Faculty of Education

Master of Education (M.Ed.)
in
*** Chemistry Education**
*** Biology Education**
*** Physics Education**
Curriculum
1999

Curriculum Development Centre
Tribhuvan University
Kirtipur, *Kathmandu*
Nepal

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Master of Education (M.Ed.)

* Chemistry Education
* Biology Education
* Physics Education

Effective from 1999

Office of the Dean
Faculty of Education
Tribhuvan University
Kathmandu, Nepal

Tribhuvan University
Faculty of Education
Master of Education (M.Ed) Programme

Education has a key role in national development. The extent to which education will be able to support the process of national development depends on the academic and professional strengths of educational planners, managers, teacher educators, headmasters and teachers. As the demand for quality schooling and higher education rises, the need for competent professionals becomes even greater. To meet this need the Faculty of Education (FOE), Tribhuvan University with its two-year Master programme is committed to providing better and qualified teachers, teacher educators, educational administrators and planners, system analysts and experts in the field of education.

The FOE has introduced three-year B.ED. programme since 1996 with the curriculum focused on meeting varying social needs. This necessitated restructuring the M.Ed. curriculum so to make it consonant with the newly developed B.Ed. programme. All in all, this change has been prompted by the visions and the experiences of teacher educators and other professionals working in the field of education all these years.

I. Programme Objectives

The overall objective of the M.Ed. program is to produce higher level manpower in the field of education. More specifically, the main objectives are :

- to develop leadership manpower in the field of education;
- to produce better qualified and competent teacher educators;
- to produce efficient educational planners, administrators and supervisors and other educational experts;
- to promote innovative practices in the field of education; and
- to produce better trained teachers especially at the higher level.

II. Curriculum Structure

The curriculum structure for this programme consists mainly of the core and specialization areas. The weightage and full marks given to these areas are as follows:

Areas	Weightage	Full Marks
a. Core Courses	30%	300
b. Specialization	65%	650
c. Elective	5%	50
Total	100%	1000

a. ***The core courses consist of the following:***

Courses	Full Marks
i. Foundations of Education	100
ii. Psychology in the Classroom	50
iii. Curriculum Planning and Practices	50
iv. Measurement and Evaluation in Education	50
v. Research Methodology	50
Total	300

b. ***Each specialization subject covers the following areas:***

Areas	Full Marks
i. Content Courses	350-450
ii. Pedagogical Courses	100-200
iii. Practicum	50
iv. Thesis	50
Total	650

Students can specialize in any one of the following subjects provided that they have basic background knowledge in that subject:

i Curriculum and Evaluation
ii Educational Planning and Management
iii English Education
iv Nepali Education
v Science Education
vi Health Education
vii Physical Education
viii Geography Education
ix Economics Education
x History Education
xi Political Science Education
xii Mathematics Education

In addition to specializing in any one of these subjects, the students of this program are required to conduct independent research work and participate in teaching and its related activities (practicum). Both the thesis writing and practicum have to be related to the specialization subject of the student.

III. Course Cycle

Area	First Year	Full Marks	Second Year	Full Marks
Core area	Core Courses	200	Core Courses	100
	i. Foundation of Education	100	i. Measurement and Evaluation in education	50
	ii. Psychology in the classroom	50	ii. Research Methodology	50
	iii. Curriculum Planning and Practices	50		
Specialization	As approved by concerned subject committee	300	As approved by concerned subject committee	350
Elective			As approved by concerned subject committee/dept.	50
Total		500		500

IV. Instructional Days

Generally an academic year will consist of 150 teaching days excluding the days taken by admission and annual examination. A theory paper of 100 marks will generally carry 150 lectures and 5 periods a week and a paper of 50 marks, 75 lectures and 3 periods a week. A practical course of 50 marks requires the students to attend 4 periods per week. Each lecture must be of 55 minutes, duration.

V. Method of Instruction

The method of teaching in the M.Ed. programme will be a combination of several approaches. Class lecture, group discussion, demonstrations, guest lectures, seminar, term paper presentation, case analysis, problem solving, practical experiences and fieldwork approaches will be used as different techniques of giving instruction in the courses so that students will be able to develop abilities for self learning, problem solving and critical thinking.

VI. Eligibility for Admission

A graduate with B.Ed. degree either one year, two year or three year from Tribhuvan University or a university recognized by Tribhuvan University will be eligible to apply for admission to the two year M.Ed. programme.

VII. Admission Criteria

An applicant seeking admission to the M.Ed. programme must appear in the Entrance Test (ET) of two hour's duration conducted by the FOE. The ET questions will be related to general education, educational aptitude and the subject of specialization. Fifty percent weightage will be given to education-related areas and the remaining fifty percent weightage will be given to specialization subject. A merit list of the applicants will be prepared by adding the percentage of marks they have obtained in their previous qualification for application with the marks scored by them in ET. An applicant who fails to obtain a minimum qualifying score of 35 percent will not be eligible for admission. Admission of candidates will be based on the merit list and the intake capacity of the Central Department/Campuses. Each student will have to appear in the year-ending examination of all the courses offered in the first year to be eligible for enrolment in the second year.

VIII. Thesis Writing and Evaluation

Thesis writing within the specialization area is compulsory. **Only those students who have passed all the courses of the first year programme will be allowed to undertake thesis writing.** The thesis has to be written under the direct supervision of a Faculty member of the Campus/Department. The format for writing the research proposal and the procedure for approving it will be as fixed by the Departmental Research Committee. The evaluation of the thesis will be based both on the written part and viva-voce. Of the total weightage given to thesis course, seventy percent weightage will be allocated to the written quality of the thesis and the remaining thirty percent will be allocated to viva-voce. Viva -voce for the thesis of the student will be conducted only after passing all the courses offered in the second year of M.Ed.

IX. Practicum

The practicum is an integral part of the M.Ed. programme. It is designed to provide opportunities to students to actually participate in the activities of the campus or of higher secondary school level. Each student is required to complete three activities - classroom teaching. internship and curriculum evaluation in their specialization subject. However, students specializing in Educational Planning and Management are required to undertake other activities in place of classroom teaching. This practicum course is carried out within or after the second year of the programme for six weeks. **Students who have passed all the courses offered to them in the first year can participate in this course.**

X. Attendance and Evaluation System

- Minimum attendance (i.e. 7op. c.) in accordance with the University regulation is required in each subject in order to be eligible for the annual examinations (i.e. 70 percent).
- Controller of Examination, T.U., will conduct the annual examinations at the end of each academic session. Each student must appear in and pass all those examinations in order to qualify for M.Ed. degree.
- The evaluation procedures for practical courses will be as specified by the subject committees.
- The minimum pass marks for the theory paper is 40 percent and for the practicum, 50 percent.

XI. Grading System

The grading system will be as follows:

Third Division:	40% and above
Second Division	50% and above
First Division	60% and above
Distinction	75% and above

XII. Graduation Requirements

The M.Ed. programme extends over two academic years. M.Ed. degree is awarded on its successful completion. All the candidates for M.Ed. degree must fulfill the following requirements:

- The successful completion of 1000 marks as prescribed with the passing grades in all the courses.
- Completion of courses for the fulfillment of this programme must occur within the time frame prescribed by T.U.

Educational Core Courses

First Year

Course No.	Course Title	F. M	Year	Nature
Ed. Psy. 501	Foundations of Education	100	I	Theoretical
Ed. Psy. 502	Psychology in the Classroom	50	I	Theoretical
Ed. 503	Curriculum Planning and Practices	50	I	Theoretical
	Second Year			
Ed. 504	Research Methdology	50	II	Theoretical
Ed. Psy. 505	Measurement and Evaluation in Education	50	II	Theoretical

Foundations of Education

Course No.: Ed. 501 | Full Marks: 100
Nature of the course: Theoretical | Pass Marks: 40
Year: First | Periods per week: 5

Course Description

This is a compulsory course designed for the students of Master Degree in Education. It intends to develop a comprehensive theoretical knowledge and understanding related to the philosophy, history and sociology of education. It also deals with the education system in selected countries of the world.

General Objectives

The general objectives of this course are (a) to assist the students in developing a philosophical base of education, (b) to explore the use of sociological knowledge in education, and (c) to acquaint the students with the basics of education in various countries.

Specific Objectives

- Explain the meaning, uses and functions of philosophy.
- Explain progressivism and existentialism and their contributions in education.
- Discuss the concepts of reality, nature of knowledge, values system and their implications in education of Hindu and Buddhist Philosophy.
- Explain the Origin, Nature and Structure of the Sociology of Education.
- Analyse the Theories of Social Stratification in Education.
- Describe the perspective of Social Mobility in Education.
- Explain the factors of cultural reproduction and the process of transmission of knowledge.
- Describe the process of social transformation in Education.
- Explain the political role in Education.
- Describe major educational systems of the Ancient, Medieval and Modern periods.
- Explain the structure of education in the context of selected countries.
- Identify the national goals of education in different countries.
- Study and explore the subject areas taught in the primary and secondary levels including their major focus.
- Explore the evaluation systems of different countries, and make a comparative analysis.
- Describe the administrative structure of education at the central, district and local levels.
- Analyze the provision of teacher education in selected countries.

Course Contents

Part I: Philosophical Foundation

Unit I Introduction to Philosophy **6 hrs.**

- Approaches to study philosophy
- Philosophy and Education
- Uses of philosophy
- Fields of philosophy (Metaphysics, Epistemology, Axiology, Logic)
- Functions of Philosophy (Descriptive, Speculative, Prescriptive, Analytic)

Unit II Progressivism in Education **6 hrs.**

- Basic principles
- Progressivism and Education
- Progressivism and Aims of Education
- Progressivism and Curriculum
- Progressivism and Role of the Teacher, School and Students.

Unit III Existentialism in Education **6 hrs.**

- Existentialism and Education
- Existentialism and Aims of Education
- Existentialism and Curriculum
- Existentialism and Role of the Teacher, Student and School

Unit IV Hindu and Buddhist Philosophy **7 hrs.**

Views of Hindu Philosophy

- Concept of Reality
- Nature of Knowledge
- Value system

Views of Buddhist philosophy

- Concept of Reality
- Nature of Knowledge
- Value system
- Implications of their views in Education

Part II Sociological Foundation

Unit V The Origin, Nature and Structure of the Sociological Foundation of Education **6 hrs.**

- Origin and development stage
- Educational Sociology and the Sociology of Education (concept, differences and functions)
- The content and the scope of the Sociology of Education.

- Theory and methodology related to the Sociology of Education (The nature of theory, Major theoretical orientation: Structural - Functionalism, conflict Theory, Symbolic Interactions and Contradiction Theory of Marx)

Unit VI Theories of Social Stratification **6 hrs.**

- Social Stratification: five basic characteristics (Ancient, Ubiquitous, The social patterning, the diversity of form, amount and the consequences)
- Thought and theory of stratification (consensus vs conflict theories)
- The shape of stratification (classes and status groups, continuous versus discrete variables, objective versus criteria, the reputation approach)

Unit VII Education and Social Selection **6 hrs.**

- The nature of Social Mobility (concept, measures and trends)
- Socio-economic status; intelligence and the attainment of higher education.
- Educational Factor and Social Mobility

Unit VIII Social Transformation and Education **6 hrs.**

- Social policy and Education (concept, need and impact)
- Educational opportunity and equity.
- The problems of the economics of education.
- Changes-place in society (evolutionary theory, cyclic theory and conflict theory)
- Changing process in the context of Nepalese society.

Unit IX The Politics of Education **7 hrs.**

- The nature of power (force, authority, and democratic representative)
- The distribution and use of power (structure approach, the power elite approach, the pluralist approach)
  - Characteristics
  - Nature of Society
  - Social Changes
  - Social Mobility
- The role of the state in Education (power, functions, order, and rules and regulations)
- The teacher and the student movement (concept, organizational structure and the role)

Unit X Education and Culture **5 hrs.**

- Concept of Culture (pattern and functions)
- Relation between Education and Culture
- The process of Cultural Transmission

- comparatively explain the social justice approaches in education

Unit XI Education and Social Justice **5 hrs.**

- Approaches to Social justice
  - International Conventions: - Human Right, Child Rights, Labourers' Rights, Women's Rights.
  - National Legislative Provisions: - Human Right, Child Rights, Labourers' Rights, Women's Rights.
- Marginalized and Disadvantaged Population
- Approaches to Promote Social Justice in the Society
  - Education
  - Legislative provision
  - Advocacy for Social Justice
  - Rehabilitation program

Part III Historical Foundations of Education

Unit XII Historical Background of the Education System **7 hrs.**

- Bird's Eye- view
  - Ancient Education system in the west - Greek & Roman Education
  - Ancient Education system in the East-Hindu and Buddhist Education.
  - Education during the Medieval period
  - Development of Education in Nepal from Ancient to Modern periods.

Unit XIII Major Educational Movements Leading to the Development of Education in the Modern Period **7 hrs.**

- Basic Needs Approaches in Education
- Movement from Selective to Mass Education
- Movement from Religion to Nationalism
- Movement from Authoritarian to Democratic Education
- Human Rights Movement
  - Right to education
  - Gender equality
  - Peace education

Part IV Education System of Nepal, India, China, USA, Russia and Japan

Unit XIV Bases of Education of Above mentioned Countries **20 hrs.**

- National Goals
- Cultural factors
- Social factors
- Relegious factors
- Geographical factors

- National economic factors
- Political system factor

Unit XV Structure and Levelwise Goals of Education of Above Mentined Countries **30 hrs.**

- Pre-primary Education
- Primary Education
- Secondary
- Higher secondary
- Higher Education
- Teacher Education

Unit XVI Problems of Education Systems Interrelation of Education of Above Mentined Countries **20 hrs.**

- Curriculum organization
- Examination system
- Student of admission
- Financing education

Instructional Techniques

- Lecture
- Discussion
- Assignments
- Presentations
- However, the following techniques may be useful for the study of the Education Systems in selected countries.
- Have the students study the materials provided by the teacher.
- The contents should be dealt with in a comparative form, not on an individual basis
- Comparative charts of each of the said contents should be developed, both by the teachers (for a model) and students in groups.
- Presentation of comparison (at least two countries) from each group is expected

Evaluation Technique

Final examination at the end of the academic year
External Examination 100%

Textbooks and References

- Allan C. Ornstein and David V, Levine, (1989), **Foundations of Education**, Houghton Mifflin Company, Boston, USA
- Boyd, William (1957), **History of Western Education**, London, Adam and Charts Black.
- Butler, **Four Philosophies and their practice in Education and Religion,** Harper & Row Publication.
- Chanube SP and Chanbe A (1994) **Foundations of Education** New Delhi: Vikas Publishing House.

- Dandekar, **Psychological Foundations in Education** Macmillan India Limited.
- Good, H.G. (1960), **History of Western Education**, New York, MacMillan Company.
- George L.F. Beredey, (1967) **Comparative Method in Education,** Oxford and IBS Publishing Company Calcutta, India.
- Haralambos, Michael and Holborn, Martin (1995) **Sociology: Themes and Perspectives.** London: Collins Educational
- Hans, Nicholas, **Comparative Education,** Routledge and Kegan Paul Ltd. London.
- Kneller, George F (1964). **Introduction to the Philosophy of Education.** New York: Johnwiley & Sons.
- Mukherjee, **Comparative Education** Kitab Mahal, Pvt. Ltd., Allahabad, India.
- Morris, Ivor (1976). **The Sociology of Education: An Introduction.** London: George Allen & UNwin Ltd.
- Tumin, Melvin. M., (1982), **Social stratification** Prentice Hall of India.
- Thakur, A.S., (1977), **The Philosophical Foundations of Education,** National, New Delhi.
- Wagley M. & Karki, H. (1998), **Different Foundations of Education,** Bidhyarthi Publications, Kathmandu.

Psychology in the Classroom

Course No.: Ed. Psy. 502 | Full Marks: 50
Nature of the course: Theoretical | Pass Marks: 20
Year: First | Periods per week: 3

Course Description

This is an educational psychology course focussing upon the theories and principles of human development, learning and guidance in education. It briefly deals also with the concept and causes of the different types of developmental deviations and their remedial measures.

General Objectives

The main objective of this course is to familiarise and orient the students with the different approaches to human development, learning theories, principles of guidance and the concept of developmental deviations so as to enable them to draw implications for teaching and education.

Specific Objectives

- Identify the stages of human development and their major characteristics.
- Explain the physical, mental and emotional charateristics of the adolescent and their implications in education.
- Compare the characteristics of the Nepalese adolescent with those of the west.
- Identify major factors involved in human development and their implications in education.
- Be familiar with different approaches to human development and their educational implications.
- Be acquainted with deviations and their remedial measures.
- Define guidance and counseling.
- Identify the areas of guidance.
- Explain the inter-relationship between guidance and education.
- Identify the needs of guidance in schools.
- Discuss the status of guidance services in Nepal today.
- Identify major theories of learning.
- Distinguish between behaviouristic and cognitive approaches to learning.
- Discuss the implications of each of the major behaviouristics and cognitive theories of learning.
- Explain the psychological base of some models of teaching
- Familarise themselves with the nature of experiments done in learning.

Course Contents

Unit I Nature and Stages of Human Development **2 hrs.**

- A review of the different stages of human development and their major characteristics.
- Concept of developmental norms and status of the normative studies in Nepal.

Unit II Domains of Human Development **3 hrs.**

- A review of physical, mental and emotional characteristics of adolescence and their educational implications.
- The Nepalese adolescent vis-avis the adolescent in the west.

Unit III Major Factors Influencing Human Development **4 hrs.**

- Genetic and sex-related factors.
- Socio-economic and educational factors.
- Eco-cultural factors.

Unit IV Theories of Human development **8 hrs.**

- Major Issues in Human Development
  - Nature Vs Nurture
  - Universal Vs Culture Specific.
  - Maturation Vs Learning
- Major Approaches to Human development
  - Behaviouristics Approach: Skinner's view
  - Psychoanalytic Approach: Freud's view
  - Humanistic Approach: Maslow's view
  - Cognitive Approach: Piaget's view

Unit V Developmental Deviation: A General Survey **13 hrs.**

- Nature and Types
  - Mental Retardation: symptoms and causes
  - Sexual Perversions: sex diseases and perversions
  - Behavioural Disorders: delinquency and psycho-sociopaths
  - The Drug Abusers
  - The economically and culturally deprived children.
- Remedial Measures
  - Medical Measures
  - Institutionalization and Family Rehabilitation.
  - Special Education Programs: headstart program and education for the out-of school children.
  - Psychotherapies.
  - Practical: Case studies of the deviated.

Unit VI Orientation to Guidance **3 hrs.**

- Guidance Program (Preventive Measures)
  - Meaning of guidance

- Guidance and education
- Purpose of guidance
- Role of teachers and parents in guidance

Unit VII Scope and Functions of Guidance **6 hrs.**

- Process and Functions of Guidance
  - Understand the individual and his/her environment.
  - Help the individual develop his/her potentialities.
  - Enable him/her to solve life problems and live a happy life.
- Types of Guidance
  - Educational Guidance
  - Personal Guidance
- Guidance Services
  - Inventory Service
  - Information Service
  - Counselling Service
  - Placement Service
  - Follow-up and Research

Unit VIII Counselling **6 hrs.**

- The Concept
  - Meaning of Counselling
  - Relation of Counselling
  - Purpose and functions of counselling and the counselor.
- Types of Counselling
  - Diagnostic Counselling
  - Therapic Counselling
  - Directive and non-directive approaches to counselling.
- Techniques of Counselling
  - Individual Counselling
  - Group Counselling

Unit IX Introduction to the Theories of Learning **7 hrs.**

- Major issues in psychology of learning
  - Process and mechanism of learning
  - Role of practice, reward and punishment, and understanding in learning.
- Introduction to the behaviouristic and cognitive theories of learning and their distinctive features.

