

## **BACHELOR OF SCIENCE BACHELOR OF EDUCATION (ZBC) – SIXTH SEMESTER**

<b>Sixth Semester</b>			
<b>S. No.</b>	<b>Name of Subject</b>	<b>Credits</b>	<b>Total Marks</b>
1	Quantum Chemistry, Spectroscopy & Photochemistry	4	100
2	Quantum Chemistry, Spectroscopy & Photochemistry Lab	3	100
3	Bioinformatics	4	100
4	Bioinformatics Lab	3	100
5	Insect, Vector and Diseases	4	100
6	Insect, Vector and Diseases Lab	3	100
7	Apiculture	3	100
	Pedagogy of School Subject- (Any Two)		
	1.Teaching of Hindi		
	2.Teaching of English		
	3.Teaching of Mathematics		
8	4. Teaching of Biological Science	4	100
9	5.Teaching of Social Science	4	100
	6.Teaching of History		
	7. Teaching of Political Science		
	8. Teaching of Commerce		
	9.Teaching of Physical Science		
	10. Teaching of General Science		
10	School Organisation and Management	4	100
<b>Total</b>		<b>36</b>	

**Subject Name:** QUANTUM CHEMISTRY, SPECTROSCOPY & PHOTOCHEMISTRY

**Subject Name:** QUANTUM CHEMISTRY, SPECTROSCOPY & PHOTOCHEMISTRY-LAB

**Subject Name:** BIOINFORMATICS

**&**

**Subject Name:** BIOINFORMATICS LAB

**Unit 1. Introduction to Bioinformatics**

Introduction, Branches of Bioinformatics, Aim, Scope and Research areas of Bioinformatics.

**Unit 2. Databases in Bioinformatics**

Introduction, Biological Databases, Classification format of Biological Databases, Biological Database Retrieval System.

### **Unit 3. Biological Sequence Databases**

National Center for Biotechnology Information (NCBI): Tools and Databases of NCBI, Database Retrieval Tool, Sequence Submission to NCBI, Basic local alignment search tool (BLAST), Nucleotide Database, Protein Database, Gene Expression Database. EMBL Nucleotide Sequence Database (EMBL-Bank): Introduction, Sequence Retrieval, Sequence Submission to EMBL, Sequence analysis tools. DNA Data Bank of Japan (DDBJ): Introduction, Resources at DDBJ, Data Submission at DDBJ. Protein Information Resource (PIR): About PIR, Resources of PIR, Databases of PIR, Data Retrieval in PIR. Swiss-Prot: Introduction and Salient Features.

### **Unit 4. Sequence Alignments**

Introduction, Concept of Alignment, Multiple Sequence Alignment (MSA), MSA by CLUSTALW, Scoring Matrices, Percent Accepted Mutation (PAM), Blocks of Amino Acid Substitution Matrix (BLOSUM).

### **Unit 5. Molecular Phylogeny**

Methods of Phylogeny, Software for Phylogenetic Analyses, Consistency of Molecular Phylogenetic Prediction.

### **Unit 6. Applications of Bioinformatics**

Structural Bioinformatics in Drug Discovery, Quantitative structure-activity relationship (QSAR) techniques in Drug Design, Microbial genome applications, Crop improvement

#### **Practical**

1. Nucleic acid and protein databases.
2. Sequence retrieval from databases.
3. Sequence alignment.
4. Sequence homology and Gene annotation.
5. Construction of phylogenetic tree.

#### **Suggested Readings**

1. Ghosh Z. and Bibekanand M. (2008) Bioinformatics: Principles and Applications. Oxford University Press.
2. Pevsner J. (2009) Bioinformatics and Functional Genomics. II Edition. Wiley-Blackwell.
3. Campbell A. M., Heyer L. J. (2006) Discovering Genomics, Proteomics and Bioinformatics. \_II Edition. Benjamin Cummings.

**Subject Name:** INSECT, VECTOR AND DISEASES

#### **Unit I: Introduction to Insects**

General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth parts w.r.t. feeding habits

#### **Unit II: Concept of Vectors**

Brief introduction of Carrier and Vectors (mechanical and biological vector), Reservoirs, Host-vector relationship, Vectorial capacity, Adaptations as vectors, Host Specificity

#### **Unit III: Insects as Vectors**

Classification of insects up to orders, detailed features of orders with insects as vectors – Diptera, Siphonaptera, Siphunculata, Hemiptera

#### **Unit IV: Dipteran as Disease Vectors**

Dipterans as important insect vectors – Mosquitoes, Sand fly, Houseflies; Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Viral encephalitis, Filariasis; Control of mosquitoes

Study of sand fly-borne diseases – Visceral Leishmaniasis, Cutaneous Leishmaniasis, Phlebotomus fever; Control of Sand fly Study of house fly as important mechanical vector, Myiasis, Control of house fly

#### **Unit IV: Siphonaptera as Disease Vectors**

Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases –Plague, Typhus fever; Control of fleas

#### **Unit V: Siphunculata as Disease Vectors**

Human louse (Head, Body and Pubic louse) as important insect vectors; Study of louse-borne diseases – Typhus fever, Relapsing fever, Trench fever, Vagabond's disease, Phthiriasis; Control of human louse

#### **Unit VI: Hemiptera as Disease Vectors**

Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical vectors, Control and prevention measures

#### **Subject Name: INSECT, VECTOR AND DISEASES LAB**

1. Study of different kinds of mouth parts of insects
2. Study of following insect vectors through permanent slides/ photographs: Aedes, Culex, Anopheles, Pediculus humanus capitis, Pediculus humanus corporis, Phthirus pubis, Xenopsylla cheopis, Cimex lectularius, Phlebotomus argentipes, Musca domestica, through permanent slides/ photographs
3. Study of different diseases transmitted by above insect vectors

#### **SUGGESTED READINGS**

- Imms, A.D. (1977). A General Text Book of Entomology. Chapman & Hall, UK
- Chapman, R.F. (1998). The Insects: Structure and Function. IV Edition, Cambridge University Press, UK
- Pedigo L.P. (2002). Entomology and Pest Management. Prentice Hall Publication
- Mathews, G. (2011). Integrated Vector Management: Controlling Vectors of Malaria and Other Insect Vector Borne Diseases. Wiley-Blackwell

#### **Subject Name: APICULTURE**

##### **Unit 1: Biology of Bees**

History, Classification and Biology of Honey Bees. Social Organization of Bee Colony

##### **Unit 2: Rearing of Bees**

Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth Bee Pasturage Selection of Bee Species for Apiculture Bee Keeping Equipment Methods of Extraction of Honey (Indigenous and Modern)

##### **Unit 3: Diseases and Enemies**

Bee Diseases and Enemies Control and Preventive measures

##### **Unit 4: Bee Economy**

Products of Apiculture Industry and its Uses (Honey, Bees Wax, Propolis), Pollen etc

##### **Unit 5: Entrepreneurship in Apiculture**

Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens

### SUGGESTED READINGS

- Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.
- Bisht D.S., Apiculture, ICAR Publication.
- Singh S., Beekeeping in India, Indian council of Agricultural Research, New Delhi.

