)$.

3. Show that the gradient of a scalar quantity is a vector and express the gradient in spherical polar coordinates.

OR

[9]

Expand $f(x) = x(1-x)$ for $-\pi \leq x \leq \pi$ and hence find the value of π^2 using Fourier series.

4. How does the Ehrenfest theorem relates classical equations to quantum ones?

OR

[6]

Show that the momentum operator is Hermitian.

5. What is the significance of non-zero value of the zero-point energy? Explain.

OR

[6]

Find the Laplace transform of $\sin(\omega t)$.

6. Explain how the ranks of a tensor are determined. Give examples.

OR

[6]

Explain how the diagonalization of a matrix results in its eigenvalues.

7. Answer ALL questions:

[6x3=18]

- What are allowed transition and forbidden transition?
- Even an 'ideally' precise instrument cannot measure energy of a system and time simultaneously. Why?
- Is the expectation value of position of an electron in an atomic nucleus equals to zero? Explain.
- Write and explain an equation relating the line integral and surface integral of a vector.
- Find the rank of AIB to determine whether it is a scalar or a vector.
- Write down the differential form of heat conduction equation. How is this different from general wave equation?

8. What are group and phase velocities? Explain, why the phase velocity may exceed C ? [6]
9. Solve the problem of linear harmonic oscillator using the operator formalism. [6]
10. What is tunnelling effect? How does this explain α -decay? [6]
11. Evaluate $\nabla \cdot \vec{r}^n$, where \vec{r} is a radial vector. [6]
12. Discuss how the Green's identities are used in Physics. [6]
13. Write the Laplace equation in spherical coordinates and discuss its solution.

Tribhuvan University, 2069

Bachelor Level / III Year Science,
Ecology, Wildlife & Fishery (Zol.331)
New Course

Full Marks: 100
Time: 3 hrs.

Group "A"

Attempt any TWO questions 2x12.5=25

- A. 1. Write a brief essay on Protected Areas of Nepal.
- A. 2. What do you understand by ELS? Discuss its importance and implementation.
- A. 3. Give an account of renewable energy resources in Nepal.

Group "B"

Attempt any TWO questions 2 x 12.5=25

- B. 4. What are different special organs in fishes? Discuss the sound producing organs in fishes.
- B. 5. Define aquaculture. Give an account of rainbow trout culture practice in Nepal.
- B. 6. What are different types of planktons? Discuss their roles in fish production.

Group "C"

Attempt ALL questions 8x5=40

- C.7. Explain the faunal diversity of Ethiopian region.
- C.8. Write an account of endangered mammals of Nepal.

OR

Mention the causes of depletion of wildlife in Nepal.

- C.9. What are the sources of water pollution in Nepal? Discuss its effect on human health.
- C.10. Write briefly about the phylogeny of modern horse.
- C.11. What is meant by nutrient cycle in ecosystem? Describe briefly oxygen cycle in nature.
- C.12. Discuss the morphology of Wallago attu.

OR

Describe the structural modifications of hill-stream fishes in Nepal.

- C.13. Define exotic fishes. What are their impacts on indigenous species of Nepal?
- C.14. Mention the role of temperature in fish production.

15. Write short notes on any TWO
- Induced breeding by hypophysation
 - Cycloid scales in fishes
 - Energy crops in Nepal

2x5=10

Tribhuvan University, 2069

Bachelor Level/ III Year Science

Full Marks: 100

Medical Zoology & Applied Entomology (Zo1.332)

Time: 3 hrs.

Illustrate your answers with suitable diagrams wherever necessary.

New course

Group "A"

Attempt any Two questions

2x 12.5=25

- Name the organism causing Chicken-pox. Give its mode of transmission, diagnosis and preventive measures.
- Give the life-cycle and pathogenicity of cryptosporidium parvum.
- Write an account of life history and pathogenicity of Heterorhabdids.

Group "B"

Attempt any TWO questions

2x 12.5=25

- Discuss the habit & habitat, morphology, and short life cycle of cash crop pest *Pyrilla perpisilla*.
- Describe the micro and macro-types of 4xsect collection and preservation.
- Discuss the concept of Integrated Pest Management (IPM).

Group "C"

Attempt ALL questions

8x5=40

- Name the organism causing Cholera. How is this disease transmitted and epidemic is caused?
- Discuss the biological methods for the control of insect pests.
- Discuss damage caused in wheat by the pest *Sesamia*.
- Enumerate the occurrence and control measures of *Echinococcus*.

OR

Describe in brief the structure and function of any one type of cell responsible for defense mechanism in the body.

- Mention the diseases caused by *Anopheles* and *Culex*. What are the prophylaxes for those diseases?
- Describe the mode of action of B-cells to antigens.

OR

Discuss cockroaches as household pests.

- Mention the economic importance of honey bee.
 - Give the pathogenicity caused by *Toxoplasma gondii*.
15. Write short notes on any TWO.

- IgG antibody

6

- b. Sericulture
- c. Syphilis

Tribhuvan University, 2069

Bachelor Level / III Year Science

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)

1. What are carbohydrates? Differentiate monosaccharides, disaccharides and polysaccharides.

OR

[10]

Describe the double helical model of DNA and discuss its significance in biological system.

2. What do you understand by dipole structure of water molecule? Discuss the biological significance of water. [10]
3. Define triglycerides. Write down properties and functions of triglycerides. [5]
4. What are reducing sugars? Write structural formula of any one of them. [5]
5. What are fatty acids? Give any two examples. [5]
6. Write a note on general properties of enzymes. [5]
7. Name the different types of vitamins found in plants. [5]
8. Describe important carotenoids with their structures. [5]

Section "B" (Plant Bio-Technology)

9. Discuss the role of cyanobacteria in agriculture.
What is meristem culture? Explain its significance.
10. Define micropropagation and describe the steps involved in it. [5]
11. What is rhizobia? Describe formation and functions of root nodules in legumes.
12. How haploid plants are produced by tissue culture? Describe its significance. [5]
13. Discuss the role of mycorrhiza in forestry. [5]
14. What is synthetic seed? Discuss the technology of synthetic seed production. [5]
15. What is protoplast? Describe how protoplasts, are produced from plant cell. [5]
16. Describe the role of cryopreservation in Germplasm bank. [5]
17. Write short notes on any TWO:
- a. Somaclonal variation
 - b. Frankia
 - c. Genetic engineering
 - d. Organ culture [5]

Tribhuvan University, 2069

Bachelor Level / III Year Science
Agricultural & Food Microbiology (MB.331)

Full Marks: 100

Time: 3 hrs.

New Course

Group "A"

(Long Answer Questions)

Attempt ALL FIVE questions each of ten full (or break down) marks.

1. Describe soil micro-organisms with their characteristics. [10]
2. Describe microbiology of methane gas production with a well labelled diagram. [10]
3. Describe sources of microbial contamination and role of microorganisms in spoilage poultry products. [10]
4. Enlist different food preservation methods. Describe methods of food preservation using temperature. [5+5]
5. Define botulism. Describe the types of botulism and mention characteristics of clostridium perfringens. [2+8]

OR

Explain in detail the role of bacteria in enzymatic degradation of pectin and chitin.

Group "B"

(Short Answer Questions)

Attempt any FIVE questions each of seven full marks.

6. Explain role of micro-organism in degradation of xenobiotics.
7. Brief on the factors affecting the growth of rhizoplastic microorganisms.
8. Explain HACCP system of quality control.
9. Enlist lactic acid bacteria and describe their uses in dairy industry.
10. Explain intrinsic parameters of food influencing the growth of micro-organisms.
11. Describe in brief application of viral biopesticides.

Group "C"

Attempt ALL FIVE questions each of three full marks.

12. Very Short Answer Questions.
 - a. Define cyanobacteria.
 - b. Define probiotics.
 - c. List characteristics of actinomycetes
 - d. Define biofertilizer with example
 - e. Outline procedure of phosphatase test of milk
 - f. Define Mycotoxins and aflatoxin.

Tribhuvan University, 2069

Bachelor Level / III Year Science
Medical and Environmental Microbiology (MB.333)

Full Marks: 100
Time: 3 hrs.

New Course

Group "A"
(Long Answer Questions)

5x10=50

Attempt ALL FIVE questions each of ten full (or break down) marks.

