Mid-Western University (MWU)

Four Years B.Sc.

Course of Study

(VI Semester)

Electronics

Course No.: Phy 461 Semester: VI
Nature of the Course: Theory Credit: 3
Course Objectives:
At the end of the course,the students will able to:

- acquire sufficient knowledge in electronics.
- apply their knowledge to learn major courses.
- solve mathematical problems related to the topics.
- deduce mathematical relations and formulas.

Network: Thevenin Theorem, Norton theorem, Maximum power transfer theorem, Superposition principle, T and Π networks **(4 hours)**

Semiconductor Diodes: p-n junction diode, I-V characteristics, Zener diode and its applications, optoelectronic diodes: LED, photo diodes **(4 hours)**

Bipolar Junction Transistors: PNP and NPN transistors, active and saturation regions, characteristics of BJT, common emitter configuration, input and output characteristics, α and β of a transistor and their interrelation, common base configuration, output characteristics, two port analysis of a transistor, definition of h-parameters, loadline concept, emitter follower, biasing methods, stability factor, low frequency model, comparison of CB, CC and CE amplifiers **(9 hours)**

Field Effect Transistors: Classification of various types of FETs, construction of junction FET, drain characteristics, biasing, operating region, pinch-off voltage, MOSFET: construction of enhancement and depletion type, principle of operation and characteristics **(5 hours)**

Amplifier: Voltage and current gain, principle of feedback, positive and negative feedback, advantages of negative feedback, multistage amplifier, frequency response of a two stage R-C coupled amplifier, gain and band width and their product, operating point of class A, amplifier, analysis of single tuned voltage amplifier, requirement of power amplifiers; Properties of operational and differential amplifiers, CMRR, inverting and non-inverting mode **(9 hours)**

Oscillators: Barkhausen criterion, L-C, Weinbridge, Hartley and Colpitt's oscillators, monostable, bistable and astable multivibrators **(6 hours)**

Digital Circuits: Boolean algebra, OR, AND, NOT, NAND, NOR, Ex-OR, Ex-NOR gates, de-Morgan's theorem, binary number addition, subtraction and multiplication, functional completeness, half adder, full adder, digital comparator, decoder, encoder, multiplexure, RS, D, JK, JKMS flip-flops (8 hours)

Text Books

1) Leach, D. P. and Malvino, A. P.,1995, *Digital Principles and Applications*, McGraw-Hill
2) Malvino, A. P., 1993, *Electronic Principals*, Glencoe/Mcgraw-Hill

References

1) Bhargava, N. N., Kulshreshtha, D. C. and Gupta, S. C., 2006, *Basic Electronics & Linear Circuits*, Tata McGrawHill
2) Bogart, T. F., 1999, *Electronic Devices and Circuits*, Universal Book Stall
3) Boylestad, R. and Nashelsky, L., 2004, *Electronic Devices and Circuit Theory*, Pearson Education
4) Floyd , T. L., 1998, *Digital Fundamentals*, Universal Book Stall
5) Mottershead, A., 1997, *Electronic Circuits and Devices*, Prentice-Hall

6) Streetman, B. G. and Banerjee, S., 2006, *Solid State Electronic Devices*, Prentice Hall
7) Theraja, B. L.2006, *Basic Electronics*, S. Chand & Co. Ltd.
8) Thomas, J. W. N and Susan, A, R., 1996, *Electric Circuits*, Addison Waseley

Physics Practical

Course No.: Phy 462 Semester: VI
Nature of the Course: Practical Credit: 2
The objectives of practical courses is to train students to

- develop proper laboratory skills.
- design basic physics experiments.
- interpret experimental results and draw logical conclusions.
- relate theoretical concepts to practical skills

List of Experiments:
Comparison of Illuminating Powers by a Photometer
Determination of refractive index of sugar solution of different concentrations
To determine the coefficient of viscosity of water by rotating cylinder method
To determine the wavelength and the velocity of ultrasonic waves in a liquid (kerosene oil, xylene, etc.) by studying the diffraction of light through an ultrasonic grating
To evaluate a definite integral by Simpson's 3/8 rule
Wavelength determination from diffraction due to a sharp edge
Wavelength determination using plane diffraction grating
To draw a graph between wave length and minimum deviation for various lines from a Mercury discharge source
Measurement of (a) Specific rotation (b) concentration of sugar solution using polarimeter
Ordinary and extra ordinary refractive indices for calcite or quartz
Determine the velocity of ultrasonic in the Kerosene oil

Solid State Physics

Course No.: Phy 463 Semester: VI
Nature of the Course: Theory Credit: 3
Course Objectives:
At the end of the course,the students will able to:

- acquire comprehensive and in depth knowledge on major topics of Solid state physics.
- apply their knowledge to learn major courses.
- solve mathematical problems related to the topics.
- deduce mathematical relations and formulas.

Crystal Structure
Crystalline and amorphous solids, translational symmetry, elementary ideas about crystal structure, lattice and bases, unit cell, reciprocal lattice, fundamental types of lattices, Miller indices, lattice planes, simple cubic, fcc and bcc lattices, Laue and Bragg equations, determination of crystal structure with X-rays **(10 hours)**

Structure of Solids: Different types of bonding- ionic, covalent, metallic, van der Waals and hydrogen, band theory of solids, periodic potential and Bloch theorem, Kronig-Penny model, energy

band structure, band structure in conductors, direct and indirect semiconductors and insulators **(10 hours)**

Free electron theory: Free electron theory of metals, density of states, Fermi energy, effective mass, drift current, mobility and conductivity, Wiedemann-Franz law, Hall effect **(5 hours)**

Magnetic Properties of Materials: Dia, para and ferro-magnetic properties of solids, Langevin's theory of diamagnetism and paramagnetism, quantum theory of paramagnetism, Curie's law, Ferromagnetism - spontaneous magnetization and domain structure, temperature dependence of spontaneous magnetization, Curie-Weiss law, hysteresis **(5 hours)**

Lattice Vibrations: Elastic and atomic force constants, dynamics of a chain of similar atoms and chain of two types of atoms, optical and acoustic modes, interaction of light with ionic crystals, Einstein's and Debye's theories of specific heats of solids **(5 hours)**

Superconductivity: Introduction (Kamerlingh-Onnes experiment), effect of magnetic field, Type-I and type-II superconductors, Isotope effect, Meissner effect, heat capacity, energy gap, high-Tc superconductors **(7 hours)**

Text Books

1) Kittel, C., 2005, Introduction to Solid State Physics, Wiley
2) Kachhava, C. M., 2003, Solid State Physics, Tata McGraw Hill Publishing co Ltd

