HEMCHNAD YADAV VISHWAVIDYALAYA, DURG (C.G.)

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SCHEME OF EXAMINATION
&
SYLLABUS
of
B.Sc. B.Ed Part- III

Annual Exam
UNDER
Session 2021-22

B.Sc. B.Ed Part-III

विषय–सूची

B.Sc. B.Ed. - III
SCHEME OF EXAMINATION
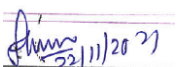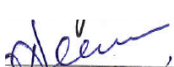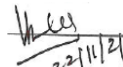
Subject	Paper	Max. Marks	Total Marks	Min. Marks
Foundation Course				
Hindi Language	I	75	75	26
English Language	I	75	75	26
Maths Group				
1. Physics	I		50	
	II	50	100	33
	Practical		50	20
2. Chemistry	I	33		
	II	33	100	33
	III	34		
	Practical		50	20
3. Mathematics	I	50		
	II	50	150	50
	III	50		
Bio Group				
4. Botany	I	50		
	II	50	100	33
	Practical		50	20
5. Zoology	I	50		
	II	50	100	33
	Practical		50	20
6. Chemistry	I	33		
	II	33	100	33
	III	34		
	Practical		50	20
B.Ed. Group				
7. Learner and Learning Process			100	33
8. PEDAGOGICAL STUDIES (Elective Part-I)			100	33
A) PEDAGOGY OF MATHEMATICS				
B) PEDAGOGY OF BIOLOGICAL SCIENCE				
C) PEDAGOGY OF PHYSICAL SCIENCE				

PRACTICUM

Subject	Paper	Max. Marks	Total Marks	Min. Marks
Psycho-metric Assessment			50 (External)	20

At least 5 Practicals have to be conducted.

1. Span of attention by techisto-scope.

2. Transfer of learning by mirror drawing.

3. Case study to measure the problematic behavior of the child.

4. Value Test.

5. Testing individual differences/ intellegence test.

6. Reasoning ability.

7. Aptitude test in any school subject (Compulsory)

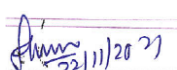8. Achievement test in any school subject with finding dificulty level only.(Compulsory)

Internship (1month)

Reflective Diary & Supervisor's Assessment   50 (Internal)   20

Preparation of Teaching aids   50 (Internal)   20

USE OF CALCULATORS

The Students of Degree/P.G. Classes will be permitted to use of Calculators in the examination hall from annual 1986 examnination on the following conditions as per decision of the standing committee of the Academic Council at its meeting held on 31-1-1986.
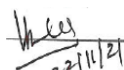
1. Student will bring their own Calculators.

2. Calculators will not be provided either by the University or examination centres.

3. Calculators with, memoty and following variables be permitted +, -, x, ¸ square, reciprocal, expotentials log, square root, trignometric functions, wize, sine, cosine, tangent etc. factiorial summation, xy, yx and in the light of objective approval of merits and demerits of the viva only will be allowed.

बी.ए. बी.एड./बी.एस–सी. बी.एड.

भाग – तीन, आधार पाठ्यक्रम

प्रश्न पत्र – प्रथम (हिन्दी भाषा)

पूर्णांक– 75

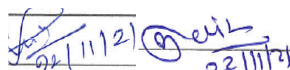इकाई–एक   (क)   भारत माता : सुमित्रानंदन पंत

(ख)   कथन की शैलियाँ

1. विवरणात्मक शैली   2. मूल्यांकन शैली

3. व्याख्यात्मक शैली   4. विचारात्मक शैली

इकाई–दो   (क)   सूखी डाली : उपेन्द्रनाथ अश्क

(ख)   विभिन्न संरचनाएँ

1. विनम्रता सूचक संरचना   2. विधि सूचक संरचना

3. निषेध परक संरचना   4. काल–बोधक संरचना

5. स्थान–बोधक संरचना   6. दिशा बोधक संरचना

7. कार्य–कारण सम्बन्ध संरचना   8. अनुक्रम संरचना

इकाई–तीन   (क)   वसीयत : मालती जोशी

(ख)   कार्यालयीन पत्र और आलेख

1. परिपत्र   2. आदेश

3. अधिसूचना   4. ज्ञापन

5. अनुस्मारक   6. पृष्ठाकंन

इकाई–चार   (क)   योग की शक्ति : हरिवंश राय बच्चन

(ख)   अनुवाद : स्वरूप एवं परिभाषा, उद्देश्य

स्त्रोत भाषा और लक्ष्य भाषा,

अच्छे अनुवाद की विशेषताएँ,

अनुवाद प्रक्रिया, अनुवादक

इकाई–पांच   (क)   संस्कृति और राष्ट्रीय एकीकरण : योगेश अटल

(ख)   घटनाओं, समारोहों आदि का प्रतिवेदन, विभिन्न प्रकार के निमंत्रण पत्र

मूल्यांकन योजना : प्रत्येक इकाई से एक–एक प्रश्न पूछा जाएगा। प्रत्येक प्रश्न में आंतरिक विकल्प होगा। प्रत्येक प्रश्न के 15 अंक होंगे। इसलिए प्रत्येक प्रश्न के दो भाग 'क' और 'ख' होंगे एवं अंक क्रमशः 8 एवं 7 अंक होंगे। प्रश्नपत्र का पूर्णांक 75 निर्धारित है।

B.A. B.Ed. / B.Sc. B.Ed
PART - III
Foundaion Course
ENGLISH LANGUAGE

M.M. 75

The question paper for B.A.B.Ed / B.Sc.B.Ed -III Foundation course, English Language and General Answers shall comprise the following items :

Five question to be attempted, each carrying 3 marks.

UNIT-I Essay type answer in about 200 words. 5 essay type question to be asked three to be attempted.   15
UNIT-II Essay writing   10
UNIT-III Precis writing   10
UNIT-IV (a) Reading comprehension of an unseen passage   05
      (b) Vocabulary based on text   10
UNIT-V Grammar Advanced Exercises   25

Note :

Question on unit I and IV (b) shall be asked from the prescribed text. Which will comprise of popular create writing and the following items. Minimum needs housingand transport Geo-economic profile of M.P. communication Educate and culture. Women and Worm in Empowerment Development, management of change, physical quality of life. War and human survival, the question of human social value survival, the question of human social value, new Economic Philosophy Recent Diberaliation Method) Demoration docontralisation (with reference to 73, 74 constitutional Amendment.

Books Prescribed:

Aspects of English Language And Development - Published by M.P. Hindi Granth Academy, Bhopal.

B.A. B.Ed. / B.Sc. B.Ed
PART - III

CHEMISTRY

The new curriculum will comprise of three papers of 33, 33 and 34 marks each and practical work of 50 marks. The Curriculum is to be completed in 180 working days as per UGC norms and conforming to the directives of Govt. of Chhattisgarh. The theory papers are of 60 hrs. Each duration and practical work of 180 hrs duration.

Paper – I
INORGANIC CHEMISTRY   60 Hrs., Max Marks 33

UNIT-I
METAL-LIGAND BONDING IN TRANSITION METAL COMPLEXES
(A) Limitations of valence bond theory, Limitation of Crystal Field Theory, Application of CFSE, tetragonal distortions from octahedral geometry, Jahn–Teller distortion, square planar geometry. Qualitative aspect of Ligand field and MO Theory.

(B) Thermodynamic and kinetic aspects of metal complexes. A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes, Trans- effect, theories of trans effect. Mechanism of substitution reactions of square planar complexes.

UNIT-II
MAGNETIC PROPERTIES OF TRANSITION METAL COMPLEXES
Types of magnetic behavior, methods of determining magnetic susceptibility, spin only formula, L-S coupling, correlation of $\mu_{so \text{ (spin only)}}$ and $\mu_{eff.}$ values, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes.
Electronic spectra of Transition Metal Complexes.
Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectro-chemical series. Orgel-energy level diagram for d^1 and d^2 states, discussion of the electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complex ion.

UNIT-III
ORGANOMETALLIC CHEMISTRY
Definition and classification of organometallic compounds on the basis of bond type. Concept of hapticity of organic ligands. Metal carbonyls: 18-electron rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation (direct combination, reductive carbonylation, thermal and photochemical decomposition) of mono and binuclear carbonyls of 3d series.
Structures of mononuclear and binuclear carbonyls of Cr, Mn, Fe, Co and Ni using VBT. π-acceptor behavior of CO (MO diagram of CO to be discussed), Zeise's salt: Preparation and structure.

Catalysis by Organometallic Compounds –
Study of the following industrial processes and their mechanism :
1. Alkene hydrogenation (Wilkinsons Catalyst)
2. Polymeration of ethane using Ziegler – Natta Catalyst

UNIT-IV
BIOINORGANIC CHEMISTRY
Essential and trace elements in biological processes, Excess and deficiency of some trace metals, Toxicity of some metal ions (Hg, Pb, Cd and As), metalloporphyrins with special reference to hemoglobin and myoglobin. Biological role of alkali and alkaline earth metals with special reference to Ca^{2+} and Mg^{2+}, nitrogen fixation.

UNIT-V
HARD AND SOFT ACIDS AND BASES (HSAB) Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, Applications of HSAB principle.

INORGANIC POLYMERS
Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones. Silicates, phosphazenes and polyphosphate.