1. Describe host-parasite relationship in bacterial infections to humans. [10]
2. Describe principle of invitro antigen-antibody reactions. Briefly describe procedure of ELISA test and its application in disease diagnosis. [4+6]
3. Define water pollution. List the water borne pathogens. Describe point and non-point sources of water pollution. [2+3+5]
4. What are biogeochemical cycles? Describe the role of microorganisms in nitrogen cycle. [2+8]
5. Mention the characteristics of Mycobacterium, and briefly explain pathogenesis of pulmonary tuberculosis. [5+5]

OR

Explain the approaches and steps of sewage treatment.

[10]

Group "B"
(Short Answer Questions)

5x7=35

Attempt any FIVE questions each of seven full marks.

6. Describe the pathogenesis of influenza-virus.
7. Enlist the diseases caused by Candida and describe diagnosis of Candida spp.
8. Draw a labelled diagram of Entamoeba histolytica and mention its diagnostic features.
9. Define antibiotics and briefly describe mode of action of beta lactam antibiotics.
10. Briefly explain the components of microbial ecology.
11. Briefly describe methods of disposal municipal solid waste.

Group "C"

5x3=15

Attempt ALL FIVE questions each of three full marks.

12. Very Short Answer Questions.
 - a. Brief on phage typing.
 - b. Point out prevention measures of malaria outbreak.
 - c. Define biosafety and biohazard.
 - d. Mention an example of microbial predation.
 - e. List out survival factors of thermophiles.
 - f. List out methods of microbial monitoring of air quality.

Tribhuvan University, 2069

Bachelor Level / III Year Science
CHEMISTRY (CHEM.331)

Full Marks: 100
Time: 3 hrs.

New Course

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 is meant by ionizing and non-ionizing solvents? Discuss the following types of reactions in liquid ammonia as solvent (a) acid-base reaction. (b) solvolysis reaction (c) precipitation reaction (d) redox reaction. [1+2+2+2+2]

OR

What are silicates? Classify silicates into different types and give one example of each type with structure and composition. [1+8]

Short Answer Questions

8x3=24

- 1.1. What are hydrides? How are they classified? Give one example of each class.
- 2.2. Draw the structure of XeOF_4 , XeF_6 and XeO_3 .
- 2.3. What is inorganic benzene? How is it prepared?
- 2.4. How is diborane prepared? Comment upon its structure and bonding.
- 2.5. What are silicones? Give the important applications of silicones.
- 2.6. What is meant by chemical oxygen demand? How does it differ from biochemical oxygen demand?
- 2.7. Explain the terms: (a) photochemical smog (b) ozone hole.
- 2.8. What are the synthetic fertilizers? How are superphosphate and triple superphosphate prepared?
- 2.9. What are interhalogen compounds? Draw the structures of IF_7 and IF_5 .
- 2.10. What is meant by eutrophication? How plant nutrient plays a vital role in eutrophication?
- 2.11. What are essential qualities of a good fertilizer?

GROUP "B" (ORGANIC)

Comprehensive Question

3. Why do not aromatic compounds respond to electrophilic addition reactions? Explain. Define aromaticity and anti-aromaticity.
Which of the following compounds are aromatic and why?

a.



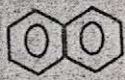
b.



c.



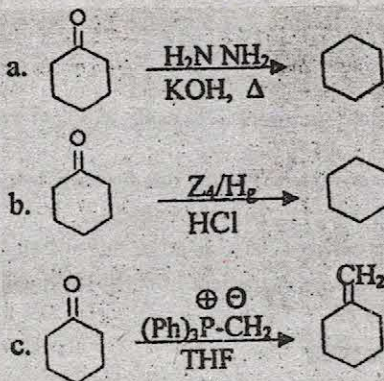
d.



OR

[9]

Write mechanism of the following reactions



Short Answer Questions

8x3=24

- 4.1 Which reaction is more energetically favoured, one with $\Delta G^\circ = -44 \text{ kJ/mole}$ OR one with $\Delta G^\circ = +44 \text{ kJ/mole}$? Explain why.
- 4.2 Explain does stereochemical evidence determine the mechanism of a reaction? Illustrate with an example.
- 4.3 Distinguish between classical and non-classical carbonium ions giving examples.
- 4.4 Out of primary secondary and tertiary carbocation ions, which is the most stable and why?
- 4.5 Write three applications of mass spectrometry.
- 4.6 Define (a) chemical shift (b) spin-spin coupling.
- 4.7 Give an example of electrophilic substitution reaction of furan giving mechanism.
- 4.8 Which is more basic, Pyrrole or pyridine? Give reason for your answer.
- 4.9 Give an example of Aldol condensation with mechanism.
- 4.10 Write the structures of singlet and triplet carbenes.
- 4.11 Give a reaction showing nucleophilic substitution reaction in pyridine.

Group "C" (PHYSICAL)

Comprehensive Question

5. Derive the expression for measurement of AIM and AS from emf measurements. Consider the concentration cell without transference. Pt, $\text{H}_2(\text{g})/\text{HCl}(0.2\text{M})$, $\text{AgCl}(\text{s})/\text{Ag}-\text{Ag}/\text{AgCl}(\text{s})$, $\text{HCl}(0.015\text{M})/\text{H}_2(\text{g})$, Pt write the individual cell reaction as well as overall cell reaction. Calculate the emf of cell. [5+5]

OR

What is phase rule? Explain the terms involved in phase rule with suitable example. Discuss the phase diagram for water. [2+4+4]

Short Answer Questions

8x3=24

- 6.1 What is ionic strength? Calculate the ionic strength of decimolar solution of cadmium sulphate.

- 6.2. State distribution law. Deduce the formulae for distribution law in case of association of solute in one of the phases.
- 6.3. Discuss the principle of fractional distillation.
- 6.4. Discuss how do you determine viscosity average molecular weight of macromolecules?
- 6.5. Write a concise note on Schulze - Lardy rule for coagulation.
- 6.6. Explain the origin of charge on colloidal particles.
- 6.7. Write the differences between chemical adsorption and physical adsorption.
- 6.8. Calculate the mean activity coefficient of 0.1M NaCl solution at 25°C, using the relation $\log f_{\pm} = -AZ^2\sqrt{m}$,
[A for NaCl = 0.51 at 25°C]
- 6.9. Write BET equation and define the term involved in it.
- 6.10. Define the terms (a) liquid junction potential (b) hydrogen overvoltage.
- 6.11. Explain the phase diagram of phenol - water system.

Tribhuvan University, 2069

Bachelor Level / III Year / Science

Full Marks: 100

CHEMISTRY (CHEM.333)

Time: 3 hrs.

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. (a) Write down the general methods of preparation of metal carbonyls.
1. (b) Explain the nature of bonding and structure of $\text{Fe}_2(\text{CO})_9$. [4+5]

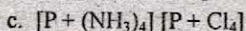
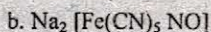
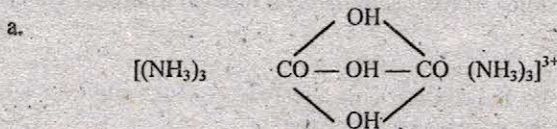
OR

1. (a) Predict the structure of $[\text{Ni}(\text{H}_2\text{O})_6]^{++}$ & $[\text{Ni}(\text{CN})_4]^-$ on the basis of crystal field theory.
1. (b) Differentiate between inner orbital and outer orbital complexes with the help of suitable example. [5+4]

Short Answer Questions

8x3=24

- 2.1. Name the following complexes by IUPAC system



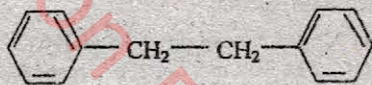
- 2.2. Explain how metal is bonded to allylic group.
- 2.3. What is the cause of formation of d_{π} & p_{π} bonding in metal carbonyl?

- 2.4. How many isomers are possible for the complex $[\text{Pt}(\text{NH}_3)(\text{py})\text{ClBr}]$? py – pyridine
- 2.5. Which one bond is- stronger $\text{M} - \text{C} \text{O}$: or $\text{M} - \overline{\text{N}} \equiv \text{N} \text{O}$? Explain with an example.
- 2.6. In lanthanides the size of atoms decreases along the period. Explain why?
- 2.7. Apply the $18 e^-$ rule in following compounds: $[\text{FC}_3(\text{CO})_{12}]$, $[\text{Fe}(\text{NO})_2(\text{CO})_2]^{2-}$ and $[\text{Cr}(\text{CO})_3(\text{NO})_2]^{2-}$
- 2.8. Explain the role of haemoglobin and mechanism of oxygen transport.
- 2.9. Point out the role of Fe in biological system with reference to its role as oxygen carrier.
- 2.10. Give three examples of Chelating agents.
- 2.11. What do you mean by CFSE? Calculate the number of unpaired electrons in $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ and $[\text{CO}(\text{NH}_3)_6]^{2+}$ complexes.