Unit X Behaviouristic Theories

1 Pavlovian Conditioning **7 hrs..**

- Principles and Applications
  - Acquisition of Conditioned Response (CR): The Pavlovian conditioning procedure,
  - Application of Pavlovian conditioning in

* Habit formation,
* Fear and other emotional conditioning,
* Verbal learning
* Sensitization

- Different Types of Conditioning
  - Aversive and escape conditioning
  - Vicarious conditioning
- Application of different forms of conditioning in acquiring and changing behaviour.
- Extinction of CR.
  - The extinctionn or unconditioning process.
  - The nature and type of inhibition process.
  - The phenomenon of spontaneous recovery and its implication.
  - Application of unconditioning in desensitization and
  - emotional control.
- Contribution of Pavlov to the development of the theory and practice of learning.
- Practical demonstration of a simple Pavlovian conditioning experiment in the class or in Psychology lab.

2 Skinnerian Operant Conditioning **6 hrs.**

- Acquisition of operant response: The technique of operant conditioning.
- Role of reinforcement in operant conditioning
  - Nature of reinforcement: Skinner's view.
  - Types of reinforcement
* Primary and secondary reinforcement.
* Positive and negative reinforcement.
  - Schedule of reinforcement.
* Fixed-variable
* Interval-ratio
* Differential schedule
  - Impact of different schedules of reinforcement on operant behaviour.
- Application of operant conditioning in
  - Personnel management; group contingency management
  - Behaviour therapy
  - Verbal learning
  - Programmed instruction
  - Use of token economy.
  - Group Contingency
- Practical: The teacher demonstrates a simple experiment to show the effect of reinforcement and non-reinforcement on learning and teaching.

3 Thorndike's Connectionism **3 hrs.**

- Thorndike's Trial and Error Process of Learning
- Application of Trial and Error in skill learning.
- Thorndike's Laws of Learning
- Applications of the primary laws of learning in teaching.
- Practical: Demonstrate the role of practice on learning verbal or motor skill.

Unit XI Cognitive Approaches to Learning **6 hrs.**

- The information processing theory of learning
- Contribution of
  - Tolman's place learning, latent learning and expectancy learning experiments.
  - Wortheimer's productive thinking
  - Kohler's insight learning
  - Piaget's cognitive development to the developemnt of cognitive theory of learning.
- Applications of information processing in
  - Memory
  - Concept and principle learning
  - Problem solving and creative thinking

Unit XII Models of Teaching **6 hrs.**

- The Basic Teaching Model
- The Teacher Centred Teaching Models: the lecture, recitation and classical technological models of teaching.
- Child-centred Teaching Model: the progressive teaching and systems.
- Interactional Teaching Model: The constructivists' model.
- Model Planning from the students

Instructional Techniques

- Lecture-cum-discussion
- Group discussion
- Library work and
- Individual activity

Evaluation Technique

Final examination at the end of the academic year

External Examination 100 %

Instructional Materials

Main texts

- Bernard, Harold W. and Fullmer, Daniel W. 1977, **Principles of Guidance**. Thomas Y. Crowell Company.
- Begee, Morris L. 1976, **Learning Theoris for Teachers**. Harper & Row.
- Bhatia, **Textbook of Educational Psychology** Macmillan India Limited.
- Beggi, Morri, L. and Hunt, Maurce P. 1968, **Psychological Foundations of Education Harper and Row,** New York.
- Craig, Grace J. **Human Development,** Prentice Hall 1989.
- DeCecco, John P. and Crawford, 1977, W. **The Psychology of Learning and Instruction.** Prentice Hall of India.
- Hilgard, Wrnest R. and Bower, Gordon H. 1977, **Theories of Learning**. Prentice Hall of India.
- Hill, Winfred F. Learning: **A Survey of Psychological Interpretations.** Methuen & Co. Ltd. The Latest Edition.
- Hulse, S.H.; Desse, James; and Egeth, H. 1975, **The Psychology of Learning.** Mcgraw-Hill Kogakusha, Ltd.
- Hurlock, Elizabeth B. **Developmental Psychology.** Mc Graw-Hill Kugakusha. Latest-Edition.
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- Mahanty, Girishbala. 1989, **A Text Book of Abnormal Psychology,** Kalyani Publishers. 24 Daryaganj, New Delhi.
- Mohsin, S.M., 1985, **Experiments in Psychology.** Motilal Banarshi,
- Van Hoose, William H.; and Pietrofesa, john J. (Eds.) 1970, **Connseling and Guidance in the Twenticth Centure.** Houghton Miffin Company.

Curriculum Planning and Practices

Course No.: Ed.503
Nature of the course: Theoretical
Year: First

Full Marks: 50
Pass Marks: 20
Periods per week: 3

Course Description

This is a compulsory course on curriculum designed for the students of Master Degree in Education. This course deals with the concept of curriculum and its development procedures, the patterns of organization as well as the issues and challenges in its development. The course aims at acquainting the students with the theoretical base of the existing practices in curriculum planning and development.

General Objective

To acquaint the students with the theoretical bases of the existing practices in curriculum planning and development.

Specific Objective

- Explore the meaning of curriculum in different perspectives.
- Explain the process of curriculum development.
- Discuss the systemic view of curriculum.
- Explore different issues in curriculum
- Identify emerging challenges in curriculum development.
- Appraise different patterns of curriculum organisation.

Course Contents

Unit I Changing Concept of Curriculum **8 pds.**

a. Curriculum as syllabus / subject matter / courses of study.
b. Curriculum as a plan for instruction
c. Curriculum as an organization of educational process.

Unit II Steps of Curriculum Development **8 pds.**

a. Objectives
b. Contents
c. Methods / strategies
d. Evaluation

Unit III Patterns of Curriculum Organization (To address specific issues) **10 pds.**

a. Activity-based curriculum
b. Broadfield Curriculum
c. Curriculum based on life situation (intergrated curriculum)
d. Core Curriculum

Unit IV A Systemic View of Curriculum **22 pds.**

a. Curriculum Inputs
- Operant
  - * Contents
  - * Materials
  - * Facilities
- Operator
  - * Teachers
  - * Students
  - * Administrative personnel

b. Curriculum Process
- Teaching Learning Process
- Time and Task
- Activities

c. Curriculum Output
- Student Achievement
- Institutional Development
- Cost-effectiveness
- External Efficiency

Unit V Issues in Curriculum **12 pds.**

a. Relevance to life (Does education help the learner to solve his daily problems of life ? Does education help the learner to become a good member of society?)

b. Medium of instruction

c. integration of courses

d. monolithic vs diversities of course.

Unit VI Emerging Challenges in Curriculum Development **15 pds.**

a. Impact of Science and Technology on Social life and Curriculum Plan.

b. Behavioural Problems (Social evils)

c. Impact of drugs, alcohol, sex problems, aculturation and deculturation of society.

d. Student migration out for education.

Instructional Techniques
- Lecture
- Discussion
- Term paper writing

Evaluation Technique
Final examination at the end of the year
External Examination 100%

Textbooks

- Taba, Hidda: 1962, **Curriculum Development: Theory and Practice,** Harcourt Brace World Inc. New York,
- Samual A. Krik. **Educating Exceptional Children**,
- Alexander, W.M. & Saylov, J.G. (1974), **Curriculum Planning for School,** Halt, Rinehard and Winston, Inc.

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- Hayman, R.T. (1973) ; **Approaches in Curriculum,** Prentice Hall.
- **Report of Various Commissions on Education in Nepal.**
- Sowell, J. (1996): **Curriculum: An integrated Introduction,** Merril and Imprint, Prentice Hall, Englewood Cliffs, New Jersey (Ohio)
- Print, Marray (1993) **Curriculum Development and Design**, Allen & Unwin.
- Tyler, R.W., (1974), **Basic Principles of Curriculum and Instruction** Open University Publication, London
- Tanner, D., and Tanner., L. (1980), **Curriculum Development Theory into Practice.**
- Zais, R.S., (1976), **Curriculum Principles and Foundations**, Harper and Row Publication London,

Research Methodology

Course No.: Ed. 504 Full Marks: 50
Nature of the course: Theoretical Pass Marks: 20
Year: Second Period per week: 3

Course Description

This course on Research and Evaluation in Education is designed to acquaint the students with and to enable them to conduct evaluation and research studies on education. The course will plan, write proposal, construct and administer tools and analyse the results. At the end of the course the students will be required to submit a research proposal.

Course Objectives

- Discuss the concept and the purpose of educational research.
- Explain the purpose and methods of sampling
- State different types of research designs and their use.
- Explain the uses and importance of different kinds of methods and tools in research and evaluation.
- Analyze and present the data in different forms.
- Develop a research proposal on any educational topic.
- State basic concepts and use of statistics in education.
- Use basic statistics for research and other purposes.
- Analyse and interpret statistical data

Course Contents

Unit I Concept of Research **6 hrs.**

a. Definition and purpose of research in Education.
b. Quantitative and qualitative research.
c. Statement of problems and hypothesis.
d. Measurement: Scales, reliability, validity
e. Sampling:
    - Random sampling,
    - Stratified sampling,
    - Purposeful sampling,
    - Sampling size

Unit II Research Designs **6 hrs.**

a. Factors jeopardizing internal and external validity
b. Pre-experimental designs
    - The one shot case study
    - The one group pretest post test
    - The static group comparision
c. Experimental designs

- The pre-test-post test control group
- The post test only control group

d. Quasi-experimental designs
- The time-series experiment
- Time equivalent time-samples
- The non equivalent control group
- Ex post facto

Unit III Methods and Tools of Data Collection **6 hrs.**

a. Interview schedule
b. Observation
c. Tests: types and uses.
d. Case - study
e. Questionnaire
f. Checklists
g. Opinionnaire/gallop poll.
h. Rating scales
i. Anecdotal records

Unit IV Introduction to Educational Statistics **5 hrs.**

a. Meaning and uses of statistics
b. Population and sampling
c. Variables - continuous and discrete
d. Measurement - nominal, ordinal, interval, and ratio

Unit V Measures of Dispersion (Meaning, Purpose and Computation) **5 hrs.**

a. Range
b. Variance
c. Standard deviation
d. Probability of normal distribution: normal probability, normal distribution, application of normal probability curve.

Unit VI Measure of Relative Position **5 hrs.**

a. Percentile rank
b. Percentile score
c. Standard score

Unit VII Measures of Relationship / Association **15 hrs.**

- Significance of testing differences and association: testing of significance of means, chi-square (x^2 tests), concept of multiple regression.
- Coefficient of correlation (r test)
- t test
- Analysis of variance (concept and applications)
- Analysis of co-variance (concept only)

Unit VIII Analysis and Presentation of Data **5 hrs.**

- Tabulation and graphic presentation
- Computation of percentage
- Central Tendency (mean, median, and measures of dispersion, standard deviation)

Unit IX Research Proposal **15 hrs.**

- Statement of the problem
- Significance of the problems
- Definition, assumption, limitation and delimitation
- Review of related literature
- Hypothesis
- Methods: sampling, date collection procedure (instruments/tools, manpower), data analysis and interpretation.
- Time schedule
- Budget

Unit X: The Research Report **7 hrs.**

- Executive summry
- Introduction
- Objectives
- Statement of hypothesis
- Methodology sampling plan, data collection, tools, analysis
- Presentation: based on findings: summary, conclusion and recommendations

Instructional Techniques

- Lecture
- Assignment/term paper
- Presentation

Evaluation Technique

Final examination at the end of the year

External Examination 100%

Textbooks

1. Best, J.W. and Kahn, Jams V. (1995). **Research in Education,** New Delhi: Prentice Hall of India Private Limited
2. Koul, Lokesh (1997). **Methodology of Educational Research,** New Delhi: Vikash Publishing House Pvt. Ltd.

References

1. APA (1974). **Publication Manual**. Washington, D.C.: American Psychological Association (Available in Dept. Library)
2. Campbell, D.T. and Stanley, J.C. (1963). **Experimental and Quasi-experimental Designs for Research**. Chicago: Rand MNally & Company.
3. Cohen, Louis and Manion, Lawrence (1994m **Research Methods in Education** London, Routledge.
4. Dewivedi, R.S. **Research Methodology in Behavioural Science**, Mac Millan of India Limited.
5. Fowler, Jr. F.J. (1987). **Survey Research Methods**. New Delhi: SAGE Publications.
6. Issac, S. and Michael, W.B. (1978). **Handbook in Research and Evaluation**. San Diego, CA :EDITS Publication.
7. Jack R. Fraenkel, Norman E. Wallen (1996), **How To Design and Evaluate Research in Education,** Mc. Graw-Hill, Inc.
8. Kerlinger, F.N. (1995) **Foundations of Behavioural Research**. New York: Holt Reinsert and Winston, Inc.

Measurement and Evaluation in Education

Course No.: Ed. Psy. 505 — Full marks: 50
Nature of the course: Theoretical — Pass Marks: 20
Year: Second — Periods per week: 3

Course Description

This course deals with the nature of measurement and evaluation in education along with planning, constructing, testing, scoring and analyzing the test. Measurement analysis, graphic representation of the data; and evaluation tools, techniques and approaches are given which are applicable in education. Major examples of standardized tests are oriented towards widening the students' visions. The students are required to fulfill the practical activities mentioned in this course.

General Objectives

The objective of the course is to provide knowledge and skills on educational measurement and evaluation.

Specific Objectives

- Explain the concepts of measurement and evaluation.
- Explain the need of classroom tests.
- Describe the difference between teacher made test and standardized tests.
- Develop different types of tests.
- Plan, administer, score, analyse and improve a test.
- Analyse the test statistically.
- Describe the different kinds of standardized tests and their uses.
- Plan and conduct testing program.

Course Contents

Unit I Concept of Measurement — **10 hrs.**
(Physical measurement and psychological measurement)

a. Purposes of measurement
b. Uses of measurement
c. Scales: nominal, ordinal, interval, ratio
d. Characteristics of Measuring Instruments
    - Reliability
    - Validity
    - Practicability
    - Comparability
    - Utility

e. Errors of measurement and methods of minimizing errors
f. Norm and criterion referenced measurement.

Unit II Concept of Evaluation **12 hrs.**

a. Comprehensive Concept of Evaluation: Student Evaluation, Teacher Evaluation, Curriculum Evaluation, Program Evaluation

b. Types of Evaluation
   - Formative
   - Summative
   - Evaluation at all levels (primary, secondary and higher education)

c. Components of Student Evaluation
   - Social Development
   - Attitudinal Development
   - Emotional Development
   - Intellectual Development
   - Achievement/Performance
   - Co-curricular Activities

Unit III Construction of a Test **16 hrs.**

a. Differences between Teacher-made Test and Standardized
b. Need and Purposes of Test
c. Planning Test
   - Why Testing
   - What to test (selection of subject matter, area)
   - How to test (written / oral, subjective, objective, practical)
   - When to test (testing schedule)
d. Construction of Test
   - Content analysis
   - Specification Chart
   - Writing test items
   - Editing and arranging test items
   - Writing directions for test administration
   - Administering.test
   - Interpretation of test results
   - Pilot study.
   - Item analysis and selection of final test items

Unit IV Standardization of a Test **11 hrs.**

a. Item Analysis
b. Reliability (with computation)
c. Validity (with computation)
d. Norms
e. Administration of Final Test
f. Scoring
g. Interpretation of Test Result

Unit V Standardized Test **12 hrs.**

a. Historical Development of Tests, Functions and Uses
b. Intelligence test: Standford Binet, WAIS
c. Achievement test: STEP, SAT
d. Aptitude test: DAT, GATB
e. Personality Inventory: MMPI
f. Interest Inventory: Strong's and Kudir's Inventories
g. Projective Technique: Rorchach's inh.-blot Technique

Unit VI Non- Testing Devices **6 hrs.**

a. Observation
b. Questionnaire
c. Interview Schedules
d. Opinionnaire
e. Sociometric Test
f. Gallop Poll

Unit VII Planning Testing Program **8 hrs.**

a. Steps of Testing Program
b. Purposes
c. Organizing a test library (Question Bank)
d. Selection of Competent Personnel
e. Test Administration
f. Reporting Test Results
g. Organizing remedial measures

Practical Activities

Each students is required to undertake the following practical activities (any two):

1. Construction of a teacher-made test including preparation of specification chart, writing items, editing and arranging the items, and preparation of final format with specific directions.
2. Items analysis of achievement test including difficulty level, discrimination index, power of distractors and language of the items.
3. (a) Construction of rating scale or check list for observation; opinionnaire or questionnaire; interview schedule; sociometric test; (b)Trail test of the evaluations tools mentioned above & their improvement.
4. Development of a school testing program

Instruction Techniques

- Lecture
- Discussion
- Assignment
  - Individual work
  - Group work

Evaluation Technique
Final Examination at the end of the year
External Examination 100%

References

1. Ebel, L.R. and Frisbie, D.A. (1991) **Essentials of Educational Measurement**, Prentice Hall of India Pvt. Ltd. New Delhi.
2. Groulund , N.E., (1976), **Measurement and Evaluation** in Teaching, New York: Macnillan
3. Sing, A.K., **Measurement and Research in Behavioural Science**, McGraw Tata.
4. Thorndike, A.W. and Hagen, E. (1977) (Recent) **Measurement and Evaluation in Psychology and Education**. John Weley and Sons, Inc. New York.

Specialization

M.Ed. Science Education

Chemistry Education

Biology Education

Physics Education

Specialization

Chemistry Education

Specialization

Chemistry Education

Course No.	Course Title	F.M.	Nature
	First Year		
Sc.Ed. 521	Organic Chemistry	100	Theoretical
Sc.Ed. 522	Organic Chemistry Practical	50	Practical
Sc.Ed. 523	Inorganic Chemistry	100	Theoretical
Sc.Ed. 524	Inorganic Chemistry Practical	50	Practical
	Second Year		
Sc.Ed. 561	Physical Chemistry	100	Theoretical
Sc.Ed. 562	Physical Chemistry Practical	50	Practical
Sc.Ed. 590	Fundamentals of Science Education	50	Theoretical
Sc.Ed. 591	Teaching Chemistry Education	50	Theoretical
·Ed. 598	Thesis	50	Practical
Ed. 599	Practicum	50	Practical

Elective

Sc.Ed. 571	Environmental Science	50	Theo. + Pra.

Note: Sc.Ed. 590 Fundamentals of Science Education and Elective Course Sc.Ed. 571 Environmental Science are common to all the Science Education courses. So these two courses are given only in the last part of the Physics Education course.

Organic Chemistry

Course No. : Sc.Ed. 521 — Full Marks : 100
Nature of the course : Theoretical — Pass Marks : 40
Year: First — Periods per week : 5

Course Description

This course is designed to provide the prospective science teachers with the ability to command lessons in organic chemistry at B.Ed. and Higher Secondary School levels. This course deals with the structure of organic molecules, reaction mechanisms, polynuclear aromatic compounds, heterocyclic compounds, cycloalkanes, organometallic compounds carbohydrates, aminoacids, proteins, alkaloids, terpenoids, vitamins, steroids, hormones, fats and oils. The topics covered in this course are to be taught in consideration of the pedagogical aspects.

Course Objectives

- Explain the structure of organic molecules;
- Explain the reaction mechanism of organic compounds ;
- Explain the chemistry of polynuclear aromatic compounds, heterocyclic compounds, cycloalkanes and organometallic compounds;
- Explain the chemical principles of carbohydrates, aminoacid and proteins;
- Explain the chemistry of steroids, terpenoids, vitamins;
- Explain the basic concepts of hormones fats and oils.

