UNIVERSITY OF THE PUNJAB

NOTIFICATION

It is hereby notified that on the recommendations of the Board of Studies in Education, the Vice-Chancellor in anticipation of the approval of the other relevant bodies, has approved the Syllabi and Courses of Reading for M.A. Education (Elementary and Secondary) & M.Ed (General and Science), under Annual System for Affiliated Colleges w.e.f Academic Session 2006.

The Syllabi and Courses of Reading is attached herewith, vide Annexure "A".

Sd/-
Prof. Dr. Muhammad Naeem Khan
REGISTRAR

Admin Block
QUAID-E-AZAM CAMPUS,
Lahore.

No. /4769 -/Acad. Dated: 6-9- /2007.

Copy of the above is forwarded to the following for information and further action:-

1. Dean, Faculty of Education
2. The Director,
   Institute of Education & Research.
3. Members of the Board of Studies in Education.
4. Chairperson, DPCC
5. Principals of Affiliated Colleges
6. Controller of Examinations
7. Deputy Controller (Secrecy)
8. Treasurer
9. Deputy Registrar (General)
10. A.R. (Statutes)
11. Secretary to the Vice-Chancellor
12. Secretary to the Registrar
13. Information Cell

Deputy Registrar (Academic)
for Registrar

Annex-A

No. IER/[illegible]

1

June 7, 2007

Deputy Registrar
Academic
University of the Punjab
Lahore

Subject: Scheme of Studies of Annual System of M.A Education (Elementary and Secondary) & M.Ed (General and Science) of Affiliated Colleges

Reference letter No. D/2329/AF dated 26-02-2007. (Copy attached)

As per decision of the University, affiliated colleges have to shift to annual system of examination. The colleges affiliated to the University of the Punjab in Education was asked vide above refereed letter to provide syllabus of Annual Examination.

The Board of Studies in Education has developed the syllabus as per requirement. Copy of the same is attached for notification.

Prof. Dr. Hafiz Muhammad Iqbal
Director IER and
Convenor Board of Studies in Education

Cc:

Deputy Registrar Affiliation for Registrar

M. Ed. Science

Core Courses:

1	Foundations of Education	100
2	Research Methods in Education	100
3	Curriculum & Instruction	100
4	Educational Assessment & Evaluation	100
5	Instruction Technology & Computer Application in Education	40+60
6	Educational Leadership and Management	100
	Area of Specialization	
7-8	Laboratory Techniques and Management Concept Learning in Science Education	200

//

Guidelines for Student Teaching Practice (200 Marks)

1. Duration of teaching practice will be of six weeks with minimum 100 lessons
2. Teaching practice will be in relevant subjects and level
3. Student teacher will plan and teach minimum 100 lessons
4. Student teacher will observe 20 lessons and write criticism
5. Student teacher will organize 5 co-curricular activities in practicing schools
6. Faculty supervisor will be overall responsible for teaching practice and will be responsible for the following:
    a. Coordination of teaching practice
    b. Supervision of teaching practice
    c. Evaluate student teacher in both subjects of teaching practice, activity organization etc.
    d. Faculty supervisor will award marks out of 50 in each subjects
7. There will be a cooperative supervisor for a student teacher from the staff of the practicing school. He will award marks out of 25 in each subject.
8. Two model lessons will be delivered by student teacher. An external examiner appointed by the university will award marks out of 25 for each delivered model lesson.