Group "B" (ORGANIC)

Comprehensive Question

3. What are the advantages of retrosynthetic analysis? Using retrosynthetic analysis, how would you prepare the following compound? [3+6]



OR

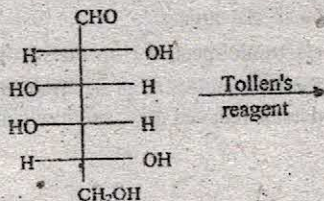
What is mutarotation? Open chain structure of glucose does not explain mutarotation properties and formation of isomeric methyl D - glucosides. Explain it.

How are these properties explained by cyclic structure of glucose? [2+3+4]

8x3=24

Short Answer Questions

- 4.1. Define synthon giving an example.
- 4.2. What is the role of phase transfer catalyst? Explain.
- 4.3. Write the structural difference between soap and detergent. Give their washing action.
- 4.4. Predict the product of glycine with (a) acetic anhydride (b) NaNO_2/HCl (c) PCl_5
- 4.5. What is secondary structure of protein? Describe giving example.
- 4.6. What evidences support the double helical structure of DNA? Describe.
- 4.7. Complete the rxn



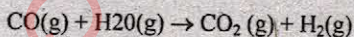
- 4.8. Write the mechanism of biological oxidation of ethanol into acetaldehyde.
- 4.9. Write a note on organic chemistry of vision giving pertinent chemical reaction.
- 4.10. Give two methods of protection and deprotection of alcohol functional group.
- 4.11. Show your acquaintance with the term "Genetic Code".

GROUP "C" (PHYSICAL)

Comprehensive Question

5. Define Gibb's free energy? Explain its significance. Derive the expression of Gibb's Helmholtz equation in terms of Gibb's free energy change and enthalpy change at constant pressure.

Consider the reaction



the standard enthalpy change for reaction is - 41.19 kJ and absolute standard entropy for CO(g), H₂O(g), CO₂(g) and H₂(g) are 197.91, 188.72, 213.64 and 130.59 JK⁻¹ mol⁻¹, respectively. Indicate whether reaction is feasible or not at 298K. [1+2+3+4]

OR

Define reversible reaction. Derive the expression for integrated rate equation for first order reversible reaction.

The rate constant for decomposition of HI at 356°C and 44.3°C are $3.02 \times 10^{-5} \text{ mol}^{-1} \text{ L sec}^{-1}$ and $2.53 \times 10^{-3} \text{ mol}^{-1} \text{ L sec}^{-1}$, respectively. Calculate activation energy for reaction. [2+4+4]

Short Answer Questions

8x3=24

- 6.1. Explain how can the absolute entropy of substance be determined with help of third law of thermodynamics.
- 6.2. Calculate entropy change when 2 mol of ideal gas are allowed to expand isothermally at 293 K from pressure of 10 atm to pressure of 2 atm.
- 6.3. Derive the Clausius - Clapeyron equation which relates temperature, pressure and volume in physical change.
- 6.4. Calculate equilibrium constant (K_p) for a reaction.
3O₂ = 2O₃, if standard free energy change is 163.43 KJ.
- 6.5. Write a concise note on collision theory for bimolecular react. Ion.
- 6.6. Explain the effect of temperature on reaction-rate.
- 6.7. Define parallel reaction with a suitable example.
- 6.8. Define the terms (a) colour centre (b) Schottky defects.
- 6.9. Explain how Bragg's equation for diffraction of X - rays by crystal lattice is utilised to determine crystal structure.
- 6.10. What is meant by electronic spectra? How does it originate?
- 6.11. The bond length for HCl molecule as determined from rotational spectra is $1.663 \times 10^{-20} \text{ cm}$. Calculate reduced mass and moment of inertia.

Tribhuvan University, 2069

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

Full Marks: 100

Time: 3 hrs

New Course

Section "A"

1. Attempt any THREE questions. 3x10= 30
- 1.1. Describe the impacts of air pollution on materials and human beings. Discuss briefly the importance of air quality standards and legislations to control such effects.
 - 1.2. What are the categories of water pollutants? Explain briefly on the methods or primary treatment of wastewater.
 - 1.3. Discuss briefly on baseline data collection while conducting IEE. List out the importance of conducting IEE for developmental projects.
 - 1.4. What is mass movement? Elaborate briefly on the major mass movement phenomenon in Nepal.

Section "B"

2. Describe briefly any TEN Questions: 10x5=50
- 2.1. Types of soil erosion
 - 2.2. Criteria for selection of disposal site for solid waste management
 - 2.3. Control measures for noise
 - 2.4. Toxicity and its effects
 - 2.5. Radioactive decay
 - 2.6. Hill slope bioengineering practices
 - 2.7. Methods of making urban areas sustainable
 - 2.8. Type of toxicants.
 - 2.9. Importance of TOR in EIA
 - 2.10. Ecological impacts of climate change
 - 2.11. River training works
 - 2.12. Urban growth in developing countries

Section "C"

3. Attempt ALL the Questions. 10x2=20
- Differentiate between:
- 3.1. Outdoor and indoor air pollution
 - 3.2. DO and BOD
 - 3.3. Splash and rill erosion
 - 3.4. Sanitary and secure landfills
 - 3.5. Genetic and teratogenic effects of radiation
 - 3.6. Dose and frequency responses
 - 3.7. Debris flow and landslide
 - 3.8. Internal insecticides and fumigants
 - 3.9. P-waves and S-waves

3.10. Corrective and preventive measures

Tribhuvan University, 2069

Bachelor Level / III Year Science
Environmental Science (ENV.332)

Full Marks: 100
Time: 3 hrs.

New Course

Section "A"

Attempt any THREE questions. 3x10=30

- 1.1. What are the major food resources of the world? Describe the new trend in food resource consumption.
- 1.2. Discuss briefly biological and climatic constraints of mountain life.
- 1.3. Discuss and classify land based on its suitability and capability. Why is such classification necessary?
- 1.4. Describe briefly on status and threats to biological resources of Nepal.

Section "B"

2. Describe briefly any TEN Questions: 10x5=50

- 2.1. Principles of conservation
- 2.2. Population distribution in ecological zones of Nepal
- 2.3. Sustainable management of water resources
- 2.4. Environmental consequences of energy consumption
- 2.5. Contingent valuation method
- 2.6. Institutional arrangement for environmental conservation in Nepal
- 2.7. Underground mining
- 2.8. Use of traditional energy resource in Nepal
- 2.9. Components of a hydropower plant
- 2.10. Organic farming
- 2.11. Provisions in Environmental Protection Act, 1996 of Nepal.
- 2.12. World's growth trend of human population

Section "C"

3. Attempt ALL the Questions. 10x2=20

Differentiate between:

- 3.1. Genetic and species diversity
- 3.2. Metallic and non-metallic minerals
- 3.3. Formal and informal education
- 3.4. Traditional and industrialized agriculture
- 3.5. Second and third order of landforms
- 3.6. Ecotourism and mass tourism
- 3.7. Local and biological extinction
- 3.8. Economic growth and development
- 3.9. Carrying capacity and minimum viable population

Tribhuvan University, 2069

Bachelor Level / III Year Science
Environment & Biodiversity (Bot.333)

Full Marks: 100

Time: 3 hrs

New Course

Section "A"

Give explanatory answer to the following: (any TWO) 2x10=20

1. What are the major constraints in the development of energy resources in Nepal? Discuss.
2. What is green house effect? Discuss major causes, consequences and mitigation measures that can be adopted to reduce this problem.
3. What are ecosystem services? Explain different measures that can be adopted to upgrade the ecosystem services in watersheds in context to Nepal.