Specific Objectives

- Explain atomic orbitals, molecular orbitals and hybrid orbitals in organic molecules
- Explain stereoisomerism, enantiomerisn, configurations and conformational analysis of organic molecules.
- Explain substitution, elimination and addition reactions
- Identify and explain the structure and reaction of naphathalene, naphthols, pyrole and pyridine
- Explain reaction and conformations of cyclo alkanes
- Explain preparation, properties and applications of organometalic compounds.
- Classify and name different carbohydrates.
- Explain the structure of glucose
- Classify amino-acids and proteins.
- Explain the composition of proteins
- Compare the properties of amino-acids and proteins
- Classify alkaloids
- Explain the isolations of alkaloids
- Explain the structure of alkaloids
- Explain the chemistry of pyridine, tropane, Qninoline and Phenanthrene and allkaloids

- Classify terpenoids
- Explain the isolation of terpenoids
- Explain the properties and structure of terpenoids
- Explain the chemistry of mono, sesqui, di-and triterpenoids.
- Classify and name vitamins
- Explain biological and physiological functions of vitamins
- Explain the chemistry of vitamin A, B-complex, C, D, E and K.
- Classify and name steroid hormones
- Explain the isolations of steroid
- Explain the relation of structure of steroid and hormones to physiological activity.

Course Contents

Unit I : Structure of Organic Compounds **10 hrs.**

- Introduction
- Atomic and Molecular orbitals
- Hybridisation and hybrid orbirals
- Stereoisomerism in organic compounds.
- Configurational and Conformational analysis

Unit II : Reaction Mechanism **20 hrs.**

- Introduction
- Electrophilic and Nucleophilic Substitution Reactions (effect of solvent and structure; Stereochemical implications, effect of entering and leaving groups)
- Elimination Reactions (stereospecificity, effect of activating groups, α, β and cis eliminations) Elimination Vs substitutions Reaction
- Addition Reactions (stereochemistry of addition, structure and reactivity, effects of group and orientation of addition)

Unit III : Polynuclear Aromatic compounds **10 hrs.**

- Introduction
- Structure and Reactions of Naphthalene and Naphthols
- Structure and Reactions of Anthracene and Phenanthrene

Unit IV : Heterocyclic Compounds **10 hrs.**

- Introduction
- Structure and Reactions of Pyrrole and Pyridine

Unit V : Cycloalkanes **5 hrs.**

- Introduction
- Reactions and conformations

Unit VI : Organometallic Compounds **10 hrs.**

- Introduction
- Preparation, Properties and Applications of organomagnesiam halides, organolithium compounds , organozinc compounds and tetra ethyl lead.

Unit VII : Carbohydrates **15 hrs.**

- Introduction
- Classification and Nomenclature
- Configuration of monosaccharides
- Structure of glucose

Unit VIII : Aminoacids and Proteins **10 hrs.**

- Introduction
- Classification and Nomenclature
- Composition of Proteins
- Properties of aminoacids and Proteins

Unit IX : Alkaloid **15 hrs.**

- Introduction
- Classification
- Isolation
- Properties
- Chemistry of pyridine, Tropane, alkaloids.

Unit X : Terpenoids **15 hrs.**

- Introduction
- Classification
- Isolation
- Properties of terpenoids
- Chemistry of mono, sesqui

Unit XI : Vitamins **15 hrs.**

- Introduction
- Classification
- Biological and physiological functions
- Chemistry of vitamins

Unit XII : Steroids and Hormones **10 hrs.**

- Introduction
- Classification
- Isolations
- Relations of structure to physiological activity

Unit XIII : Fats and Oil **5 hrs.**

- Introduction
- Properties
- Analysis

Instructional Techniques

Lecture / Discussion / Groupwork / Project work / Field visit / Report presentation.

Evaluation Scheme

Final examination at the end of the session

External Examination 100%

Questions must be related to and consistent with the level of objectives of the concerned topics mentioned in the curriculum.

Textsbooks

1. Agrawal. O.P. (1996), **Organic Chemistry** - Goel Pub. House. Meerut.
2. March, J. **Advanced Organic Chemistry** - Willey Eastern Ltd. New Delhi.
3. Mukherji S.M. and Singh., S.P. **Reaction Mechanism in Organic Chemistry** - MacMillan India Ltd. New Delhi.

Reference Books

1. Bansal. R.K. **A Textbook of Organic Chemistry** -WEL
2. Mukherji, S.M. - **Organic Chemistry**, Wil. Es. Ltd.
3. Nadkarny. V.V. and Kothave, A.N. **Organic Chemistry** - Popular Prakashan, Bombay.

Organic Chemistry (Practical)

Course No. : Sc.Ed. 522	Full Marks : 50
Nature of the course: Practical	Pass Marks : 25
Year: First	Periods per week : 4

Course Description

This course is designed to provide the prospective science teachers with skills required to conduct practical lessons in organic chemistry at the higher secondary level and B.Ed. level science classes.

Course Objectives

- Handle and manipulate chemical apparatus and equipment
- Observe, record the observations and draw conclusions
- Plan, organize and perform experimental investigations.

Specific Objectives:

- Identify the given organic substances
- Prepare the said organic compound
- Identify the given carbohydrate
- Identify the given aminoacids and proteins
- Analyse the given alkaloid
- Analyse the given terpenoid
- Perform charomatographic analysis of the given substances.

Course Contents

1. Identification of organic compounds (at least five compounds)
2. Preparation of organic compounds (at least five compounds)
3. Chromatographic analysis of organic substances.
4. Identification of carbohydrates.
5. Identification of aminoacids and proteins.
6. Analysis of alkaloids
7. Analysis of terpenoids.
8. Chromatographical analysis for the identification of the above-mentioned substances.

Instructional Techniques

Individual laboratory work / Group work / Project work / Field visit / Report presentation

Evaluation Scheme

1. Internal Evaluation **10.0**
   - Regularity
   - Regular practical work
   - Record book

2. External evaluation **40.0**
   - Major experiment 25.0
   - Minor experiment 10.0
   - Viva 5.0

Reference Book

1. Vogel A.I. **Textbook of Practical Organic Chemistry.** ELBS and Longman, London.

Inorganic Chemistry

Course No. : Sc.Ed. 523 | Full Marks : 100
Nature of the course : Theoretical | Pass Marks : 40
Year: First | Periods per week : 5

Course Description

This course is designed to provide the prospective science teachers with indepth knowledge in inorganic chemistry, with special emphasis on forces between atoms, coordination chemistry, periodic table, noble gases, spectroscopy, fertilisers, inorganic polymers, organomettalic compounds and chemistry and industry so as to command chemistry lessons at the higher secondary school and B.Ed. level classes. This course should be taught in consideration of the pedagogical aspect.

Course Objectives

- Explain the nature of forces between atoms
- Explain the linkage in complex comhrs.
- Explain periodic table on the basis of electronic configuration
- Compare the properties of elements in a group.
- Explain general chemistry of noble gas elements.
- Explain the fundamental particles in an atom
- Explain the basic principles of spectroscopy
- Explain the basic principles of chemical process in selected industries.
- Explain the chemical principles of fertilizers

Specific Objectives:

- Explain the nature of subatomic particles
- Explain the properties of nuclear particles.
- Explain the structure of the nucleus
- Explain types of forces between atoms
- Explain werner's theory
- Explain the nature of linkage and factors affecting the linkages
- Explain isomerism in coordination compounds
- Explain group discussion of the said groups
- Explain the chemistry of some of the important compounds of the said group elements
- Discuss the position of noble gas elements in the periodic table
- Explain the sources and properties of noble gases
- Explain the nature and structure of nucleus of an atom
- Explain the properties of nuclear particles
- Explain the nature of isotopic constitution of the elements
- Explain the principles of separation of isotopes
- Explain the nature of isobars, isotones and isomers
- Explain the principles and application of different types of spectroscopy

- Explain the principles of chemical process in metal, oil, cement and glass industries.
- Explain the chemecial principles of nitrogenous, phosphatic, Potassic fertilizers
- Explain the principles of analysis of fertilizers.
- Explain the chemical principles and applications of polymer chemistry of Si and S.
- Explain the chemistry of organometallic compounds of transitional metals.

Course Contents

Unit I : Structure of an Atom **20 hrs.**

- Fundamental particles
- Structure of the nucleus : Nuclear forces, Electron - proton concept, Proton - Neutron concept, Meson theory of nuclear forces, Mass defects in atomic nucleii, Nuclear binding energy, Nuclear stability.
- Properties of nuclear particles
- Isotopes and isotopic constitutions of the elements
- Isobars, Isotones and Isomers

Unit II : Forces between Atoms **25 hrs.**

- Origin of the chemical bond
- Pairing of electon spins
- Ionization Energy and electron affinity
- Lattice energy
- The Born-Haber cycle
- Solvation energy
- Ionic radii and crystal structures
- Physical properties of ionic comhrs
- Valency - bond approach to Molecular structure
- Resonance and resonance hybrid
- Molecular orbital approach to molecular structure
- Physical properties of covalent comhrs.
- Metallic bond and metallic state
- Pauling theory of metals
- Alloys and their types
- Physical properties of metals
- Dipole bond, Hydrogen bond, and Vanderwal forces.

Unit III : Coordination Compounds **20 hrs.**

- Introduction
- Werner's theory
- Electronic interpretation of coordination compounds.
- Nature of linkage in complex ions and coordination compounds.

- Factors affecting the stabilities of complex ions and coordination compounds
- Isomerism in coordination compounds

Unit IV : Periodic Table and Group Discussion **25 hrs.**
- Periodic table based upon electronic configuration
- Group discussion of Gr. IA (K, Rb, Cs); Gr. III A (Al. Ga, In, Tl); Gr. IV A (Sr, Ge, Sn. Pb) and Group IV B (Ti, Zr, Hf)
- Chemistry of some of their important compounds.

Unit V : Noble Gases **10 hrs.**
- Position of the noble gases in the P.T. sources, and properties of noble gases.

Unit VI : Spectroscopy **15 hrs.**
- Introduction
- Types of spectroscrpy
- Visible spectroscopy
- Ultraviolet spectroscopy
- Vibrational spectroscopy
- Nuclear Magnetic resonance
- Mass spectrometry
- Applications of spectroscopy

Unit VII : Chemistry and Industry **10 hrs.**
- Introduction
- Chemical processes in metal industry, oil industry, cement industry and glass industry - Soap and detergent industry.

Unit VIII : Fertilizers **15 hrs.**
- Introduction (Natural and chemical fertiliser)
- Soil fertility and productivity
- Nitrogen and nitrogenous fertilizers
- Phosphorus and phosphatic fertilizers
- Pottasium and potassic fertilizers
- Hazardous nature of fertilizers

Unit IX : Inorganic Polymers **5 hrs.**
- Introduction
- Polymer chemistry of Si, and S

Unit X : Organometallic Compounds **10 hrs.**
- Introduction
- Compounds of Transitional metals and their general homogenous catalytic reactions

Instructional Techniques
Lecture / Discussion / Group work / Project work / Report Presentation

Evaluation Scheme
Final examination at the end of the session
External examination 100%

Questio ıs must be consistent with and related to the level of objectives of the concern ·d topics mentioned in the curriculum.

Textbooks

1. Exmarch S. silreath, **Fundamental Concepts of Inorganic Chemistry** - Mc Graw - Hill International Edition
2. Liptrot, **Modern Inorganic Chemistry** - Bell and Hyman.
3. Prakash, Satya, Tuli G.D. and Basu, S.K, **Advanced Inorganic Chemistry** - S. Chand and Co. New Delhi.

References

1. Agrawal - (1990), **Modern Inorganic Chemistry**, Kitab Mahal Allahjabad.
2. Cotton W. - **Advanced Inorganic Chemistry**, WEL.
3. Gurdep Raj, (1996), **Advanced Inorganic Chemistry** - Goel Pub. House, Meerut.

Inorganic Chemistry (Practical)

Course No. : Sc.Ed. 524 — Full Marks : 50
Nature of the Course: Practical — Pass Marks : 25
Year: First — Periods per week : 4

Course Description

This course is designed to provide the prospective science teachers with the skills that are essential for conducting practical lessons in organic chemistry at the higher secondary level and B.Ed. level science classes.

Course Objectives

- Handle and manipulate chemical apparatus and equipment
- Observe, record the observations and draw conclusions
- Plan, organize and perform experimental investigations.

Specific Objectives:

- Analyse the given inorganic salt mixture
- Perform volumetric analysis
- Perform quantitative analysis
- Perform spectrocopic analysis.

Course Contents

1. Analysis of salt mixture containing six ions (at least five mixtures)
2. Estimation of ferrous ions in Mohr's salt.
3. Determination of chlorine in bleaching power
4. Determination of hardness of water by EDTA titration
5. Iodimetry - Iodometry titrations
6. Titrations involving precipitation reactions
7. Estimations of some common cations and anions
8. Spectroscopic analysis of simple substances.

Instructional Techniques

Individual laboratory work / Group work / Project work / Field visit / Report presentation

Evaluation Scheme

1. Internal evaluation	**10.0**
• Regularity	
• Regular practical work	
• Record book	
2. External evaluation	**40.0**
• Major experiment	25.0
• Minor experiment	10.0
• Viva	5.0

Reference Books

1. Vogel, A.I. - **Textbook of Practical Inorganic Chemistry** ELBS and Longman, London

Physical Chemistry

Course No. : Sc.Ed. 561
Nature of the course : Theoretical
Year: Second

Full Marks : 100
Pass Marks : 40
Periods per week : 5

Course Description:

This course is designed to familiarise the prospective science teacher with advanced concepts, principles, theories and applications of Physical Chemistry that will help him/her to teach at the higher secondary level, Certificate and Diploma level in science education.

The course consists of topics such as chemical bonding, chemical kinetics, thermodynamics, electrochemical cell, colloids and phase equilibria, structure of an atom, catalysis, nuclear chemistry, and dipole moment. This course should be taught in consideration of the pedagogical aspect.

Course Objective

- Explain the chemical bonding in relation to packing of ions in crystal, Born equation, Born Haber cycle, bond moment and dipole moments, electro negativity, ionic solids;
- Explain chemical kinetics in relation to order, consecutive reaction, free radical reaction, collision theory, theory of absolute reaction;
- Explain Thermodynamics in terms of scope and limitation, Isothermal work of an ideal gas, First law, enthalpy, relation between Cp and Cr, isothermal and adiabatic expansion and law of constant heat summation
- Explain the electro chemical cells in terms of electrolytic and galvanic cell, electronic concept redox reaction, working of electro chemical cell, Nernst's equation.
- Explain the colloids, emulsion and Gels in terms of meaning, properties, characteristic and uses.
- Explain Phase equilibria in terms of concept, solubility, absorption, pressure and Henry's law, Raoult's law.
- Explain the structure of atom
- Explain chemical bondings
- Explain the principles of catalysis
- Explain Ionic equilibria
- Explain dissociation of solutions.
- Solve simple problems.
- Explain nuclear chemistry
- Explain dipole moment

Specific Objectives

- Explain the chemical bonding in terms of packing of ions in crystal; Born equation, Born-Haber cycle,
- Define bond moment and dipole moments.

- Explain electronegativity and electronegativity differences
- Draw the structure of different ionic solids
- Calculate the percentage of ionic character from dipole moment.
- Explain the meaning, scope, process, limitation of Thermodynamics
- Explain Isothermal reversible and irreversible expansion of an ideal gas
- Explain enthalpy, molar heat capacity, adiabatic expansion.
- Explain Hess's Law of constant heat summation
- Explain electro chemical cells in terms of types, redox reaction, and working.
- Explain the meaning, properties and uses of Colloids, Emulsion and Gels.
- Explain wave mechanical concept of atom.
- Derive de-Broglie's equation
- Explain the wave nature of an electron, Heisenberg's principle, Quantum numbers, ground state electronic configuration of electron
- Explain the condition of formation of bonds, crystal structure of metals.
- Draw geometries of molecules
- Explain VSEPR theory
- Explain catalysis, its meaning, types, criteria and theory and catalytic poisoning
- Explain Ionic equilibria in terms of Ostwald's dilution law, factors, Debye - Huckel theory.
- Explain the degree of dissociation and factors related to it
- Derive Debye - Huckel Onsagar conductance equation
- Solve simple numerical problems
- Explain nuclear chemistry in terms of radioactivity, radiation, types, detection, measurement, disintegration, half life.
- Explain nuclear fission, fusion, nuclear equations, nuclear energy and reactor.
- Explain dipole moment interms of concept, unit, properties, application

Course Content

Unit I : Structure of Atom **20 hrs.**

Wave mechanical approach, wave mechanical concept of atom, de Broglie equation, wave nature of an electron, Heisen-berg's uncertainity principle, Schrodinger wave equation, Quantum numbers and their significance, energy distribution and orbitals, distribution of electrons in orbitals, schematic representation of electronic configuration, ground state electron configuration of elements

Unit II : Chemical Bondings **15 hrs.**

Metallic bonds, Characteristics of metallic bond, Arrangement of atoms in metal, crystal structure of metals, Free electron theory, Valence bond approach, Electron sea model, Geometries of molecules, VSEPR theory :- a) Linear molecules, b) Trigonal planner molecule, c) Tetrahedral molecule, d) Pyramidal molecule, e) Bent or angular molecules. Packing of ions in Crystal - Born equation - Born Haber cycle - Covalent characters in ionic compound - Bond moment and Dipole moments - Percentage of ionic character from dipole moment - electronegativity differences - structure of ionic solids.

Unit III : Electrochemical Cells **15 hrs.**

Electrolytic and galvanic cell - Electronic concept of redox reaction - redox reaction and working of electro chemical cells - representation of electro chemical cells - half cells, single electrode potential and normal hydrogen electrode - measurement of standard electro potential - electro chemical series - reference electrode, measurement of emf of a cell - Nernst's equation.

Unit IV : Thermodynamics **20 hrs.**

- Some thermodynamics terms - Scope of thermodynamics - limitations of thermodynamics - thermodynamics processes - reversible and irreversible process - isothermal reversible expansion work of an ideal gas - isothermal irreversible expansion work of an ideal gas - maximum workdone in reversible expansion - First law of thermodynamics - Enthalpy of a system (units and sign convention of enthalpy) - molar heat capacity molar heat capacity at constant pressure and at constant volume - Relation between Cp and Cr - Adiabatic expansion of an ideal gas - comparision between Isothermal and adiabatic expansion - Hess's Law of constant heat summation and its application (Related numerical problems).

Unit V : Chemical Kinetics **15 hrs.**

Consecutive reactions, Parallel reaction, - Chain reactions - Kinectics of chain reactions - Free radicals and chain reactions - Simple collision theory of reactions rates - Failure of simple collision theory - Theory of absolute reaction rates.

Unit VI : Colloids, Emulsion and Gels **10 hrs**

- Introduction - properties - uses of Colloids
- Introduction - preparation - properties and uses of Emulsions
- Introduction - types - properties and uses of Gels.

Unit VII : Phase Equilibria **15 hrs.**

Introduction - Absorption and solubility coefficient - Influence of temperature - Influence of pressure- Deviation from Henry's law - Solubility of gases mixture - solubility of gases in Aqueous solutions - Henry's and law - Ideal solution and nature of the gas.

Unit VIII : Dipole Moment **5 hrs.**

Concept of dipole moment - units of dipole moment - dipole moment and molecular structure - dipole moment and ionic characters - bond moment - applications of dipole moments.

Unit IX : Catalysis **10 hrs.**

Introduction - meaning - types - criteria - theory of catalysis - activation energy and catalysis - catalytic poisoning - auto-catalysis - Negative catalysis - enzyme catalysis.

Unit X : Ionic Equilibria **10 hrs.**

Ostwald's dilution law - experimental verification of Ostwald's dilution law - limitation of Ostwald dilution law - factors that explain the failure of Ostwald's law in case of strong electrolyte - Debye Huckel theory - Factors influencing the degree of dissociation - simple problems.

Unit XI : Nuclear Chemistry **15 hrs.**

Introduction - radioactivity- types of radiation - detection and measurement of radioactivity - cloud chamber- ionization chamber - Geiger muller counter - types of radioactive decay - radioactive disintegration series - rate of radioactive decay - half life period, average life - nuclear reaction - nuclear fission and nuclear fusion reaction - nuclear equations - artificial radioactivity - energy released in nuclear reaction - Einstein equation - mass defects and mass deficit - nuclear binding energy - neutron - proton ratio and nuclear stability - nuclear chain reaction - nuclear energy - nuclear reactor.