**Subject Name:** PEDAGOGY OF SCHOOL SUBJECT- (ANY TWO)

### 1. Teaching of Hindi

उद्देश्य :

- शिक्षा में भाषा के महत्त्व को रेखांकित कर सकेंगे।
- हिन्दी भाषा शिक्षण के उद्देश्यों की पूर्ति के लिए प्रभावी साधनों एवं समुचित विधियों का प्रयोग कर सकेंगे।
- स्वयं में अपेक्षित भाषा- कौशलों का विकास कर सकेंगे।
- प्रथम भाषा अधिगम की समस्याओं को समझकर उन्हें दूर करने का प्रयास कर सकेंगे।
- विद्यार्थियों के अधिगम का समुचित मूल्यांकन कर सकेंगे।

इकाई 1 हिन्दी भाषा- शिक्षण: सैद्धान्तिक परिप्रेक्ष्य

- भाषा: अर्थ, महत्त्व एवं प्रकार्य
- विद्यालयी पाठ्यचर्या में हिन्दी का स्थान, विभिन्न शिक्षा आयोगों एवं समितियों की संस्तुतियाँ
- प्रथम भाषा, अन्य भाषा, संपर्क भाषा एवं राज भाषा के रूप में हिन्दी , प्रथम भाषा एवं अन्य भाषा के रूप में हिन्दी शिक्षण उद्देश्यों में अंतर
- हिंदी भाषा के तत्त्व, हिन्दी शिक्षक के लिए इन तत्त्वों के ज्ञान की उपयोगिता, भाषा के तत्त्वों का शिक्षण

इकाई 2 भाषा कौशल एवं व्याकरण शिक्षण

- भाषा कौशलों से अभिप्राय, भाषा शिक्षण में उनका स्थान एवं महत्त्व
- सुनने तथा बोलने के कौशल का शिक्षण – महत्त्व, उद्देश्य, प्रकार , शिक्षण विधियाँ, कौशल विकासक क्रियाएँ, श्रवण एवं उच्चारण संबंधी सामान्य दोष, कारण एवं निराकरण

### 2. Teaching of English

**Unit 1: Nature and Role of Language**

**Language and Society** — Language and Power; Language and Class (society); Language and Identity; Language and Gender.

**Language in School** — Home language and school language — Medium of understanding; Multilingual and multicultural classroom; Difference between language as a school subject and language as a Medium of Instruction; Centrality of language in curriculum — Different school subjects as registers of language.

### **Practicum**

Discussion on

- Position paper on 'Teaching of English'
- Position paper on 'Teaching of Indian Languages'
- 'Multilingualism as a resource'
- Analysis of advertisements aired on Radio/Television on the basis of language and gender.

### **Unit- 2: Role and Position of Languages - Constitutional provisions and policies of language education**

Position of Languages in India; Article 343-351, 350A; Kothari Commission (1964-66); NPE-1968, NPE-1986; POA 1992; National Curriculum Framework-2005.

**Role of English language in the Indian context** - English as a colonial language, English in Post-colonial times; English as a language of knowledge; Position of English as second language in India; English and Indian languages; English as a link language in global context; challenges of teaching and learning English.

### **Practicum**

- Discuss in groups how the role of English language has changed in the 21st c.
- Topic for Debate — Globalisation & English
- Discussion on the topic 'War begins When Words Fail'
- Keeping in view the topics given in this unit, prepare a questionnaire. Interview ten people and write a report on 'English Language in India'.

### **Unit-3: Language Teaching - An Overview**

#### **1. Different approaches/theories to language learning & teaching -**

Philosophical, social and psychological bases of approaches to Language acquisition and Language learning; Western and Indian overview of language learning (John Dewey, Bruner, J. Piaget, L. Vygotsky, Chomsky, Krashen), (Gandhi Ji, Sri Aurobindo, Rabindranath Tagore, Zakir Hussain, Radhakrishnan, Giju Bhai Bhadeka)

#### **2. A critical analysis of the evaluation of language teaching methodologies-**

Grammar translation method, Structural method, Direct method, Audiolingual method, Natural method; Communicative approach, Whole language approaches — Task based approach, Thematic Approach etc.

### **Practicum**

- Discussion on the topic 'Mother Tongue and Other Tongue'

### **Unit-4: Linguistic Behaviour and System**

1. **Linguistic Behaviour**— language as a rule governed behaviour and linguistic variability; Pronunciation-linguistic diversity, its impact on English, pedagogical implication; speech and writing.
2. **Linguistic system**— the organisation of sounds; the structure of sentences; The concept of Universal grammar; Nature and structure of meaning; Phonetics, Syntax and semantics; etc.

### **Practicum**

Have a discussion on the topic 'Difference Between Spoken and Written Language'

### **Unit-5: Developing Language Skills**

**Grammar in context; vocabulary in context.**

### **Language skills - listening, speaking, reading and writing.**

- Listening and Speaking — Sub skills of listening: Tasks; Materials and resources for developing the listening and speaking skills: story telling, dialogues, situational conversations, role plays, simulations, speech, games and contexts, language laboratories, pictures, authentic materials and multi-media resources.
- Reading— Sub skills of reading; Importance of understanding the development of reading skills; reading aloud and silent reading; extensive and intensive reading; Study skills including using thesauruses, dictionary, encyclopedia etc
- Writing— Stages of writing; Process of writing; Formal and Informal writing such as poetry, short story, letter, diary, notices, articles, reports, dialogue, speech, advertisement etc. Reference skills; Study skills; Higher order skills.

#### **Practicum**

- Collect 10 examples of Grammar in context from English textbooks of VI to VIII and have a group discussion.
- Prepare activities for listening, speaking, reading and writing. (5 Each)
- Prepare 3 activities to develop the reading skills of class VI students.

### **Unit-6: Language, Literature and Aesthetics –I**

**Different creative forms of English Language** - Literature, media and translation; Understanding different forms of literature; Literature in the school curriculum: needs, objectives and relevance; role and relevance of media in school curriculum; Translation: importance and need, Translation as a creative activity.

#### **Practicum**

- Take three editorial pieces on the same topic from different newspapers. Have a discussion on their language and presentation.
- Take two translations of any piece of creative writing. Read these pieces and then translate the piece yourself.
- Take any creative writing related to history eg. *Discovery of India* and prepare a flow chart on the main events.
- Review any story and have a discussion in groups.
- Take any piece on Geography and prepare a teaching strategy for teaching any Geographical phenomena eg. Climate change, water.