Write short notes on any FOUR of the following: 4x5=20

4. Desert biome
5. EIA methodology
6. Adverse effects of pesticides
7. Participatory Technology Development (PTD) approach for natural resource management
8. Role of lower plants in Environmental monitoring
9. National Wetland Policy

Give short answers for the following: (any FOUR) 4x2,5=10

10. Adverse effects of fertilizers
11. Role of ICIMOD in nature conservation
12. Future of wind energy in Nepal
13. Effects of bio-toxins on human health
14. Adverse effects of deforestation

Section "B"

Give explanatory answer to the following: (any TWO) 2x 10=20

15. What are the features of biodiversity in Nepal? Discuss major factors which tend to increase and decrease biodiversity in Nepal.
16. Discuss the methods of ethnobotanical studies. Trace out its importance in giving emphasis on the use of plant resources for community development.
17. "Strict laws and regulations of government alone are not sufficient to protect biodiversity in nature." Discuss how stakeholders contribute in the conservation of biodiversity.

Write short notes on any FOUR of the following: 4x5=20

18. Mountain biodiversity
19. Species extinction
20. Importance of plant germplasm in conservation

21. Biodiversity prospecting
22. Role of botanical garden in biodiversity conservation

Give short answer for the following: (any FOUR)

4x2.5=10

23. Intellectual property rights
24. Non timber forest products
25. Role of network and connectivity in wild life conservation
26. Importance of agro - biodiversity in rural community
27. Nepal Biodiversity strategy, 2002.
28. Protected areas

Tribhuvan University, 2069

Bachelor Level / III Year Science

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) What is correlation? What are the paleontological criteria for correlation and their limitations?
(b) Explain briefly the Ar/Ar and Rb/Sr methods of radiometric dating with highlighting demerits, if any.
2. (a) Explain the methods to establish the lithostratigraphy of a new area. Why the lithostratigraphy is well established in Lesser and Tethys Himalayas? Justify your answer.
(b) What is an index fossil? Why an index fossil is used to establish the biostratigraphy?
3. (a) What is fluvial deposit? How do you distinguish the humid and arid alluvial deposits in field?
(b) What are the criteria for recognition of ancient sedimentary environments?
4. Describe short notes on (any two):
 - (a) Reynolds Number
 - (b) Tidal bedding
 - (c) Diagenesis and lithification

Group "B"

5. (a) Describe the evolutionary trend of class Trilobite of phylum Arthropod.
(b) What are the methods of functional morphologic analysis.
6. (a) What are principles of Taxonomy? Write short note on type specimen.
(b) Describe the morphology, geological distribution of the class Ammonoidea with a neat diagram.
7. (a) Explain the trend in the evolution of the modern man.
(b) Explain briefly the morphologic characteristics of the class Anthozoa of the phylum Coelenterate with a neat sketch.

8. (a) Justify the statement that all the index fossils are fossils but all the fossils are not index fossils.
(b) Describe the plant life in the Paleozoic era.

Group "C"

9. (a) Describe basic forms of mineral bodies. Describe tabular ore bodies in brief
(b) How economic types of gold deposits are formed? Describe the uses of gold.
10. (a) What is an economic mineral deposit? Describe the process of early magmatic concentration.
(b) Describe the sources of hydrothermal solutions. Explain briefly the fissure vein deposits.
11. (a) Give the ore minerals, tenor and uses of zinc. Explain the economic and genetic types of zinc deposits.
(b) What is the zone of oxidation? Describe in brief the mechanism of formation of supergene enrichment deposits with mineral examples.
12. (a) What do you mean by texture? Describe the texture of sedimentary ores.
(b) Write short notes on:
(i) Isometric ore bodies (ii) Gem stones

Tribhuvan University, 2069

Bachelor Level / III Year Science

Full Marks: 100

Engineering, Exploration and Environmental Geology (GEO.333) Time: 3 hrs.

Attempt NINE questions, selecting THREE from each Group.

Group "A"

1. (a) What are the reasons that soil and rocks are treated differently in engineering geological practices?
(b) What is soil consistency? How do you recognize the cohesive and non-cohesive soils in the field?
2. (a) What are the engineering properties required to describe an intact rock? Explain with examples how grain size affects the strength of an intact rock.
(b) Describe briefly how the surface roughness of discontinuities play role in creating instability in a rock slope.
3. (a) Describe the effect of source rock and mineral composition in the quality of construction materials with suitable examples.
(b) Define GIS and discuss its uses in various fields.
4. (a) Define remote sensing. What are the means of acquiring remote sensing data?
(b) What are the most common digitizing problem in remote sensing?

Group "B"

5. (a) Describe the processes of ore dressing and beneficiation.
(b) Define reserve and classify them.
6. (a) Describe different prospecting guides in short.
(b) Differentiate between rotary drilling and percussion drilling.
7. (a) Write short notes on:

1. Blasting

2. Mine ventilation and lighting

(b) Describe the principles of lithological and geophysical prospecting criteria.

9.(a) What is sampling? Describe its types and spacing in mine openings.

(b) Describe the geological and geochemical methods of prospecting.

Group "C"

10.(a) What is Environmental geology? How the geological processes can affect environment around us?

(b) Give classification of landslide and describe how landslide hazard can be minimized.

11.(a) Define earthquake. Give reasons why Kathmandu Valley is said to be prone to earthquake disaster.

(b) Describe different aquifers and spring types.

12.(a) What is Darcy's law? Discuss soil properties that affect groundwater flow.

(b) Describe the principal sources of groundwater pollution and suggest the methods of minimizing the groundwater pollution.

13.(a) What are the environmental impacts from energy sector and how it can be improved?

(b) Describe in brief the factors that make the volcanic eruption violent.

Tribhuvan University, 2069

Bachelor Level / III Year Science

Full Marks: 100

Elective English

Time: 3 hrs.

Attempt ALL the questions.

1. State the main idea of the essay "How Sane Are We?" [10]

2. Summarize the plot of "The Telegram on the Table." In one long paragraph. [5]

3. Edit the following sentences: [5]

a. I should have went to Dharan.

b. She smile as she sing.

c. If one wants to be a mountain climber, you should lift weights.

d. Chandra likes to reads books.

e. He never bother about his weaknesses.

4. Applying four reading levels (retelling, interpreting, criticizing, and assimilating) to "Piano" Or "Mr. Know All." [15]

5. How does the poet contrast between the world of lunatic and sane people? What are some of these contrasts and how do they bring out the irony of the poem? ("The Lunatic") [10]

6. What does Rushdie mean, when he says that "defiance is an inevitable and essential aspect of what we call freedom?" Do you agree with him? Have you ever defied anyone? If so, write that specific episode from your own life. ("A 1996 Commencement Speech") [10].

OR

Do you agree with Prof. Ramchandran that science has a great deal in common with poetry? Give reasons for your answer. ("The Making of a Scientist")

7. Imagine that you are the Cabuliwallah - a poor itinerant peddler from the Kabul region selling fruit in the foreign city of Calcutta. Write a letter to your daughter in Afghanistan, explaining to her how you feel about her, how it feels like being a stranger in a strange land, and why you must live so far away from house. [10]
8. Match the following prefixes and suffixes to the correct definitions: [5]

a) ecto-	i. body
b) endo-	ii. intermediate'
c) meso-	iii. in, into
d) -morph	iv. shape, form
e) somato-	v. external, outer
9. Write an essay stating the merits and demerits of human cloning. [10]
10. Write a paragraph (in about 100 words) illustrating the topic sentence, the body of paragraph and the concluding sentence. [10]
11. Write a newspaper article on "Free Web-Downloading" or "Piracy in Music." [10]

Tribhuvan University, 2069

Bachelor Level / III Year Science

Full Marks: 100

Earth Hazard Control - Optional Paper

Time: 3:

Attempt any FIVE Questions from each Group.

Group "A"

1. Describe the geomorphological divisions of Nepal Himalaya. Discuss the instabilities of the Sub-Himalaya.
2. Define danger, hazard and risk. Discuss briefly the landslide hazard assessment.
3. What do you understand by shear strength? Discuss the factors on which shear strength of rocks is dependent.
4. Define soil. Describe the basic criteria for Unified Soil Classification System.
5. What is hazard map? How do you prepare hazard map?
6. What is meant by intensity of an earthquake? Describe how earthquake hazard is assessed.

Group "B"

7. What do you understand by erosion? What are the different approaches of erosion classification?
8. What do you understand by glacial lakes? Discuss the role of remote sensing techniques for Glacial Lake Outburst Flood (GLOF) hazard assessment.
9. What is debris flow? Describe various methods of flood hazard assessment.
10. What is green house effect? Discuss the causes and impact of draught in Nepal.
11. What is bio-engineering? Name different types of a vegetation structure used for slope protection. Discuss the plant species selection for roadside bioengineering.