REFERENCE BOOKS
1. Basic Inorganic Chemistry, F. A. Cotton, G. Wilkinson and P. L. Gaus, Wiley.
2. Concise Inorganic Chemistry, J. D. Lee, ELBS.
3. Concepts of Models of Inorganic Chemistry, B. Douglas, D. Mc Daniel and J. Alexander, John Wiley.
4. Inorganic Chemistry, D. E. Shriver, P. W. Atkins and C. H. Langford, Oxford.
5. Inorganic Chemistry, W. W. Porterfield, Addison – Wiley.
6. Inorganic Chemistry, A. G. Sharp, ELBS.
7. Inorganic Chemistry, G. L. Miessler and D. A. Tarr, Prentice Hall.
8. Advanced Inorganic Chemistry, Satya Prakash.
9. Advanced Inorganic Chemistry, Agarwal and Agarwal.
10. Advanced Inorganic Chemistry, Puri, Sharma, S. Naginchand.
11. Inorganic Chemistry, Madan, S. Chand.
12. Aadhunik Akarbanic Rasayan, A. K. Shrivastav & P. C. Jain, Goel Pub.
13. Uchchattar Akarbanic Rasayan, satya Prakash & G. D. Tuli, Shyamal Prakashan.
14. Uchchattar Akarbanic Rasayan, Puri & Sharma.
15. Selected topic in Inorganic Chemistry by Madan Malik & Tuli, S. Chand.

Paper – II
ORGANIC CHEMISTRY   60 Hrs. Max Marks 33

UNIT-I
HETEROCYCLIC COMPOUNDS

Classification and nomenclature, Structure, aromaticity in 5-membered and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Indole (Fischer indole synthesis and Madelung synthesis), Quinoline and isoquinoline, (Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, Doebner- Miller synthesis, Bischler-Napieralski reaction, Pictet- Spengler reaction, Pomeranz-Fritsch reaction).

UNIT II

A.   ORGANOMETALLIC REAGENT

Organomagnesium compounds: Grignard reagents formation, structure and chemical reactions.

Organozinc compounds: formation and chemical reactions.

Organolithium compounds: formation and chemical reactions.

B.   ORGANIC SYNTHESIS VIA ENOLATES

Active methylene group, alkylation of diethylmalonate and ethyl acetoacetate, Synthesis of ethyl acetoacetate: The Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate. Robbinson annulations reaction.

UNIT-III
BIOMOLECULES
A.   CARBOHYDRATES

Occurrence, classification and their biological importance. Monosaccharides: relative and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani Fischer synthesis and Ruff degradation; Disaccharides – Structural comparison of maltose, lactose and sucrose. Polysaccharides – Elementary treatment of starch and cellulose.

B.   AMINO ACIDS, PROTEINS AND NUCLEIC ACIDS

Classification and Nomenclature of amino acids, Configuration and acid base properties of amino acids, Isoelectric Point, Peptide bonds, Protein structure, denaturation/ renaturation, Constituents of nucleic acid, DNA, RNA nucleoside, nucleotides, double helical structure of DNA.

UNIT-IV

SYNTHETIC POLYMERS

A. Addition or chain growth polymerization, Free radical vinyl polymerization, Ziegler-Natta polymerization, Condensation or Step growth polymerization, polyesters, polyamides, phenols- formaldehyde resins, urea-formaldehyde resins, epoxy resins and polyurethanes, natural and synthetic rubbers.

B. **SYNTHETIC DYES**

Colour and constitution (Electronic Concept). Classification of Dyes. Chemistry of dyes. Chemistry and synthesis of Methyl Orange, Congo Red, Malachite Green, Crystal Violet, phenolphthalein, fluorescein, Alizarine and Indigo.

UNIT-V

A. **INFRA-RED SPECTROSCOPY**

Basic principle, IR absorption Band their position and intensity, IR spectra of organic compounds.

B. **UV-VISIBLE SPECTROSCOPY**

Beer Lambert's law, effect of Conjugation, Types of electronic transitions λ_{max}, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption Visible spectrum and colour.

C. **NMR SPECTROSCOPY**

Basic principles of Proton Magnetic Resonance, Tetramethyl silane (TMS) as internal standard, chemical shift and factors influencing it; Spin – Spin coupling and coupling constant (J); Anisotropic effects in alkene, alkyne, aldehydes and aromatics, Interpretation of NMR spectra of simple organic compounds. ^{13}CMR spectroscopy: Principle and applications.

REFERENCE BOOKS
1. Organic Chemistry, Morrison and Boyd, Prentice-Hall.
2. Organic Chemistry, L. G. Wade Jr. Prentice Hall.
3. Fundamentals of Organic Chemistry, Solomons, John Wiley.
4. Organic Chemistry, Vol I, II, III S. M. Mukherjee, S. P. Singh and R. P. Kapoor, Wiley Easters (New Age).
5. Organic Chemistry, F. A. Carey, McGraw Hill.
6. Introduction to Organic Chemistry, Struiweisser, Heathcock and Kosover, Macmillan.
7. Acheson, R.M. Introduction to the Chemistry of Heterocyclic compounds, John Wiley & Sons (1976).
8. Graham Solomons, T.W. Organic Chemistry, John Wiley & Sons, Inc.
9. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning IndiaEdition, 2013.
10. Kalsi, P. S. Textbook of Organic Chemistry 1st Ed., New Age International (P) Ltd. Pub.
11. Clayden, J.; Greeves, N.; Warren, S.; Wothers, P.; Organic Chemistry, Oxford University Press.

PAPER-III
PHYSICAL CHEMISTRY   60 Hrs., Max Marks 34

UNIT-I

QUANTUM MECHANICS–I

Black-body radiation, Planck's radiation law, photoelectric effect, Compton effect. Operator: Hamiltonian operator, angular momentum operator, Laplacian operator, postulate of quantum mechanics, eigen values, eigen function, Schrodinger time independent wave equation, physical significance of ψ & ψ^2, application of Schrodinger wave equation to particle in a one dimensional box, hydrogen atom (separation into three equations) radial and angular wave functions.

UNIT-II

A.   QUANTUM MECHANICS–II

Quantum Mechanical approach of Molecular orbital theory, basic ideas-criteria for forming M.O. and A.O., LCAO approximation, formation of H_2^+ ion, calculation of energy levels from wave functions, bonding and antibonding wave functions, Concept of σ, σ^*, π, π^* orbitals and their characteristics, Hybrid orbitals-sp,sp^2,sp^3 Calculation of coefficients of A.O.'s used in these hybrid orbitals.

Introduction to valence bond model of H_2, comparison of M.O. and V.B. models. Huckel theory, application of Huckel theory to ethene, propene, etc.

UNIT III

SPECTROSCOPY

Introduction: Characterization of Electromagnetic radiation, regions of the spectrum, representation of spectra, width and intensity of spectral transition, Rotational Spectrum of Diatomic molecules. Energy levels of a rigid rotor, selection rules, determination of bond length, qualitative description of non-rigid rotator, isotopic effect.

Vibrational Spectroscopy: Fundamental vibration and their symmetry vibrating diatomic molecules, Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, determination of force constant, anharmonic oscillator

Raman spectrum: Concept of polarizability, quantum theory of Raman spectra, stokes and antistokes lines, pure rotational and pure vibrational Raman spectra. Applications of Raman Spectra.

Electronic Spectroscopy: Basic principles, Electronic Spectra of diatomic molecule, Franck-Condon principle, types of electronic transition, application of electronic spectra.

UNIT-IV

ELECTROCHEMISTRY-I

A. Electrolytic conductance: Specific and equivalent conductance, measurement of equivalent conductance, effect of dilution on conductance, Kohlrausch law, application of Kohlrausch law in determination of dissociation constant of weak electrolyte, solubility of sparingly soluble electrolyte, absolute velocity of ions, ionic product of water, conductometric titrations.

B. Theories of strong electrolyte: limitations of Ostwald's dilution law, weak and strong electrolytes, Elementary ideas of Debye – Huckel - Onsager's equation for strong electrolytes , relaxation and electrophoretic effects.

C. Migration of ions: Transport number, Determination by Hittorf method and moving boundary method, ionic strength.

UNIT-V

ELECTROCHEMISTRY-II

A. Electrochemical cell and Galvanic cells – reversible and irreversible cells, conventional representation of electrochemical cells, EMF of the cell and effect of temperature on EMF of the cell, Nernst equation Calculation of ΔG, ΔH and ΔS for cell reactions.

B. Single electrode potential : standard hydrogen electrode, calomel electrode, quinhydrone electrode, redox electrodes, electrochemical series

C. Concentration cell with and without transport, liquid - junction potential, application of concentration cells in determining of valency of ions , solubility product and activity coefficient

D. Corrosion-types , theories and prevention

REFERENCE BOOKS

1. Physical chemistry, G.M.Barrow. International Student Edition McGraw Hill.
2. University General Chemistry, CNR Rao, Macmillan.
3. Physical Chemistry R.A.Alberty, Wiley Eastrn.
4. The elements of Physical Chemistry P.W.Alkin,Oxford.
5. Physical Chemistry through problems, S.K.Dogra, Wiley Eastern.
6. Physical Chemistry B.D.Khosla.
7. Physical Chemistry, Puri & Sharma.
8. Bhoutic Rasayan, Puri & Sharma.
9. Bhoutic Rasayan, P.L.Soni.
10. Bhoutic Rasayan, Bahl & Tuli.
11. Physical Chemistry, R.L.Kapoor, Vol- I-IV.
12. Introduction to quantum chemistry,A.K.Chandra,Tata McGraw Hill.
13. Quantum Chemistry,Ira N.Levine, Prentice Hall.