### **Unit-7: Language, Literature and Aesthetics–II**

**Teaching different texts: Poetry, Prose, Drama** – Teaching of prose, poetry and drama; the study of contemporary English and Indian literature; Developing tasks, activities and materials for lesson design.

#### **Practicum**

- Review any two stories of your choice.
- Interview any local artist/poet/writer.
- Collect Indian folktales in English (translated) for your portfolio.
- Prepare a newsletter on the basis of your school experience programme (hand written).

### **Unit-8: Development and Analysis of Syllabus and Textual Materials**

1. Understanding the relationship between curriculum, syllabus and textbook; Selection of materials and developing activities and tasks as per the differentiated needs of the learners (Connecting learning to the world outside; Moving away from rote-learning to constructivism) Teacher as a researcher and facilitator — keeping in view the inclusive classroom.

#### **Practicum**

- Do a comparative study of one textbook of English from any class (VI to VII) developed by any two states.
- Prepare an outline for the development of the textbook for the same class for your state.

### **Unit-9: Teaching-Learning Materials**

Print media; Other reading materials such as learner chosen texts, Magazines, News Papers, Class libraries etc., ICT - audio-visual materials, internet including CALL programmes; Radio, T.V., Films; Planning activities such as discussion, debates, workshops, seminar etc.; Language labs etc.

#### **Practicum**

- Prepare a list of audio-visual aids related to teaching of English and use them wherever necessary.
- Identify and prepare different types of teaching aids for children with special needs (speech impaired).
- Organize a workshop/seminar/conference on the topic — 'Language of Children' or any other related topic.

### **Unit-10: Assessment - Its Role and Importance**

1. Progress and assessment of development of language; Continuous and comprehensive evaluation; Techniques of evaluation—oral, written, portfolio; Cloze test, Self-evaluation; Peer evaluation; Group evaluation.
2. Typology of questions; activities and tasks (open ended questions, MCQ, true and false etc.) reflecting— Problem solving, creative and critical, thinking, Enhancing imagination and environmental awareness.
3. Feedback to students, parents and teachers;

#### **Suggested Readings**

1. National Curriculum Framework 2005; NCERT, December 2005.
2. National Curriculum Framework 2005; Position Paper, National Focus Group on Teaching of English; NCERT, 2006.
3. National Curriculum Framework 2005, Position Paper, National Focus Group on Teaching of Indian languages, NCERT, 2006.
4. The Right of Children to Free and Compulsory Education Act-2009, The Gazette of India, 2009.
5. Brumfit. C (1984); Communicative methods in Language Teaching; Cambridge University press: Cambridge.
6. Chomsky (1964) in Day. E. M (2002): Identity and the young English language learner; Multilingual Matters Limited; London.
7. Gardner and Lambert (1972) Attitudes and Motivation in second language learning; Rowley; Newbury house.
8. Jeremy Harmer, Longman Handbooks for Language Teachers, The Practice of English Language Teaching, 1998.
9. Srijan<sup>1</sup>, Creative Writing and Translation, National Council of Educational Research and Training, New Delhi 2010.
10. Samajh ka Madhyum, National Council of Educational Research and Training, New Delhi 2009
11. Source Book on Assessment for Classed I-V, Language English, NCERT, October 2008.
12. Learning Indicators till the Elementary Stage, National Council of Educational Research and Training, New Delhi 2015

13. Continuous Comprehensive Evaluation – Exemplar Package for Upper Primary Stage in English, National Council of Educational Research and Training, New Delhi 2015
14. Agnihotri, R.K., Khanna, A.L. 1994. (eds.), Second Language Acquisition: Socio-cultural and Linguistic Aspects of English in India (RAL1). New Delhi: Sage Publications.
15. Beaumont, M. 1996. The Teaching of Reading Skills in Second/Foreign Language. Patras: The Hellenic Open University.
16. Cummins, J. and Swain, M. 1986. Bilingualism in Education. London: Longman.
17. Ellis, R. 1985. Understanding Second Language Acquisition. Oxford: Oxford University Press.
18. Prabhu, N.S. 1987. Second Language Pedagogy. Oxford; New York: Oxford University Press.
19. Krashen, Stephen. 1989. We acquire vocabulary and spelling by reading: Additional evidence for the input hypothesis. *Modern Language Journal* 73:4. Pp. 440-64.
20. Kumar, Krishna, 2011. *The Child's Language and the Teacher, a Handbook*, New Delhi, National Book trust India.

### **3. Teaching of Mathematics**

#### **Unit 1: Nature and Scope of Mathematics**

Meaning and building blocks of mathematics-undefined terms, definitions, axioms, theorems; the nature of mathematical propositions- truth values, truth tables, Open sentences, logically valid conclusions, use of quantifiers, implications - necessary and sufficient conditions, a mathematical statement and its variants—converse, inverse and contrapositive , compound propositions; Venn diagram; proofs and types of proofs, Difference between proof and verification; Deductive nature of mathematics; History of mathematics with special emphasis on teaching of mathematics, contribution of Indian mathematicians; Aesthetic sense in mathematics, three aesthetic experience variables identified by Birkhoff and their relation, coexistence of precision and beauty in mathematics; Scope of mathematics.

#### **Unit 2: Exploring Learners**

Cultivating learner's sensitivity like intuition; encouraging learner for- probing, raising queries and relating mathematics to real life situations; appreciating dialogue and cooperative learning among peer group; promoting the student's confidence (carrying out examples from various mathematical content areas, such as Number Systems, Geometry, Sets, etc.).

#### **Unit 3: Aims and Objectives of Teaching School Mathematics**

Need for establishing general objectives for teaching mathematics; Study of the aims and general objectives of teaching mathematics vis-a-vis the objectives of school education; writing learning objectives and teaching points of various content areas in mathematics like Algebra, Geometry, Trigonometry, etc.

#### **Unit 4: School Mathematics Curriculum**

Objectives of curriculum, principles for designing curriculum, designing curriculum at different stages of schooling, some highlights of curriculum like vision of school mathematics, main goal of mathematics education, core areas of concern in school mathematics, curricular choices at different stages of school mathematics education, construction of syllabi in various disciplines of mathematics, for example, Algebra, Geometry, etc.; Pedagogical analysis of various topics in mathematics at various levels of schooling—Arithmetic (Development of Number Systems), Algebra, Trigonometry, Statistics and Probability, etc.

#### **Unit 5: Approaches and Strategies in Teaching and Learning of Mathematical Concepts**

Nature of concepts, concept formation and concept assimilation, Moves in teaching a concept—defining, stating necessary and/or sufficient condition, giving examples accompanied by a reason, comparing and contrasting; giving counter examples; Non-examples; Planning and implementation of strategies for teaching a mathematical concept like Activity based method, Inductive-deductive method etc.;



Problem posing and solving, discovering or exploring various options for solving the problems; formulation of conjecture and generalisations through several illustrations; Difference between teaching of mathematics and teaching of science.