CURRICULUM FOR M.Ed.SCIENCE

Under annual system

UNIVERSITY OF THE PUNJAB LAHORE

SCHEME OF STUDIES

PAPER NUMBER	COURSE TITLE	TOTAL MARKS
Paper 1	Foundations of Education	100
Paper 2	Leadership and Management in Schools	100
Paper 3	Curriculum and Instructions	100
Paper 4	Assessment and Evaluation	100
Paper 5	Research Methods in Education	100
Paper 6	Instructional Technology and Computer Applications in Education	40 + 60
Paper 7	Concept Learning in Science Education	100
Paper 8	Laboratory Techniques and Management	100

Paper-I

FOUNDATION OF EDUCATION

Philosophical Foundations

Concept of Education
Nature and Functions of Philosophy
Relationship between Education and Philosophy
Various Philosophies with focus on their basic principles and educational implications:

Idealism
Realism
Pragmatism
The Contribution of various educational thinkers to Education:
Imam Ghazali
Ibne-e-Khaldoon
Allama Iqbal
Rousseau
John Dewey
Robert Hutichins

Islamic Foundations

Aims and objectives of Education in Islam
Sources of knowledge in Islam
Ideological Foundations of Education in Pakistan
Islamization of Education in Pakistan

Social Foundations

Nature of Society
Relationship between education and society
Social Functions of Education

Economic Foundations

The concept of Economics of education
Education as an investment
Implications for economics of education in Pakistan

Historical Foundations

A brief Account of British Educational Policy in the Indo-Pak
Sub-continent under the following headings:
A brief review of education in the sub-continent before the English
Era
Macaulay's Minutes
Wood's Dispatch
Hunter Commission
Indian University Act
Sadler Commission
Hartog Committee
Sargeant Scheme

Development of the idea of National Education in the Sub-Continent Institutions of National Education:

Dar-ul-Uloom Deoband, Jamia Milla Islamia, Nadvat-ul-Ulama

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Education in Pakistan

First Educational Conference	1947
National Commission on Education	1959
Education Policy	1970
New Educational Policy	1972
National Education Policy	1978
Education Policy	1998
Education Sector reforms	

Psychological Foundations

Introduction
Learning Theories
Classroom Management
Guidance and Counseling

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Paper-2
Educational Leadership and Management In Schools

On completion of this course a person will have enough knowledge about basic concepts theories and models of Educational Administration and Supervision. It is expected that the person will be able to work as administrator of any Educational Institution competently.

Education: Definition and explanation

Management Administration & Supervision: Definition, Differences and explanation

POSD CoRB

Planning : Definition
Why we plan
Planning process
Kinds of Planning
Types of planning

Organization Structure

Basic concepts of Organizational structure
Why people from organizations
Characteristics of an effective organization

Need of Administration
Development of Administrative Theory
What is a theory
Classical organization theory
Scientific management
Administrative management
Human relation approach
The hawthorne studies
Behavioral science approach
The individual and the organization
Development of administrative thought
System theory

Conflict management
Effective time management
Managing meetings
Interpersonal relationships
Management of staff development
Management of school records
Management school environment (with special reference to Islam)
Managing Behavior/school discipline
Classroom management
Budget
Staff Evaluation

Leadership and Leadership theories

Basic System Model

A System view of school administration

Educational administration: Definition and explanation
Principles of an effective educational organization and administration
Some roles of an administrator
Some qualities for a competent administrator

Administrative Process:

Motivation
Communication
Decision Making
Leadership

Theories and Models of administration
Difference between theory and a Model
Introduction to Theories of Administration

- Great Man theory
- Charismatic Theory
- Social system theory
- Situational theory
- Path Goal theory
- Life Cycle theory
- Theory X-Y
- Theory Z
- Personal Qualities theory/trait theory

Models of administration:

Formal Models:
Authoritarian/Autocratic Model

System Model
Hierarchical Model
Democratic Model
Lasses faire Model

Total quality management: The educational perspective
Islamic concept of administration (Mushawari Model of administration)
The use of Information technology in administration
Classroom management

Text books

Educational Administration: Concepts and practices By Lunenburg and Ornstin
Theories of Educational Management By Tony Bush

Further Readings:

Burden P (1995) Classroom management and discipline. New York

Longman

Hoy, W. K. & Miskel G.C (1996) Educational administration : Theory research and practice (5th ed) New York: Mc Graw Hills Inc.