PRACTICAL

Max. Marks-50

INORGANIC CHEMISTRY

Gravimetric analysis:

- Estimation of nickel (II) using Dimethylglyoxime (DMG).
- Estimation of copper as CuSCN
- Estimation of iron as Fe_2O_3 by precipitating iron as $Fe(OH)_3$.
- Estimation of Al (III) by precipitating with oxine and weighing as Al $(oxine)_3$ (aluminium oxinate).
- Estimation of Barium as $BaSO_4$

Inorganic Preparations:

- Tetraamminecopper (II) sulphate, $[Cu(NH_3)_4]SO_4.H_2O$
- Cis and trans K $[Cr (C_2O_4)_2. (H_2O)_2]$ Potassium dioxalatodiaquachromate (III)
- Tetraamminecarbonatocobalt (III) ion
- Potassium tris(oxalate)ferrate(III)/ Sodium tris(oxalate)ferrate(III)
- Cu(I) thiourea complex, Bis (2,4-pentanedionate) zinc hydrate; Double salts (Chrome alum/ Mohr's salt)

ORGANIC CHEMISTRY

1.   Preparation of organic Compounds

- Acetylation of one of the following compounds: amines (aniline, o-, m-, p- toluidines and o-,m-, p-anisidine) and phenols (β-naphthol, vanillin, salicylic acid)
- Benzolyation of one of the following amines (aniline, o-, m-, p- toluidines and o-, m-, panisidine) and one of the following phenols (β-naphthol, resorcinol, p cresol) by Schotten-Baumann reaction.
- Bromination of any one of the following: a. Acetanilide by conventional methods b.Acetanilide using green approach (Bromate-bromide method)
- Nitration of any one of the following: a. Acetanilide/nitrobenzene by conventional method b. Salicylic acid by green approach (using ceric ammonium nitrate).
- Reduction of p-nitrobenzaldehyde by sodium borohydride.
- Hydrolysis of amides and esters.
- Semicarbazone of any one of the following compounds: acetone, ethyl methyl ketone, cyclohexanone, benzaldehyde.
- Benzylisothiouronium salt of one each of water soluble and water insoluble acids (benzoic acid, oxalic acid, phenyl acetic acid and phthalic acid).
- Aldol condensation using either conventional or green method.
- Benzil-Benzilic acid rearrangement.
- Preparation of sodium polyacrylate.
- Preparation of urea formaldehyde.
- Preparation of methyl orange.

The above derivatives should be prepared using 0.5-1g of the organic compound. The solid samples must be collected and may be used for recrystallization, melting point and TLC.

1. Qualitative Analysis Analysis of an organic mixture containing two solid components using water, $NaHCO_3$, NaOH for separation and preparation of suitable derivatives.
2. Extraction of caffeine from tea leaves.
3. Analysis of Carbohydrate: aldoses and ketoses, reducing and non-reducing sugars.
4. Identification of simple organic compounds by IR spectroscopy and NMR spectroscopy. (Spectra to be provided).
5. Estimation of glycine by Sorenson's formalin method.
6. Study of the titration curve of glycine.
7. Estimation of proteins by Lowry's method.
8. Study of the action of salivary amylase on starch at optimum conditions.
9. Effect of temperature on the action of salivary amylase.

PHYSICAL CHEMISTRY

Conductometry
- Determination of cell constant
- Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
- Perform the following conductometric titrations:
    - i. Strong acid vs. strong base
    - ii. Weak acid vs. strong base
    - iii. Mixture of strong acid and weak acid vs. strong base
    - iv. Strong acid vs. weak base
- To determine the strength of the given acid conductometrically using standard alkali solution.
- To determine the solubility and solubility product of a sparingly soluble electrolyte conductometrically
- To study the saponification of ethyl acetate conductometrically.

Potentiometry/pH metry
    Perform the following potentio/pH metric titrations:
    i. Strong acid vs. strong base
    ii. Weak acid vs. strong base
    iii. Dibasic acid vs. strong base
    iv. Potassium dichromate vs. Mohr's salt
    v. Determination of pKa of monobasic acid

UV/ Visible spectroscopy
- Verify Lambert-Beer's law and determine the concentration of $CuSO_4$/$KMnO_4$/$K_2Cr_2O_7$ in a solution of unknown concentration
- Determine the concentrations of $KMnO_4$ and $K_2Cr_2O_7$ in a mixture.
- Study the kinetics of iodination of propanone in acidic medium.
- Determine the amount of iron present in a sample using 1,10-phenathroline.
- Determine the dissociation constant of an indicator (phenolphthalein).
- Study the kinetics of interaction of crystal violet/ phenolphthalein with sodium hydroxide.

- Study of pH-dependence of the UV-Vis spectrum (200-500 nm) of potassium dichromate.
- Spectral characteristics study (UV) of given compounds (acetone, acelaldehyde, acetic acid, etc.) in water.
- Absorption spectra of $KMnO_4$ and $K_2Cr_2O_7$ (in 0.1 M H_2SO_4) and determine λ_{max} values.

Note: **Experiments may be added/deleted subject to availability of time and facilities**

REFERENCE BOOKS:
1. Vogel, A.I. Quantitative Organic Analysis, Part 3, Pearson (2012).31
2. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
3. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)
4. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).
5. Ahluwalia, V.K. & Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000)
6. Manual of Biochemistry Workshop, 2012, Department of Chemistry, University of Delhi.

8 Hrs.   **PRACTICAL EXAMINATION**   **M.M.50**

Five experiments are to be performed.

1. **Inorganic** - Two experiments to be performed.

    - Gravimetric estimation compulsory   **08 marks**. (Manipulation 3 marks)

    - Anyone experiment from synthesis and analysis   **04 marks**.

2. **Organic -** Two experiments to be performed.

    - Qualitative analysis of organic mixture containing two solid components.

      Compulsory carrying **08 marks** (03 marks for each compound and two marks for

      Separation).

    - One experiment from synthesis of organic compound (Single step)
      04 marks.

3. Physical-One physical experiment   **12 marks**.

4. Sessional   **04 marks**.

5. Viva Voce   **10 marks**.

In case of Ex-Students one mark each will be added to Gravimetric analysis and Qualitative analysis of organic mixture and two marks in Physical experiment.

B.A. B.Ed. / B.Sc. B.Ed
PART - III
PHYSICS

OBJECTIVES OF THE COURSE

The undergraduate training in physics is aimed at providing the necessary inputs so as to set forth the task of bringing about new and innovative ideas/concepts so that the formulated model curricula in physics becomes in tune with the changing scenario and incorporate new and rapid advancements and multi-disciplinary skills, societal relevance, global interface, self-sustaining and supportive learning.

It is desired that undergraduate i.e. B.Sc. level besides grasping the basic concepts of physics should in addition have broader vision. Therefore, they should be exposed to societal interface of physics and role of physics in the development of technologies.
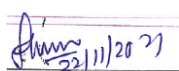
EXAMINATION SCHEME:
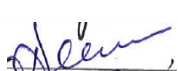
1. There shall be 2 theory papers of 3 hours duration each and one practical paper of 4 hours duration. Each paper shall carry 50 marks.
2. Numerical problems of at least 30% will compulsorily be asked in each theory paper.
3. In practical paper, each student has to perform two experiments one from each groups as listed in the list of experiments.
4. Practical examination will be of 4 hours duration- one experiment to be completed in 2 hours.
   The distribution practical marks as follows:
   Experiment   : 15+15=30
   Viva voce   :   10
   Internal assessment   :   10
5. The external examiner should ensure that at least 16 experiments are in working order at the time of examination and submit a certificate to this effect.
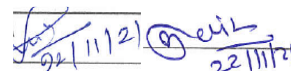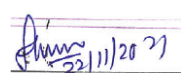
Paper-I

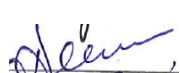## RELATIVITY, QUANTUM MECHANICS, ATOMIC MOLECULAR AND NUCLEAR PHYSICS

Unit-1 Reference systems, inertial frames, Galilean invariance propagation of light, Michelson- Morley experiment, search for ether. Postulates for the special theory of relativity, Lorentz transformations, length contraction, time dilation, velocity addition, variation of mass with velocity, mass-energy equivalence, particle with zero rest mass.

Unit-2 Origin of the quantum theory : Failure of classical physics to explain the phenomena such as black-body spectrum, photoelectric effect, Compton effect, Wave-particle duality, uncertainty principle, de Broglie's hypothesis for matter waves, the concept of Phase and group velocities, experimental demonstration of mater waves. Davisson and Germer's experiment. Consequence of de Broglie's concepts, Bohr's complementary Principle, Bohr's correspondence principle, Bohr's atomic model, energies of a particle in a box, wave packets. Consequence of the uncertainty relation, gamma ray microscope, diffraction at a slit.

Unit-3 Quantum Mechanics: Schrodinger's equation, Statistical interpretation of wave function, Orthogonality and normalization of wave function, Probability current density, Postulatory basis of quantum mechanics, operators, expectation values, Ehrenfest's theorem, transition probabilities, applications to particle in a one and three dimensional boxes, harmonic oscillator in one dimension, reflection at a step potential, transmission across a potential barrier.

Unit-4 Spectra of hydrogen, deuteron and alkali atoms spectral terms, doublet fine structure, screening constants for alkali spectra for s, p, d and f states, selection rules. Discrete set of electronic energies of moleculers, quantisation of vibrational and rotational energies, determination of inter-nuclear distance, pure rotational and rotation vibration spectra. Dissociation limit for the ground and other electronic states, transition rules for pure vibration and electronic vibration spectra. Raman effect, Stokes and anti-Stokes lines, complimentary character of Raman and infrared spectra, experimental arrangements for Raman spectroscopy.
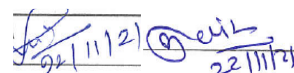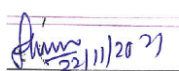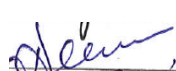
Unit-5 Structure of nuclei:- Basic Properties of Nuclei: (1) Mass, (2) Radii, (3) Charge, (4) Angular Momentum, (5) Spin, (6) Magnetic Moment (μ), (7) Stability and (8) Binding Energy, Nuclear Models:- Liquid Drop Model, Mass formula, Shell Model, Types of Nuclear reactions, laws of conservation, Q-value of reactions, Interaction of Energetic particles with matter, Ionization chamber, GM Counter, Cloud Chambers, Fundamental Interactions, Classification of Elementary Particles, Particles and Antiparticles, Baryons, Hyperons, Leptons, and Mesons, Elementary Particle Quantum Numbers: Baryon Number, Lepton Number, Strangeness, Electric Charge, Hypercharge and Isospin, introductory idea of discovery of Higg's Boson.