### **Unit 6: Planning for Teaching-Learning of Mathematics**

Selecting the content for instruction; Identifying concepts to be transacted at various levels with special emphasis on content (Algebra, Geometry, Trigonometry, Coordinate Geometry, Statistics and Probability, etc.); organisation of concepts for teaching-learning of mathematics, stating instructional objectives, identifying learning experiences, appropriate strategies, teaching aids (Using low-cost material – preparation of various activities, such as verification of algebraic identities, surface areas and volumes of cube, cuboids, cylinder, cone, sphere, conic sections, etc.); ICT applications; Evaluation tools and learners participation in developing instructional materials, etc.

### **Unit 7: Learning Resources in Mathematics**

Textbooks ,audio-visual multimedia–Selection and designing; Using community resources for mathematics learning, pooling of learning resources in school complex/block/district level, handling hurdles in utilising resources.

### **Unit 8: Assessment and Evaluation**

- Informal Creative Evaluation

Encouraging learner to examine a variety of methods of assessment in mathematics so as to assess understanding of mathematical concepts, processes and communication, creativity, problem-solving and experimentation/activity performance; appreciating evaluation through overall performance of the child; self and peer evaluation.

- Formal Ways of Evaluation

Variety of assessment techniques and practices, assessing Product Vs Process, Knowing Vs Doing, practise of conducting midterm/terminal examination, practising continuous and comprehensive evaluation to test regular programmes/achievements of learner.

- Assessment Framework

Identifying and organising components for developing framework of question paper at different stages of learning; Framing questions based on concepts and sub concepts so as to encourage critical thinking, promote logical reasoning and to discourage mechanical manipulation and rote learning; Framing of open-ended questions providing the scope to learners to give responses in their own words; Framing of conceptual questions from simple questions.

### **Unit 9: Mathematics for All**

Identifying learners strength and weaknesses; Activities enriching mathematics learning – assisting learning, supplementary text material, summer programmes, correspondence course, mathematics club, contests and fairs, designing mathematics laboratory and its effective use, recreational activities—games, puzzles and riddles in mathematics, cooperative learning, ensuring equal partnership of learners with special needs, stimulating creativity and inventiveness in mathematics.

### **Unit 10: Professional Development of Mathematics Teachers**

Types of in-service programmes for mathematics teachers; role of mathematics teachers association; Journals and other resource materials in mathematics education; Professional growth—participation in Conferences/seminars/workshops.

### **Suggested Readings**

1. NCERT (2006) , Position Paper-National Focus Group On Teaching of Mathematics , New Delhi.
2. Novak,J.D. & Gowin ,D.B.,(1984) , Learning How To Learn ,New York, NY, Cambridge University Press

3. Balkrishna Shetty (2013), What Is Mathematics? , National Book Trust, India
4. Kilpatrick J, Hoyles C and Skovsmose,O (EDS.);(2005),Meaning in Mathematics Education, Springer, New York, NY
5. Polya ,George (1965),Mathematical Discovery, John Wiley and sons, INC., Vol.II
6. Skemp,R.R., (1971), The Psychology of Learning mathematics, Penguin Books
7. Anice James,(2005),Teaching of Mathematics, Neelkamal Publications Pvt. Ltd. , Hyderabad,India
8. Davis D.R.,(1951),The Teaching of Mathematics, Addison Wesley Press, London
9. Roy Hollands (1990), Development of mathematical skills, Blackwell Publishers, Oxford, London
10. Schonnel F.J.(1965) , Diagnostic and Remedial Teaching in Arithmetic , Lever and Boyd , London
11. Pamela Cowan (2006), Teaching Mathematics, A Handbook for Primary and Secondary School Teachers, Routledge , London and New York
12. Beckmann C.E ,Thompson D.R and Rubenstein,R.N(2010), Teaching and Learning High School Mathematics , John Wiley and Sons Inc., New Jersey
13. Britton E, Huntley M.A., Jacobs G and Weinberg A.S.(1999),Connecting Mathematics and Science to Workplace Contexts : A Guide to Curriculum materials, Corwin Press Inc., California
14. Chambers P,(2010),Teaching Mathematics: Developing as a Reflective Secondary Teacher, SAGE, New Delhi
15. Katz, V.J. (ED.)(2007), The Mathematics of Egypt, Mesopotamia, China, India and Islam – A Sourcebook, Princeton University Press, Princeton
16. NCERT (2012), Pedagogy of Mathematics Textbook for Two-Year B. Ed Course.
17. William D.(1998) ‘A Framework for Thinking About Research in Mathematics and Science Education’ .In Malone J.A., Atweh B. and Northfield J.R. (EDS.) Research and Supervision in Mathematics and Science Education, Lawrence Erlbaum Associates Inc. Publishers, New Jersey
18. Noss R.(19988) , ‘The Computer as a Cultural Influence in Mathematical Learning.’ In Bishop A.J. (EDS.) Mathematics Education and Culture, London : Kluwer Academic Publishers
19. NCERT (2009),Source book on Assessment of Mathematics - Primary Classes, New Delhi
20. NCERT (2013),Source book on Assessment of Mathematics –Classes VI-VIII, New Delhi
21. NCERT (2011), Laboratory Manual in Mathematics-Elementary Stage, New Delhi
22. NCERT, Laboratory Manual in Mathematics-Secondary Stage, New Delhi
23. EugeneP.Northdrop (1944), Riddles in Mathematics, D.Van Nostrand Co. Inc., Princeton, New Jersey
24. Sidhu K.S.(1967) , The Teaching of Mathematics, Sterling Publishers , Delhi
25. Clements M.A. and Ellorton N.F.(1996), Mathematics Education Research :Past, Present and Future, UNESCO Principal Regional Office for Asia and the Pacific, Bangkok
26. Tanner H. And Jones S. (2000) , Becoming a successful teacher of mathematics, Routledge Falmer , London

#### **4. Teaching of Social Studies**

##### **Unit 1: Social Sciences as an Integrating Area of Study: Context and Concerns**

- Distinguishing between Natural and Social Sciences: Major Social Sciences disciplines in Schools.

- What is 'social' about various Social Sciences?
- Uniqueness of disciplines vis-a-vis interdisciplinarity
- Linking child's natural curiosity with natural phenomena like weather, flora and fauna; spatial and temporal contexts; important social and economic issues and concerns of the present-day Indian society.
- Multiple perspectives/plurality of approaches for constructing explanations and arguments.

### **Unit 2: Teaching-Learning Resources in Social Sciences**

- People as resource: The significance of oral data.
- Types of Primary and Secondary Sources: Data from field, textual materials, journals, magazines, newspapers, etc.
- Using the library for secondary sources and reference material, such as dictionaries and encyclopaedias.
- Various teaching aids: Using atlas as a resource for Social Sciences; maps, globe, charts, models, graphs, visuals.
- Audio-visual aids, CD-Rom, multimedia, internet.