12. Write short notes on any TWO
- Retaining structure
 - Cyclone
 - Use of wasteland

Tribhuvan University, 2069

Bachelor Level / III Year Science

Full Marks: 100

Bio-Statistics (Electives)

Time: 3 hrs.

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

- Describe the main sources of data for biological studies. Distinguish between categorical and non categorical data.
- The following data refer to a certain type of chemical impurity measured in parts per million in 25 drinking water samples randomly collected from different areas of Kathmandu Valley.
11, 19, 24, 30, 12, 20, 25, 29, 15, 21, 24, 31, 16, 23, 25, 26, 32, 17, 22, 26, 35, 18, 24, 18, 27.
By taking suitable class interval find mean, variance and standard deviation.
- Define independent and mutually exclusive events. Bean seeds from supplier X have an 85% germination rate and those from supplier Y have a 75% germination rate. A seed packing company purchases 40% of their bean seed from supplier X and 60% from supplier Y and mixes these seeds together. (i) Find the probability that a seed selected at random from the mixed seeds will germinate (ii) Given "that the seed germinates, find the probability that the seed was purchased from supplier X?
- What is the principle of method of least squares? Fit a straight line for the following data, and estimate the value of y when $x = 10$.

x:	1	2	4	6	7	9	13
y:	-2	0	4	8	10	14	22
- Define coefficient of multiple determination. On the basis of observation made on 35 cotton plants, the total correlations of yields of cotton (X_1), number of seed vessels (X_2) and height (X_3) are found to be $r_{12} = 0.86$, $r_{13} = 0.65$, $r_{23} = 0.71$. Determine the partial correlation $r_{12.3}$ and multiple correlation $R_{1.23}$ and coefficient of multiple determinations. Interpret the result.
- What is the difference between a random variable and probability distribution? Mr. X finds that when he takes a cutting from a particular plant, the probability that it roots successfully is $1/3$. He takes nine cuttings. Find the probability that, (i) exactly seven cuttings root successfully (ii) at least two cuttings root successfully.
- What are the parameters of normal distribution? What information is provided by these parameters? In a certain paediatric population, systolic blood pressure is normally distributed with mean 115 mm Hg. and standard deviation 10 mm Hg. Find the probability that a randomly selected child from this population will have a systolic blood pressure greater than 125mm Hg.
- What is an estimator? How does an estimator differ from an estimator? To estimate the percentage of species of rodent that cause a viral infection, 128 are

histologically examined and 72 of them are found to be infected. Compute 95% confidence interval for the population proportion.

9. Describe what the null and alternative hypotheses typically represent in the hypothesis testing process. In a cancer research investigators wanted to know if the chance of a woman having breast cancer is influenced by her mother having similar disease. Family history of 400 women taken randomly was studied and the following information was obtained.

Daughter has cancer	Mother has cancer	
	Yes	No
Yes	7	191
No	5	197

Is the chance of daughter having cancer depend on her mother having cancer? Take 5% level of significance.

10. What do you mean by degree of freedom? Oak trees of a certain type has an average growth of 11.3 inches in 3 years under the specific environment. A botanist claims that a new type will have greater average growth in the same time period under same condition. A sample of 15 trees of the new type was observed to have an average growth of 11.9 with a standard deviation of 2.1 inches. Is the botanist's claim substantiated? Use $\alpha = 0.10$.

11. Define type I and type II errors in testing of hypothesis.

Given $f(x, \theta) = (1 + \theta)^x$, $0 \leq x \leq 1$.

$= 0$ otherwise

If $H_0: \theta = 1$ is to be tested by single observation of x axis and using interval $x < 0.5$ as the critical region, calculate the size of type I error.

12. What do you mean by gene and genotype frequencies 250 individuals are examined for their blood groups. The number of individuals indifferent blood groups are found as A(95), B(38) O(105) and AB(12). Compare the gene frequencies.

Tribhuvan University, 2069

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

Full Marks: 75

Mathematical Analysis (Math.331)

Time: 3 hrs.

Attempt ALL the questions.

Group "A"

5x7=35

1. Define convergent double sequence. Let $\lim_{p, q \rightarrow \infty} f(p, q) = \ell$

If for each fixed p , the limit $\lim_{q \rightarrow \infty} f(p, q)$ exists, then prove that the iterated

limit $\lim_{q \rightarrow \infty} \left(\lim_{p \rightarrow \infty} f(p, q) \right)$ also exists and has the same value ℓ .

Investigate the existence of iterated limit and double limit of the double sequence given by

$$f(p, q) = \frac{pq}{p^2 + q^2}, \quad p, q = 1, 2, \dots \quad [1+4+2]$$

2. Define an accumulation point of a set in \mathbb{R}^n .

Prove Bolzano - Weierstrass theorem for $\mathbb{R}^n, n > 1$. [1+6]

OR

Define metric subspace. Let (S, d) be a metric subspace of the metric space (M, d) and X a subset of S , prove that X is open in S if and only if $X = A \cap S$ for some set A which is open in M . [1+3+3]

3. Assume that g is differentiable at 'a' with total derivative, $g'(a)$. Let $b = g(a)$ and assume that f is differentiable at b with total derivative $f'(b)$. Prove that the composite function $h = fog$ is differentiable at a with the total derivative $h'(a)$ and is given by $h'(a) = f'(b) \circ g'(a)$. [7]

4. Define upper and lower Stieltjes integrals. Assume that $\alpha \rightarrow$ on $[a, b]$, prove that $1(f, \alpha) \sim I(f, \alpha)$ and show that this inequality holds by means of suitable example. [2+2+3]

5. State and prove Dirichlet's test for the convergence of improper integral of the first kind. Show that $\int_a^{\infty} \frac{\sin nx}{x^p} dx$ converges if $a > 0, p > 0$. [1+4+2]

OR

Define an improper integral $\int_a^{\infty} f(x) dx$. Interpret it geometrically. Let f, g be integrable over $[a, t]$ for all $t \geq a$ and $0 \leq f(x) \leq g(x)$ for all $x \geq a$, prove that if $\int_a^{\infty} g(x) dx$ converges, then $\int_a^{\infty} f(x) dx$ converges or if $\int_a^{\infty} f(x) dx$ diverges then $\int_a^{\infty} g(x) dx$ diverges. [1+3+3]

Group "B"

10x4=40

6. Prove that absolute convergence of an infinite series $\sum_{n=1}^{\infty} a_n$ implies the convergence. Is convergence true? Give an example. [2+2]
7. Prove that the series $\sum (-1)^n (1-x)^n$ converges point wise but not uniformly on $[0, 1]$. [4]

OR

Let $\{f_n\}$ be a sequence of functions defined on a set S . If $\{f_n\}$ satisfies the Cauchy's condition, then prove that $f_n \rightarrow f$ uniformly on S . [4]

8. Prove that the integral $\int_x^{-1} \frac{e^x}{x} dx$ converges. [4]
9. Define accumulation point of a subset of \mathbb{R}^n . If x is an point of S , then prove that every open n -ball $B(x)$ contains infinitely many points of S . [4]
10. State and prove Lindelof covering theorem. [4]

OR

Prove that the set $[-2, 2] \cup [3, 4]$ in \mathbb{R} is compact. [4]

11. Let F be any collection of sets in T and let $f: S \rightarrow T$ be a function, prove that

$$f\left(\bigcup_{A \in F} A\right) = \bigcup_{A \in F} [f^{-1}(A)] \quad [4]$$

12. Define a directional derivative. Justify that a function can have a finite directional derivative $f'(c; u)$ of a function at c for every u but may not imply the continuity of that function at c , by taking

$$f(x, y) = \begin{cases} \frac{xy^2}{x^2 + y^4} & \text{if } x \neq 0 \\ 0 & \text{if } x = 0 \end{cases}$$

OR

Let S be an open and connected subset of \mathbb{R}^n and let $f: S \rightarrow \mathbb{R}^m$ be differentiable on S . If $f'(c) = 0 \forall c \in S$, then prove that f is continuous on S . [4]

13. Determine whether or not the function

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

is bounded variation on $[0, 1]$. [4]

14. Evaluate $\int_0^x x d(\cos 2x)$ by using integration by parts. [4]

15. State and prove first Mean Value Theorem for Riemann Stieltjes integral. [4]

OR

Show that the second Mean Value Theorem for Riemann integral does not hold on $[-1, 1]$ for $\Lambda^x = g(x) = x^2$. [4]

Tribhuvan University, 2069

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

Full Marks: 75

Sample Surveys and Design of Experiments (Stat.331)

Time: 3 hrs.