References

1) Elliott, R. J. and Gibson, A. F., 1974, An Introduction to Solid State Physics and its Applications, Macmillan Publishers Limited
2) Hall, H. E., 1979, Solid State Physics, ELBS Publication
3) Keer, H. V., 1968, Principle of Solid State, Wiley Eastern Ltd.
4) Phillips, P. , 2002, Advanced Solid State Physics, Westview Press
5) Pillai, S. O., 2010, Solid State Physics, New Age Science
6) Saxena, B. S., Gupta, R. C. and Saxena, P. N., 2000, Fundamentals of Solid State Physics, Pragati Pakashan
7) Singhal, R. L., 2001, *Solid State Physics*, Kedar Nath Ram Nath Publishing Co.
8) Snoke, D. W., 2009, Solid State Physics: Essential Concepts, Addison-Wesley
9) Wahab, M. A., 2005, Solid State Physics: Structure and Properties of Materials, Alpha Science International

Physics Practical

Course No.: Phy 464 Semester: VI
Nature of the Course: Practical Credit: 2
The objectives of practical courses is to train students to

- develop proper laboratory skills.
- design basic physics experiments.
- interpret experimental results and draw logical conclusions.
- relate theoretical concepts to practical skills

List of Experiments:
Study double slit interference by He-Ne laser
Determine the diameter of a wire using (He-Ne Laser) diffraction method
Thickness of a paper using interference fringes in an air wedge
Liquid Lens –Refractive index of a liquid and material of the lens with mercury
Liquid Lens –Refractive index of a liquid and material of the lens with another liquid of known refractive index
To draw common base and common emitter characteristics of a transistor and calculate transistor characteristics parameters
Determination of surface tension of water by capillary rise method
To solve a Differential Equation by Euler's method
Study of voltage doubler
Verification of inverse square law by photo-cell

Advanced Chemistry III

Course No.: Chem 461 Semester: VI
Nature of the Course: Theory Credit: 3
The aims of the course are to enable students to:

- acquire basic knowledge about cement,glass and paper.
- understand the fundamental concepts of organic synthesis and oxidants and reductants used in organic chemistry.
- gain knowledge about the preparation,structure and bonding of phosphrous,sulphur and nitrogen compounds.
- basic knowledge about Lanthanide,Actinide elements.
- gain knowledge about photochemical reactions and their kinetics.

Physical Chemistry

Unit 1: Spectroscopy
Electromagnetic radiation; Origin of molecular spectra; Classification of molecular spectra; Rotational Spectrum**:** Microwave spectrum; Application of rotational spectra; Qualitative description of non-rigid rotor; Vibrational spectrum: Infrared spectrum; Vibrational spectrum; Effect of anharmonic motion; Idea of vibrational frequency of different functional groups; Raman Spectrum: Concept of polarizibility; Pure rotational and pure vibrational; Raman spectra of diatomic molecules; Electronic Spectrum: Electronic transition; Frank Condon principles; Application of electronic Spectroscopy. **9 hrs**

Unit II: Chemical Kinetics
Energy of activation; Theories of reaction rates; Collision theory of bimolecular and unimolecular reactions; Transition state theory; chain reaction; Kinetics of the following photochemical reactions: (a) hydrogen and chlorine (b) hydrogen and bromine. **6 hrs**

Inorganic Chemistry

Unit III: Lanthanides and Actinides
Electronic structure; Oxidation; states; Separation of the lanthanide elements; Color and spectra; magnetic properties; Lanthanide contraction. **3 hrs**

Unit IV: Cement; Glass and Paper
Inorganic cementing materials; Lime and its manufacture; Gytpsum; Cement and its types; Chemical composition; Manufacture of Portland cement; Setting and harderning of Portland cement; Heat of hydration of cement; Special cement; Concrete and RCC; Decay of concrete.
Glass and ceramics; Manufacture of glass; Varieties of glasses; White wares; Glazing; Earthenwares and stonewares; Optical fibres.
Pulp and paper; Manufacture of pulp; Sulphate or Kraft pulp; Soda pulp; Rag pulp; Beating; refining; filling; sizing and colouring; Manufacture of paper; Nepali paper. **5 hrs**

Unit V: Compounds of Phophorous,oxygen, Sulphur and Nitrogen
Preparation; properties; Bonding and structure of the following:- Oxides and oxyacids of phosphorous; ozone; sodium thiosulphate; peracids of sulphur; potassium permanganate; potassium dichromate. hydrazine; hydroxylamine; hydrazoic acid; hydrogen peroxide. **7 hrs**

Unit VI: Principle of Organic Synthesis
Retrosynthetic analysis; Synthon; retron and transform; Synthesis of organic molecules via disconnection approach; Linear vs convergent synthesis; Use of protecting groups; activating group and bridging elements; Stereospecific and regiospecific control elements.

Basic principle of combinatorial chemistry with examples; Principle of Green chemistry and its synthetic applications. **7 hrs**

Unit VII: Oxidation and Reduction

Catalytic hydrogenation; Dissolving metal reductions; Reduction with metal hydrides; Reduction with hydrazines; Oxidation with Cr (IV) and Mn (VII) reagents; Oxidation with peracids; lead tetra acetate; selenium dioxide and DMSO with oxalyl chloride. **8 hrs**

Suggested Books

1. K. N. Ghimire and D. Wagle, **Essential of Physical Chemistry for B.Sc. level,** Dikshant Prakashan, Kirtipur, 2010.
2. S. H. Maron; C. Prutton; **Principles of Physical Chemistry;** Oxford and IBH Publication and Co.; 1992.
3. F. Daniels; R. F. Alberty; **Physical Chemistry**; John Wiley & Sons; Latest Edition.
4. Gilbert. W. Castellan; **Physical Chemistry**; Narosa Publishing House; 1985.
5. J.D. Lee; **Concise Inorganic Chemistry**; 5th Edition; John Wiley and sons. Inc.; 2007.
6. F.A. Cotton; G. Wilkinson; C. Gaus**; Basic Inorganic Chemistry**; John Wiley & Sons (Asia) Pvt. Ltd.; 2007.
7. D. F. Shriver; P. W. Atkins; **Inorganic Chemistry**; W. H. Freeman and Co.; London; 1999.
8. R. T. Morrison; R. N. Boyd; **Organic Chemistry**; Prentice- Hall of India Pvt. Ltd.; 2008.
9. John McMurry; **Introduction to Organic Chemistry**; Brookes/Cole; 2007.
10. J. S. H. Pine; **Organic Chemistry**; McGraw Hill International Edition Series; New York; USA; 1987.
11. T. W. G. Solomons; **Organic Chemistry**; John Wiley and sons; 1996.
12. I. .L. Finar, **Organic Chemistry**, Vol. I and Vol. II, Prentice Hall, London, 1995, (available recent edition).
13. R.M. Silverstein, G.L. Bassler & T.C. Morril**, Spectrometric Identification of Organic Compounds**, Wiley, New York, 1981, (Preferably available recent edition).
14. House, **Modem Synthesis Reactions**, 2nd Edition, W.A. Benjamin, New York, 1972.
15. K.L. Kapoor, **Text book of Physical Chemistry**, Macmillan India Ltd., Vol. I to Vol. V, 3rd edition, 2001.
16. Alberty, **Physical Chemistry**, 6th Edition, Wiley Eastern Ltd., New Delhi, 1992.
17. S. Glasstone & D. Lewis, **Elements of Physical Chemistry, Mcmillan & Co. Ltd.**
18. James, E. Huheey, Ellen A. Keiter, Richard L. Keiter, **Inorganic Chemistry: Principles of Structure and Reactivity**, Addison Wesley Publishing House.
19. James, E. Huheey, Ellen A. Keiter, Richard L. Keiter, **Inorganic Chemistry: Principles of Structure and Reactivity,** Addison Wesley Publishing House.