### **Unit 3: Social Sciences Curriculum for Schools in India**

- Curriculum development process: National and State levels.
- Studying the Social Sciences syllabus - aims and objectives, content organisation and presentation of any State Board and CBSE for different stages of school education.

### **Unit 4: Teaching-Learning of Geography—Space, Resources and Development**

Meaning, Nature and Scope of Geography: Current Trends Teaching and Learning Major Themes and Key Concepts in Geography

**LOCATION:** Absolute (Grid system of latitudes and longitudes) and relative location: two ways of describing the positions of places and people on the earth's surface. Differentiating between sites (location) and situation (place).

**PLACE:** Distinct physical and human characteristic of places that distinguish one from the other.

**HUMAN-ENVIRONMENT INTERACTIONS:** Distribution of resources; patterns of human activities reflecting modifications/adaptations to natural/physical settings based on the prevailing cultural values, economic and political circumstances and technological abilities (one case study each of primary, secondary, tertiary/quaternary activities may be taken up). Environmental degradation and its preservation; disasters and preparedness.

**MOVEMENTS:** Interdependence and interaction across space, migration of people, transport and communication; trade and commerce, patterns of centres, pathways and hinterlands.

**REGIONS:** Formation and change.

The above content may be used to understand teaching, learning strategies and skill development in Geography.

### **Developing Skills in Geography**

Observation, recording and interpretation of physical and social features and phenomena; Reading and interpreting geographical information through tables, figures, diagrams, photographs; Map reading and interpreting using scale (distance), direction, symbols, point, line and area; Visual-to-verbal and verbal-to-visual transformation leading to mental mapping; Identifying, constructing and asking geographical questions; Developing and gathering relevant information and data and analysing them to answer geographical questions and offering explanations and interpretations of their findings; applying acquired knowledge and skills for understanding the wider world and taking personal decisions; taking up activities

to study environmental degradation in the local area and its preservation methods; studying any disaster involving all factors at the local/global levels.

### **Teaching Strategies in Geography**

Questioning; Collaborative strategies; Games, simulations and role plays; Values clarification; Problem-solving and decision-making.

**METHODS:** Interactive verbal learning; Experiential learning through activities, experiments; Investigative field visits based on students' own interests with teacher's support as facilitator; Engagement with 'places' at an emotional or sensory level using art, poetry and literature.

**TECHNIQUES:** Using textbooks and atlas as a part of oral lessons, non-oral working lessons; using medium and large scale maps; using pictures, photographs, satellite imageries and aerial photographs; using audio-visual aids, CDs, multimedia and internet; case study approach.

### **Unit 5: Teaching-Learning of Economics: State, Market, and Development**

As a branch of social science, economics is concerned with people. It studies how to provide them with means to realise their potential. This unit on economics deals with the broad themes of state, market, and development. Market and state are interrelated as instruments of development. The course endeavours to introduce the learners to key economic concepts and issues that affect their everyday lives.

#### *Meaning, Nature and Scope of Economics: Current Trends*

##### *Key Concepts in Economics*

Scarcity and choice, opportunity cost, productivity, demand, supply and market mechanism, Division of labour and specialisation.

##### *Classification of Economic System*

Capitalism, Socialism, mixed economy (case study: India)

##### *Developmental Issues in Economics*

Sustainable Development—economic growth and economic development - indicators of measuring the well-being of an economy; Gross Domestic Product; economic planning; Poverty; Food Security; Price rise; Role and functions of Money—formal and informal financial institutions and budget; Classification of Production Activities—primary, secondary and tertiary; Economic Reforms and Globalisation (discuss these developmental issues with reference to India). The above content may be used to understand the teaching, learning strategies and skill development in economics.

##### *Teaching-Learning Methods in Economics*

In addition to usual methods like lecture, discussion, storytelling, other methods like problem-solving, simulation games, use of media and technology, concept mapping, project and activities like field visits (e.g. visit to a construction site for data on wages and employment), collection of data from documents (e.g. Economic Survey, Five Year Plan), analyzing and interpreting data (using simple tables, diagrams and graphs) can be undertaken. Self-study and collaborative learning activities should be encouraged.

##### *Teaching-Learning Materials*

Using textbook, analysis of news (Newspaper, TV, and Radio); documents (e.g. Economics Survey, Five Year Plan), Journals and News Magazines.

### **Unit 6: Teaching-Learning of History**

#### *Continuity and Change over Time and Historical Construction*

This Unit seeks to introduce student-teachers to some of the seminal issues and concepts of social change in Indian and World History. It also aims to explain how historians do History and how it ought to be done in schools. It, therefore, focuses on constructivist pedagogy in History and the general competencies that children are likely to develop through the study of History.

### *Historical Methods*

- Evidence, facts, arguments, categories and perspective; Distinctions between fact and opinion and between opinion, bias and perspective; Evidence-based History teaching; Primary sources and the construction of History
- Thinking in terms of problems for analysis in History.

### *Social Formations in History*

- Different social formations in History and the periodisation of World History; The periodisation of Indian History: Ancient, medieval, modern and contemporary societies
- State-formation and different types of states in History
- Capitalism, democracy and citizenship (Case Studies: American Revolution/French Revolution)
- The varieties of socialism (Case Study: the erstwhile USSR and/or China and/or Cuba)
- Fascism and dictatorships (Case Study: Germany or Italy of the inter-war period).

### *Select Issues of Social Change in Indian History*

- Culture, social stratification and social change in India; Caste and class in Indian society
- Shared religious cultures and conflicts between religious communities in India
- Gender differentials and how these cut across caste and class structures as well as religious communities. (Case Study: India) The above content may be used to understand the teaching, learning strategies and skill development in History.

### *Pedagogical Concerns Regarding School History*

- Interactive, constructivist and critical pedagogies in History
- Going beyond the textbook; Getting children to craft little nuggets of History from primary sources
- Encouraging children to think from first principle in History.

### *The Lateral Development of Different Skills*

- Observation of skills relating to primary and secondary data; Observing coins, inscriptions (if available), the material remains of the past and visuals; Helping children to read passages from primary sources; Thinking about what all these sources might or might not reveal
- Learning to analyse critically and to argue; Observing how arguments have been made in the standard secondary sources and how these muster facts and evidences
- Helping children to develop oral and written expression.

## **Unit 7: Teaching-Learning of Political Science Democracy, Development, and Diversity**

The Unit on Political Science deals with the broad themes of democracy, development, and diversity. These three interrelated themes are concerned with political, economic, and social aspects of our everyday life. The contents in this unit contain key political concepts and issues. While explaining them, teachers are expected to refer to both historical and current events, processes and personalities from India and different parts of the world. They are also expected to make references to key concepts in the disciplines of Sociology, Economics, and Geography, so as to highlight the interrelationship between Political Science and these disciplines.