Group "A"

1. (Compulsory) Attempt any SIX questions.

6x5=30

a. Explain what do you mean by Analysis of Variance. Write down its basic assumptions.

b. Explain in brief the principles of experimental design.

- c. How can the sum of squares of analysis of variance for a randomized block design with 'K' treatments and 'b' blocks in case of one observation per experimental unit be calculated?
- d. Explain what is meant by main effects and interaction effects in factorial experiment.
- e. What is a sample? In what situations sampling is inevitable?
- f. Show that in simple random sampling the sample mean is an unbiased estimate of the population mean.
- g. Describe the procedure of stratified random sampling.

Group "B"

Attempt any FIVE questions.

5x7=35

2. Discuss the advantages of two way classification over one way classification in analysis of variance technique.
3. The following a partial ANOVA table

Source	Sum of squares	d.f.	Mean sum of square	f-value
Treatments		2		
Error			20	
	500	11		

Complete the table and answer the following questions:

- i. How many treatments are there?
 - ii. What is the total sample size?
 - iii. What is the critical value of F?
 - iv. Write down the null and alternative hypotheses.
 - v. What is your conclusion regarding the null hypotheses.
4. Give out layout of 4x4 Latin square design. Discuss advantages and disadvantages of Latin square design.
 5. What do you mean by factorial experiment? Explain the technique of measuring main effects in 2² - experiment.
 6. In what ways can the analysis of variance of data of a randomized block design one missing value be carried out?
 7. Distinguish between partial and total confounding in factorial experiments. Discuss the main consideration in the use of confounded factorial design.

Group "C"

Attempt any FIVE questions.

5x7=35

8. Explain the different steps used in conducting a sample survey.
9. Differentiate between sampling and non sampling error. The estimate of the proportion is to be within plus or minus 0.05 with a 95 percent level of confidence. The best estimate of population proportion is 0.45. How large a sample is required?
10. In a stratified random sampling with a cost function $C = a + \sum C_h/n_h$ prove that the variance of estimated mean $\frac{y_{..}}{y'}$ is minimum when n_h is

is proportional to $N_n S_n / \sqrt{c_n}$, where notations have usual meanings.

- What do you understand by systematic sampling? Show that systematic sampling will be more efficient as compared to simple random sampling without replacement if $\rho < \frac{1}{(hk-1)}$ Where ρ is the intra-correlation coefficient between the units of the same systematic sample, n is the sample size and K is the sampling interval.
- Describe probability proportional to-size (PPS). Explain how PIPS samples are drawn.
- Explain the difference, between ratio and regression method of estimation. Obtain the sample estimate of the variance of the ratio estimator.

Tribhuvan University, 2069

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

Full Marks:75

Advanced Calculus VI Paper (332)

Time: 3hrs.

Attempt ALL the questions.

Group 'A'

5x7=35

- State Serret - Frenet formulae.

For the curve $\vec{r} = (a \cos \theta, a \sin \theta, a \theta \cot \beta)$, find expressions for k and T .

[2+5]

OR

Prove that $(x^m)^2 + (y^m)^2 + (z^m)^2 = \frac{1}{p^2 \sigma^2} + \frac{1+p^2}{p^4}$ [7]

OR

- Solve: $\frac{d^3 y}{dx^3} + 9y = \sec 3x$, by the variation of parameter method. [7]

OR

Find the first and second integrals of

$$x \frac{d^3 y}{dx^3} + (x^2 - 3) \frac{d^2 y}{dx^2} + 4x \frac{dy}{dx} + 2y = 0$$

Hence find the solution.

[3+2+2]

- State Green's theorem for a plane. Verify the theorem for $\int_C (xy + y^2) dx + x^2 dy$, where C is closed curve of the region bounded by $y = x$ and $y = x^2$. [2+5]
- Define analytic function. Show that the function $f(z) = e^{-z^4}$, $z \neq 0$, $f(0) = 0$ is not analytic at $z = 0$ although C.R. conditions are satisfied at that point. [2+5]

5. Define Fourier series and its coefficients.

Prove that $2 \left[\frac{\sin x}{1} + \frac{\sin 2x}{2} + \frac{\sin 3x}{3} + \dots \right] = x - \pi, x \in [0, \pi].$ [2+5]

Group "C"

10x4=40

6. Solve: $\frac{d^4 y}{dx^4} + a^2 \frac{d^2 y}{dx^2} = 0$ [4]

7. Solve: $\frac{d^2 y}{dx^2} + \cot x \frac{dy}{dx} + 4y \operatorname{cosec}^2 x = 0$ [4]

by change of independent variable method.

8. Solve: $\frac{dx}{y-ax} = \frac{dy}{x+yz} = \frac{dz}{x^2+y^2}$ [4]

OR

Find the general solution of $2 \frac{\partial z}{\partial x} + 3 \frac{\partial z}{\partial y} = x + y + 1$

9. Solve by Charpit's method:

$(p+q)(px+qy)-1=0$ [4]

OR

Find the PDE from $z = f(x+ay) + \phi(x-ay)$

10. Solve: $r - 7x + 12t = e^{x-y}$

OR

Solve by Mng'e's method: $q^2 r - 2pq s + p^2 t = 0$

11. $\iint_C x^2 dy dz + y^2 dz dx + 2z(xy - x - y) dx dy$, where S is the surface of the cube, $0 \leq x \leq 1, 0 \leq y \leq 1, 0 \leq z \leq 1.$ [4]

12. $\int_C [(x^2 + y^2) \vec{i} - 2xz \vec{j}] \cdot d\vec{r}$, where C is a rectangle in xy plane bounded by $y = 0, y = b, x = 0, x = a.$ [4]

13. Find the harmonic conjugate of $u = x^3 - 3xy^2$ and the corresponding analytic function. [4]

OR

Show that an analytic function with constant modulus in a domain is constant.

14. Find the Fourier series of $f(x) = |x|$ in $-\pi \leq x \leq \pi.$ [4]

15. Prove that: $\ddot{r} = k^1 n - k^2 t + k \tau b$

and $r''' = (k'' - k^3 - k r^2) n - 2k k' t + (2k' t + k t') b.$ [2+2]

Tribhuvan University, 2069

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

Full Marks: 100

Applied Statistics (Stat.332)

Time: 3 hrs.

1. (Compulsory) Attempt any SIX questions.

6x5=30

a. Explain the theoretical background of control charts.

b. Discuss mathematical model of time series analysis.

- What is meant by deflation of index number? Write down the formula to estimate the real wage and real income index number.
- What do you understand by national income? What are its basic components?
- Describe UN's sex-age adjusted birth rate.
- What are the measures of mortality to express death rates and how they can be determined?
- How can one estimate population by simple exponential model?

Group "A"

Attempt any FIVE questions.

5x7=35

- Discuss various components of life table and their interrelationship. Give the assumptions used in the construction of life tables.
- Explain the various measures of fertility in common use. How does total fertility rate differ from gross reproduction rate?
- From the data given below calculate gross and net reproduction rates.

Age group	No. of Children born to		Mortality rate per 1000
	1000	women	
15-19	150		120
20-24	1500		180
25-29	2000		150
30-34	800		200
35-39	500		220
40-44	200		230
45-49	100		250

Sex ratio being males : females 52 48.

- What are the different measures of population growth rate? If growth rate of population is 2.4% per annum. Find time period for the population to be double.
- Define stable population and stationary population. Show that with T the usual

notations, (i) $m_x = \frac{2q_x}{2 - q_x}$ (ii) $\frac{e^0 T_x}{x l_x}$

- What are the different errors usually encountered in age reporting. Discuss main pattern observed in Nepal.

Group "B"

Attempt any FIVE questions.

5x7=35

- What are the different causes of variation in statistical quality control? Describe how \bar{x} and R is constructed.
- Give the concept of sampling inspection. What do you understand by consumer's risk and producer's risk in single sampling plan?
- Name the components of time series and illustrate them with suitable examples.

11. You are given the annual profit figures for a certain firm for the year 2005 to 2011. Fit a straight line trend to the data and estimate the expected profit for the year 2012.

Year	2005	2006	2007	2008	2009	2010	2011
Profit in lakh Rs.	25	30	42	35	44	49	45

12. Examine the various points that are to be considered in the construction of index numbers. From the following data calculate Fisher's ideal index number.