Robbins, S.P (1996) The administrative process Sydney: Prentice Hall

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Paper-3

CURRICULUM AND INSTRUCTION

Concept of Curriculum

a. Education and Curriculum Relationship
b. Definition of Curriculum
c. How Curriculum differs form:

Syllabus
Course of Study
Educational Programme
Teaching
Instruction
Level of Curriculum

d. Level of Curriculum
e. Types of Curriculum
f. Scope of Curriculum
g. Basic Elements of curriculum

Curriculum Development

a. Nature and Meaning of Curriculum
b. Need for Planning
c. Curriculum Development Levels.

Culture and Curriculum Development

a. Nature and Meaning of Culture
b. Basic Elements of Culture
c. Culture core and persistent life situation
d. Cultural root of the curriculum
e. Cultural change and Curriculum

Factors and Forces Influencing Curriculum Development

a. Internal forces: Teacher Pupil School Environment etc.
b. External forces: Contemporary life Technology, knowledge Ideology Economics Pressure groups. Legal constraints.

Foundations/Bases of Curriculum

a. Philosophical Bases
b. Psychological Bases.

c. Sociological Bases
d. Economic Bases

Curriculum Development Process

a. Analysis of Situtation
b. Formulation of Aims and Objectives
c. Selection of Learning Experiences
d. Selection of Content
e. Organization of Experiences and Content
f. Selection of Teaching-learning Strategies
g. Evaluation

Organizing for Curriculum Development

a. A Curriculum Development organization model
b. Organization Personnel

Formulating Curricular Objectives

a. Educational Aims Soures
b. Validation of Educational Objectives Criteria
c. Classification of Objectives-Blooms Taxonomy
d. Preparing instructional objectives

Selection of Learning Experiences and Content

a. Selection of appropriate learning experiences
   Learning Principle
   Development task
   Developmental Stages of Piaget

b. Selection of Content/Subject matter
   Conceptual frame work
   Basic Themes or Key ideas

c. Principles of Selection of Experiences and Content
   Procedures of Content Selection
      a. Judge mental procedure
      b. Analytical Procedure
      c. Consensual Procedure
      d. Experimental Procedure

   Organization of Experiences and Content

      a. Organization Approaches

a. Planning Process in Pakistan
b Agencies Responsible for Curriculum Development at national and Provincial level
c Critical evaluation of the Situation

Text Book(s): Lawton, Denis School Curriculum Panning, London: Hodder & Stoughton 1986

Further Readings:-

1. Nichols, Andrey and S. Howard Nichols, Developing a Curriculum: Practical Guide. London: Garage Allen & Unwin, 1978.
2. Saylor J.G.W.M. Alexander and A. J. Lewis, Curriculum Planning for Better Teaching and Learning, 4th ed. Tokyo: Holt Saunders Japan, 1981.
3. Smith B.O. W.O Stanley and J.H. Shores, Fundamental of Curriculum Development
4. Taba Hidra Curriculum Development: Theory and Practice. New Yark: Harcourt Brace & World Inc., 1962.
5 Venable T.C Patterns in Secondary School Curriculum, New Yark: Harper & Row. 1958
6 Wheeler. D.K Curriculum Process, and London: Hodder & Stoughton, 19367

Paper-4

Assessment and Evaluation

Introduction

- Historical overview of assessment and evaluation
- Definition of the terms, test measurement and assessment
- General Principles of assessment
- Assessment and the Instructional process
- Types of testing and Assessment procedures

Preparing Instructional Objectives

- Instructional Objectives
- Selecting Instructional Objectives
- Taxonomy of Education Objectives
- Methods of stating Instructional Objectives
- Instruction vs. Behavioral Objectives

Planning for Classroom Test

- Importance/purpose of classroom testing
- Planning a classroom test
- Defining Objectives
- Specifying content
- Preparing blue prints/master charts
- Preparing test items

Constructing Test Items

Selection Type (Objective types)

- Multiple choice questions (Characteristics, uses, Advantages, Limitations Rules for Construction)
- True false Questions
- Matching items
- Completions Items

Supply Type (Essay type)

- Forms and uses
- Advantages/Limitations
- Rules for Construction
- Evaluation/scoring

Issues of Quality in Assessment and Evaluation

- Validity
- Relibality

Elementary Statistical concepts used in Assessment and Evaluation

Frequency Distribution

Types of Scales
Continuous and Discreet Series
Drawing up frequency distribution
Graphic representation of frequency distribution

Measures of Central tendency

Calculation of Arithmetic Mean
Calculation of Median
Calculation of Mode

Measures of Variability

New Trends and Issues

Portfolio Assessment
Dynamic Assessment
Computer assisted assessment and evaluation

References.