- What is Politics?  
Political Science: Nature and scope, key concepts, current trends Elements of State: Population, Territory, Government, and Sovereignty Forms of Government: Democratic (Liberal and Social), non-

democratic Rule of Law, Authority, Power, Legitimacy, Civil Society, Citizenship, Rights, separation of Powers

Organs of Government: Legislature, Executive, and Judiciary.

- Constitutional Vision for a Democratic India

The making of the Constitution of India

Justice (with special reference to Social Justice and Empowerment) Liberty, Equality, Dignity, Socialism  
Secularism (Relationship between State and Religion): Western and Indian Versions  
Fundamental Rights (Prohibition of discrimination; Rights of Dalits, Tribes, minorities [Religious/Linguistic], Women and Children, the Disabled)

Directive Principles of State Policy (with special reference to welfare of the people) Fundamental Duties.

- The Working of the Government

Structures and Functions of the Government at different levels Union, State/UT, District and Local Bodies (Panchayats and Municipalities)

Relationship among the three organs of the Government Relationship between the three levels of the Government

Democratic decentralisation, citizen participation.

- Society and Political Processes

Elections, political parties, pressure groups

Social movements: Dalit movement, Tribal movement, Women's movement, environmental movement; Role of media, Role of NGOs, RTI The above content may be used to understand the teaching-learning strategies and skill development in Political Science.

- Teaching-learning Strategies

The teaching-learning process needs to take into account the lived experiences of student-teachers. The issues in this Unit can be introduced by referring to the relevant items from daily newspapers (e.g. instances of violation and protection of human rights). The contents are to be transacted through participatory methods involving all participants. 'Learning by discussing' is to be followed as a regular practice in the classroom.

Social inquiry approaches can be used in teaching, learning of Political Science. The student-teachers may be encouraged to observe actual functioning of the institutions of different local Government bodies in own district and prepare reports as group projects. They may also be encouraged to undertake field research, conduct in-depth interviews, and interpret field data and critically understand political concepts.

- Teaching-learning Materials: Constitution of India, atlas, political maps (World, Asia, India, States, Districts), globe, two daily newspapers, news magazines.

### **Unit 8: Assessment for Learning in Social Sciences**

- Characteristics of Assessment in Social Sciences: Types of questions best suited for examining/assessing/understanding the different aspect of Social Sciences; Questions for testing quantitative skills, Questions for testing qualitative analysis; Open-ended questions
- Open-book tests: Strengths and limitations

- Evaluating answers: What to look for? Assessing projects: What to look for?
- Continuous and Comprehensive Evaluation (CCE) in Social Sciences.

### **Unit 9: Analysis of Social Sciences Textbooks and Question Papers**

- Analysing textbooks in Social Sciences in the light of the syllabus and from the perspective of the child (Textbooks of the same class may be taken up for all subjects in Social Sciences)
- Analysing question papers of any State Board/CBSE and NCERT's textbooks in the light of the subject specific requirements in terms of understanding and skills.

## **5. Teaching of Biological Science**

### **Unit 1: Nature and Scope of Science and Biology**

- Science as a domain of inquiry and exploration; A continuously evolving discipline with focus on processes for understanding of concepts leading to knowledge and application with reference to living organisms, their surroundings, processes and phenomena.
- Scope of Biological Science for understanding the diversity of the living world, origin of life and its evolution, environment, health, sustenance of the ecosystem vis-à-vis values and ethics.
- Significance of inquiry, observation and experiments in biological science, its interdisciplinary linkages and societal concerns.
- History of biological sciences

### **Unit 2: Aims and objectives**

- Development of scientific attitude and temper and nurturance of curiosity, creativity and value.
- Curricular concerns and its development with reference to biological sciences; Content selection and its organization; Understanding of facts, principles and its application biological principles with cognitive abilities and development of learners.
- Acquiring skills to understand processes of studying biology e.g. observation, exploration, experiments etc. Generalisation of observations and validation of knowledge.
- Problem solving relating to biological sciences. Relationship of biology education with environment and its sustenance.
- Understanding learning objectives of different areas of Biology; Anderson and Krathwohl's taxonomy with illustrations; learning objectives in constructivist perspective.

### **Unit 3: Exploring Learners**

- Linkage of learner's previous understanding (classroom, environment, society and peer group) and knowledge in the area of biology.
- Cultivating habit of listening ideas of learners and involving them in the process of teaching- learning, setting dialogue and discussion among peer groups, involving them in activities in individual and group set-up.
- Important discoveries and inventions in the area of Biology and its impact on the curriculum
- Learning is a lifelong process: Nurturance of natural curiosity of observation, facilitation of learning depending on needs and requirement of biological sciences,
- Stimulation of creativity and inventiveness in the area of biological science among learners
- Organisation of activities in the area of biological sciences like discussion, debate, drama and various other curricular experiences (poster making, essays, slogans, etc.), observing specific days involving learners

- Nurturance of creative talents among learners through activities in various club activities in the area of Science, preparing learners for Science Exhibitions, Fairs and other gatherings at local/districts/state and national level

#### **Unit 4: Pedagogical shift in Biological Science**

- Pedagogical shift from science as a fixed body of knowledge to the process of constructing knowledge; Pedagogical shift in nature of science, knowledge, learners, learning and teachers, assessment, science curriculum and planning
- teaching-learning experiences (taking examples from science/ Biology, such as Photosynthesis, Life Processes, Diversity in Living Organisms, Biotechnology, etc.)
- Democratising Science learning: Critical pedagogy
- Need of inclusion in all aspects of teaching-learning of biological science –science curriculum, approaches, ICT and professional development of teachers.

#### **Unit 5: Approaches and Strategies of learning Biology**

- Process of learning through observation, inquiry, hypothesis, experimentation, data collection, interpretation and generalization (taking suitable example from living world and related areas in an age as well as stage appropriate manner).
- Approaches and strategies of learning Biology: Expository approach, investigation, projects, peer interactions, collaborative approach, experiential learning, concept mapping and self-learning, etc., designing learning experiences with all these approaches.

#### **Unit 6: Curriculum of Biology at School stage**

- Recent trends of Science and Biology Curriculum; Gradual evolution of Biology as a discipline; Environment oriented approach of Biology curriculum
- Selection and organization of contents in Biology
- Analysis of various syllabi (NCERT and other states) and text-books pertaining to subject areas of Biology at various stages of school education (Upper Primary, Secondary and Higher Secondary)
- Analysis of other print and electronic materials in the area of Biology.