TEXT AND REFERENCE BOOKS:
1. H.S. Mani and G.K. Metha: "Introduction to Modern Physics"" (Affiliated East-West Press, 1989).
2. A Beiser, "Prospective of Modern Physics".
3. H.E. White, Introduction to Atomic Physics".
4. Barrow, "Introduction to Molecular Physics".
5. R.P. Feynman, R.B. Leighton and M Sands, "The Feynman Lectures on Physics", Vol.III (B.I. Publications, Bombay, Delhi, Calcutta, Madras).
6. T.A. Littlefield and N Thorley, "Atomic and Nuclear Physics" (Engineering Language Book Society)
7. H.A. Enge, "Introduction to Nuclear Physics", (Addision-Wesly)
8. Eisenberg and Resnick, "Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles" (John Wiley)
9. D.P. Khandelwal, "Optics and Atomic Physics", (Himalaya Publishing House, Bombay, 1988).
10. Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi, 1984.
11. Radiation detection and measurement, G.F. Knoll (John Wiley & Sons, 2000).
12. Theoretical Nuclear Physics, J.M. Blatt & V.F.Weisskopf (Dover Pub.Inc., 1991).
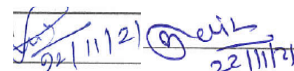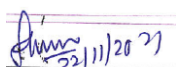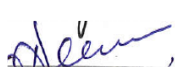13. Electronic Devices & Circuits By Milliman Helkiyan.

Paper-II

SOLID STATE PHYSICS, SOLID STATE DEVICES AND ELECTRONICS

Unit-1 Amorphous and crystalline solids, Elements of symmetry, seven crystal system, Cubic lattices, Crystal planes, Miller indices, Laue's equation for X-ray diffraction, Bragg's Law, Bonding in solids, classification. Cohesive energy of solid, Madelung constant, evaluation of Parameters, Specific heat of solids, classical theory (Dulong-Petit's law), Einstein and Debye theories, Vibrational modes of one dimensional monoatomic lattice, Dispersion relation, Brillouin Zone.

Unit-2 Free electron model of a metal, Solution of one dimensional Schrödinger equation in a constant potential, Density of states, Fermi Energy, Energy bands in a solid (Kronig-Penny model without mathematical details), Difference between Metals, Insulator and Semiconductors, Hall effect, Dia, Para and Ferromagnetism, Langevin's theory of dia and para-magnetism, Curie- Weiss's Law, Qualitative description of Ferromagnetism (Magnetic domains), B-H curve and Hysteresis loss.

Unit-3 Intrinsic and extrinsic semiconductors, Concept of Fermi level, Generation and recombination of electron hole pairs in semiconductors, Mobility of electrons and holes, drift and diffusion currents, p-n junction diode, depletion width and potential barrier, junction capacitance, I-V characteristics, Tunnel diode, Zener diode, Light emitting diode, solar cell, Bipolar transistors, pnp and npn transistors, characteristics of transistors, different configurations, current amplification factor, FET and MOSFET Characteristics.

Unit-4 Half and full wave rectifier, rectifier efficiency ripple factor, Bridge rectifier, Filters, Inductor filter, L and π section filters, Zener diode, regulated power supply using zener diode, Applications of transistors, Bipolar Transistor as amplifier, h-parameter, h-parameter equivalent circuit, Transistor as power amplifier, Transistor as oscillator, principle of an oscillator and Bark Hausen's condition, requirements of an oscillator, Wein-Bridge oscillator and Hartley oscillator.

Unit-5 Digital Circuits: Difference between Analog and Digital Circuits, Binary Numbers, Decimal to Binary and Binary to Decimal Conversion, AND, OR and NOT Gates (Realization using Diodes and Transistor), NAND and NOR Gates as Universal Gates, XOR and XNOR Gate, De Morgan's Theorems, Boolean Laws, Simplification of Logic Circuit using Boolean Algebra, Digital to Analog Converter, Analog to Digital Converter.
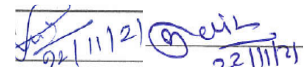
TEXT AND REFERENCE BOOKS:
1. Introduction to solid state physics: C. Kittel.
2. Solid State Physics: A.J. Dekkar.
3. Electronic Circuits: Mottershead.
4. Electronic Circuits: Millman and Halkias.
5. Semiconductor Devices: S.M. Sze.
6. Electronic devices: T.L. Floyd.
7. Device and Circuits: J. Millman and C. Halkias.
8. Electronic Fundamental and Applications: D. Chatopadhyay and P.C. Rakshit.
9. Electricity and Magnetism: K.K. Tiwari.

PRACTICALS
Minimum 16 (Eight from each group)
Experiments out of the following or similar experiments of equal standard
1. Determination of Planck's constant.
2. Determination of e/m by using Thomson tube.
3. Determination of e by Millikan's methods.
4. Study of spectra of hydrogen and deuterium (Rydberg constant and ratio of masses of electron proton).
5. Absorption spectrum of iodine vapour.
6. Study of alkali or alkaline earth spectra using a concave grating.
7. Study of Zeeman effect for determination of a Lande g-factor.
8. Analysis of a given band spectrum.
9. Study of Raman spectrum using laser as an excitation source.
10. Study of absorption of alpha and beta rays.
11. Study of statistics in radioactive measurement.
12. Coniometric study of crystal faces.
13. Determination of dielectric constant.
14. Hysteresis curve of transformer core.
15. Hall-probe method for measurement of magnetic field.
16. Specific resistance and energy gap of semiconductor.
Characteristics of transistor.
Characteristics of tunnel diode.
Study of voltage regulation system.
Study of regulated power supply.
Study of lissajous figures using CRO.
Study of VTVM.
Study of RC and TC coupled amplifiers.
Study of AF and RF oscillators.
Find roots of $f(x) = 0$ by using Newton-Raphson Method.
Find root of $f(x) = 0$ by using secant method.
Integration by Simpson rule.
To find the value of V at

String manipulations.
Towers of Hanoi (Non-recursive).
Finding first four perfect numbers.
Quadratic interpolation using Newton's forward-difference formula of degree two.
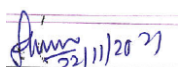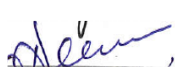
TEXT AND REFERENCE BOOKS:
B.G. Strechman, Solid state electronics devices II edition (Prentice-Hall of India New Delhi 1986)
W.D. Stanley, Electronics devices, circuits and applications (Prentice-Hall new jersey, USA 1988).
S. Lipschutz and A Poe; Schaum's outline of theory and problems of programming with Fortran (Mc Graw-Hill Book Co. Singapore, 1986).
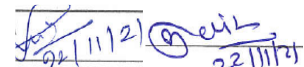C Dixon, Numerical Analysi

B.A. B.Ed. / B.Sc. B.Ed
PART - III
<u>MATHEMATICS</u>

There shall be three theory papers. Two compulsory and one optional. Each paper carrying 50 marks is divided into five units and each unit carry equal marks.

PAPER - I
ANALYSIS

METRIC SPACES

UNIT-I   Definition and examples of metric spaces. Neighbourhoods, Limit points, Interior points, Open and Closed sets, Closure and interior. Boundary points, Sub-space of a metric space. Cauchy sequences, Completeness, Cantor's intersection theorem. Contraction principle, construction of real numbers as the completion of the incomplete metric space of rationals. Real numbers as a complete ordered field.

UNIT-II   Dense subsets. Baire Category theorem. Separable, second countable and first countable spaces. Continuous functions. Extension theorem. Uniform continuity, isometry and homeomorphism. Equivalent metrics. Compactness, sequential compactness. Totally bounded spaces. Finite intersection property. Continuous functions and Compact sets, Connectedness, Components, Continuous functions and Connected sets.
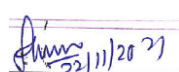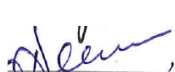
COMPLEX ANALYSIS

UNIT-III   Complex numbers as ordered pairs. Geometrical representation of complex numbers. Stereographic projection. Continuity and differentiability of complex functions. Analytic functions. Cauchy- Riemann equations. Harmonic functions. Elementary functions. Mapping by elementary functions. Mobius transformations. Fixed points, Cross ratio. Inverse points and critical mappings. Conformal mappings.

REAL ANALYSIS

UNIT-IV   Series of arbitrary terms. Convergence, divergence and oscillation. Abel's and Dirichlet's test. Multiplication of series. Double series. Partial derivation and differentiability of real-valued functions of two variables. Schwarz and Young's theorem. Implicit function theorem. Fourier series. Fourier expansion of piecewise monotonic functions.