Advanced Chemistry Lab III

Course No.: Chem 462 Semester: VI
Nature of the Course: Practical Credit: 2

The aims of the course are to enable students to:

- develop skills on the experiments related adsoption isotherms.
- develop skills on ion exchange chromatography.
- develop skills on inorganic and organic preparations and their characterization.
- develop skills on isolation of natural products.
- develop skills on observation; recording and interpretation of an experiment.

List of Experiments

1. Verification of Freundlich and Langmuir adsorption isotherms.
2. Verification of Lambert Beer law and determination of concentration of a solution.
3. Qualitative analysis of some inorganic anions and cations by paper chromatography.
4. Separation of metal ions from mixture from ion exchange chromatography.
5. Preparation of potassium trioxalatoferrate (III) trihydrate and measurements of its conductivity.
6. Estimation of amount of iron in potassium trioxalatoferrate (III) trihydrate prepared.
7. Isolation of lactose from milk.
8. Isolation of caffeine from tea.
9. Isolation of camphor from eucalyptus leaves.
10. Two or three steps organic synthesis; (Two experiments).
11. Analysis of sample of cement.

Suggested Books

1. A. I. Vogel; **A Text Book of Qualitative Inorganic Analysis**; ELBS & Longman; Latest edition.
2. A. I. Vogel; **A Text Book of Practical Organic Chemistry; Including Qualitative Organic Analysis**; Longman; Latest edition.
3. B. P. Levitt; ed. **Findlay's Practical Physical Chemistry**; Longman; London; 1973.
4. J. N. Gurtu; R. Kapoor; **Advanced Experimental Chemistry** (Vol I-III); S. Chand & Co.; New Delhi; India.
5. B. D. Khosla; A. Guali; V. C. Garg; **Senior Practical Physical Chemistry**; S. Chand & Co.; New Delhi; 1987.
6. S. K. Agrawal; Keemti Lal; **Advanced Inorganic Chemistry**; Pragati Prakasan; Meerut; India.
7. L. Shriner; R. C. Fusion; D.Y. Cartin; **The Systematic Identification of Organic Compounds; A Laboratory Manual**; John Wiley and sons Inc. New York; Latest edition.
8. F. G. Mann; B. N. Saunders; **Practical Organic Chemistry**; Orient Longman; Latest edition.
9. Moti Kaji Sthapit; R. R. Pradhananga; **Experimental Physical Chemistry**; Taleju Prakasan; Kathmandu; 1998.
10. K. N. Ghimire; M. R. Pokhrel K. P. Bohara**; University Experimental Inorganic Chemistry**; Quest Publication; Kirtipur; Kathmandu; 2008.
11. N. M. Khadka; S. D. Gautam; P. N. Yadav**; A Core Experimental Chemistry for B.Sc.**; Benchmark Education Support Pvt Ltd; Kathmandu; Nepal.
12. K. N. Ghimire; K. P. Bohara; **University Experimental Physical Chemistry**; Quest Publication; Kirtipur; Kathmandu; 2008.

Advanced Chemistry IV

Course No.: Chem 463 Semester: VI
Nature of the Course: Theory Credit: 3
The aims of the course are to enable students to:

- develope interest on coordination chemistry.
- acheive basic knowledge on bioinorganic chemistry.
- gain concept about retrosynthetic analysis.
- understand the concept of thermodynamics and its significance.

Physical Chemistry

Unit I: Second Law of Thermodynamics and its Applications

Second law of thermodynamics; Limitations of the first law and the need for the second law; Formulation of the second law on the basis of Carnot cycle; Thermodynamic principle of the working of refrigerator.

Entropy: Entropy change in isolated system; Dependence of entropy on volume temperature; and pressure; Entropy change in ideal gas; Free energy and free enegy change for a reaction; Properties and significance of ΔG; Criteria of spontaneity; Changes in S; G and A as criterea for spontaneous change; Evaluation of ΔG and ΔS for the mixing; Maxwell's equation and themodynamic equation of state; Gibbs-Helmholtz equation; Reaction isotherms; Clapeyron equation; Clausius-Clapeyron equation; Thermodynamics of equilibrium constant; Kp and Kc for gaseous system; Properties of equilibrium constant; Thermodynamic criteria of equilibria; Third law of thermodynamics and its significance. **15 hrs**

Inorganic Chemistry

Unit II: Coordination Chemistry

Stability of coordination compounds; kinetic and thermodynamic stability; inert and labile complexes; bonding and application of coordination compounds; effective atomic number and its limitations; valence bond theory; inner orbital and outer orbital complexes; crystal field theory; crystal field splitting energy; crystal field stabilization energy; spectrochemical series; chelate complexes and their importance in analytical works and biological systems; magnetic properties of coordination compounds; characterization of coordination complexes; stereochemistry of complexes with coordination number 4 (square planner and tetrahedral); coordination number 6 substitution reaction in octahedral complexes; dissociation mechanism; associative mechanism; Trans effect; electron transfer reaction. **11 hrs**

Unit III: Bio-inorganic Chemistry

Roles of metals in biological systems; Essential and trace elements in biological systems; Metals and its complex as therapeutic agents; Biological roles of alkali and alkaline earth metals; Metalloporphyrins (haemoglobin and myoglobin); Study of Fe in biological systems (oxygen carrier and electron transfer). **4 hrs**

Organic Chemistry

Unit IV: Carbon-Carbon Bond Forming Reactions

Alkylation of active methylene group; Halogenation; Aldol condensation and related reactions; Acylation at carbon; Diels-Alder reaction and synthesis of cyclic compounds. **12 hrs**

Unit V: Representative Synthesis

Synthesis of Caryophylene and Longofoline from the perspective of retrosynthetic analysis. **3 hrs**