Ebel. R L. and Frisbie D.A (1986) Essentials of Educational Measurement. Englewood Cliffs Printice Hall

Gay. L.R. (1985). Educational Evaluation and Mesurement: Competencies for Analysis and Application. New York Macmillian Publishing Co.

Grounlun N. E & Linn Robert L. (2000) Measurement and Assessment in Teaching New York Macmillan.

Hopkins. C.D and Antesl. R. (1990) Classroom Measurement and Evaluation: Itasca Peacock Publishers Inc.

Thorndike. R.L. and Hayen. E.P. (1977) Measurement and Evaluation in Psychology and Education. New York Macmillan

Thorndike. B.W. (1975) Measuring Educational Outcomes: Fundamentals of Testing. New York Harcourt Bree Jovanovich

Wiresma. W. and Jurs. S.G (1990) Educational Measurement and Testing. New York: Bacon.

Paper-5

RESEARCH METHODS IN EDUCATION

INTRODUCATION TO EDUCATIONAL RESEARCH

- Meaning and definition of education research
- The Scientific method
- Purposes and features of research
- Application of the scientific methods in education

TYPES OF RESEARCH

- Basic verses applied research
- Historical research
- Descriptive research
- Correlational research
- Causal comparative research
- Experimental research
- Action research
- Qualitative and Quantitative Research

RESEARCH PROBLEM

- Selection
- Sources
- Characteristics/criteria
- Statement

REVIEW OF RELATED LITERATURE

- Defination purpose and scope
- Preparation
- Sources
- Abstracting
- Reporting

RESEARCH HYPOTHESIS OR QUESTIONS

- Definition and purpose
- Characteristics
- Types of Hypotheses
- Stating the hypothesis/question

SAMPLING

- Definition and purpose
- Techniques of sampling
- Probability Sampling Techniques
    - Random sampling
    - Stratified sampling
    - Cluster sampling
    - Systematic sampling
- Non-probability sampling techniques
    - Convenience sampling

- Purposive/Judgmental sampling
- Snowball sampling
- Quota sampling

RESEARCH INSTRUMENTS

- Purpose of research instruments
- Characteristics of research instruments
- Validity
- Reliability
- Usability

- Construction of Instruments

- Questionnaire
- Observation scale
- Rating scale
- Tests (and their types)

RESEARCH TYPES (DETAIL DISCRIPTION)

Historical Research

- Descriptive research
- Correlational research
- Causal-comparative research
- Experimental research

COLLECTION AND ANALYSIS OF DATA

- Data Collection
- Scoring coding and tabulation of data
- Data Analysis
- Interpretation of data

STATISTICS IN EDUCATION

- Need of Statistical Analysis
- Levels of measurement
- Descriptive Statistics
- Inferential statistics
- Parametric tests (t-test, fest)
- Non-parametric test (X)

WARITING RESEARCH PROPOSAL AND REPORT

- General rules for writing and typing
- Format and style
- Types of research reports
- Theses and dissertations
- Journals Article
- Papers read at professional meetings

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Recommended Textbooks

Gay. L.R (1996) Educational research: competencies for analysis and application. New York: Macmillan Publishing Co.

Cohen. L. and Manian S (1994). Research methods in education. London: Routledge.

ADDITIONAL READING LIST

Anderson. G. (1990). Fundamentals of educational research London: The Falmer Press.

Bell. G (19940). Action research special needs and school development London: Fulton Publishers.