UNIT-V   Riemann integral. Intergrability of continuous and monotonic functions. The fundamental theorem of integral calculus. Mean value theorems of integral calculus. Improper integrals and their convergence. Comparison tests. Abel's and Dirichlet' tests. Frullani's integral. Integral as a function of a parameter. Continuity, derivability and integrability of an integral of a function of a parameter.
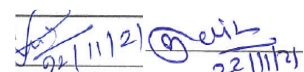
REFERENCES :

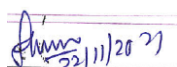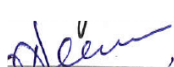1. T.M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
2. R.R. Goldberg, Real Analysis, Oxford & IBH publishing Co., New Delhi, 1970.
3. S. Lang, Undergraduate Analysis, Springer-Verlag, New York, 1983.
4. D. Somasundaram and B. Choudhary, A First Coarse in Mathematical Analysis, Narosa Publishing House, New Delhi, 1997.
5. Shanti Narayan, A Course of Mathematical Analysis, S. Chand & Co. New Delhi.
6. P.K. Jain and S.K. Kaushik, An introduction to Real Analysis, S. Chand & Co., New Delhi, 2000.
7. R.V. Churchill and J.W. Brown, Complex Variables and Applications, 5th Edition, McGraw- Hill, NewYork, 1990.
8. Mark J. Ablowitz and A.S. Fokas, Complex Variables : Introduction and Applications, Cambridge University Press, South Asian Edition, 1998.
9. Shanti Narayan, Theory of Functions of a Complex Variable, S. Chand & Co., New Delhi.
10. E.T. Copson, Metric Spaces, Cambridge University Press, 1968.
11. P.K. Jain and K. Ahmad, Metric Spaces, Narosa Publishing House, New Delhi, 1996.
12. G.F. Simmons, Introduction to Topology and Modern Analysis, McGraw-Hill, 1963.
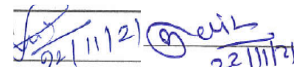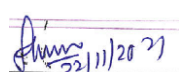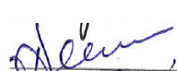
PAPER-II
ABSTRACT ALGEBRA

UNIT-I Group- Automorphisms, inner automorphism. Automorphism of groups and their computations, Conjugacy relation, Normaliser, Counting principle and the class equation of a finite group. Center for Group of prime-order, Abelianizing of a group and its universal property. Sylow's theorems, Sylow subgroup, Structure theorem for finite Abelian groups.

UNIT-II Ring theory-Ring homomorphism. Ideals and quotient rings. Field of quotients of an integral domain, Euclidean rings, polynomial rings, Polynomials over the rational field. The Eisenstien criterion, polynomial rings over commutative rings, unique factorization domain. R unique factorisation domain implies so is $R[x_1, x_2 ..... x_n]$. Modules, Submodules, Quotient modules, Homomorphism and Isomorphism theorems.

UNIT-III Definition and examples of vector spaces. Subspaces. Sum and direct sum of subspaces. Linear span, Linear dependence, independence and their basic properties. Basis. Finite dimensional vector spaces. Existence theorem for bases. Invariance of the number of elements of a basis set. Dimension. Existence of complementary subspace of a finite dimensional vector space. Dimension of sums of subspaces. Quotient space and its dimension.

UNIT-IV Linear transformations and their representation as matrices. The Algebra of linear transformations. The rank nullity theorem. Change of basis. Dual space. Bidual space and natural isomorphism. Adjoint of a linear transformation. Eigenvalues and eigenvectors of a linear transformation. Diagonalisation. Annihilator of a subspace. Bilinear, Quadratic and Hermitian forms.

UNIT-V Inner Product Spaces-Cauchy-Schwarz inequality. Orthogonal vectors. Orthogonal Complements. Orthonormal sets and bases. Bessel's inequality for finite dimensional spaces. Gram-Schmidt Orthogonalization process.

REFERENCES :
1. I.N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
2. N. Jacobson, Basic Algebra, Vols. I & II. W.H. Freeman, 1980 (also published by Hindustan Publishing Company).
3. Shanti Narayan, A Text Book of Modern Abstract Algebra, S.Chand & Co. New Delhi.
4. K.B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2000.
5. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal, Basic Abstract Algebra (2"" Edition) Cambridge University Press, Indian Edition, 1997.
6. K. Hoffman and R. Kunze, Linear Algebra, (2nd Edition), Prentice Hall. Englewood Cliffs, New Jersey, 1971.
7. S.K. Jain, A. Gunawardena and P.B. Bhattacharya, Basic Linear Algebra with MATLAB. Key College Publishing (Springer-Verlag) 2001.
8. S. Kumaresan, Linear Algebra, A Geometric Approach, Prentice-Hall of India, 2000.
9. Vivek Sahai and Vikas Bist, Algebra, Norosa Publishing House, 1997.
10. I.S. Luther and I.B.S.Passi, Algebra, Vol. I-Groups, Vol. II-Rings. Narosa Publishing House (Vol. I-1996, Vol. II-1999)
11. D.S. Malik, J.N. Mordeson, and M.K. Sen, Fundamentals of Abstract Algebra, McGraw- Hill International Edition, 1997.
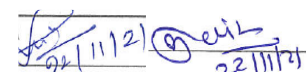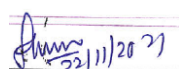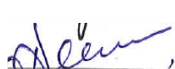
PART-III
PAPER - III - (OPTIONAL)
PRINCIPLES OF COMPUTER SCIENCE

UNIT-I   Data Storage - Storage of bits. Main Memory. Mass Storage. Coding Information of Storage. The Binary System. Storing integers, storing fractions, communication errors.
Data Manipulation - The Central Processing Unit. The Stored-Program Concept. Programme Execution. Other Architectures. Arithmetic/Logic Instructions. Computer- Peripheral Communication.

UNIT-II   Operating System and Networks - The Evolution of Operating System. Operating System Architecture. Coordinating the Machine's Activities. Handling Competition Among Process. Networks. Networks Protocol.
Software Engineering - The Software Engineering Discipline. The Software Life Cycle. Modularity. Development Tools and Techniques. Documentation. Software Ownership and Liability.

UNIT-III Algorithms - The Concept of an Algorithm, Algorithm Representation. Algorithm Discovery. Iterative Structures. Recursive Structures. Efficiency and Correctness. (Algorithms to be implemented in C++). Programming Languages - Historical Perspective. Traditional Programming Concepts, Program Units. Language Implementation. Parallel Computing. Declarative Computing.

UNIT-IV   Data Structures - Arrays. Lists. Stacks. Queues. Trees. Customised Data Types. Object Oriented Programming.
File Structure - Sequential Files. Text Files. Indexed Files. Hashed Files. The Role of the Operating System.
Database Structure - General Issues. The Layered Approach to Database Implementation. The Relational Model. Object-Oriented Database. Maintaining Database Integrity. E-R models

UNIT-V   Artifical Intelligence - Some Philosophical Issues. Image Analysis. Reasoning, Control System Activities. Using Heuristics. Artificial Neural Networks. Application of Artificial Intelligence.
Theory of Computation - Turning Machines. Computable functions. A Non computable Function. Complexity and its Measures. Problem Classification.

REFERENCES :
1. J. Glen Brookshear, Computer Science : An Overview, Addition -Wesley.
2. Stanley B. Lippman, Josee Lojoie, C++ Primer (3rd Edition), Addison-Wesley.
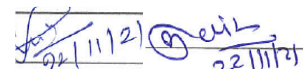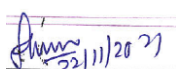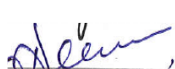
Part-III
PAPER - III - (OPTIONAL)
(II) DISCRETE MATHEMATICS

UNIT-I   Sets and Propositions - Cardinality. Mathematical Induction, Principle of inclusion and exclusion. Computability and Formal Languages - Ordered Sets. Languages. Phrase Structure Grammars. Types of Grammars and Languages. Permutations. Combinations and Discrete Probability.

UNIT-II   Relations and Functions - Binary Relations, Equivalence Relations and Partitions. Partial Order Relations and Lattices. Chains and Antichains. Pigeon Hole Principle.
Graphs and Planar Graphs - Basic Terminology. Multigraphs. Weighted Graphs. Paths and Circuits. Shortest Paths. Eulerian Paths and Circuits. Travelling Salesman Problem. Planner Graphs. Trees.

UNIT-III Finite State Machines - Equivalent Machines. Finite State Machines as Language Recognizers. Analysis of Algorithms - Time Complexity. Complexity of Problems. Discrete Numeric Functions and Generating Functions.

UNIT-IV   Recurrence Relations and Recursive Algorithms - Linear Recurrence Relations with constant coefficients. Homogeneous Solutions. Particular Solution. Total Solution. Solution by the Method of Generating Functions. Brief review of Groups and Rings.

UNIT-V   Boolean Algebras - Lattices and Algebraic Structures. Duality, Distributive and Complemented Lattices. Boolean Lattices and Boolean Algebras. Boolean Functions and Expressions. Prepositional Calculus. Design and Implementation of Digital Networks. Switching Circuits.

REFERENCES :

1. C.L. Liu, Elements of Discrete Mathematics, (Second Edition), McGraw Hill, International Edition, Computer Science Series, 1986
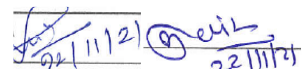
Part-III
PAPER - III - (OPTIONAL)
(III) PROGRAMMING IN C AND NUMERICAL ANALYSIS
(Theory & Practical)

Theory component will have maximum marks 30.
Practical component will have maximum marks 20.

UNIT-I   Programmer's model of a computer. Algorithms. Flow Charts. Data Types. Arithmetic and input/output instructions. Decisions control structures. Decision statements. Logical and Conditional operators. Loop. Case control structures. Functions. Recursions. Preprocessors. Arrays. Puppetting of strings. Structures. Pointers. File formatting.
Numerical Analysis

UNIT-II   Solution of Equations: Bisection, Secant, Regula Falsi, Newton's Method, Roots of Polynomials. Interpolation: Lagrange and Hermite Interpolation, Divided Differences, Difference Schemes, Interpolation Formulas using Differences. Numerical Differentiation. Numerical Quadrature: Newton-Cote's Formulas. Gauss Quadrature Formulas, Chebychev's Formulas.

UNIT-III Linear Equations: Direct Methods for Solving Systems of Linear Equations (Guass Elimination, LU Decomposition, Cholesky Decomposition), Iterative Methods (Jacobi, GaussSeidel, Relaxation Methods).
The Algebraic Eigenvalue problem: Jacobi's Method, Givens' Method, Householder's Method, Power Method, QR Method, Lanczos' Method.