Instructional Techniques

Lecture-cum-discussion-presentation - demonstration - illustration experimentation - workshop - microlessons - Problem solving.

Evaluation Scheme

Final examination at the end of the session

External examination 100%

Questions must be consistent with and related to the level of objectives of the concerned topics mentioned in the curriculum.

Textbooks

1. Bahl, B.S. and Tuli, G.D., Bahl Arun. **Essentials of Physical Chemistry** - S.Chand and Co. N. Delhi .

References

1. Glassstone S. Dscphd **Textbook of Physical Chemistry**.
2. Glasstone S. and Lewis D, **Elements of Physical Chemistry**, Mcmillan co. Ltd.
3. Maron S.H., Prutton C.F., **Principles of Physical Chemistry**, Oxford and I.B. 4 Pub. Co.
4. Maron S.H., Prutton C.F. **Principles of Physical Chemistry**, Oxford and I.B.H. Pub. Co.

Physical Chemistry (Practical)

Course No. : Sc.Ed. 562 — **Full Marks : 50**
Nature of the course : Practical — Pass Marks : 25
Year: Second — Periods per week : 4

Course Description

This course is designed to provide the prospective science teachers with the skills that are required to conduct practical lessons in physical chemistry at the higher secondary level and B.Ed. level science classes.

Course Objectives

- Handle and manipulate chemical apparatus and equipment
- Observe, record the observations and draw conclusions
- Plan, organize and perform experimental investigations.

Specific Objectives :

1. Make preparation of Ferric Hydroxide sol.
2. Determine enthlpy of neutralization.
3. Determine E.C.E. of copper
4. Determine of composition of water.
5. Determine dissociation constant
6. Study the rate of chemical reactions
7. Determine the heat of ionisation
8. Determine the heat of neutralisation
9. Determine partition co-efficient
10. Determine the heat of solution.

Course Contents

1. Study the effect of temperature, catalyst, particle size in the rate of chemical reaction.
2. Study the effect of concentration of reactants under the rate of reactions between $Na_2S_2O_4$ and Hcl.
3. Measurement of equivalent conductance. Verification of dilution law by measuring the conductance of acetic acid at different concentrations and to determine the dissociation constant of the acid.
4. Determine the heat of ionisation of acetic acid and ammonium hydroxide.
5. Determine the heat of neutralization of hydrocloric acid and sodium hydroxide.
6. Determine partition co-efficient of Iodine in Carbon tetrachloride and water (distribution of two immiscible liquids)
7. Determine the heat of solution of Copper sulphate
8. Study the effect of temperature, catalyst, particle size in the rate of chemical reaction.
9. Study the effect of concentration of reactants under the rate of reactions between $Na_2S_2O_2$ and Hcl.

Evaluation Scheme

1. Internal evaluation **10.0**
   - Regularity
   - Regular practical work
   - Record book

2. External evaluation **40.0**
   - Major experiment 25.0
   - Minor experiment 10.0
   - Viva 5.0

Questions must be consistent with and related to the level of objectives of the concerned topics mentioned in the curriculum.

Textbooks

1. Sharma K., **Introduction to Practical Chemistry** - Vikash Publishing House, N.Delhi
2. S.C. Jain, Balasubramanyam G., Sethi R., **Experimental Chemistry** (Part I).

Reference books

1. Jain S. C, Balsubramanyam G, Sethi R, **Experimental Chemistry Part II,.**
2. Sharma K.K. and Sharma D.S., **An Introduction to Practical Chemistry**, Vikash Pub. House.

Teaching Chemistry Education

Course No. : Sc.Ed. 591
Nature of the course : Theoretical
Year: Second

Full Marks : 50
Pass Marks : 20
Periods per week: 3

Course Description

This course is designed to provide the basic concepts of chemistry education, its development and innovative approaches followed in school chemistry in various countries. It also provides knowledge, skills and practice in designing chemistry laboratory and in managing resource materials. Moreover it will give essential skills in the preventive measures of common chemistry laboratory accidents and their first aid treatments. This course also provides opportunity to visit and evaluate different kinds of chemistry laboratories and chemistry-based industries.

Course Objectives

- Be aware of the importance of chemistry education in school and in society
- Review innovative approaches in chemistry teaching and apply some of the selected approaches in our schools.
- Review critically the linkage between chemistry and society
- Develop teaching modules in chemistry.
- Be aware of the criteria involved in planning chemistry laboratory.
- Design and organise chemistry laboratory and manage resource materials.
- Improvise apparatuses for chemistry lessons.
- Follow safety rules and first aid treatments in chemistry lab.

Specific Objectives:

- Differentiate between the meaning of chemistry and chemistry education.
- Trace the developmental phases of chemistry education at the school level and at the tertiary level in Nepal and in other selected countries.
- Explain modern trends in chemistry education in the U.K.. U.S.A., Nepal and India
- Compare school chemistry teaching in Nepal with that in other countries
- Explain the importance of chemistry and chemistry education in our lives.
- Explain innovative approaches in school chemistry curriculum in the U.K., U.S.A.
- Explain innovative approaches in school chemistry teaching
- Explain the methods of assesssing chemistry students
- Explain the methods of assessing chemistry practical work
- Explain the need and the ways of chemistry teacher training at the school level.
- Explain the qualities and responsibilities of a chemistry teacher at school
- Explain the management of chemistry class in and out of school

- Explain the bond between chemistry and society with special emphasis on environment, industry, agriculture, health and kitchen
- Construct teaching modules in chemistry at the school level.
- Practice the constructed chemistry modules in chemistry teaching.
- Explain the importance and types of chemistry practical work
- Evaluate and observe the facilities in chemistry laboratory in our schools and campus through visits and observations.
- Compare the chemistry lab facilities in Nepal with neighbouring countries.
- Explain the characteristic and requirements of a chemistry laboratory.
- Prepare layout models of a chemistry laboratory.
- Set-up of a prototype chemistry lab. for a school or campus.
- write the lab. instructions for chemistry teachers, lab. assistants and students.
- Develop the skill of storage and maintaining record keeping of chemicals and equipment.
- Develop expertise in storing the chemicals and equipment.
- Improvise equipment for use in schools and campus level chemistry work.
- Explain the role of computer, T.V., Film strip, slides in chemistry practical work.
- Prepare and use charts and models in chemistry practical work.
- Identify common lab accidents and explain their preventive measures in chemistry laboratory.
- Use first-aid treatment in Chemistry labs.
- Use industries as chemistry resources.

Course Contents

Unit I : Chemistry Education **10 hrs.**
- Chemistry and chemistry education
- Importance of chemistry and chemistry education in our lives.
- Development of chemistry and chemistry education
- Modern trends in chemistry education

Unit II : Curriculum Innovations in School Chemistry **10 hrs.**
- Introduction
- Chemistry and school science curriculum in Nepal, India, U.S.A., U.K.
- Innovative approaches in school chemistry curriculum in U.K., U.S.A.

Unit III : Chemistry Teacher Education **15 hrs.**
- Introduction
- Innovative approaches in school chemistry teaching
- Assessment of chemistry students
- Responsibilities and qualities of a chemistry teacher at school
- Management of chemistry class in and out of school
- Chemistry teacher training at school

Unit IV : Chemistry and Society **5 hrs.**

- Introduction
- Chemistry and Environment
- Chemistry and Health
- Chemistry and Industry
- Chemistry and Agriculture
- Chemistry and Kitchen

Unit V : Chemistry Teaching Modules **10 hrs.**

- Introduction
- Construction of innovative teaching modules at the school level on selected topics such as chemical bonding; Oxd^n. and Red^n, At. Str.
- Practice on the constructed modules

Unit VI : Chemistry Laboratory and Instruction **10hrs.**

- Importance of laboratory work in chemistry.
- Types of laboratory activities.
- Present position of facilities in chemistry laboratories in Nepal and in neighbouring countries.
- Kinds of chemistry laboratory
- Characteristic features of chemistry lab.
- Requirements of chemistry lab.
- Planning chem. lab. (paper, model and planning) and its instructional use.
- Instructions to chemistry teachers.
- Instructions to chemistry laboratory assistants
- Instruction to chemistry students.

Unit VII : Equipment and Chemicals **10 hrs.**

- Record keeping of chemicals and equipments.
- Storage of chemicals and equipments.
- Arrangement and care of chemicals and equipments.
- Improvisation of few equipments for schools and campus level practical work.
- Audio visual aids in chemistry work (T.V. computer, Film strip, slides, chart, model)

Unit VIII : Accidents and Safety Rules **5 hrs.**

- Common lab. accidents
- Preventive measures
- First-aid treatment

Instructional Techniques

1. Lecture / Discussion
2. Lab. visit / Observation / Report writing / Report presentation and discussion.

Evaluation Scheme

Final examination at the and of the session
External examination 100%

Questions must be related to the level of objectives of the concerned topics mentioned in the curriculum.

Reference Books

1. **Journal of Chemical Education**
2. Jurgen Schemidt Ed. Hans, (1994), **Problem Solving and Misconcepting in Chemistry**, University of Dostmund.
3. K. Guy, **Laboratory Organization and Administration**. Macmillan .
4. **School Chemistry Curriculum in U.S.A.**; U.K.; India
5. **School Science Curriculum**, C.D.C. H.M.G. Nepal
6. Suckling, Colin J. Bell and Hymann, **Chemistry Through Models**, U.K.
7. Waddington Ed. D.J. - (1984), **Teaching School Chemistry**. UNESCO.

Specialization

Biology Education

Specialization

Biology Education

First Year

Course No.	Course Title	F.M.	Nature
Sc.Ed. 511	Diversity of Plants & Animals	100	Theoretical
Sc.Ed. 512	Diversity of Plants & Animals Practical	50	Practical
Sc.Ed. 513	Functional and Applied Biology	100	Theoretical
Sc.Ed. 514	Functional and Applied Biology	50	Practical
	Second Year		
Sc.Ed. 551	Cellular & Developmental Biology	100	Theoretical
Sc.Ed. 552	Cellular & Developmental Biology Practial	50	Practical
Sc.Ed. 590	Fundamentals of Science Education	50	Theoretical
Sc.Ed. 591	Teaching Biology Education	50	Theoretical
Ed. 598	Thesis	50	Practical
Ed. 599	Practicum	50	Practical

Elective

Course	F.M.	Nature
Sc.Ed. 571 Environmental Science	50	Theo.+ Pra.

Note: Sc.Ed. 590 Fundamentals of Science Education and Elective Course Sc.Ed. 571 Environmental Science are common to all the Science Education courses. So these two courses are given only in the last part of the Physics Education course.

Diversity of Plant and Animal Life

Course No. : Sc.Ed. 511 | Full Marks : 100
Nature of the course: Theoretical | Pass Marks : 40
Year: First | Periods per week : 5

Course Description

This course has been developed to provide advance knowledge in the field of "diversity of plant and animal life." It consists of units on the diversity of lower plants, non-flowering plants, gymnosperms, taxonomy of angiosperm and economic plants, animal taxonomy, characteristics features and the life cycle of animals belonging to different phylum, class, order and genus. This course will impart adequate knowledge to conduct theoretical classes of biology at the Higher Secondary School and the Campus level.

Course Objectives

- Describe, explain, interpret, and classify the recent classification of algae, fungi, Bryophyta, and pteridophyta
- Describe the lifecycle of lower plants and nonflowering plants.
- Acquire advanced knowledge in recent classification of gymnosperm and angiosperm.
- Develop and explain the necessary semi-technical terms of the family Description of the flowering plants.
- Classify animals with diagnostic characters.

Specific Objectives

- Describe the recent classification of algae.
- List and prepare the chart of recent classification of algae.
- Explain the general characteristics features and the life cycles of the chlamydomonas, cladophara, diatoms, ectocarpus and polysiphonia
- Explain the pigments. Plastids and chromatophores and economic importance of Algai
- Explain the Aniswort system of classification of fungi
- Describe the structure and the life cycle of some species of fungi
- List and explain the economic importance of fungi
- Describe the recent classification of bryophyta and pteridophyta
- Explain the origin and ecology of bryophyta
- Explain the structure and reproduction and development of some species of non-flowering plants.
- Explain the distribution and recent classification of gymnosperm.
- Describe the structure and reproduction of some species of gymnosperm.
- Explain the general principles of phylogeny of angiosperm.
- Describe the some theories on "Origin of Angiosperm"
- Describe the vegetative and floral characters, systematic position, affinity and economic importance of some angiospermic plants.

- Organise field trip - external and internal tours for the collection and preservation of plants.
- Develop power of observations and sense of enquiry in the study of diversity of animal life.
- Classify animals upto genus;
- Describe habit, habitat, structure, general features, development and life cycle of different animals
- Comparative study of structure, habit, habitat and structure of important species of different phylum.

Course Contents

Unit I : Lower Plants **20 hrs.**

A. Algae
- Recent classification of Algae (Fritch)
- Structure and life-cycle of the following genera : chlamydomonas, cladophora, diatoms, polysiphonia, ectocarpus
- Pigments, Plastids, Chromatophors
- Economic importance of Algae

B. Fungi
- Recent classification of fungi (Anisworthr)
- Structure and life cycle of the following genera : Saprolegnia, Phythoptheria, penicillium, piziza, ustilago, Alternaria
- Economic importance of fungi

Unit II : Non-flowering Plants **20 hrs.**

A. Bryophyta
- Recent classification of Bryophyta
- Structure, development and reproduction of the following typical genera : Pellia, Plagiochasma, sphagnum
- Origin of Bryophyta
- Ecology of Bryophyta

B. Pteridophyta
- Recent classification of Pteridophyta
- Habit, Habitat, external and internal structure, development and life cycle of following typical genera : psilotum, selaginella, and pteridium

Unit III : Gymnosperm **2 hrs.**
- Recent classification of gymnosperm
- Distribution, external and internal structure, reproduction of the following genera : Ginkgobiloba, taxus and cedrus.
- Study of important fossil group : Bennattitales, Cycadofilicales.

Unit IV : Angiosperm **20 hrs.**

- General principles of phylogeny
- Monophylitic and polyphylitic origin
- Origin of angiosperm
- Systematic study, affinities and economic importance of the following typical families
  - A. Dicotyledons: Nymphacea, Papervaracae, Polygonaceae, Acanthaceae, Euphorbiaceae, Meliaceae.
  - B. Monocotyledons: Orchidaceae, Zingiberaceae, Araceae.

Unit V : Economic Plants **5 hrs.**

a. Distribution, Identification and importance of the following plants
- Medicinal plants
- Crop plants
- Fiber plants
- Timber plants
- Alcoholic beverage plant
- Oil plants

Unit VI : Concept of Taxonomy **10 hrs.**

1. Historical background of taxonomy (Introduction to diversity of life)
2. Binomial nomenclature
3. Naming of Animals
4. Taxonomic Units
5. Roy and linnaeus in Taxonomy
6. Recent Trends in Taxonomy
7. Criteria for classification of Animals
8. Difficulties in classification.

General Classification **38 hrs.**

A. Non-chordata

Classification of Non-chordata upto genus with important characters and suitable examples.

1. Phylum Protozoa
   - Comparative study of structure, habit, habitat and structure of some of the important species of protozoa.
   - Life cycle of Traponosoma

2. Phylum Porifera
   - Comparative study of structure, habit, habitat and structure of some of the important species of phylum porifera.
   - Life cycle of Leucosolena

3. Phylum Coelenterata
   - Comparative study of structure, habit, habitat and structure of some of the important species of phylum coelenterata.
   - Life cycle of Aurelia.

4. Phylum Helmenthes
   - Comparative study of structure, habit, habitat and structure of some of the important species of Phylum helmenthes.
   - Life cycle of Echinococces.

5. Phylum Annelida
   - Comparative study of structure, habit, habitat and structure of some of the important species of Phylum Annelida.
   - Life cycle of Neries

6. Phylum Arthroporda
   - Comparative study of structure, habit, habitat and structure of some of the important species of Phylum Arthroporda.
   - Life cycle of Paloeman

7. Phylum Mollusca
   - Comparative study of structure, habit, habitat and structure of some of the important species of Phylum Mollusca.
   - Life cycle of Pila

7. Phylum Echinodermata
   - Comparative study of structure, habit, habitat and structure of some of the important species of Phylum Echinodermata.
   - Life cycle of Starfish

B. Chordata **25 hrs.**

Classification of chordata upto genus with important characters and suitable examples :

1. Hemichordata
   - Comparative study of structure, habit, habitat and structure of some of the important species of Hemichordata.
   - Life cycle of balanogloscus

2. Urochordata
   - Comparative study of structure, habit, habitat and structure of some of the important species of Urochordata.
   - Life cycle of Ascidian.

3. Cephalochordata
   - Comparative study of structure, habit, habitat and structure of some of the important species of Cephacochordata.
   - Life cycle of Ascidian

4. Cephalochordata
   - Comparative study of structure, habit, habitat and structure of some of the important species of cephalochordata.
   - Life cycle of Amphioxcus

5. Vertebrata
   - Comparative study of structure, habit, habitat and structure of some of the important species of vertebrate.
   - Life cycle of Labeorohita columbia and rabbit.

C. Minor Phyla **5 hrs.**

Classification of Minor Phyla upto genus with important characters and suitable examples:
- Comparative study of structure, habit, habitat and structure of some of the important species of miner-phyla.
- Life cycle of Hormiphora.

Unit VII : Evolution **10 hrs.**

<u>Life Origin</u>
- Special creation theory
- Abiogenesis
- Chemical evolutions
- Self assembly theories

<u>Evolutionary Evidences</u>
- Palaentological evidences
- Taxonomical
- Comparative anatomical
- Comparative embryological
- Physiological
- Comparative cytological
- Genetical
- Bio-geographical relationship evidences

<u>Evolutionary Theories</u>
- Darwinism
- Modern Synthetic theories

Instructional Techniques
Lecture / discussions / demonstration / field visit.

Evaluation Scheme
Final examination at the and of the session
External examination 100%

Questions must be consistent with related to the level of objectives of the concerned topics mentioned in the curriculum.

Textbooks

1. **College Botany,** Vol. I and Vol II, Gangullee and Kar, New Central Book Agency, Calcutta
2. Parker T.F. and W.A. Haswell, **A·Textbook of Zoology Vol. 1.,** Mzc Millan and Co. Ltd., New York.
3. P.S. Verma, **Invertebrate Zoology**, S.Chand and Co. Ltd.
4. Verma P.S., **Chordate Zoology and Animal Physiology,** S.Chan and Company (Pvt.) Ltd.
5. Y.D. Tiagi and Dr. R.P. Ray, **Modern Text Book of Botany,** by 1989 Shubhan Prakashan

Reference Books

1. **A Textbook of Zoology** vo. I and II, University , S.Chand and Co. India
2. Chopra G.L., **Gymnosperm,** S.Nagin and Co. Jullundur.
3. Lawrence G.H.M., **Taxonomy of Vascular Plant,** MacMillan
4. Kotpal, R.L. (1973)- **Protozoa, Porifera, Coelenterita, Helminthes, Annelida, Arthropoda Mollusca, Echinodermata**.
5. Prasad S.N., **A Textbook of Invertebrate Zoology, A Textbooks of Vertebrate Zoology,** Kitab Mahal, Allahabad
6. Pandey and Aniter, (1983)**Economic Botany**, S.Chand and Company Ltd. Ram Nagar, New Delhi.
7. Richard, P. **An Introduction to Biological Science,** Cambridge University Press.
8. Sharma O.P., **Textbook of Algae,** Tata McGraw - Hill Publishing Company Limited
9. Sharma O.P., **Textbook of Fungi,** Tata McGraw - Hill Publishing Company Limited.
10. Sharma O.P., **Plant Taxonomy,** Tata McGraw - Hill Publishing Company Limited
11. **Vasishta, Taxonomy of Angiosperm,** Sultanchand, New Delhi.
12. **Vasestha, Gymnosperm,** D.C. Sultanchand, Delhi

Diversity of Plants and Animals (Practical)

Course No. : Sc.Ed. 512 Full Marks : 50
Nature of the Course: Practical Pass Marks : 25
Year: First Periods per week. : 4

Course Description

This practical course of plant and animal diversity provides psychomotor activities of each Unit of theoretical Biology paper I dealing with Diversity of Plant and Animal Life. This course will develop knowledge and skills for conducting Bio-practical classes at Higher Secondary school and Bachelor of Science Ed. at the campus level on taxonomy, economic Biology and evolution.