Suggested Books

1. K. N. Ghimire and D. Wagle, **Essential of Physical Chemistry for B.Sc. level,** Dikshant Prakashan, Kirtipur, 2010.
2. S. H. Maron; C. Prutton; **Principles of Physical Chemistry;** Oxford and IBH Publication and Co.; 1992.
3. F. Daniels; R. F. Alberty; **Physical Chemistry**; John Wiley & Sons; Latest Edition.
4. Gilbert. W. Castellan; **Physical Chemistry**; Narosa Publishing House; 1985.
5. J.D. Lee; **Concise Inorganic Chemistry**; 5th Edition; John Wiley and sons. Inc.; 2007.
6. F.A. Cotton; G. Wilkinson; C. Gaus**; Basic Inorganic Chemistry**; John Wiley & Sons (Asia) Pvt. Ltd.; 2007.
7. D. F. Shriver; P. W. Atkins; **Inorganic Chemistry**; W. H. Freeman and Co.; London; 1999.
8. R. T. Morrison; R. N. Boyd; **Organic Chemistry**; Prentice- Hall of India Pvt. Ltd.; 2008.
9. John McMurry; **Introduction to Organic Chemistry**; Brookes/Cole; 2007.
10. J. S. H. Pine; **Organic Chemistry**; McGraw Hill International Edition Series; New York; USA; 1987.
11. T. W. G. Solomons; **Organic Chemistry**; John Wiley and sons; 1996.
12. I. .L. Finar, **Organic Chemistry**, Vol. I and Vol. II, Prentice Hall, London, 1995, (available recent edition).
13. R.M. Silverstein, G.L. Bassler & T.C. Morril**, Spectrometric Identification of Organic Compounds**, Wiley, New York, 1981, (Preferably available recent edition).
14. House, **Modem Synthesis Reactions**, 2nd Edition, W.A. Benjamin, New York, 1972.
15. K.L. Kapoor, **Text book of Physical Chemistry**, Macmillan India Ltd., Vol. I to Vol. V, 3rd edition, 2001.
16. Alberty, **Physical Chemistry**, 6th Edition, Wiley Eastern Ltd., New Delhi, 1992.
17. S. Glasstone & D. Lewis, **Elements of Physical Chemistry, Mcmillan & Co. Ltd.**
18. James, E. Huheey, Ellen A. Keiter, Richard L. Keiter, **Inorganic Chemistry: Principles of Structure and Reactivity**, Addison Wesley Publishing House.
19. James, E. Huheey, Ellen A. Keiter, Richard L. Keiter, **Inorganic Chemistry: Principles of Structure and Reactivity,** Addison Wesley Publishing House.

Advanced Chemistry Lab IV

Course No.: Chem 464 Semester: VI
Nature of the Course: Practical Credit: 2

The aims of the course are to enable students to:

- develop skills on the experiments related chemical kinetics.
- develop skills on gravimetric inorganic analysis.
- develop skills on quantitative organic analysis.
- develop skills on obvervation; recording and interpretation of an experiment.

List of Experiments

1. Determination of activation energy for acid catalyzed hydrolysis of methyl acetate.
2. Determination of rate constant of hydrolysis of ethyl acetate by sodium hydroxide.
3. Gravimetric analysis of Ni as dimethyl glyoxime.
4. Gravimetric analysis of magnesium as magnesium ammonium phosphate and pyrophosphate.
5. Gravimetric analysis of aluminum as oxinate.
6. Quantitative analysis of nitrogen in an organic compound.
7. Quantitative analysis of sulphur in an organic compound.
8. Quantitative analysis of glucose.
9. Quantitative analysis of -OH group.
10. Quantitative analysis of amino acid.

Suggested Books

1. A. I. Vogel; **A Text Book of Qualitative Inorganic Analysis**; ELBS & Longman; Latest edition.
2. A. I. Vogel; **A Text Book of Practical Organic Chemistry; Including Qualitative Organic Analysis**; Longman; Latest edition.
3. B. P. Levitt; ed. **Findlay's Practical Physical Chemistry**; Longman; London; 1973.
4. J. N. Gurtu; R. Kapoor; **Advanced Experimental Chemistry** (Vol I-III); S. Chand & Co.; New Delhi; India.
5. B. D. Khosla; A. Guali; V. C. Garg; **Senior Practical Physical Chemistry**; S. Chand & Co.; New Delhi; 1987.
6. S. K. Agrawal; Keemti Lal; **Advanced Inorganic Chemistry**; Pragati Prakasan; Meerut; India.
7. L. Shriner; R. C. Fusion; D.Y. Cartin; **The Systematic Identification of Organic Compounds; A Laboratory Manual**; John Wiley and sons Inc. New York; Latest edition.
8. F. G. Mann; B. N. Saunders; **Practical Organic Chemistry**; Orient Longman; Latest edition.
9. Moti Kaji Sthapit; R. R. Pradhananga; **Experimental Physical Chemistry**; Taleju Prakasan; Kathmandu; 1998.
10. K. N. Ghimire; M. R. Pokhrel K. P. Bohara**; University Experimental Inorganic Chemistry**; Quest Publication; Kirtipur; Kathmandu; 2008.
11. N. M. Khadka; S. D. Gautam; P. N. Yadav**; A Core Experimental Chemistry for B.Sc.**; Benchmark Education Support Pvt Ltd; Kathmandu; Nepal.
12. K. N. Ghimire; K. P. Bohara; **University Experimental Physical Chemistry**; Quest Publication; Kirtipur; Kathmandu; 2008.

Ethnobotany and Economic Botany

Course No.: Bot. 461 Semester: VI
Nature of the Course: Theory Credit: 3
Course objectives:
At the end of this course the students are able to:

- know the concept, origin, distribution of agriculture and impact of plant resources on human civilization.
- understand objective, scope, methods and approaches of ethnobotanical study.
- understand the application of ethnobotany for conservation of biodiversity.

Unit 1 Economic Botany

Impact of plant resources on human civilisation and national economy **1 Hrs**
Origin of Agriculture: Early sites of agriculture (The Near East, The Far East, The New World) Characteristics of origin **2 Hrs**
Introduction, origin, distribution, description, wild relatives, cultivation and utilisation of the following plants and plant products –cereals (Rice, Maize), pulses (Black gram, Pigeon pea), oil seed (mustard, soya bean), fruits (citrus, mango), fibers (cotton, jute), cash crops (sugarcane, tea) **15 Hrs**
General account of the important vegetables, spices and medicinal plants and aromatic plants **5 Hrs**

Unit 2: Ethnobotany

History, concept, scope and objective of ethnobotany as an interdisciplinary science, methods and approaches of ethnobotanical study **7Hrs**
Branches of ethnobotany (Ethnoecology, Ethnobiology, Ethnopharmacology, Medical ethnobotany) **5Hrs**
Traditional knowledge and biodiversity (Cultural diversity and biological diversity; traditional conservation strategies and methods) **4Hrs**
Indigenous knowledge and intellectual property rights **3Hrs**
Application of ethnobotany for conservation and community development: lesson learnt from case studies in Nepal and India. **3Hrs**

Text Books and Reference Books

Bhatt, D.D. 1970. Natural History and Economic Botany of Nepal. HMG publication.