Item	price per unit (in Rs.)		Quantity used	
	2010	2011	2010	2011
A	10	12	5	6
B	8	9	10	10
C	4	7	6	7
D	2	3	4	5

13. What do you mean by official statistics? Describe the source and limitations of official statistics, in Nepal related to agriculture and industry.

Tribhuvan University, 2069

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

Full Marks: 75

Algebra II (Math.333)

Time: 3 hrs.

Attempt ALL the questions.

Group "A"

5x7=35

- Define dimension of a vector space and kernel of a linear map. If $L: \mathbb{R}^3 \rightarrow \mathbb{R}^3$ defined by $L(x, y, z) = (x - y, x + z, x + y + 3z)$, then show that L is linear map. Determine the kernel L and its dimension. [2+3+2]
- Define dual space. Let V be a finite dimensional vector space over a field K , prove that the dual space V^* is also finite dimensional and $\dim V = \dim V^*$. [1+6]
- Define inner automorphism of a group. If $I(G)$ is the set of all inner automorphism of a group G , then prove that $I(G) \cong \frac{G}{Z(G)}$ where $Z(G)$ is the centre of G . [1+6]

OR

Let H and K be two subgroups of a group G .

Let $HK = \{hk/h \in H, k \in K\}$. Prove that HK is a subgroup of G if and only if $HK = KH$. In S_3 , find two subgroups of S_3 such that $HK \neq KH$. If $0(H) \sqrt{0(G)}, 0(K) > 0(G)$, then prove that that $H \cap K \neq \{e\}$. [3+2+2]

- What do you mean by a Euclidean ring? Show that the integral domain $[Z, +, \cdot]$ is a Euclidean ring where Z is the set of integers. Let R be a Euclidean ring and $a, b \in R$, if $b \neq 0$ is, not a unit in R , then show that $d(a) < d(ab)$. [1+2+4]

OR

How do you define an ideal of a ring? Let R be a commutative ring with unit element whose only ideals are (0) and R itself. Prove that R is a field. [1+6]

5. Let $f(x) \in F[x]$ be of degree $n \geq 1$. Prove that there is an extension E of F of degree at most $n!$ in which $f(x)$ has n roots. [7]

Group "B"

10x4=40

6. Let V be a vector space. Let $P : V \rightarrow V$ be a linear map such that $P \circ P = P$. Let U be the image of P and W be the kernel of P , show that $V = U \oplus W$. [4]

7. Let $V = \mathcal{R}^3$ be a vector space. If two bases

$$\beta = \{(1, 1, 0), (-1, 1, 1), (0, 1, 2)\} \text{ and}$$

$$\beta' = \{(2, 1, 1), (0, 0, 1), (-1, 1, 1)\}, \text{ then find } M_{\beta'}^{\beta}(\text{id}). [4]$$

8. Let V be the subspace of \mathcal{R}^3 generated by the two vectors $A = (1, 1, 1)$ and $B = (1, -1, 2)$. If $X = (x_1, x_2, x_3)$ and $y = (y_1, y_2, y_3)$ are vectors in \mathcal{R}^3 , define their product to be $\{x, y\} = x_1y_1 + 2x_2y_2 + x_3y_3$, then find an orthogonal basis of V with respect to this product. [4]

OR

What is scalar product on a vector space V ?

For all $v, w \in V$, prove that $|\{v, w\}| \leq \|v\| \|w\|$. [1+3]

9. Let V be a finite dimensional vector space over the complex field with positive definite hermitian form. Let A be an operator. Prove that A is hermitian if and only if $\{Av, v\}$ is real for all $v \in V$. [4]
10. Define minimal polynomial of a matrix A . Prove that the minimal polynomial of a matrix A exists and is unique. [1+3]

OR

Let V be a finite dimensional vector space over the field K and $\lambda \in K$. Let $A : V \rightarrow V$ be a linear map. Prove that λ is an eigen value of A if and only if $A - \lambda I$ is not invertible. [4]

11. What is fan basis? Let $\{u_1, u_2, \dots, u_n\}$ be a fan basis for a linear map $A : V \rightarrow V$. Prove that the matrix associated with A relative to this basis is an upper triangular matrix. [1+3]
12. Distinguish between order of a group and order of an element of a group. Let G be a group and $o|G| = p^2$, p a prime, prove that G is abelian. [1+3]

OR

Define conjugacy class of an element $a \in G$, where G is a group. Find conjugacy class of (12) in S_3 and also find $N(12)$ in S_3 .

13. Suppose that G is the internal direct product of N_1, N_2, \dots, N_{n_0} prove that for $i \neq j$, $N_i \cap N_j = (e)$ and if $a \in N_i, b \in N_j$ then $ab = ba$. [4]
14. If a ring R is an integral domain, then prove that $R[x]$ is also an integral domain, where $R[x]$ is the ring of polynomials of R . [4]
15. Define an algebraic element of degree n over a field F . Prove that the element in which is algebraic over F form a subfield of K . [4]

OR

If $p(x) \in F[x]$ and if K is an extension of F , then prove that for any element $b \in K$, $p(x) = (x - b)q(x) + p(b)$ where $q(x) \in K[x]$ and $\deg q(x) = \deg p(x) - 1$

Tribhuvan University, 2069

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

Full Marks: 75

Mechanics (Math.334)

Time: 3 hrs.

Attempt ALL the questions.

Group "A"

3x10=30

1. What is the system of coplanar forces? Prove that a system of coplanar forces acting at different points of a rigid body may be always reduced to a single force through a given point and a couple. Find the necessary conditions for the equilibrium of the rigid body. [1+6+3]
2. Find the components of acceleration along the tangent and normal to the curve at any instant for a particle moving in a plane curve. Hence find them for a particle moving in a circle. [8+2]

OR

The velocities of a particle along and perpendicular to the radius from a fixed origin are γr and $\mu\theta$; find the path. Show that the acceleration along and perpendicular to the radius vector are

$$\gamma^2 r - \frac{\mu^2 \theta^2}{r} \quad \text{and} \quad \mu\theta \left(\lambda + \frac{\mu}{r} \right)$$

3. If the M.I. and P.I. of a body about three mutually perpendicular and intersecting lines are known then to determine M.I. of the body about any other line through the point of intersection. Hence define momental ellipsoid. [8+2]

Group "B"

9x5=45

4. Forces P, Q, R act along the lines

$$x = 0, y = 0 \text{ and } x \cos \theta - y \sin \theta = p,$$

axes being rectangular. Find the magnitude and the line of action of the resultant. [5]

OR

A uniform beam of length $2a$, rests in equilibrium with one end resting against a smooth vertical wall and with a point of its length resting upon a smooth horizontal rod which is parallel to the wall, and at distance b from it. Show that, the inclination of the beam to the vertical is $\sin^{-1} (b/a)^{1/2}$.

5. State the principle of virtual work for a system of coplanar forces acting on a particle. A regular hexagon ABCDEF consists of six equal rods which are each of weight W and are freely joined together. The hexagon rests in a vertical plane and AB is in contact with a horizontal table. If C and F be connected by a light string, prove that its tension is $\frac{w}{\sqrt{3}}$ [1+4]

6. What are the catenary and uniform catenary? Obtain its equation in Cartesian form. [1+4]

7. Find the centre of gravity of the area included between the curve

$$y^2(2a-x) = x^3$$

and its asymptote.

OR

[5]

Find the centre of gravity of the volume formed by the revolution of the portion of the parabola $y^2 = 4ax$, cut off by the ordinate $x = h$, about the axis of x .

8. Define S.H.M. Deduce the equation $x = a \cos \sqrt{\mu} t$ with usual notations. [1+4]

9. A particle describes a curve (for which s and y vanish simultaneously) with

uniform speed v . If the acceleration at any point s be $\frac{v^2 c}{s^2 + c^2}$ curve prove that curve is a catenary.

[5]

10. A particle is projected with velocity V from the cusp of a smooth inverted cycloid vertex is $2r$ down the arc; show that the time of reaching the vertex 2

$$\sqrt{\frac{a}{g}} \tan^{-1} \left(\frac{\sqrt{4ag}}{r} \right) \quad [5]$$

11. Define central force and central orbit. If the central orbit is an ellipse with centre of force at focus, find the law of force. [1+4]

OR

A particle moves under a central repulsive force = $\left(\frac{m\mu}{(\text{distance})^2} \right)$ and is

projected from an apse at a distance a with velocity V . Show that the equation

to path is $\text{cosp } \theta = a$ where $p^2 = \frac{a^2 v^2 + \mu}{a^2 v^2}$ [5]

12. Determine M.I. of a hollow sphere about a diameter; a, b being external and internal radii. [5]

Tribhuvan University, 2069

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

Linear Programming (Math.335)

Attempt ALL the questions.