Course Objectives:

- Develop the skill of making collection and preservation of lower plants and higher plants,
- Study general characteristic features, structure and reproductive parts of important plants included in the content course.
- Prepare the temporary as well as permanent slides of important genera of algae, fungi, bryophytes, pteridophytes and gymnosperms included in the content course.
- Culture the possible genera of the fungi in the laboratory
- Identify and describe a flowering plant in semi-technical terms and assign it to its respective taxonomic group.
- Identify and classify animals with important characters.
- Draw diagrams of different animals, their parts and label them.
- Prepare slides of different parts of animals and draw their diagrams and label the parts.
- Dissect and expose different organs and systems of animals and to identify and explain their parts and the methods of preservation.

Course Contents

1. Prepare temporary as well as permanent slides of following genera (available and possible only) : Chlamydomones, Cladophora, Diatoms, Polysiphonia, Draparnaldiopres, Vaucheria ectocarpus, Sargassum and study their characteristic features and reproductive parts also.
2. Prepare temporary as well as permanent slides of the following possible genera : saprolegnia, phythotheria, penicellium, alternaria and study their characteristic features and reproductive parts also.
3. Culture the possible genera of the fungi.
4. Study the external and internal structure of pellia and plagiochasma and other possible genera also.
5. Prepare the permanent slide of pellia and plagiochasma
6. Prepare the permanent slides and study the anatomical structure of selaginella, and pteridium.
7. Prepare the permanent slides of the stem of taxus and ginko, cedrus.

8. Study the important fossil groups from preserved materials of permanent slides.
9. Systematic study of the following plants with floral formula and floral diagrams of the families from the available plants.
   A. Nymphaceal, paper veraceal, polygoniaceale, acathaceale, euphorbiaceale, meliaceae
   B. Orchidaceale, Cizgiberaceal, Araceale
      - Prepare the herberia of the importante plant
      - Collection and preservation of the lower and higher plants included in the content course.
      - Field trip - for the collection and preservation of the plant materials
      - Field-trip - internal as well as external
      - Report writing

10. Collection. preservation. identification and study of animals belonging to different Phyla.
11. Preparation of slides of :
    - Paramacium, Hydra, nephridea, mouth parts of mosquito, housfly and cockroach, muscles of rabbit etc.

1. Excursions to national parks, reserves, and zoos.

Instructional Technique
Demonstration / student performance / Field visit / Report presentation

Evaluation Scheme

1.	Internal evaluation	10.0
	• Regularily	
	• Regular Practical Work	
	• Record Book	
2.	External evaluation	40.0
	* Major experiment	25.0
	* Minor experiment	10.0
	* Viva	5.0

Reference Books

- Pandey. **Practical Botany** Vol. I and Vol II.
- Kotpol, R.L. (1973) - **Protozoa, Porifera, Gelentereta, Helminthes, Annelida, Arthothroposla m.... and Echinodermata,** Restogi and Company, Merut, India.
- Jorden, E.L. and Nigan H.C. (1971) - **Animal Biology** Hindustan Book Depot, Lucbnow -1.
- Jordan E.L. and Verma P.S. (1988). **Chardate Zoology and Animal Physiology,** S.Chand and Company (Pvt.) Ltd.
- Vidyarthi, R.D. (1986). **A Textbook of Zoology**. S.Chand and Co. Ltd.

Functional and Applied Biology

Course No. : Sc.Ed. 513 | Full Marks : 100
Nature of the course : Theoretical | Pass Marks : 40
Year: First | Periods per week : 5

Course Description

This paper is related with the biological topics of secondary level school syllabus, the higher secondary level biology subjects and three year diploma level biology papers of SC.Ed.. The units deal in this course with general introduction to organic chemicals, transport mechanism in plant and animals body, anabolism and catabolism mechanism, response or coordination and control mechanism of living organisms; microbial study, Biotechnology and breeding technique.

Course Objectives

- Describe, explain and enterpret the structure, functions and characteristics of organic chemicals of the living body.
- Explain, compare, evaluate and conclude the gas, movements of water, blood and screen and minerals salts movement within the body of living organisms.
- Explain, compare and conclude anabolism and catabolism processes, as well as the coordination and control mechanisms in living organisms.
- Summarise, explain, identify and conclude the role of microorganism on human health and plant diseases.
- Describe, explain and outline modern techniques and advances made in Biotechnology.
- Explain, summarise and justify the methods used in plant breeding methodologies.

Specific Objectives

- Explain the biochemistry of carbohydrates, lipids, aminoacids along with their properties
- Explain and compare the absorption, transportation and getting rid of water and minerals in plant body.
- Explain the circulatory mechanism in animals
- Describe the osmoregulatory and excretory process of animals.
- Explain and compare the synthesis and analysis of carbon compounds in living organisms
- Explain the importance of the nervous mechanism and systems of lower and higher animals.
- Describe and interpret the growth process and related hormones in plants.
- Describe the structure and lifecycle of microorganism
- Explain the host defense mechanism.
- Explain the pathogenic activity of microorganism in human beings, plants and animals

- Explain the technologies of potable water and sewage, milk and milk-products, and soft and hot drinks.
- Explain the latest biotechnology of tissue culture
- Describe the plant breeding techniques and methodologies.

Course Contents

I Life Chemicals **20 hrs.**

Biochemistry

- Introduction
- Types of biochemicals : Simple and macromolecules

Carbohydrates

- Introduction
- Mono- Diand Polysaccharides
- Structure of Glucose

Lipids

- Introduction
- Fatty acids
- Types of Lipids

Proteins

- Introduction
- Structure and types of amino-acids
- Properties
- Structure and propertis of proteins
- Types of protiens

II Transport Mechanism **20 hrs.**

Water Movement in Plants

- Intake mechanism
- Transportation process
- Removel of excess water
  - Transpiration process

Mineral Nutrition (Plants)

- Mineral requirement - Micro and Macro
- Site of mineral accumulations
- Absorption mechanism
- Salt translocation process

Circulation in Animals

- General principles
  - Pumps and condients
- Vertebrate circulation mechanism

- Body water and Blood
- Circulation pattern
- Heart and cardiac output
- Conducts

- Invertebrate circulation Mechanism

<u>Osmoregulation and Excretion</u>

- Concept
- Controlling factors of Osmoregulation
- Epethelial water transport
- Vertebrate kidney
  - Urine formation
  - Glomerular filtration
  - Tubular reabsorption
  - Nephron mechanism
  - Water regulation
- Invertebrate Osmoregulatory organs
- Avian and Reptilian salt glands

III Anabolism and Catabolism **20 hrs.**

<u>Synthesis of Organic Compounds in Plants</u>

- Photosynthetic apparatus
- ATP. NADP. TPNH etc.
- Nature of Sunlight
- Water photolysis
- Carbondioxide reduction mechanism
- Carbohydrate formation

<u>Complex Organic Compound Degradation</u>

- Concept
- Glycolysis mechanism
- Kreb's cycle
- Factors affecting the processes

<u>Gaseous Exchange in Animals</u>

- Oxygen and carbondioxide transport mechanism
- Lungs - Gas exchange site
- Insect tracheal exchange system
- Capillary wall gaseous exchange
- Vertebrate Gills

<u>Heterotropic Nutrition of Animals</u>

- Feeding mechanism of animals
- Mammalian nutrition

- The alimentary canal
- Digestive secretions
- The digested food absorption

IV Coordination and Control Mechanism **10 hrs.**

The Nervous System

- Nature of Nerve impulse
  - Resting potentials
  - Action potentials

Synapse

- Mechanism of transmission
- Neuro muscular junctions (NMJ)
- Synapse functions and NMJ
- Chemical influence on Synapse and NMJ.

Vertebrate Nervous System

- Peripheral nervous system
- Anatomic nervous system
- Central nervous system
  - Spinal cord and Brain
  - Human brain structure
- Sensory Receptors
  - Mechanism of transduction
  - Receptors - structure and functions and properties

V Growth **10 hrs.**

Introduction

- Concept of plant growth

Growth Pattern

- Isometric and allometric
- Lenuted and unlenuted

Growth Inflowering Plants

- Seed dormancy
- Germination process
- Growth of embryos

Plant Growth Substances

- Phototropism and Geotropism
- Artificial growth substances
- Apical dominance
  - Photoperiodism

- Vernalisation

VI Microbial Study **20 hrs.**

Microbial Structure and Life cycle

- Structure and Life-cycle
  - Virus and Bacteria
  - Protozoa
  - Molds
  - Parasitic worms

Host Defense-Mechanism

1. Infection Process
   - Microbial adherence
   - Penetration of epithelial layer
   - Events after penetration
   - Microbial virulence factors.
2. Resistance and Defense
   - Natural Resistance of body
   - Internal definse mechanism
   - Nonspecific defense mechanism
3. Immune Response
   - Antigen and antibodies
   - Immune system
   - Hypersensetivity

VII Pathogenic Activities **20hrs.**

1. Diseases of Human Beings
   - Diseases concept
   - Diseases types - infections
     - Air-borne,
     - Water-borne and
     - Food borne
2. Plant Diseases
   - General Symptoms
   - Mechanism of pathogen actions
   - Air, Soil and seed borne disease
   - Wilt and root diseases
   - Parasitic-worm-caused plant diseases

Domestic Microbiology

- Water and sewage microbiology
- Milk and milk products technology
- Soft and Hard drink productions

VIII Biotechnology

Tissue Culture Technique **20 hrs.**

- Introduction
  - Concept and importance
  - Types of tissue culture technique
- Culture Media and Nutritional Components
- Liquid media
- Callus preparations
- Organogenesis
- Somati embryogenesis
- The apex culture
- Anther and pollen culture

Cloning the Animals

- Principles of cloning
  - Introductions
  - Concepts
  - Techniques
- Advances made
  - Lamb cloning
  - Test tube babies

IX Plant Breeding

- Technique of selections **10 hrs.**
- Hybridization
- Methods of plant improvements
  - Improvements of
  - Paddy
  - Wheat and Maize
  - Jute
  - Potato
  - Sugarcane, etc.

Evaluation Scheme
Final examination at the end of the session
External examination 100%

Questions must be consistent with and related to the level of objectives of the concerned topics mentioned in the curriculum.

Reference Books

1. Conn, E.E. and Stumpf, P.K. Title: **"Outline of Biochemistry"** Jahe Weley and Sons Hr. pub. New York.
2. Campbell, P.No. and Smith, A.D. Title: **"Biochemistry Illustrated"** Churchill Livengstone Pub. London, Edmburge.
3. Dube, H.C., **"Fungi, Bacteria and Virus"**, Vikash Publishing House Pvt. Ltd., Masjed Road, Jangpur, New Delhi, India.
4. Echert, R. and Rendelm David **"Animal Physiology"**, Surjeet Publication, Kohlapur Road, Kamlanagar, Delhi.
5. Frazier, W.C. **"Food Microbiology"** Tata McGraw-Hill Publishing Company Ltd. Bombay-New Delhi, India.
6. Hess, Dieter **"Plant Physiology"** Narosa Publishing House, New Delhi, Springer International Student Edition.
7. Jordan, E.L.; Verma, P.S. **"Chordate Zoology and Elements of Animal Physiology"**, S.Chand and Company Ltd. New Delhi
8. Leopold, A.C. and Kreidemann, P.E. **"Plant Growth and Development"** Tata - McGraw Hill, New Delhi, India
9. Mallik, C.P. and Srivastav, A.K. (1994), **"Text Book of Plant Physiology"**, Kalyom Publication, New Delhi - Ludhiana.
10. Mundkar, R.B. **"Fungi and Plant Diseases"** McMillan and Co. Ltd. Calcuta, Bombay, Madras, London.t
11. Pelezar, M.J.: Chan, E.C.S. and Crieg, N.R. **"Microbiology"** McGraw Hill Book Publishers, New York, U.S.A.
12. Street, H.E., **"Plant Metabolism"** ELBS and Pergamon Press, London, New York.
13. Schmidth - Nilsen, K. **"Animal Physiology"** Cambridge University Press, Cambridge London.
14. Wild, A. (1993), **"An Introduction to Soil and The Environment"**, Cambridge University Press.

Functional & Applied Biology (Practical)

Course No. : Sc.Ed. 514	Full Marks : 50
Nature of the Course: Practical	Pass Marks : 25
Year: First	Periods per week : 4

Course Description

This practical paper links the activities in the laboratory and the field on the biological science dealing with the topics of plant and animal physiology, microbiology, Biotechnology and plant breeding, and are listed in school and three year bachelor level science and science education in the above branches.

Objectives

- Conduct experiments on physiological or biological processes of plant and animal body or parts.
- Direct and demonstrate various systems in animals
- Prepare slides of different materials of plant and animal parts.
- Handle and operate the concerned equipment and apparatuses for various experiments.
- Prepare different media for culture.
- Prepare slides in relation to the content of the paper.
- Operate and handle instruments and apparatu as required by the experiments.
- Prepare and standardise chemicals and solution necessary for various activities.

Course Contents	Inst. Materials
• Differentiation of mono-, di-and polysaccharides	1. Kjeldahl apparatns
• Study of properties of proteins	
• Estimation of water requirement of a potted plants	2. Ganong Potometer 3. Live specified animals
• Dissection of laboratory mammal — rabbit, rat, squirrel etc. (Circulatory mechanism)	
• Determination of oxygen gas given out by green plants	4. Respirometer
• Investigation of respiratory quotient (RQ) in test animals	
• Investigation of effects of IAA on plant growth	5. Chemical IAA 6. Setant / Stop watches
• Determination of growth rate of various plants.	
• Report writting on - Seedling transplantation of	

paddy
  - Vegetable growth ratio
- Preparation of slides of
  - Protozoans
  - Bacteria
  - Fungus (molds)
- Culture preparation of yeast / microbes — Incubator, Hor air oven
- Study of infections diseases
  - Air-borne samples
  - Water borne samples
  - Food-borne samples
- Study of plant diseases
  - Fungus
  - Viral and bacterial
- Study of life cycle of parasitic worms in
  - Animals
  - Plants
- Preparation of culture media — Hot air oven, Incubator, sterelizer Petride
  - Solid media
  - Liquid media
- Clone preparation of plant from various parts of organs
- Study of improved plant varieties
- Pedagogical works

Evaluation Scheme

1.	Internal evaluation	**10.0**
	• Regularily	
	• Regular Practical Work	
	• Record Book	
2.	External evaluation	**40.0**
	* Major experiment	25.0
	* Minor experiment	10.0
	* Viva	5.0

Reference Books

1. Plummer D.T. "**An Introduction to Practical Biochemistry**" Tata - MCGraw Pub. Bombay.
2. Jayarman J. "**Laboratory Mannuals in Biochemistry**" Welly Eastern Ltd. Bombay.
3. Pelezar, M.J. "**Microbiology**" McGraw Hill Book International.
4. Jain V.K. " **Fundamentaks of Plant Physiology**" S.Chand and Co. New Delhi.
5. Singh Amar (1977), "**Practical Plant Physiology**" Kalyani Pub. New Delhi.

Cellular and Developmental Biology

Course No. : Sc.Ed. 551 Full Marks : 100
Nature of the course : Theoretical Pass Marks : 40
Year: Second Periods per week : 5

Course Description

This paper contains biological science topics on cytology, Genetics and Bio-chemical nature of chromosomes of the secondary school, intermediate or higher secondary, as well as three year diploma level science and science education. It deals in detail the micro and macro constituents and functions of cells in general, molecular biology of chromosomes, development processes of embryos, tissues and organs in the plants and animals, and heredity or genetics.

Course Objectives

- Describe, explain, compare, analyse and summarise the cell structure and the microscopic organelles present in the cytoplasm
- Explain, catagorise, differentiate and summerise the functions and structures of nucleus.
- Explain, compare and summarise the biochemical nature and structure of DNA and RNA molecules along with the synthesis of protein compounds.
- Explain, describe, illustrate and summarise embryo development of plant and animals.
- Describe, explain, relate and conclude the formation of primary and secondary bodies in plants.
- Explain, demonstrate, describe and conclude the development of chick.

Specific Objectives

- Identify various types of plants and animal cells with their specific characteristics.
- Explain the structure and functions of cytoplasm and organelles inclusions.
- Explain the structure, functions and role of nucleus and nuclear inclusions.
- Eescribe the structure of DNA and RNA along with their functions and their role in protein synthesis.
- Explain the cytogenetical concepts and principles of linkage, crossingover, mutation and determenation of sex.
- Explain the embryo development processes in plants and animals
- Explain the anatomical development of meristem, primary and secondary bodies in plants.
- Explain the chick development process.
- Describe the biological process of evolution with evidence.

Course Contents

I Cell Study **30 hrs.**

<u>Introduction</u>

- Cell theories
- Related biological sciences
- Measuring units for cell

<u>Cells Type</u>

- Prokaryotic cells structures
- Eukaryotic cell structures

<u>Cytoplasm</u>

- Introduction to matrix
- Physical nature of matrix
- Chemical organization of matrix
- Compound types of matrix
    - Inorganic and organic
- Physical and biological properties of matrix

Cytoplasmic Organelles

- Plasma membrane
    - Introduction
    - Structure
    - Physiology
- Endoplasmic reticulum
    - Morphology and types
    - Functions of ER
- Plastids
    - Introduction
    - Chloroplast : morphology and utra structure
    - Functions
- Ribosomes
    - Introduction
    - Structure - physical and chemical
    - Functions
- Mitochondria
    - Introduction
    - Morphology and structure
    - Functions
- Lysosomes - structure and functions

II Nucleus **20 hrs.**

- Introduction
    - Occurrence and position
    - Morphology

- **Structures**
    - **Karyothecee**
    - **Neucoplasm**
    - **Chromatin fibres**
    - **Nucleolus**
- **Functions of Necleus**

Chromosome

- **Introduction**
    - **History**
    - **Chromosome Number**
    - **Morphology of chromosome**
- **Chromosome structure**
    - **Chromonema**
    - **Chromomere**
    - **Centromere**
    - **Chromosomal Materials**
    - **Ultra structures**
- **Gaint Chromosomes**
    - **Poilytene**
    - **Lampbrush**
- **Functions of Chromosomes**

III Molecular Biology **20 hrs.**

The DNA Molecules

- **Chemical nature of genetical materials**
- **Models of DNA**
- **Replication of DNA**
- **Genetic Code**
- **Cracking the genetic code**

The RNA Molecule

- **Chemical Composition**
- **Nongenetic RNA types**
- **Ribosomal RNA (r RNA)**
- **Messenger RNA (m RNA)**
- **Transfer RNA (t RNA)**
- **Heterogeneous RNA**

Protein Biosynthesis

- **Protein synthesis machinery**
- **Amino-acids,**
    - **DNA**
    - **Nongenetic RNA,**
    - **Ribosome and**
    - **Enzymes**

IV Embryo Development **20 hrs.**

Morphogenesis

- Concept of development
- Growth and development
- Morphogenesis

Cell Types in Animal Embryo

- Development theories
- Theories validity
- Uses

Heterogenety in Plants

- Unequal divisions
  - Embryo development
  - Cell differentiations
- Polarity
- Apical meristem (seed plants)
  - Shoot apices
  - Root apices
  - Properties

V Anatomical Development in Plants **30 hrs.**

Meristem

- Concept
- Merestem types
- Developmental theories

Primary Plant Body

- Primary Tissues and its system
- Primary Vascular tissues
  - Procambium
  - Protophloem and Protoxylem
- Primary phloem and primary xylem
- Primary Vascular cylinder
- Cartex, Endodermis and pericycle
- Pith

Secondary Body

- Secondary body development
- Relationship to primary body
- Cambial activity

VI Chick Development **10 hrs.**

Egg Formation Process

- Male reproductive process (cock)

- Female reproductive process (hen)
- Egg formation and fertilization
- Developmental Stages

VII Genetics **20 hrs.**

Mendels Laws

- Domainance
  - Segregation
  - Law of independent assortment
- Inbreeding, Outbreeding and hybrid vigar
- Some important modification of mendal's Law

Linkage and Crossing Over

- Introduction
  - Views of Linkage
- Types of Linkage
- Recombination and Crossing Over
- Mechanism of crossing over
  - Synapsis
  - Duplication of chromosomes
  - Theories of crossing over.