#### **Unit 2: Learning Resources**

- Need and significance of learning resources in Biology
- Identifying and analyzing age and stage specific learning resources and using them in teaching-learning process of Biology e.g., for classification and systematic studies of organisms, morphology and anatomy of organisms, and their parts, life processes, understanding about environment and relationships of organisms among themselves and with their environment, etc.
- Biology Laboratory as a learning resource; Design and components of Biology laboratory
- Use of Science and Biology experiment kits in teaching-learning of Biology
- Field visits and excursion as learning resource in Biology: Planning, its organization and observation
- Use of ICT tools and online resources at various stages of school education; ICT based virtual experiments and simulations as learning resource in Biology ;Role of the teacher
- Limitations and hurdles in the use of various learning resources in Biology.

#### **Unit 3: Planning of Teaching-Learning of Biological Science**

- Identification of concepts related to teaching-learning of Biology



- Planning for transaction of concepts and identification of teaching-learning materials; Involvement of learners in the process of design and development of teaching-learning materials.
- Identification of students learning with different pace and styles and students with special educational needs; Continuous and comprehensive
- assessment of learning gaps and learning needs of students and address of the issues
- Planning for exposure to various learning resources through projects (both in schools and outside), debates, discussions, field visits (Botanical and Zoological Gardens, Science Centres, Science Museums, Sea shores, etc.)
- Planning and organising activities, experiments, project work and other practical experiences.

#### **Unit 4: Tools and techniques for assessment of learning in Biological Science**

- Development of assessment framework
- Learning Indicators in biological sciences: its development and assessment of learning evidences/ outcome
- Learners' record in biological sciences: laboratory investigations, reports of field visits and excursion; Project work and its report; Oral presentation of learners' work in Biology; Portfolio
- Assessment through participation in collaborative learning: peer interaction; group discussions, seminars and presentations by learners on various topics related to biological processes, environment and recent advancements in the area of biological sciences
- Development of test-items (open-ended and structured) in biological sciences, its administration, assessment and evaluation
- Assessment of experimental work in biological sciences (formal experiments in laboratories, activities and projects)
- Exploring areas of biological sciences not usually assessed in formal examination systems
- Critical examination of various methods of assessment in biological system
- Recording and reporting of learning evidences/outcome: Measurement of students' achievement – marks and grading; Assessment as reflected process and as a reflecting process.

#### **Unit 5: Professional Development of Biology Teachers**

- Various professional developmental programmes for teachers such as in-service teachers' training, seminars and conferences, membership of professional organizations, etc.
- Field visits of teachers to botanical gardens, zoo, National Parks, National level institutes and laboratories in the area of biological sciences
- Exploration on ICT based on-line platforms for sharing of teaching-learning practices,
- Reflective practices and its role in professional development of teachers
- Collaborations of schools with colleges, universities and institutes of Higher Education
- Teacher as a researcher: learning to understand how children learn science including biological sciences, Action research in teaching-learning of Biology.

## **6. Teaching of Physical Science**

### **Unit 1: Nature of Science**

- Science as a domain of inquiry, as a dynamic and expanding body of knowledge, science as interdisciplinary area of learning (e.g. Thermodynamics, Biomolecules Surface Chemistry, etc.), Science

is an international enterprise, tentative nature of science, science promotes skepticism and perseverance.

- Science as a process of constructing knowledge; Scientific methods: a critical view, How science works; Role of science teacher.
- Science and society- Physical science and society; physical science for environment, health, peace and equity.
- Contribution of eminent scientists- Isaac Newton, John Dalton, J.C. Bose, Albert Einstein, Niels Bohr, C.V. Raman, De Bogle, Bimla Buti, V.Ramakrishan, etc.

### **Unit 2: Aims and Learning objectives of Physical Science**

- Knowledge and understanding through science ;Nurturing process skills of science , developing scientific attitude and scientific temper.
- Nurturing curiosity, creativity and aesthetic sense in science (Secondary Stage)/ Physics and Chemistry (Higher Secondary stage).
- Relating Science (Physics/ Chemistry) education to environment (natural environment, artifacts and people), technology and society and appreciating the issues at the interface of science, technology and society; Imbibing various values through teaching –learning of Science; Developing problem solving skills.
- Learning objectives- Meaning; features of a well defined learning objective; Anderson and Krathwohl's taxonomy.
- Identifying and writing learning objectives for different content areas in Science/ Physics/ Chemistry consistent with the cognitive development of learners (e.g Mechanics, Heat, Electricity, magnetism, Light, Acids, Bases and Salts, Thermodynamics, Metallurgy, Physical and Chemical changes, Nature and state of Matter, etc.); Learning objectives in constructivist perspective.

### **Unit 3: Exploring Learners**

- Each learner is unique; Motivating them to bring his/her previous knowledge gained in Science/ Physics and Chemistry into classroom; Naive concepts, Involving learners in teaching- learning process through dialogue, discussion, argumentation.
- Negotiating and mediating learning in Physical Science ; Encouraging learners to raise and ask questions, creating the habit of listening to learners; Encouraging learners to collect materials from local resources(soil, water, etc.) and to develop/fabricate activities in Science/Physics/Chemistry.

### **Unit 4: School Science Curriculum**

- History of development of Curriculum Framework, Curriculum Framework, curriculum and syllabus.
- From subject-centered to behaviorist to constructivist approach to curriculum development; Review of NCERT and a state syllabus; recommendations of NCFs on science curriculum.
- Trends of NCERT syllabi; Moving from textbooks to teaching-learning materials; Teacher as a curriculum developer.

### **Unit 5: Pedagogical shift and Approaches and strategies of learning Physical Science**

- Pedagogical shift from science as a fixed body of knowledge to the process of constructing knowledge; Pedagogical shift in nature of science, knowledge, learners, learning and teachers, assessment, science curriculum and planning teaching -learning experiences (taking examples from science/ Physics/Chemistry, such as Solutions, Chemical Equilibrium, Electrochemistry, Mechanical and Thermal Properties of Matter, Reflection, Refractions, Waves optics, etc.)
- Democratising Science learning: Critical pedagogy
- Need of inclusion in all aspects of teaching- learning of physical sciences – science curriculum, approaches, ICT and professional development of teachers.
- Approaches and Strategies -- Historical background of learning Physical Science; Essential components of all approaches and strategies, selecting appropriate approach and strategy.

- Constructivist approach; Collaborative learning approach, Problem solving approach; Concept mapping; Experiential learning; Cognitive conflict; Inquiry approach, Analogy strategy.
- Facilitating self- study; Communication in Science -- qualities of an effective science communicator, developing communication skills in learners.