Hill. A. F. 1952. Economic Botany. TatMcGraw Hill.

Jain, S. K. 1995. Manual of Ethnobotany. Scientific publishers, Jodhpur, India.

Martin, G. 1995. *Ethnobotany: A Method Manual*. WWF International, UNESCO, Royal Botanical Garden, Kew, UK.

Cunningham, A.B. 2001. *Applied Ethnobotany: people, wild plant use and conservation.* Earthscan Publication Ltd. London and /Sterling, VA.

Manandhar, N.P. 2002. Plants and People of Nepal. Timber Press, Oregon, USA.

Mueller-Boeker, U. 1999. *The Chitwan Tharus in Southern Nepal: an ethnoecological approach*. Nepal Research Centre Publication No. 21. Franz Steiner Verlag, Stuttgart, Germany.

Shrestha, K.K., P.K. Jha, P. Shengji, A. Rastogi, S. Rajbhandary and M. Joshi (eds.), 1998. *Ethnobotany for conservation and community development*. Ethnobotanical Society of Nepal, Kathmandu. 176 pp.

Rajbhandari, K.R. 2001. *Ethnobotany of Nepal*. Ethno-botanical Society of Nepal (ESON), Kathmandu, Nepal.

Balick, M.J. and Cox, P.A. 1996. *Plants, People and Culture: The Science of Ethnobotany.* Scientific American Library, New York. Pp. 229.

Ethnobotany and Economic Botany

Course No.: Bot. 462 Semester: VI
Nature of the Course: Practical Credit: 2

Course objective:

- Students are able to collect, preserve, identify different ethnobotanically important plants and can prepare a report.

List of Experiments:

1. Collection, preservation, identification and submission of economically and ethno-botanically important plants.
2. Study of living and preserved plant species used for different purpose: medicinal, ornamental, fibre yielding plants, rattans, food, cultural ceremonies, ecological restoration, etc. (Taxonomy, distribution, properties, vernacular names, and ethnobotanical use).
3. Study of economic plants species and its wild relatives and plant product through herbarium and museum specimens. (Taxonomy, distribution, properties, vernacular names, and ethnobotanical use).
4. Practical assignment of ethno-botanical study of a nearby area or selected ethnic community with the application of Rapid Rural Appraisal (RRA) and submission of field report.
5. Proposal writing, questionnaire development and presentation.
6. Prepare and submit a mini-dissertation report.

Microbiology

Course No.: Bot.463 Semester: VI
Nature of the Course: Theory Credit: 3
Course objectives:

- To know the characteristics, classification, distribution and different techniques of microbial culture.
- To understand importance of biological nitrogen fixation and plant microbe interactions.
- Enable to know the cultivation techniques of edible mushrooms.

Unit 1. Introduction to Microbiology: 10 hrs
(i) Scope and history of microbiology (ii) Characteristics of microorganism: morphological, cultural, chemical, ecological, genetic (ii) Microbial classification, nomenclature and identification (iii) Techniques of pure culture (iv) Distribution of microbes in nature: soil, water, air, food products and human body (v) Introduction to phyllosphere and rhizosphere (vii) Role of microbes in nitrogen and carbon cycle.

Unit 2. Bacteria: 7 hrs
(i) Morphology and structure: size, shape and arrangement of bacterial cell (ii) Structures and composition of cell wall (iii) External structure: flagella and motility, pili, capsule, sheath (iv) Reproduction (iv) Method of isolation (vi) Nutritional and Physico-chemical requirements of growth (vii) Economic importance

Unit 3. Virus, Lichen, protozoa, Algae: 8 hrs
Virus: nature of virus, morphology and types, viral multiplication, importance; **Lichen:** morphology, reproduction and symbiotic nature; **Protozoa:** occurrence, morphology, reproduction, and importance; **Algae:** morphology, algal pigments, motility and reproduction, production of algal biomass.

Unit 4. Fungi: 7hrs
(i) Basic concept on: occurrence, morphology, physiology and reproduction; Economic importance of fungi (ii) Concept of single cell protein; production of yeast biomass (iii) Mushrooms culture: nutritional value; strain preparation; spawn preparation and cultivation techniques of edible mushrooms (*Pleurotus, Agaricus*).

Unit 5. Microbial Application: 13 hrs
(i) Fermentation (ii) Concept of primary and secondary metabolites (iii) Vitamins: Microorganism and process of vitamins production (iv) Alcohol: Microorganism, fermentation process and substrate (v) Antibiotics: nature, media and fermentation process of antibiotics (vi) Biological nitrogen fixation: symbiotic and non-symbiotic (vi) Biofertilizer and green manure (vii) Micorrhhiza: concept and types (viii) Biological control of plant pathogen, insect pest and weeds (ix) Biofuel-Bioethanol: Concept, production process on non-food based feedstock (x) Bioremediation.

Text Book:
Dubey, R. C. A Textbook of Biotechnology. S. Chand and Company Ltd. Ramnagar, New Delhi.
Sharma, P. D. The Fungi. Rastogi Publication, India. 1998.

References
Bold, H. D. and M. J. Wynne. Introduction to the Algae. Structure and Reproduction, Pretence-Hall, Englewood Cliffes, N.J. 1978.

Booth, C.. Methods in Microbiology, Vol. 4. Academic Press Inc. (London) Ltd., London 1971.

Hughes, S. S. The Virus: A History of Concept, Science History Publication, New York 1977.

Kathleen, P. T., Barry, C., Foundation of Microbiology. McGraw-Hill Science. Eighth Edition.

Miles, P.G. & S.T. Chang. 2004. Mushroom: Cultivation, Nutritional Value, Medicinal Effects and Environmental Impacts. CRC Press, Florida.

Moat, A. G. Microbial Physiology, Wiley New York, 1979.

Pleasere J. M, Chan E. C.S., Krieg, N. R. Microbiology. Tata McGraw-Hill Publishing Company Limited.

Pyatkin, K. Krivoshein. Microbiology. MIR Publishing Moscow.

Wesley, A. V., Brown, J. Basic Microbiology. Addison Wesley Publishing Company; 8 Sub edition. 1997.

Microbiology

Course No.: Bot. 464 Semester: VI
Nature of the Course: Practical Credit: 2
Course objectives:

- Students are able to handle different laboratory instrument.
- Students are able to prepare different media.
- Students are able to know the cultivation technique of mushrooms.