Mutations

- Introduction
  - Historical background
  - Concept
- Mutation types
  - Spontaneous mutation
  - Induced mutations

Polyploidy

- Concept
- Types
- Significance of poly ploidy

Determination of Sex

- Chromosomal theory
- Sexual functions of x and y chromosomes
- Gene and sex determination
- Sex chromosomes in different organism

Instructional Techniques

Lecture / Discussion / Group work / Field work / Report presentation

Evaluation Scheme
Final examination at the end of the session
External examination 100%

Questions must be consistent with and related to the level of objectives of the concerned topics mentioned in the curriculum.

Textbooks

1. Grahm, F.C. and Wareing, P.F. **Developmental Biology of Plants and Animals**, English Language Book Society and Blackwell Scientific Pub. Oxford-London
2. Verma, P.S. and Agrawal, V.K. **Cell Biology, Genetics, Evolution and Ecology**, S. Chand and Company, Ram Nagar, New Delhi 110055 India

Reference books

1. McElroy, W.D. **Cellular Physiology and Biochemistry**, Prentice Hall of India Pvt. Ltd., New Delhi.
2. Sinnot, E.W., Dum, L.C. and Dobzhansky, T. **Principles of Genetics**, McGraw Hill Book Company - Inc. New York, U.S.A.
3. Deoben, R.M. **Cell Biology**, Harper and Row, New York, U.S.A.
4. Paul **Cell Biology**, Human Educational and English Language Book Society, London.
5. Pandey, B.P. **Embryology of Angiosperm**, S.Chand and Company Ltd., New Delhi, India.
6. Eames, A.J. and Mc Daniels, L.H. **An Introduction to Plant Anatomy** McGraw-Hill Book Company, INC. New York U.S.A.
7. Street, H.E. **Plant Metabolism** English Language Book Society and Pergamon Press New York, U.S.A.
8. Conn, E.E. and Stumof, P.K.. **Outline of Biochemistry** Pub. John Weley and Sons Inc. New York, U.S.A.

Cellular and Developmental Biology (Practical)

Course No.: Sc.Ed. 552 | Full Marks : 50
Nature of the Course: Practical | Pass Marks : 25
Year: Second | Periods per week :

Course Description

This practical paper is connected with the activities in the laboratory and the field on the biological science dealing with the topics on plant and animal Cytology, Embryology and Genetics, and is also related with practical activities listed in school and Bachelor level science and science education curriculum in the above-mentioned branches.

Objectives

- Prepare slides in relation to the content of the paper.
- Conduct experiments according to the content of the units
- Operate and handle instruments and apparatuses as required by the experiments.
- Prepare and standardise chemicals and solution necessary for various activities.
- Prepare report and carry out field survey.

Units	Contents
I	Slide Preparations • Different unique plant cells • Unique cells
II	Ultra-structure study of plant and animal cells
III	Slide preparations of dividing plant and cells to study the various stages
IV	Study of structures of meristems in typical plants
V	Study of different types of developing meristems
VI	Preparation of T.S., L.S. and T.L.S. of important plant parts (Permanent slide preparations)
VII	Study of various types of embryos in lower and higher plants
VIII	Study of chick embryo development by incubating fertilised egg.
IX	Study of Linkage in corn
X	Study of meetants in plants
XI	Dissection of Fowl (Cock / Quill / Pigeon) • Observation of - Male reproductive system - Female reproductive system
XII	Report writing on evolution by • anatomical structures • cytological evidences • bio-geographical relationship

Evaluation Scheme

1. Internal evaluation **10.0**
   - Regularily
   - Regular Practical Work
   - Record Book

2. External evaluation **40.0**
   - * Major experiment 25.0
   - * Minor experiment 10.0
   - * Viva 5.0

Reference Books

1. Bhatnagar S.S. x **Practical Botany** Vol. II, Ratna Prakashan Mandir, Agra - 3
2. Dodds J.H. and Ropberts L.W., **Experiments in Plant Tissue Culture** Cambridge University Press, Cambridge, London.
3. Mazpuria T.C. **Introduction to Chordates** Pradeep Pub.
4. **Microtechnique** - McGraw and Hill Publications
5. Goswami H.K. and R Goswami Practical cytology, **Applied Genetics and Biostatistics** Himalayan Pub. House Delhi.
6. Verma P.S. **A Mannual of Practical Zoology Invertebrates** S.Chand and Co.

Teaching Biology Education

Course No. : Sc.Ed. 591 | Full Marks : 50
Nature of the course : Theoretical | Pass Marks : 20
Year: Second | Periods per week: 3

Course Description

This course is designed to enable the prospective biology teacher to develop the fundamental concepts of biology education and equip them with the skills of teaching biology at the higher secondary school and the Bachelor level in education. It also will provide the basic knowledge in designing, organising and managing the Biological Laboratory and resources for the higher secondary Biology teachers and Biology teachers in campus.

Course Objective

- Describe biology education;
- Develop, compare and analyse the biology curriculum in some selected SAARC countries;
- Construct, plan and practice of modules in biology teaching;
- Design different kinds of biological laboratories;
- Organize and manage the biological laboratory work;
- Prepare the biological reagents, solution, slides herbarium, charts, models and improvised bio-materials;
- Organize seminar, workshop, fairs and field study;
- Observe and write field study report.

Specific Objectives:

- Compare biology and biology education
- Explain traditional and modern trends in biology education
- Explain the importance of biology in everyday life
- Explain the development patterns of biology curricula at the school and the campus level in some SAARC countries.
- Analyse critically the different innovative biology education projects i.e. BSCS and Nuffield biology
- Explain the ways of using community resources in the bio-curriculum development
- Explain the integrated biology teaching by using community resources.
- Develop and practicse the modules for biology teaching
- Explain the trends used in biology teacher training at the school level.
- Explain the management of biology class in and out of school
- Explain the importance and basic struture of the bio-laboratory.
- Compare the bio-practical work in higher secondary school and. campus.
- Design the different types of biological laboratories.
- Arrange the necessary bio-materials and equipment.
- Explain the safety rules of the bio-laboratory
- Explain the role of the Bio-teacher and lab - assistant in the lab.

- Collect, identify and preserve the different types of plants and animals
- Prepare the herbarium, aquarium, terarium, vivarium, taxodermy of animals and plants.
- Prepare charts and models, improvise low-cost bio-teaching materials
- Prepare the permanent slides of various parts of plants and animals
- Demonstrate the techniques of tissue culture
- Organize seminars, workshop and field trips
- Write and present field study reports.

Course Contents

Unit I : Trends in Bio-Education **5 hrs.**

- Introduction
- Biology and biology education
- Historical background of biology education in Nepal, U.S.A. and U.K.
- Importance of biology education in everyday life
- Place of Biology in School curriculum
- Modern trends in Biology education in Nepal, U.S.A. and U.K.

Unit II : Biology Curriculum **10 hrs.**

- development of biology curricula for school and higher education in some selected SAARC countries
- comparative study of Bio-curricula in some selected SAARC countries
- critical analysis of biological science curricula in some selected SAARC countries
- critical analysis of innovative science project i.e. BSCS and Nuffiels (Bio-Science)
- develop a model bio-curriculum for school and higher education level.

Unit III : Community Resource and their uses **5 hrs.**

- use of community resource in bio-science education
- role of bio-curriculum for community development
- interelation and integration of school biology and community development programme.

Unit IV : Construction and Practice of Biology Teaching Modules **15 hrs.**

- fundamentals of teaching module
- construction of teaching modules
- practice of teaching modules

Unit V : Biology Teacher Education **10 hrs.**

- Introduction
- Importance of biology teacher training for school
- role of biology teacher in school
- management of biology class in school and out of school

- evaluation of biology teacher training programme

Unit VI : Biological Laboratory **5 hrs.**

- Importance of biological laboratory work.
- Infrastructure of a biological laboratory.
- Inclusion of biology in school curriculum.
- Inclusion of biological practical laboratory work in higher secondary school and campus.

Unit VII : Designing Biological Laboratory **10 hrs.**

- Designing simple biological lab.
- Designing multipurpose Bio-Lab.
    a) Biological laboratory during demonstration and experiment.
    b) Large classroom converted into a simple bio-lab with experimental plants and animal house,

Unit VIII : Organization of Bio-Practical Work **5 hrs.**

- Arrangement of bio-materials and accessories
- Guide lines for teachers
- Guide lines for students
- Guide lines for lab - assistants
- Safety rules

Unit IX : Biological Resource Management **10 hrs.**

- Uses of community resources, i.e. zoo, botanical garden, national park, museums, agricultural forms.
- Collection, preservation, maintanance of plant and animal materials.
- Techniques of maintanance of museum specimens of plant and animals.
- Preparation and maintanance of aquarium, terarium and vivarium
- Conservation of plant and animal
- Taxodermic technique.

Instructional Technique

Lecture / demonstration / discussion / group work / field visit

Evaluation Scheme

Final examination at the end of the session

External examination 100%

Questions must be consistent with and related to the level of objectives of the concerned topics mentioned in the curriculum.

References

1. Yadav K., **Teaching Life Science,** Anmol Publications, New Delhi-India

2. Sood S.K, **New Direction in Science Teaching**, Kohli Publication, Chandigarh.
3. UNESCO **Handbook for Biology Teachers in Asia,** UNESCO Regional Office of cience and Technology for South and Central Asia, New Delhi.
4. **Biology Science Curriculum of Nepal for Secondary and Higher Secondary Level**.
5. **Biology Science Curriculum (Secondary and Higher Secondary Level of SAARC Countries.**
6. **Secondary Level Biology Curriculum of U.K. U.S.A**.
7. Sood J.K., **"Teaching Life Science"** Kohli Publishers Chandigarh.
8. Dowdeswell W.H., **The Nuffield Foundation Science Teaching Project I, Biology II**
9. Archenhold, W.F. Jenkins, E.W., Wood Robinson, 1978, **School Science Laboratories**, A Handbook of Design, Management and Organization, London, John Muray
10. Arisbr - (1970) **The Design of Multipurpose Science Laboratories for Lower Secondary Level Schools in Asia**. Colombo, ARISBR.
11. Carelse, V.F. (1982), **Making Science Laboratory Equipment,** New York, John Wiley.
12. Everette, K.; Hughes, D. (1975), **A Guide to Laboratory Design**. London, Buterworth.
13. Guy, K. (1973), **Laboratory Organization and Administration**, London, Butterworth.
14. HMSO, (1976), **Safety in Science Laboratory**, Safety Series No. 2, London, HMSO
15. UNESCO, (1972), New UNESCO **Source Book for Science Teaching**. Paris. UNESCO.
16. UNESCO, (1983), **Low-cost Equipment for Science Teaching** (Cards) Santiago, Chili, UNESCO Regional Office for Education for Latin America and the Caribean.
17. UNDP-UNESCO, (1972), **Local Production of Elementary Science Teaching Equipment.** Fiji University of Snth Pacific.
18. **Nuffield Advanced Biological Science Laboratory Book,** London, Longman Penguin Books.

Specialization

Physics Education

Specialization

Physics Education

First Year

Course No.	Course Title	F.M.	Nature
Sc.Ed. 531	Astronomy, Heat & Sound	100	Theoretical
Sc.Ed. 532	Astronomy, Heat & Sound Practical	50	Practical
Sc.Ed. 533	Atonomic Physics & Fundamentals of Electronics	100	Theoretical
Sc.Ed. 534	Atonomic Physics & Fundamentals of Electronics Practical	50	Practical

Second Year

Course No.	Course Title	F.M.	Nature
Sc.Ed. 565	Electricity, Magnetism & Quantum Optics	100	Theoretical
Sc.Ed. 566	Electricity, Magnetism & Quantum Optics Practical	50	Practical
Sc.Ed. 590	Fundamentals of Science Education	50	Theoretical
Sc.Ed. 593	Teaching Physics Education	50	Theoretical
Ed. 598	Thesis	50	Practical
Ed. 599	Practicum	50	Practical

Elective

Sc.Ed. 571	Environmental Science	50	Theo+Pra.

Note: Sc.Ed. 590 Fundamentals of Science Education and Elective Course Sc.Ed. 571 Environmental Science are common to all the Science Education courses. So these two courses are given only in the last part of the Physics Education course.

Astronomy, Heat & Sound

Course No. : Sc.Ed. 531	Full Marks : 100
Nature of the course : Theoretical	Pass Marks : 40
Year: First	Periods per week. : 5

Course Description

This course is designed to build a close link between the astronomy topics / courses offered in Certificate, Diploma and 10+2 levels. The prospective teachers will see through this course Astronomy as the most ancient science as well as the most modern science, through plenty of discussions and theories base related facts.

This course also deals with topics related to the aspects of the sky, the earth in motion, light and the telescope, the solar system and its members, the stars and the pedagogical aspects of topics on astronomy and its application to teaching.

This course also intends to acquaint the prospective teachers with further topics related to Heat and Sound as continuous linkage from Certificate and Diploma but with some indepth knowledge, which can help them take up from plus two and Certificate to the Diploma level of efficient teaching related to the topics included in the course.

The course also contains topics such as kinetic theory, behaviour of real gases, zeroth law and second law of thermodynamics, Entropy, heat and velocity of sound and practical application of sound.

Course Objectives

- Explain, illustrate theoretical background of astronomy.
- Explain the nature of celestial sphere, solar system and its members
- Describe the theoretical aspects of the universe.
- Develop abilities and skills of observing the night sky.
- Develop attitudes relevant to science and night sky watching.
- Use devices to watch the night sky.
- Make star charts.
- Describe with examples the different properties of kinetic theory.
- Explain the behaviour of real gases.
- Describe the properties of zeroth law of thermodynamics.
- Explain the characteristics of the second law of thermodynamics
- Explain the theoretical aspects of entropy.
- Explain meaning, nature and characteristics of velocity of sound
- Describe practical applications of sound
- Explain the implications of the pedagogical aspects of heat and sound related to classroom teaching.
- Explain the different aspects of the sky with reference to celestial sphere, sun's apparent anneral path.

- Describe rotation, revolution of the earth and its result
- Describe various phenomena of light and astronomical devices used for observing the sky.
- Explain the moon with respect to motion, surface, eclipse.
- Describe the solar system and its members
- Describe different views related to the origin of the solar system.
- Explain the sun - its radiation, disturbances and sunspots.
- Explain the various characteristics, types and nature of stars.
- Conduct mini project work, seminar, workshop, field visit
- Present written report of mini-project work, seminar, workshop
- Explain meaning, nature and characteristics of kinetic theory
- Deduce mathematical relation related to kinetic energy of gas molecule and viscosity of gas, Avogadro's number
- Explain the meaning, nature and charácteristic's of real gas
- Explain experiments of Andrew and Amagat
- Relate Vanderwaal's equation
- Describe thermodynamics, Zeroth law, Isothermal and adiabatic process.
- Deduce mathematical relations for adiabatic process.
- Explain heat engine, reversible and irreversible process, Carnot's theorem, Clausius statement and latent heat phenomenon.
- Explain meaning, nature and characteristics of entropy.
- Explain velocity of sound, its nature, characteristics, factors and related phenomenon.
- Conduct miniproject, workshop, seminar.
- Prepare materials, report.

Course Contents

Unit I : Aspects of the Sky **9 hrs.**
The Celestial Sphere - its apparent daily rotation - diarnal circles of the stars - the sun's apparent annual path-the constellations.

Unit II : The Earth in Motion **5 hrs.**
The Earth - its rotation, revolution - precession - seasons

Unit III : Light and the Telescope **12 hrs.**
Refraction of Light - Dispersion of Light - refracting telescope- reflecting telescope - radio telescope

Unit IV : The Moon **2 hrs.**
Motions - Surface features - eclipse

Unit V : The Solar System **12 hrs.**
Planets in general - paths of the planets - law of gravitation

Unit VI : Planets and their Satellites **12 hrs.**
Mercury - Venus - Mars - asteroids - Jupiter - Saturn - Uranus - Neptune - Pluto

Unit VII : The Sun **6 hrs.**
Radiation and temperature - sunspots - Chromosphere and corona - ionospheric disturbances

Unit VIII : The Stars and Stars Clusters **10 hrs.**
Distance - motion - spectra - magnitude - luminosity of stars - types
Galaxy and nebula - introduction - types - features rotation - radio view

Unit IX : Pedagogical Implication **6 hrs.**

Unit X : Kinetic Theory **10 hrs.**
Introduction - average ke of a gas molecule-degree of freedom - mean free path - transport phenomena - Brownian motion - avogadro's number determination

Unit XI : Behaviour of Real Gases **12hrs.**
Continuity of state - Andrew's, Amagat's experiment - behaviour of gases - Vander-waal's equation - critical constants- critical values and Vander-waal's coefficient constant a and b - reduced equation of state.

Unit XII : Zeroth Law of Thermodynamics **12 hrs.**
Thermodynamics - concept of heat - relation between heat and work - work done in an isothermal process - adiabatic process - adiabatic and isothermal curves - isochoric and Isobasic process - expression for adiabatic process

Unit XIII : Second Law of Thermodynamics **12 hrs.**
Heat engine - Ideal heat engine - reversible and irreversible process - Carnot's cycle - second law of thermodynamics - Kelvin and clausius statement - thermodynamic scales of temperature - clapoyron's latent heat equation - effect of change of pressure on the boiling point of liquid - Internal and external latent heat - latent heat of clausins.

Unit XIV : Entropy **6 hrs.**
Meaning - entropy of reversible gas, perfect gas - change in entropy in terms of T and P, interms of P and V - entropy and disorder.

Unit XV : Velocity of Sound **12 hrs.**
Newton's formula - Kundt;s tube - Doppler effect - damped and forced oscillation - review of SHM - damping force - damped harmonic oscillator - forced harmonic oscillator - ammplitude resonance - examples of resonance - factors affecting velocity of sound - simple exercises - intensity of sound level and units.

Unit XVI : Practical Applications **12 hrs.**

Siren - determination of frequency of a tuning fork by resonance method - stroboscopic method - phonic method - Gramaphone - microphone and loud speaker - Tape recording - sound ranging - locating the direction of aircraft - A coustics - A coustic intensity - factors affecting the acoustics of buildings - ultrasonics -. production, detection of ultrasonic waves - application of ultrasonic waves - simple exercises

Instructional Techniques

Illustrations - lecture discussion - demonstration - model presentation - observation - charts diagrams - video presentation

Evaluation Scheme

Final examination at the end of the session

External examination 100%

Questions must be consonant with and related to the level of objectives of the concerned topics mentioned in the curriculum.