UNIT-IV   Ordinary Differential Equations: Euler Method, Single-step Methods, Runge-Kutta's Method, Multi-step Methods, Milne-Simpson Method, Methods Based on Numerical Integration, Methods Based on Numerical Differentiation, Boundary Value Problems, Eigenvalue Problems.
Approximation: Different Types of Approximation, Least Square Polynomial Approximation, Polynomial Approximation using Orthogonal Polynomials, Approximation with Trigonometric Functions, Exponential Functions, Chebychev Polynomials, Rational Functions.Monte Carlo Methods

Unit-V   Random number generation, congruential generators, statistical tests of pseudo-random numbers. Random variate generation, inverse transform method, composition method, acceptance rejection method, generation of exponential, normal variates, binomial and Poisson variates.
Monte Carlo integration, hit or miss Monte Carlo integration, Monte Carlo integration for improper integrals, error analysis for Monte Carlo integration.

REFERENCES:

1. Henry Mullish and Herbert L. Cooper, Spirit of C: An Introduction to Modern Programming, Jaico Publishers, Bombay.
2. B.W. Kernighan and D.M. Ritchie. The C Programming Language 2nd Edition, (ANSI features) Prentice Hall, 1989.
3. Peter A Darnel and Philip E. Margolis, C: A Software Engineering Approach, Narosa Publishing House, 1993.
4. Robert C. Hutehisonand Steven B. Just, Programming using C Language, McGraw Hill, 1988.
5. Les Hancock and Morris Krieger, The C Primer, McGraw Hill, 1988.
6. V. Rajaraman, Programming in C, Prentice Hall of India, 1994.

7. Byron S. Gottfried, Theory and Problems of Programming with C, Tata McGraw-Hill Publishing Co. Ltd., 1998.
8. C.E. Froberg, Introduction to Numerical Analysis, (Second Edition), Addison-Wesley, 1979.
9. James B. Scarborough, Numerical Mathematical Analysis, Oxford and IBHPublishing Co. Pvt. Ltd. 1966.
10. Melvin J. Maron, Numerical Analysis A Practical Approach, Macmillan publishing Co., Inc. New York, 1982.
11. M.K. Jain, S.R.K. lyengar, R.K. Jain, Numerical Methods Problems and Solutions, New Age International (P) Ltd., 1996.
12. M.K. Jain, S.R.K. lyengar, R.K. Jain, Numerical Methods for Scientific and Engineering Computation, New Age International (P) Ltd., 1999.
13. R.Y. Rubistein, Simulation and the Monte Carlo Methods, John Wiley, 1981.
14. D.J. Yakowitz, Computational Probability and Simulation, Addison-Wesley, 1977.

PAPER - III - (OPTIONAL)
(IV) PRACTICAL
PROGRAMMING IN C AND NUMERICAL ANALYSIS

LIST OF PRACTICAL TO BE CONDUCTED...
1. Write a program in C to find out the largest number of three integer numbers.
2. Write a program in C to accept monthly salary from the user, find and display income tax with the help of following rules :

Monthly Salary	Income Tax
9000 or more	40% of monthly salary
7500 or more	30% of monthly salary
7499 or less	20% of monthly salary

3. Write a program in C that reads a year and determine whether it is a leap year or not.
4. Write a program in C to calculate and print the first n terms of fibonacci series using looping statement.
5. Write a program in C that reads in a number and single digit. It determines whether the first number contains the digit or not.
6. Write a program in C to computes the roots of a quadratic equation using case statement.
7. Write a program in C to find out the largest number of four numbers using function.
8. Write a program in C to find the sum of all the digits of a given number using recursion.
9. Write a program in C to calculate the factorial of a given number using recursion.
10. Write a program in C to calculate and print the multiplication of given 2D matrices.
11. Write a program in C to check that whether given string palindrome or not.
12. Write a Program in C to calculate the sum of series:

$$1 + x + \frac{1}{2!}x^2 + \frac{1}{3!}x^3 + \ ...... + \frac{1}{n!}x^n$$

13. Write a program in C to determine the grade of all students in the class using Structure. Where structure having following members - name, age, roll, sub1, sub2, sub3, sub4 and total.
14. Write a program in C to copy one string to another using pointer. (Without using standard library functions).
15. Write a program in C to store the data of five students permanently in a data file using file handling.

B.A. B.Ed. / B.Sc. B.Ed
PART - III
BOTANY
PAPER- I
(ANALYTICAL TECHNOLOGY PLANT PATHOLOGY, EXPERIMENTAL EMBRYOLOGY, ELEMENTARY BIOSTATISTICS, ENVIRONMENTAL POLLUTION AND CONSERVATION)

UNIT-I
Structure, Principle and applications of analytical instrumentation.
Chromatography technique, Oven, Incubator, Autoclave, Centrifuge, Spectrophotometere

UNIT-II
Plant Tissue culture techniques, growth media, totipotency, protoplast culture, somatic hybrids and cybrids, micropropagation, somaclonal variations, haploid culture.
Analytical techniques: Microscopy-Light microscope, Electron microscope

UNIT-III
General principles of plant pathology, general symptoms of fungal, bacterial and viral diseases, mode of infection] diseases resistance and control measures, plant quarantine. A study of epidemiology and etiology of following plant diseases.
Rust diseases of wheat, Tikka diseases of groung nut, Red rot of sugar can, Bacterial blight of rice, yellow vein mosaic of b hindi, Little Leaf of brinjal.

UNIT-IV
Introduction to pollution, green house gases, Ozone depletion, Dissolve oxygen, B.O.D., C.O.D.
Bio magnification, Eutrophication, Acid precipitation, Pytoremediation. Plant indicators, Biogeographical Zones of India, Concept of Biodiversity, CBD, MAB, National parks and biodiversity Hot spots, Conservation strategies, Red Data Book, IUCN threat categories, invasive species, endemic species. concept of sustainable development.

UNIT-V
ELEMENTARY BIOSTATISTICS:
Introduction and application of Biostatics, measure of central tendency-Mean, Median, Mode, measures of dispersal-Standard deviation, standard error.

Books Recommended:
Singh, RS, Plant Diseases, Oxford & IBH, New Delhi.
Pandey,BP, Plant Pathology, S. Chand Publishing, New Delhi
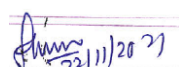Sharma, PD, Microbiology and Plant pathology, Rastogi Publications, Meerut
Sharma PD, Mycology and Phytopathology, Rastogi Publications, Meerut
Singh JS, Singh SP and Gupta, SR, Ecology Environmental Science and Conservation, S. Chand Publishing, New Delhi
Sharma, PD. Ecology and Environment, Rastogi Publications, Meerut
Bhojwani, SS and Razdan, MK, Plant Tissue Culture: Theory and Practices, Elsevier
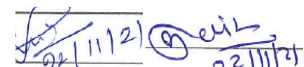Sharma AK, Text book of Biostatistics, Discovery Publishing House Pvt.Ltd.

BOTANY
PAPER- II
(GENETICS, MOLECULAR BIOLOGY, BIOTECHNOLOGY AND BIOCHEMISTRY)

UNIT-I

Cell and cell organelles, organization and morphology of chromosomes, giant chromosomes, cell division, Mendel's laws, gene interactions, linkage and crossing over, chromosomal aberration, polyploidy, sex linked inheritance, sex determination, cytolasmic inheritance, gene concept: cistron muton, recon.

UNIT- II

Nucleic acids, Structure and forms of DNA and RNA, DNA/RNA as genetic material, replication of DNA, biochemical and molecular basis of mutation, genetic code and its properties, mechanism of transcription and translation in prokaryotes, regulation of gene expression, Operon model.

UNIT- III

Recombinant DNA, Enzymes in recombinant DNA technology, cloning vectors (Plasmid, Bacteriophages, Cosmids, Phagemids), gene cloning, PCR, Application of Biotechnology; G.M.Plants, Monoclonal antibodies, DNA finger printing

UNIT- IV

Protein: Chemical composition, primary, secondary and tertiary structure of Proteins.
Carbohydrate: general account of monosaccharides, disaccharids and Polsaccharides
Fat: Structure and properties of fats and fatty acids, synthesis and breakdown.

UNIT- V

ENZYMES: Nomenclature and classifaction, components of enzymes, theories of enzyme action, enzyme kinetics (Michaelis-Menten constant), allosteric enzymes, isozymes, Abzymes. Ribozymes, factors affecting enzyme activity.

Books Recommended:
Nelson, DL, Cox, MM, Lehninger Principles of Biochemistry, W.H. freeman and Company, New York, USA.
Cooper, GM, The Cell: A Molecular Approach, ASM Press & Sunderland, Washington, D.C. Sinauer Associates, MA.
Singh BD, Fundamental of Genetics, Kalyani Publication
Singh BD, Genetics, Kalyani Publication
Gupta, PK, Cell and Molecular Biology, Rastogi Publications, Meerut
Singh, BD, Biotechnology: Expanding Horizons, Kalyani Publications
Gupta, PK, Elements of Plant Biotechnology, Rastogi Publications, Meerut
Gupta, SN, concepts of Biochemistry, Rastogi Publications, Meeru
Jain, JL, Jain S, Jain, N, Fundamentals of Biochemistry, S Chand Publishing, New Delhi

Botany
Practical

1. Study of host parasite relationship pf plant diseases listed above.
2. Demonstration of preparation of Czapek's Dox medium and potato dextrose agar medium, sterilization of culture medium and pouring.
3. Inoculation in culture tubes and petriplates.
4. Gram Staining.
5. Microscopic examination of Curd.
6. Study of plant diseases as listed in the theory paper.
7. Biochemical test of carbohydrate and protein.
8. Instrumentation techniques

PRACTICAL SCHEME

TIME: 4 Hrs.   M.M.: 50

1.	Plant Disease/Symptoms	10
2.	Instrumentation techniques	05
3.	Staining of Microbes	05
4.	Tissue Culture techniques	05
5.	Spotting	10
6.	Project Work/ Field Study	05
7.	Viva-Voce	05
8.	Sessional	05

B.A. B.Ed. / B.Sc. B.Ed
PART - III
ZOOLOGY
Paper-I

ECOLOGY, ENVIRONMENTAL BIOLOGY: TOXICOLOGY, MICROBIOLOGY AND MEDICAL ZOOLOGY

Unit: I (Ecology)
- Aims and scopes of ecology
- Major ecosystems of the world-Brief introduction
- Population- Characteristics and regulation of densities
- Communities and ecosystem
- Bio-geo chemical cycles
- Air & water pollution
- Ecological succession

Unit: II (Environmental Biology)
- Laws of limiting factor
- Food chain in fresh water ecosystem
- Energy flow in ecosystem- Trophic levels
- Conservation of natural resources
- Environmental impact assessment

Unit: III (Toxicology)
- Definition and classification of Toxicants
- Basic Concept of toxicology
- Principal of systematic toxicology
- Heavy metal Toxicity (Arsenic, Murcury, Lead, Cadmium)
- Animal poisons- snake venom, scorpion & bee poisoning
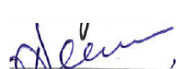- Food poisoning

Unit: IV (Microbiology)
- General and applied microbiology
- Microbiology of domestic water and sewage
- Microbiology of milk & milk products
- Industrial microbiology: fermentation process, production of penicillin, alcoholic breverages, bioleaching.