List of experiment:

1. Study of Basic tools of microbiology (Autoclave, Laminar flow, Incubator and Hot air oven)
2. Preparation of basic liquid media (broth)
3. Preparation of basic solid media (PDA) and agar slant
4. Method of obtaining pure-cultures of microorganism
5. Simple Staining of Bacteria, Negative Staining of Bacteria, Gram Staining of Bacteria
6. Lacto phenol cotton blue mounting of fungi
7. Isolation and tissue culture of edible mushroom
8. Mushroom spawns preparation and cultivation techniques
9. Morphological study of different kinds of lichen.
10. Study of permanent slides of protozoa and chlamydomonas
11. Compost preparation by vermicomposting
12. Alcohol fermentation
13. Isolation of fungi from air
14. Isolation of cynobacteria (blue green algae) from paddy fields
15. Isolation of *Rhizobium* from soyabean rood nodule.
16. Isolation of fungi from rhizosphere by soil dilution method.

Comparative Anatomy & Physiology

Course No.: Zool 461 Semester: VI
Nature of the Course: Theory Credit: 3

Course Objectives:
At the end of course,the students will able to:

- know the comparative anatomy of some structures in different classes of Vertebrates.
- explain the functional processes : Digestion, Respiration, Circulation, Excretion in the Chordata with reference to man.

Comparative Anatomy: Characteristics of Integuments, brain and heart in Vertebrates (Fishes, Amphibians, Reptiles, Birds and Mammals). **12 Pds.**

Physiology (with reference to man):
Physiology of digestion: Composition, function and regulation of Salivary, Gastric, Pancreatic, Bile and Intestinal fluid.
Physiology of respiration: Dead space. Tidal volume.Transport of O2 and CO2. Bohr's effect.
Physiology of circulation: Composition of blood and lymph. Structure and function of heart. Origin and conduction of heart beat. Blood Pressure. Heart stroke and preventive measures. Electrocardiogram(ECG). Magnetic Resonance Imaging (MRI).
Physiology of excretion: Nephron and regulation of urine formation. Osmo-regulation and excretory products. Renal failure and Dialysis.
Neuron: Nerve impulse- its conduction and synaptic transmission. Parkinson disease.

33Pds.

References:
Rostogi, S.C., Text Book of Physiology, Willey Eastern Ltd.
Yapp, W.B., An Introduction to Animal Physiology, Oxford at the Clarenden Press 1970.

Comparative Anatomy & Physiology

Course No.: Zool 462 Semester: VI
Nature of the Course: Practical Credit: 2

Course Objectives: To support in understanding the theory part.

Comparative study of Integuments, brain and heart in Vertebrates (Fishes, Amphibians, Reptiles, Birds and Mammals) by preserved specimens or by preparing.
Test for Salivary Amylase enzyme.
Measurement of blood pressure. Estimation of Haemoglobin. Enumeration of RBC and WBC by Haemocytometer.
Estimation of urea, sugar, protein in urine.
Study of knee-jerk reflex in man.

Practical note book preparation as regular study.

Endocrinology and Biochemistry

Course No.: Zool 463 Semester: VI
Nature of the Course: Theory Credit: 3

Course Objectives:
At the end of course,the students will able to:

- understand carbon compounds and the reactions they undergo in living organisms,
- understand chemical composition, metabolism, morphological structure, biological functions and changes that occur in the living material.

Endocrinology: Structure and function of Vertebrate endocrine glands (with reference to man): Pituitary, Thyroid and Parathyroid, Adrenal, Pancreatic and Gonadial types. **12 Pds.**

Biochemistry: Introduction and importance of Biochemistry. Biochemical composition of living organisms. Role of water in biological systems. Introduction and importance of Bioenergetics. Classification, types and functions of Carbohydrates, Lipids, Amino Acids and Proteins, Vitamins and Minerals. Enzymes, Cofactors and Coenzymes. Factors influencing enzyme activity. Glycolysis, Citric Acid Cycle. Chemical nature of hormones. **30 Pds.**
Instrumentation: Concept of Colorimetry, Electrophoresis and Chromatography. **3Pds.**

Books:
Powar, C.B. and Chatwal, G.R., Biochemistry , Himalaya Publishing House, Mumbai , New ed.
Satyanarayan, U.,Biochemistry, Books and Allied (P) Ltd., Kolkata, India

Biochemistry

Course No.: Zool 464 Semester: VI
Nature of the Course: Practical Credit: 2

Course Objectives: To support in understanding the theory part.

Tests for carbohydrates: Mollisch's test, Benedict's test and Iodine test.
Tests for protein: Protein precipitation, Biuret reaction Ninhydrin reaction.
Tests for lipids: Solubility test, Saponification and Dunstan's test.
Measure the DO of given simple water.
Use of Paper Chromatography and demonstration of Electrophoresis.

Practical note book preparation as regular study.

Design of Experiments

Course No.: Stat 461 Semester: VI
Nature of the Course: Theory Credit: 3

Course Objective: To familiarize students with various experimental designs that generates experimental data and analysis of such data.

Analysis of Variance and Design of Experiments (6 Lhr)

Two way of analysis of variance, introduce concept of linear models in ANOVA, statement of Cochran theorem, two way classification (1 and m observation per cell) in fixed effect model, needs for experiments in scientific inquiries, basic terminologies of experimental designs, basic principles of experimental designs

Completely Randomized Design (CRD) (10 Lhr)

Statistical analysis of CRD, expectation of sum of squares, ANOVA table, advantages and disadvantages, ANACOVA for one way layout in CRD.

Randomized Block Design (RBD) (10 Lhr)

Statistical analysis of RBD for one observation per experimental unit, expectation of sum of squares, ANOVA table, efficiency of RBD relative to CRD, estimations of missing value (one observation only), advantages and disadvantages of RBD.

Latin Square Design (LSD) (8 Lhr)

Statistical analysis of $m \times m$ LSD for one observation per experimental unit, expectation of sum of squares, ANOVA table, estimation of missing value in LSD (one observation only), relative efficiency of LSD compared to RBD, advantages and disadvantages, Greco-LSD and its analysis

Factorial Designs (8 Lhr)

Factorial experiments, basic terminologies and principles, 2^2, 2^3, 3^2 designs, Yates method of computing factorial effect totals, confounding in 2^3 factorial design
Problems and examples

Overall review and discussion (3 Lhr)

Reference Books:

1. Montgomery, D. C.(2001): 5th edition, Design and Analysis of Experiments, John Wiley and Sons.
2. Kapoor, V.K. and Gupta, S.(1993): Applied Statistics, S. Chand, new Delhi, India.
3. Das M.N, & Giri N.C., (1986): Design and Analysis of Experiments, New Age International, New Delhi, India

Practical for Design of Experiments

Course No.: Stat 462 Semester: VI
Nature of the Course: Practical Credit: 2

Pre-requisites: Knowledge of the topics in design of experiments, and the laboratory with well equipped computer facility should be arranged

Objectives: The main objective of this course is to make students able to apply techniques in experimental designs and analyze experimental data in different scenario.