Textbooks

- Baker Robert H., **Astronomy**, D. Van. Nostrand Company New Jersey
- Khanna D.R., Bedi R.S., **A Textbook of Sound**, Atma Ram & Sons N. Delhi.
- Mittal Dr. P.K. + Jaidev **Waves and Oscillation**, Anand Pub. N. Delhi.
- Rajan J.B., **A Textbook of Heat** S. Chand & Co. New Delhi
- Subramanyam N., Brij Lal, **A Textbook of Sound,** Vikash Pub. House N. Delhi.

References

1. Moore Patric - **Astronomy** - London.
2. Moore Patric - **Basic Astronomy** - Edinburgh.
3. Motz L. - **Essentials of Astronomy** - Glassgow.
4. Schatzman EL - **The Structure of Universe - London.**

Astronomy, Heat & Sound (Practical)

Course No. : Sc.Ed. 532	Full Marks : 50
Nature of the Course: Practical	Pass Marks : 25
Year: First	Periods per week .: 4

Course Description

This practical course aims to develop abilities and skills that are relevant to the study and practice of physics, develop attitudes relevant to physics such as concern for accuracy precision and the skills of enquiry and stimulate interest in students to see physics as a subject which is enjoyable and satisfying. This course deals with two sections Astronomy and Heat and Sound. The approach will be investigative.

Course Objectives

- Demonstrate knowledge and understanding in relation to scientific and technological applications with their social and environmental implication.
- Present reasoned explanations for phenomena, patterns and relationships.
- Make predictions and put forward hypothesis.
- Interpret and evaluate observations and experimental data
- Perform experiments

Practical

1. Conduct five experiments related to the course with the consent of the department.
2. Conduct miniclasses of at least five classes at ten plus two or Certificate or B.Ed. Level or micro teaching.
3. Prepare at least two sessional papers or a project.
4. Review at least two books related to the course.

Materials for No. 1 heading

- Reflecting telescope, Refracting telescope.
- Solar system colour chart.
- Planeterium model.
- Earth, moon, sun system model.
- Cassettes on solar system, stars, Galaxy.
- T.V. Screen, VCR.

Practical (Astronomy) Activities (Related to practical no. I above)

1. Study and preparation of simple astronomical charts.
2. Study and use Astronomical Telescope.
3. Watching and Identification of stars and planets.
4. Construction of model telescope.
5. Construction of Zodiac chart.
6. Construction of Celestial dome.
7. Construction of Sun, Earth, Moon system model.

8. Construction of Eclipse Chart.
9. Consruction of planisphere.
10. Conduct seminar/ workshop / field study / books review.

Practical

1. Determination of the frequency of tunning fork by falling plate method / Resonance method.
2. Comparison of the velocities of two gases at room temperature.
3. Determination of velocity of sound in a solid.
4. Determination of the frequency of an electrically maintained tunning fork by stroboscopic method.
5. Determination of Stefan's constant.
6. Determination of the ratio of C_p and C_v by clement and Desorme's method.
7. Seminar / workshop / project.

Evaluation Scheme

1.	Internal Evaluation	10.0
	• Regularity	
	• Regular Practical Work	
	• Record Book	
2.	External Evaluation	40.0
	* Major Experiment	25.0
	* Minor Experiment	10.0
	* Viva	5.0

Textbooks

1. Degree level Practical Physics- Shavna, Singh, Prasad, Bharati Bhawan Pub., Patna
2. Laboratory physics- Halliday/Resnisk/Kran, Johwiley 2. Sons, Singapore
3. Investigating the Earth- Teachers Guide ESCP, Houghton Mifflin Co. New York.
4. Geology and Earth Sciences Source Book- American Geological Institute Holt, Rinehart, California.
5. CERID Publication- Astronomy for Secondary Teachers.
6. Astronomy- Baker.

Atomic Physics & Fundamental of Electronics

Course No. : Sc.Ed. 533 Full Marks : 100
Nature of the course : Theoretical Pass Marks : 40
Year: First Periods per week : 5

Course Description

This course aims to acquaint the prospective science teachers with the basic knowledge of atomic physics with aims to enable them to handle the topics related to atomic physics at Certificate, plus two and diploma level.

This course deals with some of the important aspects of atomic physics as atomic models, molecular spectra, modern problems of radioactivity, artificial transmutation, cosmic rays fundamentals of electronics, physical transport phenomena in semi-conducting materials, logic gates and digital circuits, special semiconductors and electronic devices, Integrated sequential circuits and memories and micro processor, pedagogical importance of the topics.

This course is designed, with emphasis on the understanding and application of physical concepts and principles of electronics, to develop skills required to handle teaching on electronic topics.

Course Objectives

- Describe with examples the basic models of atom.
- Explain the basic properties of molecular spectra
- Interpret x-rays modern problems related to radioactivity
- Describe with examples artificial transmutation, cosmic rays.
- Demonstrate pedagogical approach to teaching the related topics.
- Aquire sufficient understanding and knowledge of basic aspects of electronics.
- Develop abilities and skills that are relevant to the study and practice of electronics.
- Develop attitudes relevant to electronics such as objectivity, enquiry, initiative and inventiveness.
- Stimulate interest in and care for the electronics items
- Apply electronics to daily life use.
- Recall and define terminological terms and expressions.
- Explain different atom models
- Describe zeeman and stark effect
- Explain molecular spectra, isotropic effect, raman effect
- Describe solid state spectros-copy.
- Describe the modern problems related to radioactivity
- Explain the discovery, experimental study and difficulties, results of artificial transmutation.
- Explain the meaning, discovery and nature of cosmic rays and x-ray's
- Conduct micro-lesson on related topics, seminar, workshop, mini project.

- Describe in outline the basic structure and action of a calthode ray oscilloscope
- Describe different electronic system
- Explain energy band concepts
- Describe physical transport phenomena in semiconducting materials
- Explain logic gates and digital circuits
- Illustrate semiconductors and electronic devices
- Explain Integrated sequencial circuits
- Explain memories and microprocessor
- Perform related experiments to the course.

Course Contents

Unit I : The Atom Models **10 hrs.**
Introduction - Thomson model - Rutherford Model - Bohr model - application of Bohr model - Sommerfield model - Vector model - application of vector model - zeeman and stark effect

Unit II : Molecular Spectra **15 hrs.**
Introduction - molecular structure - molecular spectra- Isotropic effect- Raman effect - Solid state - spectroscopy

Unit III : Modern Problems of Radioactivity **10 hrs.**
Introduction - origin - alpha - Beta - gamma rays - spectra.

Unit IV : Artificial Transmutation **15 hrs.**
Introduction - discovery - experimental study - difficulties - techniques - result - the neutron - artificial radioactivity - nuclear fission

Unit V : Cosmic Rays and X Rays **10 hrs.**
Introduction - dicscovery - nature - cosmic showers, X rays spectrum, debrogliewave and crompton effect.

Unit VI : Pedagogical Application of the Topics **10 hrs.**
Preparation of materials - presentation - miniproject- classroom presentation

Unit VII : **10 hrs.**
Introduction - the electron - model of the atom - importance of quantum mechanics - Maxwell equation - simple crystals, energy band concepts - metals, semiconductor insulactor, (direct indirect) pure and impure semiconductors

Unit VIII : Physical Transport Phenomena in Semiconcucting Materials **20 hrs.**
Mobility and conductivity - conduction in intrinsics semiconducting materials - extrinsic materials - N type and P type semiconductors - application of electron hole

Unit IX : Logic Gates and Digital Circuits **20 hrs.**
Intoduction - decimal and binary operational systems - binary arithmetic sequence - binary logic laws and operations - AND the NOR and NAND gates - OR gates - interfacing - IC logic gates and families

Unit X : Integrated Sequential Circuits **20 hrs.**
Introduction - Flip flop (Latch) - The clock timer - digital counters - frequency dividers - analog to digital conversion - Ramp conversion

Unit XI : Semiconductor Diode **10 hrs.**
Introduction - Semiconductor and crystal diode function - diode rectification and filter (construction of power supply) - common base amplification - common emitter amplification and related simple problems - principles of oscillation - Hartley oscillator - Phase shift oscillator (basic concepts only) - Zeener diode - Zenor diode as voltage stabilizer.

Instructional Techniques
Lecture / discussion / demonstration

Evaluation Scheme
Final examination at the end of the session
External examination 100%

Questions must be consonant with and related to the level of objectives of the concerned topics mentioned in the curriculum.

Textbooks

1. Rajam. **Atomic Physics** - S.Chand & Com. N.Delhi
2. Verma + J.D. Anand. **Electronic Principles** (Application and Devices), Haranand Publication - N.Delhi

References

1. Beiser.**Concept of Modern Physics**
2. Bagde M.K. + S.P. Singh, **Elements of Electronics**.
3. **Elements of Electronic & Instrumentation**
4. Mehta V.K.. **Principles of Electroinics**, S.Chand & Co.
5. Nelkon M. - **Principles of Atomic Physics & Electronics**, Heinemann Educational Books. London.
6. Richtmyer F.K., Kennard, Cooper, **Introduction to Modern Physics**, Tata Mcgraw Hill Pub. N. Delhi.
7. Theraja B.L., **Basic Electronics**
8. Tom Duncan & John Murray, **Electronics & Nuclear Physics**, 50 Albermale Street, London.

Atomic Physics & Fundamental of Electronics (Practical)

Course No. : Sc.Ed. 534
Nature of the course : Practical
Year: First

Full Marks : 50
Pass Marks : 25
Periods per week : 4

Course Description

This practical course aims to develop abilities and skills that are relevant to the study and practice of physics, encourage efficient and safe practice, encourage effective communication and promote an awareness that the study and practice of physics are cooperative and cummulative activities. It contains two sections, Atomic Physics and Fundamental of Electronics.

Course Objective

- Use scientific instruments and apparatus, including techniques of operation and aspects of safety;
- Translate information from one form to another;
- Follow a detailed set or sequence of instructions;
- Design and plan investigations;
- Perform experiments.

Practical (Section A)

1. Conduct five experiments with the consent of the department.
   - Study of Alpha, Beta, Gamma rays.
   - Study of Atomic Models.
   - Study of X rays Spectra.
2. Conduct class / micro class.
3. Prepare atleast two sessional papers.
4. Review at least two books related to the course .

Section B

1. Prepare two working paper / sessional paper
2. Review at least two books
3. Conduct class / microclass
4. Perform at least 10 experiments with the consent of the department

1. Study of characteristics of commonly used values to find their application as Diode value by triode values
2. Semiconductor diodes (PN junction and point contact, Zener cliode)
3. PNP or NPN transistors in common base configuration
4. ,, ,, ,, ,, ,, emitter ,,
5. Study of two stage voltage regulator using transistor's and zener diode
6. Study of semiconductor and valve diodes.
7. Voltage multiplier, clipper circuits, clamping circuits.
8. Study and calibration of CRO for measurement of voltage and frequency.

Evaluation Scheme

1. Internal evaluation **10.0**
   - Regularity
   - Regular practical work
   - Record book

2. External evaluation **40.0**
   - Major experiment **25.0**
   - Minor experiment **0.0**
   - Viva **5.0**

Textbooks

1. Adventure with Electronics
2. Adventure with Micro electronics
3. Adventure with Digital electronics
4. Success in Electronics

Tom Duncan, Publisher John Muray, Pus. Ltd. London

5. Nuffield Physics Guide to Experiments (1-5) Longmans/Penguin Book Great Britain
6. Degree level Practical Physic- Sharma, Singh, Prasad, Bharati Bhawan Pub. Patna.
7. Principles of Electronics and Instructation S. Chand 2 Comp. Ltd. Same N. Delhi.
8. Transistor for Physics and Circuit Design- D.C. Sarka S. Chand & Co. Ltd. New Delhi.

Electricity, Magnetism & Quantum Optics

Course No. : Sc.Ed. 565 Full Marks : 100
Nature of the Course : Theoretical Pass Marks : 40
Year: Second Periods per week: 5

Course Description

This course aims make the prospective science teachers broaden their knowledge in and gain further insights into the area of electricity and magnetism that can help them handle teaching at the ten plus two. Certificate and Diploma levels, besides taking up other related professional jobs both in theoretical and practical aspects.

The course contains the topics of D.C. circuits, magnetic field - Electromagnetic induction - A current - Pedagogical aspect of teaching.

This course aims to shed light on the topics related to higher topics of light which can help the prospective teachers teach with confidence at ten plus two, certificate and diploma level.

The course deals with simple treatise on topics like light quantum, their origin, laser, Holography, magnetic and electro optics, the dual nature of light and the pedagogical approach of teaching of the said topics.

Course Objectives

- Explain with examples the meaning, nature, properties and functions of D.C. and A.C. current.
- Describe the meaning, nature, characteristics and functions of magnetic field and electromagnetic induction.
- Explain pedagogical aspects of electricity and magnetism.
- Conduct different pedagogical aspects of teaching - learning and feedback processes.
- Describe with examples the light quanta and their origin.
- Explain the basic properties of laser.
- Describe the theoritical aspects of Holography.
- Explain magneto-optics and electro optics with examples.
- Describe the dual nature of light.
- Explain the application of pedagogical aspects of quantum optics teaching.
- Explain with examples the different terms related to electricity and magnetism
- Explain energy transfer in electric current, ohm's law, kirchhoff's law and its applications.
- Describe Wheatstone's net and Maxwell's cyclic current.
- Deduce mathematical relations
- Explain the meaning, nature, types characteristics, and function of magnetic induction

- Explain Faraday's Law, and Lenz's law.
- Deduce expression for Faraday's and Lenz's law.
- Explain meaning, nature, types, characteristics and devices related to A.C. current and measurement
- Recall and define terminological terms and expressions.
- Explain quantum optics in terms of light quanta and their origin.
- Explain Bohr, stoner scheme of building up atoms.
- Explain the meaning, types, nature, application & safety of laser.
- Explain the meaning, nature, types and use of Holography.
- Describe meaning and nature of magneto and electro optics.
- Explain zeeman and stark effect.
- Describe the dual nature of light.
- Conduct seminar, workshop.
- Prepare writen report and materials.

Course Contents

Unit I : D.C. Circuits **15 hrs.**
Electric current - Linear bilateral elements - energy transfer in electric circuit - EMF and p.d. - Ohm's law - resistivity - Kirchhoff's laws and applications. Wheatstone's net - Maxwell's cyclic currents and wheatstone's net - simple exercises.

Unit II : Magnetic Field **15 hrs.**
Magnetic induction - magnetic force on a conductor carrying current - Torque on a rectangular loop of wire - current loop - moving coil galvanometer - moving coil ballistic galvanometer - Correction for damping.

Unit III : Electromagnetic Induction **15 hrs.**
Faraday's experiment - Eletromagnetic induction - Lenz's law - mutual induction - self induction - energy stored in a magnetic field - expression for mutual inductance - Faraday;s law about induced emf - simple exercises

Unit IV : Alternating Currents **15 hrs.**
Introduction - growth and decay of current in an inductor - growth and decay of charge in a capacitor - Alternating current - Study of A.C. Circuits using phaser diagrams - Introduction of Complex numbers - A.C. circuits with resistance, in ductance and Capacitance - energy and power associated with L, C and R - oscillations in L, C circuit - (real) resonance resistors capacitors and inductors - simple exercises, capacitors meaning, function, connection & & use.

Unit V : Light Quanta and their Origin **15 hrs.**
Bohr atom - energy levels - Bohr stoner scheme of building up atoms - elliptical orbits - wave mechanics - the spectrum of sodium - resonance radiation - metastable states - optical pumping.

Unit VI : Laser **15 hrs.**

Stimulated emission - laser design - ruby laser - helium neon gas laser - concave mirrors and brewstor's windows - the carbon dioxide laser - resonance cavities - Coherence length - frequency doubling - other lasers - laser safety - laser applications

Unit VII : Holography **15 hrs.**

Basic principle - viewing a hologran - thick hologram - multiplex holograms - white light reflection hologram - other holograms - student laboratory holograms

Unit VIII : Magneto and Electro Optics **15 hrs.**

Zeeman effect - Inverse zeeman effect - Farday effect - voight effect - cottan mounton effect - kerr magneto optic effect - stark effect - Inverse stark effect - electric double refraction - kerr electro optic effect - Pockels electro optic effect

Unit IX : The Dual Nature of Light **15 hrs.**

Shortcomings of wave theory - evidence of light quanta - energy - momentum and velocity of photons - development of quantum mechanics - Principles of Inter-minacy - diffraction by a slit - complimentory - double slit - determination of position with a mocroscope - use of a shutter - Interpretation of dual nature - realms and applicability of waves and photons.

Unit X : Pedagogical Aspects **15 hrs.**

Pedagogical aspects of the above units while dealing in plus two, certificate and diploma level - use of local resources - ways and means of use of alternative materials - materials preparation - group work - class presentation - seminar - miniclass - project.

Instructional Techniques

Lecture / discussion / presentation / reporting writing.

Evaluation Scheme

Final Examination at the end of the session
External examination 100%

Questions must be consonant with and related to the level of objectives of the concerned topics mentioned in the curriculum.

Textbooks

1. Brij Lal and Subramanyam, **Electricity and Magnetism**, Ratna Prakashan Mandir, Agra
2. Jenkins; H.E. White, **Foundamental of Optics**, Mcgraw Hill Book Company Delhi.

Reference Book

1. Vasudev, **Electricity & Magnetism**, S.Chand & Co. New Delhi, Latest Ed.
2. Towari, **Fundamentals of Electricity & Magnetism with Electronics.** S.Chand & Co.
3. Lakhanpal, **Electricity & Magnetism**, S. Chand & Co. New Delhi.
4. Subramanyam N, and Brij Lal, **Textbook of Optics**, **S. Chand & Co.**

Electricity and Magnetism & Quantum Optics (Practical)

Course No. : Sc.Ed. 566	Full Marks : 50
Nature of the Course: Practical	Pass Marks : 25
Year: Second	Periods per week: 4

Course Description

This course aims to help the prospective science teachers broaden their knowledge and understanding of and help them gain insights into the practical aspects of Electricity and Magnetism and Quantum Optics under two seperate sections.

Course Objective

- Locate, select, organise and present information from a variety of sources.
- Present reasoned explanations for phenomena, patterns and relationships.
- Identify problems, plan and carry out investigations including the selection of techniques, apparatus, measuring devices and materials.
- Evaluate methods and suggest possible improvement.
- Perform experiments.

Section A

Activities

1. Perform five experiments with the consent of the department
2. Conduct class / micro class
3. Prepare at least two sessional papers
4. Review at least two books

Section B

Activities

1. Conduct five experiments related to the course with the consent of the department.
2. Conduct class/microclass.
3. Prepare at least two sessional papers.
4. Review at least two books.
5. Optional experiments with laser source.
6. Study of socium spectra

Evaluation Scheme

1.	Internal Evaluation	**10.0**
	• Regularity	
	• Regular practical work	
	• Record book	
2.	External Evaluation	**40.0**
	• Major experiment	25.0
	• Minor experiment	10.0
	• Viva	5.0

Textbooks

1. Textbook on Laboratory course in Electrical Engineering- S.G. Tarnchai & P.K. Kharbanda, S. Chand & Comp Ltd. N. Delhi.
2. Electricity and Magnetism with Electronics- K.K. Tewari S. Chand & Comp. Ltd N. Delhi.
3. B.Sc. Practical Physics- C.L. Arora, S. Charnd 2 Comp. Ltd. N. Delhi.
4. B.Sc. Practical Physics- Harman Singh, S. Charnd 2 Comp. Ltd. N. Delhi.
5. Laboratory Physics- Halliday / Resnick / krane. Joh Wiley & Sons Singapore

Teaching Physics Education

Course No. : Sc.Ed. 593 Full Marks : 50
Nature of the Course : Theoretical Pass Marks : 20
Year: Second Periods per week : 3

Course Description

This course aims to familiarise the prospective science teachers the nature and different types of physics education within Asia and other countries around the world. It also deals with skills related to different types of physics laboratory and workshop and their proper management while dealing with ten plus two. Certificate and Diploma level of classroom teaching.