Unit:V (Medical Zoology)
- Brief introduction to pathogenic microorganisms, Ricketssia, Spirochaetes, AIDS and Typhoid
- Brief account of life history & pathogenicity of the following pathogens with reference to man: prophylaxis & treatment
- Pathogenic protozoan's- Entamoeba, Trypanosome & Plasmodium
- Pathogenic helminthes- Schistosoma
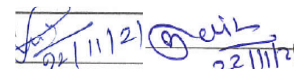- Nematode pathogenic parasites of man
- Vector insects

Zoology
Paper II

GENETICS, CELL PHYSIOLOGY, BIOCHEMISTRY, BIOTECHNOLOGY AND BIOTECHNIQUES

Unit: I (Genetics)
- Linkage & linkage maps, Sex Determination and Sex Linkage
- Gene interaction- Incomplete dominance & Codominance, Supplementary gene, Complementary gene, Epistasis Lethal gene, Pleiotropic gene and multiple alleles.
- Mutation: Gene and chromosomal mutation
- Human genetics: chromosomal alteration: Down, Edward, Patau, Turner and Klinefelter Syndrome Single gene disorders: Alkaptonuria, Phenylketonuria, Sickle cell anemia, albinism and colour blindness

Unit: II (Cell Physiology)
- General idea about pH & buffer
- Transport across membrane: Diffusion and Osmosis
- Active transport in mitochondria & endoplasmic reticulum
- Enzymes-classification and Action

Unit: III (Biochemistry)
- Amino acids & peptides- Basic structure & biological function
- Carbohydrates & its metabolism- Glycogenesis; Gluconeogenesis; Glycolysis; Glycogenolysis; Cosi-cycle
- Lipid metabolism- Oxidation of glycerol; Oxidation of fatty acids
- Protein Catabolism- Deamination, transamination, transmethylation

Unit: IV (Biotechnology)
- Application of Biotechnology
- Recombinant DNA & Gene cloning
- Cloned genes & other tools of biotechnology (Tissue culture, Hybridoma, Trasgenic Animals and Gene library)

Unit: V (Biotechniques)
1. Principles & techniques about the faollowing:
   (i) pH meter
   (ii) Colorimeter
   (iii) Microscopy- Light microscopes: Compound, Phase contrast & Electron microscopes
   (iv) Centrifuge
   (v) Separation of biomolecules by chromatography & electrophoresis

Zoology
Practical

The practical work in general shall be based on syllabus prescribed in theory.
The candidates will be required to show knowledge of the following:

- Estimation of population density, percentage frequency, relative density.
- Analysis of producers and consumers in grassland.
- Detection of gram-negative and gram-positive bacteria.
- Blood group detection (A,B,AB,O)
- R. B. C. and W.B.C count
- Blood coagulation time
- Preparation of hematin crystals from blood of rat
- Observation of Drosophila, wild and mutant.
- Chromatography-Paper or gel.
- Colorimetric estimation of Protein.
- Mitosis in onion root tip.
- Biochemical detection of Carbohydrate, Protein and Lipid.
- Study of permanent slides of parasites, based on theory paper.
- Working principles of pH meter, colorimeter, centrifuge and microscope.

Scheme of marks distribution   Time: 3:30hrs

• Hematological Experiment	08
• Ecological Experiment: Grassland Ecosystem/ Population Density/Frequency/relative density	06
• Bacterial staining	05
• Biochemical experiment	06
• Practical based on Instrumentation (Chromatography/ pH meter/microscope/centrifuge.	05
• Spotting (5 spots)	10
7 Viva	05
8. Sessional	05

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B.SC. B.ED

PAPER –VI

LEARNER AND LEARNING PROCESS

MARKS: 100

CORE STUDY

COURSE OBJECTIVES:

To enable teacher trainees to-

(i) acquire knowledge and understanding of stages of human development and developmental tasks with special reference to adolescent learners;

(ii) develop understanding of process of child learning in the context of various theories of learning;

(iii) understand intelligence, motivation and various types of exceptional children; and

(iv) develop skills for effective teaching-learning process and use of psychometric assessment.

Course Outline

Unit - I: Nature of Psychology and Learners

- Psychology: Its meaning, nature, methods and scope; functions of educational psychology.

- Stages of Human Development: Stage specific characteristics and developmental tasks.

- Adolescence in Indian Context: Characteristics and problems of adolescents, their needs and aspirations.

- Guidance and counselling for adolescents.

Unit - II: Learning

- Nature of Learning: Learning theories with specific reference to Piaget's Cognitive Theory and Vigotsky's Social Learning.

- Factors influencing learning and teaching process: Learner related, teacher related, process related, and content related.

Unit - III: Intelligence

- Nature and characteristics of intelligence and its development.

- Theories of intelligence: Two factor theory - Multifactor Theory (PMA) and SI Model.

- Measuring intelligence: Verbal, Non-Verbal and Performance tests (one representative of group test and individual test of each),- Creativity: definition & measurement

Unit - IV: Exceptional Children

- Concept of exceptional children: Types and characteristics of each type including Children with learning disabilities.

- Individual differences: Nature; accommodating Individual differences in the classroom. Learner centered techniques for teaching exceptional children.

- Personality: Definition, meaning and nature; development of personality; type and trait theories of personality.

- Group Dynamics, Psycho-analysis.

Unit - V: Socialization, Culture and Education in Indian context

- History of Indian psychology with specific reference to religions and epics.

- Durganand Sinha's Cognitive Development.

- Understanding diversity in Indian culture.

Suggested Readings:

1. Bhatia, H.R.: Elements of Educational Psychology. OrientLangman Ltd., Bombay.
2. Chauhan, S.S.: Advance Educational Psychology. Vikas Publishing House, New Delhi.
3. Chauhan, S.S.: Psychology of Adolescence. Allied Publishers, New Delhi.
4. Garrett, H.E.: Statistics in Psychology and Education. Vakils, Fetter and Simo Ltd., Bombay.
5. Gulati, Sushma: Education for Creativity, NCERT, 1985.
6. Hurlock, E.B.: Adolescent Development. McGraw Hill, New York.
7. Kapil, H.K.: Sankhiyiki ke Mool Tatva. Vinod Pustak Mandir, Agra.
8. Kulshrestha S.P: Educational Psychology.
9. Mangal, S.K.: Psychological Education. Prakash Brothers, Ludhiana.
10. Mathur, S.S.: Educational Psychology. Vinod Pustak Mandir, Agra.
11. Mathur, S.S.: Shiksha Manovigyan. Lall Book Depot, Meerut.
12. Srivastava, G. N. P.: Recent Trends in Educational Psychology. Psycho Research Cell, Agra.
13. Tripathi, S. N.: Pratibha Aur Srijnatmakta.Macmillan Co., Bombay.
14. Psychology in a Third world country: The Indian experience by Durganand Sinha.
15. Motivation and Rural development by Durganand Sinha.

PAPER - VIII

PEDAGOGICAL STUDIES

MARKS: 100

PEDAGOGY OF MATHEMATICS

COURSE OBJECTIVES:

After completion of course the students will be able to-

(i) develop insight into the meaning, nature, scope and objectives of mathematics education;

(ii) appreciate mathematics as a tool to engage the mind of every student;

(iii) appreciate mathematics to strengthen the student's resource;

(iv) appreciate the process of developing a concept;

(v) appreciate the role of mathematics in day-to-day life;

(vi) learn important mathematics: mathematics is more than formulas and mechanical procedures;

(vii) channelize, evaluate, explain and reconstruct their thinking;

(viii) see mathematics as something to talk about, to communicate through, to discuss among themselves, to work together on;

(ix) pose and solve meaningful problems;

(x) appreciate the importance of mathematics laboratory in learning mathematics;

(xi) construct appropriate assessment tools for evaluating mathematics learning;

(xii) develop ability to use the concepts for life skills;

(xiii) stimulate curiosity, creativity and inventiveness in mathematics;

(xiv) develop competencies for teaching-learning mathematics through various measures;

(xv) focus on understanding the nature of children's mathematical thinking through direct observations of children's thinking and learning processes; and

(xvi) examine the language of mathematics, engaging with research on children's learning in specific areas.

Course Outline (Part I)

Unit - I: Nature and Scope of Mathematics

Meaning and scope of mathematics. A mathematical theorem and its variants—converse, inverse and contra-positive, 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 in Vedic Mathematics. Aesthetic sense in mathematics and beauty in mathematics.