Full Marks: 75

Time: 3 hrs.

Group "A"

3x10=30

1. A company during the festival season combines two factors A and B to form a mega gift pack which must weight 5 kg. At least 2 kgs. of A and not more than 4 kgs of B should be used. The net profit contribution to the company is Rs.5 per kg for A and Rs.6 per kg for B.

(a) Formulate this problem as a linear programming.

(b) Determine the quantities of factors A and B so that the total profit is maximised using graph indicating clearly the feasible region on a graph.

[5+5]

2. Fill all basic feasible solutions for the system

$$2x_1 + x_2 - x_3 = 2$$

$$3x_1 + 2x_2 + x_3 = 3, \quad x_1, x_2, x_3 \geq 0.$$

Indicate the basic variables and non-basic variables in the solutions obtained by you. Identify degenerate and non-degenerate solutions. Show that the intersection of any two convex sets of 91° is given a convex set. What happen their union? [3+2+5]

OR

Define convex polyhedron with an example. If the feasible region of an LPP is a convex polyhedron, then show that there exists an optimal solution to the LPP and at least one basic feasible solution must be optimal. [3+7]

3. Reduce the following game into their corresponding primal and dual linear programming problem: [10]

$$\begin{array}{l} \text{Player B} \\ \text{Player A} \end{array} \begin{pmatrix} 3 & -2 & 4 \\ -1 & 4 & 2 \end{pmatrix}$$

Group "B"

9x5=45

4. Use simplex method to solve the following

$$\text{Max } Z = 3x_1 + 2x_2 + 3x_3$$

Subject to the constraints

$$2x_1 + x_2 + x_3 \leq 2; \quad 3x_1 + 4x_2 + 2x_3 \geq 8; \quad x_1, x_2, x_3 \geq 0. \quad [5]$$

5. Show that the dual of the dual of an L.P.P. is the primal. [5]
6. if $X_{12} = 6, X_{23} = 2, x_{24} = 6, x_{31} = 4, X_{33} = 6$ is the degenerate basic feasible solution of the following transportation problem whose unit cost matrix is given below:

		Destinations				
		D ₁	D ₂	D ₃	D ₄	
Origins	O ₁	1	2	3	4	6
	O ₂	4	3	2	0	8 capacity
	O ₃	0	2	2	1	10
		4	6	8	6	
		Requirements				

Check the given basic solution for optimality. If not, determine optimal schedule. [5]

7. Solve the following assignment problem. Machines:

		Machines			
		W	X	Y	Z
Job	A	18	24	28	32
	B	8	13	17	19
	C	10	15	19	22

OR

[5]

Solve the travelling salesman problem with the following cost matrix $[C_{ij}]$ where C_{ij} is the cost, travelling from city i to the city j [5]

		To city			
		1	2	3	4
From city	1	∞	15	30	4
	2	6	∞	4	1
	3	10	15	∞	16
	4	7	18	13	∞

8. Six jobs are performed first on machine X and then on machine Y. The time taken in hours by each job on each machine is given below:

Jobs	A	B	C	D	E	F
Machine X	4	8	3	6	7	5
Machine Y	6	3	7	2	8	4

Determine the Optimal sequence of jobs that minimize the total elapsed time to complete all jobs. [5]

9. The pay-off matrix of a game is as given below:

		Player B		
		1	3	1
Player A	0	-4	-3	
	1	5	-1	

Determine the number of saddle points and the corresponding optimal solutions. Find the best strategy for each player and the value of the game. Is the game fair? [2+2+1]

10. Using the method of Lagrangian multiplier, find the extreme value for the function $f(x, y) = x^2 + y^2$ subject to the constraint $x + 4y = 2$

OR

Obtain the set of Kuhn-Tucker conditions for the following non linear programming problem

$$\text{Max } Z = 2x_1^2 + 2x_1x_2 - 7x_2^2$$

Subject to the constraints

$$2x_1 + 5x_2 < 98$$

$$x_1, x_2 > 0.$$

11. Determine the initial basic feasible solution of the transportation problem given in the above Question No.6 using the Least Cost Entry method. [5]
12. Define r^{th} factorial of x . Find the function whose first difference is, $x^3 + 2x + 9$.

OR

Reduce the difference equation

$$\Delta^2 y_x - 2\Delta y_x = 3$$

to the linear form (involving successive values of dependent variable). Also find its complete solution.

Tribhuvan University, 2069

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

Full Marks:75

Mathematical Statistics (Math.336)

Time: 3 hrs.

Attempt ALL the questions.

Group "A"

3x10=30

1. Define standard deviation. "Standard deviation is the best measure of dispersion." Give reasons to justify this statement.

A computer while calculating the mean and the standard deviation of 25 observations, obtained the following values.

$$\text{Mean} = 56, \text{ standard deviation} = 2.$$

It was later discovered at the time of checking that he had wrongly copied down an observation as 64.

What is the mean and standard deviation if incorrect value is omitted? [1+3+6]

OR

What are raw moment and the central moment? What are the relations between the raw and the central moments? How do the moments use in the measure of skewness and kurtosis?

The standard deviation of a symmetrical distribution is 5. What must be the value of the fourth moment about the mean in order that the distribution is (a) leptokurtic (b) platykurtic? [2+2+2+4]

2. Define correlation coefficient between the two variables. Prove that the correlation coefficient between two variables lies between -1 and +1. What conclusion can be drawn if the correlation coefficient between two variables is 1?

In a partially destroyed laboratory record of an analysis of correlation data, the following results are legible.

$$\text{Regression: } 8x - 10y + 66 = 0$$

$$\text{and } 40x - 18y = 214$$

Find the correlation coefficient between x and y. [1+4+1+4]

3. Give the meaning of conditional probability of an event with an example. What will be the result if the events are independent?

A speaks the truth in 80% of the cases and B in 70% of the cases. In what percentage of the cases are they likely to contradict each other in stating the same fact? [3+1+6]

Group "B"

9x5=45

4. What are the graphs and diagrams? Distinguish between the graphs and diagrams. [2+3]
5. A variable takes the values $a, ar, ar^2, \dots, ar^{n-1}$ each with frequency unity. Find the arithmetic mean and the geometric mean. [5]
6. In two sets of variables x and y with 50 observations each, the following data were observed:

$$\bar{x} = 10, \alpha = 3, \bar{y} = 6, \alpha_y = 2, r = 0.3$$

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

OR

The following are the marks obtained by a group of students in two papers. Calculate the rank correlation coefficient

Eco. 78 36: 82 25 75 63

Stat. 84 51 81 69 52 62 [5]

7. If X is a random variable and a, b are constant. Prove that

(i) $E(aX) = aE(X)$, (ii) $\text{Var}(aX - b) = a^2 \text{Var}(X)$. [2+3]

8. Is the function defined below

$$f(x) = \begin{cases} 2x & 0 \leq x < 1 \\ 0 & 1 \leq x < 2 \\ \text{elsewhere} & \end{cases}$$

is a density function?

Find $P\left(\frac{1}{2} \leq x \leq \frac{3}{2}\right)$ [3+2]

9. The incidence of occupational disease in an industry is such that the workers have a 20% chance of suffering from it. What is the probability that out of six workers exactly 4 will be caught by the disease?

OR

Suppose the number of telephone calls on an operator received from 9.00 to 9.05 A.M. follows a Poisson distribution with mean 3. Find the probability that the operator will receive no calls in that time interval tomorrow. ($e^{-3} = 0.05$)

[5]

10. In a sample of 1000 cases, the mean of a certain test is 14 and standard deviation 2.5. Assuming the normality of the distribution, find the probability that a candidate selected at random will score above 15?

Given: $P(0 \leq z \leq 0.4) = 0.1554$. [5]

11. Fit a straight line trend by the method of least square for the following data:

X:	1	3	4	6	8	9
Y:	1	2	4	4	5	7

[5]

12. What is F - distribution? What are the importance's of F - distribution in Statistics?

[2+3]

OR

A random sample of 500 pineapples was taken from a large consignment and 65 were found to be bad. Show that the standard error of the proportion of bad one's in a sample of this size is 0.015. [5]

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 "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, employee_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.