Best. J.W and James V.K (1996) Research in education. New Delhi: Prentice Hall Inc.

Frankel. J. R and Norman E.W (1993). How to design and evaluate research in education. London : Routeledge.

Keeves. J.P. (Eds) (1988). Educational research methodology and measurement: An international handbook. Oxford: Pergamon Press.

Luck. M. (1999). Your student research project. Hampshire: Gower Publishing Ltd

Wiersma. W. (1995) Research methods in education: An introduction. Boston: Allyn and Bacon Inc.

Scott. D. and Usher. R. (Eds). (1996). Understanding educational research London: Routledge.

Paper-6

Instructional Technology and Computer Application in Education

Section-I

Instructional Technology

Contents

Nature of instructional Technology

- Meanings of instructions
- Various concepts of instructional technology
- Relationship between different aspects of instructional technology cone of experiences

Instructional media

- Concept and need
- Criteria for selection of Instructional Media
- Types of Instructional aids
- Projected and no projected aids
- Audio, visual and audiovisual aids

Printed media

- Types and Usage

Graphic materials

- Types and Usage

Electronic and non-electronic media

- Types and Usage

Resource centers and their usage

Low cost and no cost materials

- Types and Usage

Use of instructional technology for group and individualized teaching

Instruction Technology & Computer in Education

Section-II
Computer Applications in Education

Syllabus

Introduction to Computer

- Introduction
- What is computer?
- Data and Information

Characteristics of Computers.

- Types of Computers
- Analoge Computers
- Digital Computers
- Hybrid Computers

Classification of Computer

- Super Computers
- Main Frame Computers
- Mini Computers
- Micro Computers

The Evolution of Computers

- The Mark-I Computers
- The Atanasoff Berry Computers
- The ENIAC
- The EDSAC
- The Manchester Mark-I
- The UNIVAC-I

Computer Hardware

- Basic Computer Organization
- Basic Operations
- Input Unit
- Out put Unit
- Arithmetic Logic Unit
- Control Unit
- Control Processing Unit
- The System Concept

In Put Devices

- Key Board
- The Mouse
- Joy Stick
- Scanner

- Track Ball
- Phones & Voice recognition
- Digital Camera
- Barcode Reader/Light Pens
- Touch Screens
- Touch Pads
- Card Readers
- CD-Rom Payers

Out Put Devices

- Printers
- Video (CRTs)
- Pen Plotters
- Electrostatic Plotters
- Voice Synthesizers
- Input-Output devices

Input-Output devices

- Disk Drives (Floopy Hard)
- Magnetic Tape Drives
- Modems (External Internal)
- Intoduction to windows operating systems
- Booting of a computer
- Components of GUI
- Use of mouse (Left & Right Click)
- Starting a Program in windows
- Using my computer
- Shut Dow Process
- File Management
- Searching a file

Numbers Systems

- Non-positional number system
- Positional number system
- Decimal Number system
- Binary Number System
- Octal number system
- Hexadecimal number system

Conversion from one number system to another

- Converting to decimal from another base
- Converting from base 10 to anew base
- Converting from a base other than 10 to a base other than 10
- Binary to Octal conversion
- Octal to Binary Conversion
- Binary to Hexadecimal Conversion

- Hexadecimal to Binary Conversion
- Function Numbers

Computer Software

- What is software?
- Relationship between Hardware and Software
- Types of Software
- System Software
- Operating System
- Programming Language Translators
- Service Software
- Application Software
- Productivity Software
- Business Software
- Education Software
- Entertainment Software
- Operating System
- Functions of the Operating System
- Functions of the Operating System
- Firm Ware
- GUI & its advantages

MS Word

Changing default type size
The basics of entering text
Non printing characters
Opening editing and saving documents
Creating a new documents
Searching in a document

MS Word

- Formatting (Character, Font, Change Case, Paragraph)
- Working with indents
- Bullet and numbering
- Creating tabs
- Headers and Footers
- Page Breaks