Titles of the Experiments

Sr. No.	Title of the experiment	No. of exp.
1	Problems related to two way ANOVA with one observation and m observations per cell	2
2	Problems related to CRD	1
	Problems related to RBD	2
	Problems related to LSD	3
3.	Factorial experiments (2^2, 2^3, 3^2), confounding in 2^3	5
	Total number of experiments	13

Statistical Modeling-I

Course No.: Stat 463 Semester: VI
Nature of the Course: Theory Credit: 3

Objectives: To make students familiarize and capable of building basic linear and nonlinear statistical models for linking and assessing associations and relationships between variables.

Introduction (2 Lhr)
Deterministic and stochastic models, correlation and regression as tools for statistical modeling, statistical models in linkage phenomena, impact assessments and forecasting, use of statistical models in econometric, bio-statistical, environmental health, epidemiological, etc. analyses. Role of statistical software packages.

Measures of Association (10Lhr)
Measuring association in quantitative data: Karl Pearson correlation coefficient, simple, multiple and partial correlations (up to three variables), unadjusted and adjusted coefficient of determinations.

Measuring association in ranked data: Spearman correlation coefficient, Kendall's tau correlation coefficient, their uses.

Measuring association for categorical data (attributes): Contingency coefficient, Yule's coefficient of association and Yule's coefficient of colligation.

Problems and examples

Regression Models (22 Lhr)
Dependent (response) and independent (explanatory) variables, linearity in variables and parameters, population and sample regression functions, cross-sectional and time series models.

Simple linear regression models: Model specification, assumptions, ordinary least squares (OLS) and maximum likelihood (MLE) methods, derivation of parameter estimates and their interpretations, fitted regression model and its graphical representation, standard error of estimates, properties of OLS estimators and Gauss-Markov theorem, prediction of new observations.

Multiple linear regression models: Three variable linear regression model, derivation of OLS and maximum likelihood estimates, partial regression coefficients and their interpretations, testing significance of regression coefficients, meaning and interpretation of p values, interval estimation of parameters and mean response,

Nonlinear regression models: Data transformations and functional forms of regression models, log-linear model and measurement of elasticity, semi-log models and measurement of growth rate, reciprocal model, logistic growth model, polynomial regression model (up to three variables), Cobb-Douglas production function and its application in econometric analysis.

Goodness of fit tests (for all above regression models): Overall goodness of fit test by coefficient of determination (unadjusted and adjusted R^2) and analysis of variance, probability and quantile plots (P-P and Q-Q plots) for assessing normality, detection and consequences of outliers, choice between linear and nonlinear models.

Problems and examples

Models with categorical (indicator) variables **(8 Lhr)**

Nature of categorical (qualitative) variables and their impacts on regression models, examples of use of such variables in modeling.

Regression with categorical independent variables: linear models with quantitative and qualitative independent variables, use of dummy variables in regression models.

Regression with categorical dependent variable: Concept, specification and application of binary logistic model (without derivations).

Problems and examples

Review and discussion of overall course **(3 Lhr)**

Reference Books:

1. Montgomery, D. C., Perk, E. A. and Vining, G. G. (2003) Introduction to Linear Regression Analysis, Third edition, John Wiley and Sons, Inc., Singapore.
2. Drapper, N. R. and Smith, H. (1998) Applied Regression Analysis, Third edition, Wiley, New York.
3. Gujarati, D. N. (1995) Basic Econometrics, Third Edition, McGraw-Hill, Inc., New Delhi.
4. Maddala, G.S (2002) Econometrics, Third Edition, John Wiley and Sons, Singapore.

Practical for Statistical Modeling-I

Course No.: Stat 464 Semester: VI
Nature of the Course: Practical Credit: 2

Pre-requisites: Knowledge of the topics in correlation and regression analysis, and the laboratory with well equipped computer facility should be arranged.

Objectives: The main objective of this course is to make students able to build statistical models based correlation and regression.

Titles of the Experiments

Sr. No.	Title of the experiment	No. of exp.
1	Computations of simple, partial and multiple correlations, rank correlations, and measures of association for qualitative data	4
2	Linear (simple, multiple) and nonlinear regression models	7
3.	Regression models with indicator variables	3
	Total number of experiments	14

Discrete Mathematics

Course No.: Math 461 Semester: VI
Nature of the Course: Theory Credit: 3
Objectives:
At the end of course,the student will able to:

- identify statement , write them in set notation , logical framework.numbers and counting technique.
- discuss intergers , their properties, real numbers ,subset and design .
- define partitions, classification ,distribution,modular arithmatics,algorithms and graphs.

Course Contents:
The first 15 chapters of Discrete Mathematics, by Norman Biggs form the contents of this course.

[45Hrs]

1. Statements and proofs
2. Set notation
3. The logical framework
4. Natural numbers
5. Functions
6. How to count
7. Integers
8. Divisibility and prime numbers
9. Fractions and real numbers
10. Principles of counting
11. Subsets and degins
12. Partition, classification, and distribution
13. Modular arithmetic
14. Algorithms and their efficiency
15. Graphs

Textbook:
Biggs, N., Discrete Mathematics, 2nd Ed., Oxford University Press India.

Problems in Discrete Mathematics

Course No.: Math 462 Semester: VI
Nature of the Course: Theory Credit: 2
Course Objectives:
The main objective of this course is to make the concept clear about pre-memtioned topics and to make them able to solve the problems on the related.

Course Contents:
Problems in Math 461, Discrete Mathematics, form the contents of this problem solving course.

Modern Algebra I

Course No.: Math 463 Semester: VI
Nature of the Course: Theory Credit: 3
Course Objectives:
At the end of course, the students will able to:

- define group as algebraic structure and types of group and familiarize with the terms cosets , homomorphism , isomorphism and their elementary properties and establish the Cayley's theorem.
- difine ring , ideals and integral domains with basic properties and establish simple results on ring.
- discuss about field with elementary properties and compare with group and ring.