### **Unit 1: Learning Resources in Physical Science**

- Identification and use of learning resources from immediate environment (e.g Natural pH Indicators, Soaps and Detergents, Baking Soda, Washing Soda, Common Salts, Fruits, Fiber, Pulleys, Projectiles, Lenses and Mirrors, Propagation of Waves in solid, liquid and gas, etc.); Using community resources -bringing community to the class and taking class to the community; Pooling of learning resources in school complex/ block /district level.
- Improvisation of apparatus, identifying some inexpensive sources of chemicals, Science kits.
- Using laboratory as a learning resource, approaches to laboratory work, planning and organizing laboratory work, safety in laboratories, Physics laboratory, Chemistry laboratory, handling hurdles in utilisation of resources.
- Print and ICT resources -- Textbooks, Journal and Magazines; Dale's cone of experiences ; Different forms of ICT and its applications in science education-- audio -aids, video -aids, audio-video aids, educational T.V.; Use of computer for simulation, internet and open learning resources.
- Factors affecting media selection ICT for inclusive education, skills to be developed in students for meaningful use of ICT.
- Social networking sites and their use in Science education; Integrating ICT in teaching- learning process taking examples (e.g. Acid, Base, Salt, Dual Nature of Radiation, Radioactivity, etc.)

### **Unit 2: Tools and Techniques Assessment for Learning Physical Science**

- Using the terms test, examination measurement, assessment and evaluation in proper context; Continuous and Comprehensive Evaluation (CCE) and its features; Assessment and evaluation as intertwined process of classroom experiences.
- Performance based assessment; Planning assessment framework, learning Indicators (LIs)and its types, developing LIs for activity, presentation, group work, assignments,etc.
- Tools and technique of assessment-- assessment of written and oral work, project work, laboratory work, field trips, journal writing, concept map; Assessment of learners with special needs.
- Recording and reporting of learning evidences – Measurement of students' achievement – marks and grading, Measurement of process skills and aptitude of learners; Portfolio – its role in evaluating students' performance; Assessment as reflected process and as a reflecting process.

### **Unit 3: Planning for teaching- learning of Physical Science**

- Need of planning teaching-learning experiences; Identification and organization of concepts – basic principles and factors need to be considered for it; Basic elements of a Physical Science lesson with examples from Science/Physics/Chemistry.
- Facilitating formation of groups; Planning and organizing activities in Physical Science, planning laboratory work and ICT application in learning Science/ Physics/ Chemistry.
- Reflective planning; Unit plan; Developing lesson designs on different topics and through various approaches taking examples form Upper Primary, Secondary and Higher Secondary stage (Physical and Chemical Changes, Redox Reaction, Light, Magnetic Effect of Electric Current, etc.)

### **Unit 4: Physical Science: Lifelong Learning**

- Meaning and rationale of lifelong learning; Attributes of a lifelong learner and developing these attributed in students by exposing them to a variety of teaching-learning activities in Science/ Physics/ Chemistry.
- Appreciating every child's natural curiosity of observation and drawing conclusion, facilitating lifelong learning in students with special educational needs.

- Preparing learners for lifelong learning by stimulating creativity and inventiveness in Science – debate, discussion, drama, poster making, visit to various places, science club, celebrating specific days, field visits, science exhibitions: benefits and objectives, evaluation of exhibits, exploring linkages with district/ state/ central agencies; Teacher as a lifelong learner.

### **Unit 5: Professional Development of Science/ Physics/ Chemistry Teachers**

- Professional development – Teaching as a profession, need for pre- service and in- service professional development programme, major shift in teacher education programme.
- Various opportunities for in-service professional development – interaction with peer teachers, reading, attending training programme, membership of professional organisation, sharing through conferences, seminars and Journals, travel, cultivating science hobbies ,mentoring, teacher’s exchange programme, acquiring higher qualification, collaborating with universities and other schools,etc.
- Role of reflective practices in professional development–questionnaires, research and portfolio.
- Teacher as a researcher – learning to understand how students learn science : Action research – meaning, selecting problems for action research, developing various format for action research, area of action research.
- Steps in action research with examples of physical science; helping students to develop attitude of research.

### **Suggested Readings**

1. Textbook for B.Ed. Pedagogy of Science: Physical Science Part I & Part II. National Council of Educational Research and Training, 2013.

## **Subject Name: SCHOOL ORGANISATION AND MANAGEMENT**

### **Unit I: Administration of Schools**

- Meaning, Concept, Scope and Functions of Educational Administration
- Principles of Educational Administration
- Educational Administration and their Advantages and Disadvantages
- Role of a Head in a School as a Transformative Leader :Analysis of Need and Relevance of any Change before institutionalising the same, Taking the Team On-board
- Organisational Culture in a School to foster a Stress-free Work Environment for the Head, Teachers, Staff and Students

### **Unit II: School as an Organisation**

- The School – its functions and relationship with the society
- School building: Design and Components (including Hostels)
  - School Personnel-Roles and Responsibilities : Headmaster, Teachers, Non-Teaching Staff
- School finance – Sources of Income and Items of Expenditure ,School Budget

### **Unit III Dynamics of Supervision**

- Supervision : Concept, Need, Functions and Scope
- Role of the Head and Teachers of the Institution in Supervision
- Role of School Management Committees(SMCs),Mother Teacher Associations(MTAs),Parent Teacher Associations(PTAs) in School Development
- Democratic Decision Making :Concept and Procedure with respect to functioning of a School

### **Unit IV: Elements of School Management**

- School Climate: Meaning and Types

- Timetable - Principles and Techniques of Time -table preparation
- Preparation of a Calendar of Activities of Co-curricular Activities
- School Discipline : Concept and Approaches, Self Discipline: Concept and Relevance in a School
- Problems Faced in School Management :Issues of Security and Disaster Management
- Juvenile Delinquency: Concept and Steps to Deal Effectively in a School

**Practical Assignments/Field Engagement:**

- The students to be thoroughly acquainted with the nuances of different types of registers/records a teacher maintains in a school : Attendance Registers, Marks Registers, Cumulative Records of CCE(Continuous Comprehensive Evaluation) in particular.( Also to include the role of ICT as an Assistive Technology in the same)
- A meeting of student –teachers with the Head of the School and other Supervisory cadre to be arranged to make them understand the expectations of a school from them and the responsibilities they may shoulder apart from regular classroom teaching.
- The students to be given hands on experience in the construction of the Time Table using ICT of a School by the Faculty Mentors keeping in mind all principles of Time Table preparation.

**Suggested Readings:**

- Owens, Robert G(1970).: Organizational Behaviour in Schools, Prentice Hall Inc., Englewood Cliffs, N.J.,
- Kimbrough, R.B. and Nunnery, M.Y.(1983) : Educational Administration : An Introduction, MacMillan Publishing Co. Inc., N.Y.
- Bhatnagar, R.P. and I.B. Verma (2000): Educational Administration. Loyal Book Depot, Meerut,
- Safaya, R.N. and Shaida,B.D.(2000) : School Administration and Organization. Dhanpat Rai and Sons, Delhi
- Agarwal, J.C.(2006): School Administration, Arya Book Depot, Delhi,