MS Word

- Table creation
- Table Editing
- Mid Term Exam

Storage

- Primary Storage
- Storage capacity

- RAM
- ROM
- PROM
- EPROM
- Difference of storage and memory
- CACHE MEMORY
- Registers
- Buses
- Ports Magnetic Disks
- The Floppy Disks
- Hard Disk
- Compact Disk (CD)
- Video or (Versatile) Disk (DVD)

MS-Excel

- Introduction of MS-Excel
- Ms-Excel Screen
- Data entering
- Fixing of row or column
- Title
- Format
- Fermula
- Function
- Sort Filter
- Chart

MS-Power Point

- Introduction to Interface
- Startup of MS Power point
- File Format
- Designing Slides
- Slide Show

Use Computer in Education

- Computer Assisted Instruction (CAI)
- Packages used for CAI
- Computer Managed Learning (CML)

Internet

- Internet Based E-mail
- E-mail Address
- Advantages and Disadvantages of E-mail
- Internet
- Advantages of Internet
- Main facilities offered by Internet

- Area Network (LAN)
- Area Network (WAN)

Internet

- Searching websites for education session-II
- Searching websites for elementary education
- Searching websites for elementary education

Data Communication

- Introduction to Data Communication
- Elements of Data Communication System
- Data Communication Protocols
- Data Transmission Modes
- Simple mode
- Half Duplex mode
- Full Duplex Mode

SPSS (Software)

1. Instructional Aids/Resources White Board and white Board Markers.
2. OHP
3. Transparency sheets (useable with laser printer)
4. Multimedia
5. Software: MS-Office
6. Compter Lab Facilities to students and the resource person.
7. Photocopy facility
8. Printer
9. Package related to elementary education
10. Teaching strategies lectures
11. Slides on Multimedia/OHP
12. Demonstration
13. Hands on Labs
14. Group Discussion
15. Question Answer Session

Text Books

1. Sinah. P.K (1992) Compter Fundamen.als New Delhi: Jatwara Darya Ganj
2. Mata-Toledo A.R Cushman K.P (2000). Introduction to computer science. New York Mc Graw-Hill

Other Readings

1. Simonson M.R (1977) Education Computing Foundation, Upper Saddle River N.J.Merrill.
2. Grothe David, (2001) Dos/windows study guide, New Delhi: BPB Publications

3. Maynard J. (1984) computer programming made simple great Britain Richard clay.
4. Buzley M.B (1985) using computers USA: SRA.
5. Sanders D.H (1985) computers Today New York: Mc Graw Hill.
6. Scheid F (1987) Theory and Problems of Introduction to computer Science Singapore: Mc Graw Hill.
7. Carroll Jim et al. (1997) Internet Handbook, Ontario: Prentice Hall Inc.
8. Online Help.

PAPER 7
CONCEPT LEARNING IN SCIENCE

THE NATURE OF SCIENCE CONCEPTS

What is Concept?
Concept Formation
Kinds of Concepts
Attributes of Concepts
The importance of Concepts in the Learning of Science
Children's Science and Scientist's Science
Children's Concepts; Preconceptions, Misconceptions, Alternatives
Frameworks, Children's Science

Role of Children's Science in future learning
Outcomes of interaction of Children's Science and Teacher's Science

THEORIES OF LEARNING

Jean Piaget's Theory of Intellectual Development
David Ausubel's Theory of Learning
Robert Gange's Theory of Learning
The Learning of Science Concepts
The Teaching of Science Concepts
Concept Understanding
- Concrete Level
- Identity Level
- Classificatory Level
- Formal Level

Factors Influencing Learning

INVESTIGATIONS OF CONCEPT

Review of some selected Investigation Techniques

- The Clinical Interview
- Word-Association Tasks
- Writing or Selecting a Definition
- Identifying and Using Bipolar Dimensions in a Semantic Space

The Interview about Instances Approach

Some Theoretical Consideration about the Approach

The Main Features of Interview about Instances Approach

Potentials and Limitations of the Approach
A Review of some selected Approaches Investigating Children's Concepts

The Personal Construction of Knowledge Group (UK)
The Learning in Science Project (New Zealand)
The Children's Learning in Science Project (UK)

ASSUMPTIONS ABOUT TEACHING AND LEARNING

Assumptions about the Teaching Learning Process
The place of Science in the School Curriculum
Generative Learning
The Generative Learning Model of Teaching

CONCEPT MAPPING

What are Concept Maps?