Course Contents:
1. Groups **[30 hrs]**
    1.1 Binary operations, algebraic structure
    1.2 Equivalence relations and equivalence classes
    1.3 Properties of integers and prime numbers
    1.4 Divisors and greatest common divisors
    1.5 Congruencies and residue classes
    1.6 Definition of group and elementary properties
    1.7 Finite groups and group tables
    1.8 Subgroups
    1.9 Groups of cosets
    1.10 Cyclic groups
    1.11 Groups of permutations
    1.12 Even and odd permutations
    1.13 The alternating groups
    1.14 Cyclic groups, elementary properties
    1.15 The classification of cyclic groups
    1.16 Subgroups of finite cyclic groups
    1.17 Normal subgroups and factor groups
    1.18 Centre of a group, normalizer, centralizer and index of group
    1.19 Homomorphism, definition and elementary properties
    1.20 Isomorphism, definition and elementary properties
    1.21 Cayley's theorem

2. Rings and Fields **[15 hrs]**

- 2.1 Definition and basic properties
- 2.2 Divisors of zero and cancellation
- 2.3 Integral domain
- 2.4 The characteristic of a ring
- 2.5 Rings of endomorphisms
- 2.6 Quotient rings and ideals
- 2.7 Criteria for existence of a coset ring
- 2.8 Homomorphisms of rings, definition and elementary properties
- 2.9 Maximal and prime Ideals
- 2.10 Fields, definition and elementary properties

Textbook:
Fraleigh, J., A First Course in Abstract Algebra, 7th Ed., Pearson India.

Problems in Modern Algebra I

Course No.: Math 464 Semester: VI
Nature of the Course: Theory Credit: 2
Course Objectives:
The main objective of this course is to make the concept clear about pre-memtioned topics and to make them able to solve the problems on the related.

Course Contents:
Problems in Math 463, Modern Algebra I , form the contents of this problem solving course.

Research Methodology

Course No.: 467 Semester: VI
Nature of the Course: Theory Credit: 3

Objectives: The objective of this course is to make students familiar with research methodologies/techniques in sciences. After completion of this course, the students will be able to carry out research work independently.

Scientific Approach of Research **(7 L hrs)**

Concept and nature of researches, process of scientific enquiry, objective of research, planning of researches and formulation of hypotheses, research problems, setting goals of research problems, criterion of good research problems, statement of problems, major steps of solving research problems, significance of research problems and hypotheses, applications and characteristics of research, generality and specificity of problems, multivariate nature of behavioral research.

Literature review: Purposes of literature review, function and types of literature reviews, format of presenting the literature review, guidelines for conducting literature reviews, references/bibliographies.

Research Design **(5 Lhrs)**

Concept and meaning of research design, types and dimension of research design, purposes and needs and principles of research design, function of research design, research design process, developing a research plan, selecting a study design, criteria of good research design, adequate and inadequate research designs

Types of Researches **(6 Lhrs)**

Types of researches, social and scientific research, ex-post-facto research, historical research, laboratory research, experimental research, field experimental research, field studies research, survey research, case study research, action research, participatory action research, evaluation research, qualitative research, quantitative research.

Measurements and Scales ***(10 L hrs)***

Variables and attributes, concept of measurement scales, nominal, ordinal, interval and ratio scales, classification of scaling, scaling techniques, social scales, standard score, σ, T and Percentile scores, sources of error in measurement.

Concept of reliability and validity, test of reliability, types of validity, content validity, criterion related validity and construct validity, measure of validity, estimation of true score of the test, relationship between reliability and validity.

Data, Sample Designs, Data Analysis and Report Presentation **(14 L hrs)**

Data sources, data collection methods, schedules and questionnaires, questionnaire design, components of a questionnaire, types of questionnaires, characteristics of good questionnaires, advantages and disadvantages of questionnaires, structured and unstructured schedules, format of interview schedules, kinds of questions, types of research interviews, advantages and disadvantages of interview schedules, check lists, focus group discussion, sample designs, sample plans, selection of optimum size of sample.

Data analysis techniques, organization of data, coding and decoding of data, tabulation and presentation of data.

Research report writing, thesis writing, research paper writing, typing of research documents, writing a research grant proposal, criteria for a good research grant proposal, common shortcomings of research grants proposal, formats and examples of thesis writing, report writing and research paper writing.

Review and discussion **(3 Lhr)**

Reference Books:

- **Abbas, T. and Charles, T. (2002): Handbook of Mixed Methods in Social and Behavioral Research, Sage Publications .**
- Aryal, T.R. (2008). Migration and Occupational Mobility of Nepal, Paluwa Prakashan, Bagbazzar, Kathmandu.
- Aryal, T.R. (2008): Research Methodology, Paluwa Prakashan Ltd., Kathmandu
- Aryal, T.R. (2010). Nuptiality, Gyankunja Prakashan, Kirtipur, Kathmandu.
- Aryal, T.R. (2011). Mortality of Nepal, Prime Publication, Teku, Kathmandu.
- **Aryal. T.R. (2010). Statistics: Fundamental Concepts and Practices, Vidharthi Publication, Bhotahiti, Kathmandu.**
- **Aryal. T.R. (2011). Biostatistics: For biological, medical and health sciences, Pinnacle Publication, Bagbazzar, Kathmandu.**
- **Ayal, T.R. (2011). Fertility Dynamics of Nepal, Ekta Book Distributors, Kathmandu.**
- **Best J.W and Kahn J. V. (2010). Research in Education, PHI Learning, Pvt. Ltd. New Delhi.**
- **Cohen L., Manion L and Morrison K. (2010). Research Methods in Education. Routledge, London and New York.**
- **Donna, M. and Pauline, E.G. (2008): The Handbook of Social Research Ethics, Sage Publications**
- **Drapper, N. and Smith, H. (1968): Applied Regression Analysis, John Wiley and Sons**
- **John, F. (2008): Applied Regression Analysis and Generalized Linear Models, Sage Publication Inc.**
- Kerlinger, F.N. (1983): *Foundations of Behavioural Research*, Surjeet Publication, India
- **Kish, L. (1965): *Survey Sampling*, John Wiley and Sons**
- **Kothari C. R. (2011): Research Methodology: Methods and Techniques, New Age International Publication, New Delhi.**
- Moser, C and Kaltan, G. (1979): *Survey Methods in Social Investigations*, Heinman Education Books, UK
- **Pant P.R. (2010). Social Science Research and Thesis writing, Buddha Academic Publishers and Distributors Pvt. Ltd. Kathmandu.**
- ***Procedures for Developing Grounded Theory,* Sage Publication.**
- Richardson, J. (2002): Handbook of Qualitative Research Methods for Psychology and the Social Sciences, Blackwell Publishing Co.
- Singh, M.L. (1999): *Understanding Research Methodology*, Kathmandu.
- Strauss, A. and Corbin, C. (1998): Basics of Qualitative Research: Techniques

Term Paper

Course No.: 468 Semester: VI
Nature of the Course: Theory Credit: 1

- **A project based term paper on standerd format at least of 10 pages should be written under the supervision of subject teacher or supervisor or guide**