Course Objectives

- Identify and illustrate physics education in Asia and around
- Explain the implications of physics education in Nepal due to various Changes within Asian countries
- Explain and interpret pre-university interface
- Explain the trends and uses of physics education in Asia.
- Identify and explain the diffent types of laboratories
- Explain the role of different types of laboratories.
- Explain the importance and role of audio-visual materials
- Plan and design blueprints for diffent types of laboratories.
- Conduct field visits to different types of physics laboratories within the valley.
- Write report on the existing conditions of physics laboratory within the valley.
- Fabricate materials from locally available/waste materials in physics laboratory
- Explain ways and means to maintain management of a physics laboratory.

Specific Objectives

- Compare physics education in Nepal with other Asian countries
- Explain different types of physics education in and around the world
- Explain the cause of declining enrollment of physics students in Asian countries
- Describe the process of science curriculum development at the pre-university level in different Asian countries
- Enterpret methods used for teaching physics in different countries.
- Explain the school-university interface of physics education.
- Explain the interrelationships between secondary and university physics teaching - learning
- Suggest ways to improve the quality of teaching learning process.
- Explain standards in physics education
- Interpret different aspects of physics education

- Explain the role of physics labopratory for teachers to be
- Identify key essential types of physics laboratory
- Explain factors essential for a good physics laboratory
- Design the blueprint of physics laboratory plan according to students number and situation of site
- List the process involved in the maintenance of a laboratory
- Explain the role and importance of audio - visual aids for teaching physics.
- Identify ways to handle and make proper and correct use of different Audio-visual materials.
- Explain the maintenance of different A - V materials especially of +2 and +3 level
- Plan and design different types of laboratory
- Construct a 2D and 3D model laboratory from locally available materials.
- Visit different types of physics laboratory within the valley
- Present report of visits to different laboratories
- Study the impact on the learning by arranging laboratory in two / three different ways.
- List proper techniques of furnishing a physics laboratory

Course Contents

Unit I : Physics Education in Asia and Around **5 hrs.**
Physics education in Nepal - Malaysia - Iran - Srilanka - Newzealand - China - India - declining enrollment of physics students in Thailand - physics at school - high technology - mass education - teacher training an Australian perspective.

Unit II : Pre University Physics **5 hrs.**
Development of curriculum and science education at pre-university level in Bangladesh - Malaysia - Pakistan - Nepal - India

Case study / problems in physics teaching - methods used in class room for pre-university physics teaching.

Unit III : School - University Interface **10 hrs.**
Review of literature on the interrelationships between secondary to university learning - The school university interface in physics teaching in Philippines - Environmental and social economic impact on student performance in the college physics - the improvement in the quality of teaching learning process in school and university physics - bridging school and university physics.

Unit IV : Trends and Uses **10 hrs.**
Standards in physics education - concepts of examination in physics - towards a broad based physics curriculum - preparing for life long education - rethinking in physics education - Interdisciplinary relation

Unit V : Physics Laboratory **10 hrs.**
Introduction - theoretical aspects on laboratories in different developing countries in and around Asia - laboratories in Nepal - the setting of laboratories - shape, size and function of different physics laboratory - arcillary rooms - storage of apparatus and equipment - services - laboratory furniture - lighting system - ventillation - laboratory maintenance - laboratory techniques - fabrication of special

Unit VI : Teaching Materialds **10 hrs.**
Introduction - books - slides and film strips - The OHP (Over Head Projector) - films - film loops in cassettes, handling of laboratory and materials - adding sound visual techniques - radio and television.

Unit VII : Planning, Designing and maintenance of Laboratory **20 hrs.**
Introduction - planning - blueprints - layout - design uses - different laboratories in the valley of Kathmandu - safety measures - first aid box

Unit VIII : Different Activities **5 hrs.**

- Various Activities to be conducted with departmental consent;
- visit at least five physics laboratory and collect report and present to the department and class
- design a paper model or 2D or 3D wooden model of physics laboratory in a given situation
- set up a given room into a physics laboratory by arranging physics materials
- conduct a field study / survey the opinion of students about their physics laboratory in different campuses / schools.

Instructional Techniques
Lecture - discussion -group work / presentation / reporting writing

Evaluation Scheme
Final examination at the end of the session
External examination 100%

Questions must be consonant with and related to the level of objectives of the concerned topics mentioned in the curriculum.

Activities

1. Prepare two sessional papers
2. Review two books
3. Conduct class / microclass
4. Conduct report writing.

Reference Books:

1. Brandwein, **A Book of Methods** - Watson - Blackwood, Harcourt, watson and world, New york.
2. Lewis J.L. - **Teaching School Physics** - Penguin Eduction Middlesex
3. **Unesco booklets and articles**

Elective

Environmental Science

Course No. : Sc.Ed. 571 | Full Marks : 50 (40T+10P)
Nature of the Course : Theoretical & Practical | Pass Marks : 16T + 5P
Year: First | Duration of the period: 1 hrs.

Course Description

This course is designed to help prospective science teachers in improving and handling teaching and perusing the environmental science both at secondary and tertiary levels. This course lays emphasis on the implementation science, its principles and skills. It also explores the problems of environment affecting of public health. It deals with units such as Environmental structure, Resources, Impacts & its management, Environmental problems as well as public health, sanitation & environment.

Objectives

- Explain the importance of environmental science
- Describe the various components of environment and the principles involved.
- Explain various types of natural resources and suggest means of management.
- Explain the impact of the environmental problems on human health.
- Explain the inter-relations among health, sanitation & environment.
- Develop awareness on the interrelationship human health, sanitation and environment.

Specific Objectives

- Describe the importance, aims and objectives of environmental science study.
- Explain the various components of environmental science and basic principles involved.
- Describe the structures and their relationship with the various living organisms.
- Describe the biomes, climatic regions and land uses.
- Explain the layout of the Tropical & Temperate forests.
- Explain the structure of wetlands, Artics, Antartica and Deserts.
- Develop the criteria to show the relationship among resources, man and Nature.
- Describe the various types of resources, their nature and their status.
- Explain the consequences of the over exploitation of resources.
- Explain the role of various agencies in the conservation of resources.
- Compare the environmental problems and their consequences.
- Determine the problems related to land such as fuelwood crisis, timber trade, wild animal smugling and temperate forest destruction.

- Develop a plan to identify the problems of atmosphere i.e. greenhouse effects, ozone depletion and acid rain.
- Explain the role played by air pollution in urban area.
- Explain the factor that courses desertification process.
- Discuss the problems of water related complications.
- Explain the consequences related to spread of agrochemical.
- Develop awarness and need of healthy environment.
- Explain consequences of health hazards related with the environmental disturbances.
- Explain the role of hazardous and toxic wastes.
- Explain the role of polluted water on human health.
- Evaluate inter relation-ship of diseases and environment.
- Choose appropriate ways to overcome environmental detoriation.

Practical Activities Objectives.

- Analyse the data, interprete the results, interpretation of the results of the investigation of the situations.
- Manipulate various apparatuses and appliances as required by this experiment.
- Construct the necessary instructional materials.

Course Contents

Unit I Introduction to Environmental Science **2 hrs.**

- Importance of environmental science.
- Aims & objectives of environmental science study.

Unit II Environmental Structure **15 hrs.**

- Structures of the environmental components
- Biomes, climatic regions and landuses.
- Tropical and temperate forest layout.
- Habitats of the living organisms.
- Wetlands
- Alpine, Artics and Antartica
- Deserts

Unit III Resources, Its Impacts and Managements **15 hrs.**

- Resources, man and Nature (Interrelationship only)
- Water resources
- land: Soil, Minerals, Forest
- Energy: Renewable, Nonrenewable and alternate.

Unit IV Environmental Problems **30 hrs.**

- Introduction, Indentification & Management
- Problems related with land
- Fuelwood crisis
    - Timber
    - Wildlife
    - Medicinal Plants
    - Temperate forest destruction & threat
- Problems related with atmosphere:
    - Greenhouse effects and Ozone layer depletion
    - Acid rain & its consequences
    - Urban air pollution: Industrial pollution, Nuclear & Volcanic Pollution
- Problems related with water
    - Watershed damage
    - Freshwater pollution
    - Pollution of the sea
    - Desertification
- Hazardous impacts of agrochemicals.

Unit V Health, Sanitation and Environment **13 hrs.**

- Importances of the healthy environment
- Health hazards & environmental factors
- Toxic and hazardous wastes
- Drinking water and sanitation
- Public health management efforts.

Practical Activities

1. Study of a pond, river or land ecosystem.
2. Study of pollutants on affected areas.
3. Listing flora and fauna of a nearby local forest.
4. Study of the waste disposal process of a nearby locality.
5. Preparation of a report on the energy requirement of a local community.
6. Listing diseases originated due to the pollution of the environment.
7. Preparation of instructional materials from any theoretical topics of the above units.
8. Determination of soil pH, moisture content, humus contents.
9. Determination of dust fallout of a locality.
10. Determination of soluble & insoluble substances in a sample of water from different sources.
11. Study the quality of water in pond, river & other sources.

N.B.: The listed practical activities can be modified according to the instruction of the subject committee or the concerned department.

Instructional Techniques
Lecture/Discussion
Individual/Group work/Field work/Lab. work
Report Presentations

Evaluation Scheme
External examination at the end of the academics session (Theory) 40 marks.

For practical

1. Internal Evaluation 2.0
    - Regularity
    - Practical work
    - Record book

1. External Evaluation 8.0
    - Report writing
    - Instructional materials preparation
    - Viva

Text Book
R.N. Trivedi, **A Textbook of Environmental Science**, Anmol Publication, New Delhi, 1995.

References

1. Enthoven, A.C. & Freeman III, A.M. 1973 Problems of Modern Ecology, **"Pollution, resources & the Environment"**. Pub. W.W. Norton & Company Inc. New York.
2. Lean, g. & Hinrichsen 1992. **"Atlast of the Environment."** W.W.F. Pali. Helicon.

Common

Fundamentals of Science Education

Course No. : Sc.Ed. 590 Full Marks : 50
Nature of the Course: Theoretical Pass Marks : 20
Year: Second Periods per week: 3

Course Description

This course is designed to provide the prospective science teachers with the fundamental concept of the nature of science & science education. It also provides the concept of science objectives, implications of learning psychology in science teaching, various aspects of science curriculum and science teacher education. The prospective science teachers will be exposed to the various kinds of teaching skills along with the skills of evaluation strategies, planning for teaching and developing teaching modules. The prospective science teachers will develop teaching skills through micro teaching, group teaching & peer teaching besides other professional activities.

Course Objectives

- Be aware of the nature of science & science education
- Analyse science objectives
- Be aware of implications of learning theories in science teaching
- Review critically the science curriculum
- Analyse critically the science teacher education program.
- Develop skills of various teaching strategies
- Plan lesson for science teaching
- Develop various teaching skills
- Develop classroom observation skills
- Evaluate student's performance

Specific Objectives:

- Explain science and science education.
- Explain the implications of the nature of science in school science teaching
- Explain the impact of science in modern living
- Explain the place of science in school education
- Define & explain the characteristics of scientific attitudes
- Explain the ways of developing scientific attitudes among school science students
- Identify the qualities & responsibilities of a school science teacher.
- Define and explain the characteristics & functions of behavioral objectives.
- Write behavioural objectives
- Analyse critically aims & objectives of schools science in Nepal & other SAARC countries.
- Define & explain the characteristics of learning
- Explain the factors which influence students learning in science.

- Explain Bruner's thought regarding concept of science learning
- Explain Piaget's thought regarding cognitive development
- Explain Gagne's thought regarding student centred learning
- Define curriculum & explain the factors influencing it
- Explain the principles of and approaches to curriculum organisations.
- Explain the characteristics of a good science curriculum
- Analyse critically the process of school science curriculum development in Nepal.
- Explain the method of evaluation of school science curriculum
- Evaluate school science curriculum in Nepal
- Analyse critically innovative science curriculum projects and the existing school science curriculum of SAARC countries.
- Explain the functions of science textbooks
- Explain the characteristics of a good science textbook.
- Explain the ways of evaluating a science textbook
- Evaluate a science textbooks
- Analyse critically the school science textbooks which are in current use in Nepal and other SAARC countries.
- Conduct workshops & seminars in order to carryout classroom activities.
- Explain the importance of science teaching strategy
- Demonstrate various methods of teaching science
- Identify & select a method for science teaching
- Explain the concept of measurement and evaluation
- Explain the function of evaluation
- Explain the evaluation of teaching skills
- Explain tools of evaluation
- prepare various types of test items in science
- Explain the attributes of a good science test items
- Construct test items for school & campus level science
- Perform item analysis of the prepared test items
- Analyse critically the SLC science questions
- Analyse critically the present system of SLC examinations
- Explain the importance of an Unit plan & lesson plan
- Identify the elements of an Unit plan & lesson plan
- Develop a format for science lesson plan
- Develop lesson plan for science teaching
- Practice micro-teaching & group teaching
- Develop science teaching skill through the organization of various activities of science club.

Course Contents

Unit I : Nature of Science **5 hrs.**

- concept of science & science education
- Implications of the nature of science and science education in school science teaching.
- Impact of science and science education in modern living
- Place of science and science education in school education
- Scientific Attitudes (Definition and characteristics)
- Development of scientific attitudes among school science students
- Responsibilities and qualities of the science teacher

Unit II : Aims & Objectives of Science Education **10 hrs.**

- Differences between Aims & Objectives
- Taxonomy of educational objective (cognitive, affective & psychomotor Domains)
- Behavioral objectives (definition, functions & limitations)
- Writing behavioural objectives
- Critical analysis of Aims and objectives of school science in Nepal & some of other SAARC countries.

Unit III : Implications of Learning Theories in Science Education **10 hrs.**

- Definition & characteristics of learning
- Factors which influence learning
- Bruner's learning theory & its implications in science education
- Piaget theory & its implication in science education
- Gagne theory & its implications in Science Eucation

Unit IV : Science Curriculum materials **10 hrs.**

- Science curriculum and curriculum materials & factors influencing it
- Principles of Curriculum organization
- Approaches to curriculum organization
- characteristics of a good science curriculum
- Trends in science curriculum development in Nepal
- Evaluation of science & Science Education Curriculum
- Critical analysis of innovative science curriculum projects (B.S.C.S.; CHEM-Study, PSSC)
- Critical analysis of existing school science curriculum in Nepal and some other SAARC countries.

Unit V : Science Textbooks **5 hrs.**

- Functions of science textbooks
- Characteristics of a goiod science textbook
- Evaluation of a science textbook
- Critical analysis of school science textbook in Nepal.

Unit VI : Teaching Strategies **5 hrs.**

- Introduction (Why teaching)
- Characteristics of various methods of teaching science (overview)

Lecture - demonstration approach
Lecture- discussion approach
Investigetive approach
Laboratory approach
Process - product approach

- Selection of an appropriate method

Unit VII : Evaluation **10 hrs.**

- Introduction
- Measurement and Evaluation
- Functions of evaluation (Diagnostic, cormating & summative functions)
- Evaluation of teaching skill
- Tools of evaluations
- Types of test items
- Attributes of a good achievement
- Item analysis
- Critical analysis of school science questions
- Critical analysis of the present system of school science examination

Unit VIII : Instructional Planning in Science **5 hrs.**

- Introduction
- Elements of an Unit plan
- Development of an Unit plan
- Elements of a lesson plan
- Format of a lesson plan
- Development of lesson plan
- Practice on the developed lesson plan

Unit IX : Practicing Teaching Skills **10hrs.**

- Micro-teaching (Objective, components & planning)
- Group teaching (Objectives, steps & planning)
- Developing teaching skills through the practice of micro & group teaching
- Feedback teaching skills

Unit X : Skill Development Activities **5 hrs.**

- Introduction
- Science teaching through science club
- Planning & organization of science club
- Planning & organization of science fairs
- Organization of excussion & visit
- Reporting of skills development activities.

Evaluation Scheme
Final examination at the end of the session
External examination 100%

Questions must be related to the level of objectives of the concerned topics mentioned in the curriculum.

Texts books

2. Gupta, (1995), **Teaching & Learning in Science & Technology**, Vikash Publishing House. New Delhi.

Reference books

1. Bose, A.N., Sood, J.K., Vaidya, N. (1970), **Strategies in Science Education** - Ajmer.
2. Hurd, Paul, **New Directions in Teaching Secondary School Science**, Rand McNally & Company, Chicago.
3. Hedges, William D. **Testing and Evaluation for Science in Secondary Schools**, Wadsworth Publishing Company In. California.

Thesis Writing for:

- **Chemistry Education**
- **Biology Education**
- **Physics Education**

THESIS WRITING

Course No.: Ed. 598 | Full Marks: 50
Nature: Practical | Pass Marks: 25
Year: Second | Duration:

Course Description

The course is designed to provide the students with hands-on experience in educational research and thesis writing. In this course, the students will have an opportunity to apply the theoretical knowledge of educational research to research such as identification of research problem, development of research instruments, preparation of research design, collection, analysis and presentation of data and writing of the thesis report.

The major purposes of the course are to help students design and conduct educational research studies independently and use the findings of the studies to make the research work meaningful.

Course Objectives

The course intends to accomplish the following specific objectives:

- To develop competencies on the part of the students in identifying and defining research problems, preparing data collection instruments, and collecting and analyzing the data;
- To help students search and review relevant literature;
- To enable students to use the findings of research studies in thesis writing
- To enable students to prepare a research report in one's chosen area of study.

Prerequisites of the course

- The students must have passed the first year of M.Ed. before undertaking the thesis work.
- Viva voce for the thesis of the student will be conducted only after passing all the courses offered in the second year of M.Ed.

Requirements

- The Departmental Research Committee (DRC) will seek thesis proposals from the students approve the proposals and designate the thesis guides for the students
- The student should prepare and submit to the DRC a brief research proposal on the chosen area of study as per the format.
- The students should face an oral examination to finalize the proposal in the DRC.
- The students should undertake the study under the guidance and supervision of the guide designated the by DRC.
- The student should submit 4 copies of the thesis to the department concerned.

- **The thesis should be prepared as per the format supplied by the concerned department. A suggested format is given below:**

Format for thesis writing

I. Introduction

- Background/the context
- Statement of the problem
- Significance of the study
- Objectives of the study
- Hypotheses of the study (if applicable)
- Limitations of the study
- Definitions of appropriate terms

II. Review of Related Literature

- Theoretical framework of the study
- Related literature (in and outside Nepal)

III. Methodology

- Research design
- Population and sampling
- Instrumentation
- Data collection and analysis procedures

IV. Analysis and Interpretation of Data

V. Summary, Conclusions and Recommendations

- Summary
- Conclusions
- Recommendations

VI. *Selected References (Bibliography) Annexes/Appendices*

Evaluation of the Thesis

The thesis will be evaluated on the basis of its written quality and the performance of the student in viva voce. Of the total weightage given to thesis course, seventy percent weightage will be allocated to the written quality of the thesis and the remaining thirty percent will be allocated to viva voce. A Thesis Evaluation Committee (TEC) will evaluate both the written quality of the thesis and viva voce of the student. The average of the marks individually awarded by the TEC members will be treated as the final mark of the student. The evaluation criteria an given below.

Criteria for Evaluating Masteral Thesis

Written Quality	Weightage
Appropriateness of method (s) and the quality of instruments	10
Clarity of conceptual/theoretical framework and or literature review	10
Appropriateness of presentation and analysis of result	10
Appropriateness of conclusions and suggestions	10
Overall organization of the report (format, use of references and bibliography)	10
Contribution of the study to related theory and practice	10
Overall quality of the report	10
Total	**70%**

Oral Quality	
Presentation of the research work (Substantive part. Methodology, Findings Conclusions)	20
Accuracy, fluency and clarity of verbal presentation	10
Total	**30%**
Grand Total:	**100%**

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