Why should Concepts Maps be developed?

Steps for developing a concept Map

Various uses of Concept Maps

REVIEW OF RESEARCH FINDINGS ABOUT CHILDREN CONCEPT IN SELECTED CONCEPT AREA

Force, Energy, Light, Electric Current, Friction, Living, Animal, Physical Change, Particles etc.

Worldwide view of children's Misconceptions
The Commonality of children's Misconceptions

CHILDREN'S IDEAS AND THEIR IMPLICATIONS FOR TEACHING

IMPLICATIONS OF CHILDREN'S IDEAS FOR CURRICULUM AND TEACHER EDUCATION

INTRODUCING CHILDREN'S IDEAS TO TEACHERS

STRATEGIES FOR MODIFYING CHILDREN'S IDEAS

Recommended Books and Articles

Learning in Science the implications of Children's Science, by Roger Osborne and Peter Frey berg, Heinemann, Hong Kong 1993

Chilcren's Ideas in Science by Rosalind Priver, E. Guesne and A. Tiberghien. Open University Press Philadelphina. 1993.

Learning Science By Richard t. Ehite Blackwell,Oxford 1994.

Young People's Image of Science By Rosalind Driver, J. Leach, R Millar and PhilScott, Open University Press Philadelphina. 1996.

PAPER 8

Laboratory Techniques and Management

Why teach Science?
General objectives of science teaching.
Why do practical work?
Aims of practical work.
Contribution made by the practical work in Science Teaching.
A comparison of aims of practical work and the objectives of Science teaching.
What is an experiment demonstration, Exercise etc?

Techniques of practical work

- Standard exercise or verification type experiments examples
- Demonstrations, examples
- Discovery experiments, examples
- Projects examples

Demonstration- Function or the value of demonstration in the teaching of science.

Discovery Experiments.

- What is discovery approach to science teaching?
- Why discovery?
- Advantages of learning by discovery
- Necessary condition to stimulate discovery.
- Characteristics of discovery experiments.
- The role of teacher in discovery laboratory.

Projects

- What is Science Project?
- The project methods.
- Contribution of science project

Science Laboratories and their contribution in the teaching of science.

Design of Laboratories

- Siting, structure, size, shape of laboratories
- Function of laboratory
- Storage of apparatus
- Services (electricity, gas and water)
- Laboratory Furniture
- Lighting, ventilation and blackout

Organization of Science Laboratories

- Maintenance
- Ordering supplies

Stock record
Repair of apparatus

The course will consist of the following activities

Activity 1: **Instrumentation**

The student will be introduced to complicated laboratory apparatus such as VTVM, Power supplies, signal generators, oscilloscope Avometer, Voltmeter, Ammeter, Microscope, vernier caliper, Screw Gauge, Telescope.

Activity 2: **Science Kit**

Science kit students will be introduced to the concept of practical work using Science Kits. They will be required to work on a variety of kits such as :

a) Elementary Science Kits:

These will consist of sound, light, magnetism, motion, electrostatics, friction and inertia, electromagnetism, and simple machines.

b) Secondary Science Kits

c) Higher Level Kits

Consists of Berkeley Physics Laboratory Electronics workshops etc.

Activity 3: **Guided Discovery Experiments**

Students will be required to do at least two experiments each either in Physical Chemistry or Biology under the guidance of the instructor.

Activity 4: **Discovery Experiments**

Student will be required to plan, design, and conduct at least two discovery experiments each in their own fields of interest and submit a written report.

Activity 5: **Science Projects**

Each student will be required to complete one science project and submit written report.