Unit - II: Exploring Learners

Cultivating learner's sensitivity like intuition, encouraging learner for probing, raising queries, appreciating dialogue among peer-group, promoting the student's confidence (Carrying out examples from various mathematical content areas such as Number Systems, Geometry, Sets, etc.).

Unit - III: 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 specific objectives and teaching points of various content areas in mathematics like Algebra, Geometry, Trigonometry, etc.

Unit - IV: 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 level of schooling- Arithmetic (Development of Number Systems), Algebra, Trigonometry, Statistics and Probability, etc.

Unit - V: Approaches and Strategies in Teaching and Learning of MathematicalConcepts

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 in teaching a concept like teaching of algebra, geometry, trigonometry, mensuration, etc.; Difference between teaching of mathematics and teaching of science.

Suggested Readings:

1. The history &concept of mathematical proof- Steven G., 2007

2. One of the oldest Extent diagrams from Euclid- Bill Casselman, 2008

3. How to teach mathematics- S.K.Arora (Bhimani): Shanti Publishers, 1998

4. How children learn mathematics- Capeland (New York): Macmillan Publishers, 1979

5. Mathematics for modern mind- W.R. Fuch (New York): Macmillan Publishers, 1967

6. Vidyalaya Ganit ke liye sau prayog- J.N. Kapoor (New Delhi): Arya Book Depot, 1968

7. How to teach mathematics in secondary school- W.B.Saunders (Company), 1967

8. The spirit of mathematics- J.N. Kapoor (New Delhi): Arya Book Depot, 1964

9. Indian Mathematics- Ashok Jhunjhunwala (New Delhi): Wiley Eastern Ltd., 1993

10. Curriculum and teaching of mathematics in secondary school- R.C. Saxena, NCERT, 1970

11. The teaching of mathematics in the new Education- N.K.Ayangar

12. Teaching of essentials of mathematics- Ballard, P.B.

13. The development of mathematics- Bell, E.T.

14. The teaching of mathematics- Chadda, B. N.

15. The teaching of secondary mathematics- Butter &Wren

16. The teaching of arithmetic- Potter,F.F.

17. Mathematics for Class 9th NCERT

18. Mathematics for Class 10th NCERT

19. Teaching of Mathematics (Eng\Hindi) - Dr. S.K. Mangal

20. Teaching of Mathematics (Eng/Hindi) - Dr. A.B. Bhatnagar

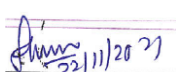21. Teaching of Mathematics- A.K. Kulshrestha.

PAPER - : PEDAGOGICAL STUDIES
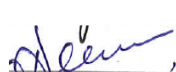## PEDAGOGY OF BIOLOGICAL SCIENCE

TOTAL MARKS: 100

COURSE OBJECTIVES:

After Completion of Course the Students will be able to-

(i) develop insight on the meaning and nature of biological science for determining aims and strategies of teaching-learning;

(ii) appreciate that science is a dynamic and expanding body of knowledge;

(iii) appreciate the fact that every child possesses curiosity about his/her natural surroundings;

(iv) identify and relate everyday experiences with learning biological science;

(v) appreciate various approaches of teaching-learning of biological science;

(vi) explore the process skills in science and role of laboratory in teaching-learning;

(vii) use effectively different activities/experiments/demonstrations/laboratory experiences for teaching-learning of biological science;

(viii) integrate the biological science knowledge with other school subjects;

(ix) analyse the contents of biological science with respect to its branches, process skills, knowledge organisation and other critical issues;

(x) develop process-oriented objectives based on the content themes/units;

(xi) identify the concepts of biological science that are alternatively conceptualised by teachers and students in general;

(xii) explore different ways of creating learning situations for different concepts of biological science;

(xiii) formulate meaningful inquiry episodes, problem-solving situations, investigatory and discovery learning projects based on upper primary, secondary and higher secondarystages, facilitate development of scientific attitudes in learners;

(xiv) examine different pedagogical issues in learning biological science;

(xv) construct appropriate assessment tools for evaluating learning of biological science;

(xvi) stimulate curiosity, inventiveness and creativity in biological science;

(xvii) develop ability to use biological science concepts for life skills; and

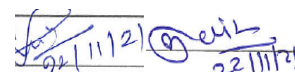(xviii) develop competencies for teaching-learning of biological science through different measures.

Unit - I: Nature and Scope of Biological Science

Science as a domain of enquiry, dynamic body of knowledge and as a process of constructing knowledge; Biological Science for environment and health, peace, equity; History of biological science, its nature and knowledge of biological science independent of human application; Origin of life and evolution, biodiversity, observations and experiments in biological sciences; Interdisciplinary linkages, biological sciences and society.

Unit - II: Aims and Objectives of Biological Science

Developing scientific attitude and scientific temper; Nurture the natural curiosity, aesthetic senses and creativity in Biology; Acquire the skills to understand the methods and process that lead to exploration; Generalisation and validation of scientific knowledge in Biological Science; Relate Biology education to environment (natural environment, artifacts and people) and appreciate the issues at the interface of science, technology and society; Imbibe the values of honesty, integrity, cooperation, concern for life and preservation of environment; Solving problems of everyday life; Know the facts and principles of Biology and its applications consistent with the stages of cognitive development of learners; Specific objective of different content areas in Biology.

Unit - III: Exploring Learners

Motivating learner to bring his/her previous knowledge in Science/Biology gained through classroom/environment/parents and peer group; Cultivating in teacher-learner the habit of listening to child; Generating discussion, involving learners in teaching-learning process, encouraging learners to raise questions, appreciating dialogue amongst peer groups, encouraging learners to collect materials from local resources and to develop/fabricate suitable activities in Biological Science (individual or group work); Role of learners in negotiating and mediating learning in Biology.

Unit - IV: School Science Curriculum (Biological Science)

Trends in Science curriculum; Consideration in developing learner-centred curriculum in Biology; Analysis of textbooks and Biology syllabi of NCERT and States/UTs at upper primary, secondary and higher secondary stages; Analysis of other print and non-print materials in the area of Biological Science used in various states.

Unit - V: Approaches and Strategies of Learning Biological Science

Pedagogical shift from science as fixed body of knowledge to process constructing knowledge, scientific method- observation, enquiry, hypothesis, experimentation, data collection, generalisation (teacher-educator will illustrate taking examples from different stage-specific content areas keeping in mind the variation, e.g. structure and function, molecular aspects, interaction between living and non-living, biodiversity, etc.); Communication in Biological Sciences; Problem solving, investigatory approach, concept

mapping, collaborative learning, and experiential learning in Biological Science (teacher-learner will design learning experiences using each of these approaches); Facilitating learners for self-study.

Suggested Readings:

1. Modern Methods of Teaching Biology. Sarup Teaching Series, Sarup & Sons, New Delhi.

2. Bhaskara Rao, D. (2000): Teaching of Biology. Nagarjuna Publishers, G4.

3. Mohan, Radha(2004): Innovative Science Teaching. Prentice Hall of India, New Delhi.

4. New UNESCO Source Book for Science Teaching (1978). Oxford & IBH, New Delhi.

5. Sharma, R.C. & Shukla C.S.(2002): Modern Science Teaching. Dhanpat Rai Publishing Company, New Delhi.

6. Sood, K.J. (1989): New Directions in Science Teaching. Kohli Publishers, Chandigarh.

7. Vaidya, N. (1996): Science Teaching for the 21st Century. Deep & Deep Publications, New Delhi.

8. Gupta S.K. (1983): Technology of Science Education. Vikas Publishing House Pvt Ltd, Delhi.

9. www.wikipedia.com Chikara, M.S. and S.Sarma (1985): Teaching of Biology. Prakash Brothers, Ludhiana.

10. S.K. Mangal: Teaching of Biological Science.

11. Dr. Shoti Shivendra Chandra: Contemporary Science Teaching.

12. R.A. Yadav & Siddiqui: Teaching of Science.

13. Prof. S.K. Tyagi: Teaching of Biological Sciences.

14. Dr. A.K. Kulshrestha: Teaching of Biological Sciences.

15. All NCERT Science Text Books from Class IX to XII.

PEDAGOGY OF PHYSICAL SCIENCE

COURSE OBJECTIVES:

After completion of course the students will be able to-

(i) gain insight on the meaning and nature of physical science for determining aims and strategies of teaching-learning;

(ii) appreciate that science is a dynamic and expanding body of knowledge;

(iii) appreciate the fact that every child possesses curiosity about his/her natural surroundings;

(iv) identify and relate everyday experiences with learning physical science;

(v) appreciate various approaches of teaching-learning of physical science;

(vi) understand the process of science and role of laboratory in teaching-learning situations;

(vii) use effectively different activities/demonstrations/laboratory experiences for teaching-learning of physical science;

(viii) integrate physical science knowledge with other school subjects;

(ix) analyse the contents of physical science with respect to its branches, process, skills, knowledge organisation and other critical issues;

(x) develop process-oriented objectives based on the content themes/units;

(xi) identify the concepts of physical science that are alternatively conceptualised by teachers and students in general;

(xii) explore different ways of creating learning situations in learning different concepts of physical science;

(xiii) formulate meaningful enquiry episodes, problem-solving situations, investigatory and discovery learning projects based on upper primary, secondary and higher secondary school science/physics and chemistry;

(xiv) facilitate development of scientific attitudes in learners;

(xv) examine different pedagogical issues in learning physical science; and

(xvi) construct appropriate assessment tools for evaluating learning of physical science.

Important: Various Concepts of Pedagogy of Physical Science listed in Units 1 to 10 (PART I & PART II) given below will be evolved around the concepts given at upper primary, secondary and higher secondary (Physics and Chemistry) Science syllabi.

Course Outline (Part I)

Unit - I: Nature of Science

Science as a domain of enquiry, as a dynamic and expanding body of knowledge; Science as a process of constructing knowledge; Science as interdisciplinary area of learning (Thermodynamics, Biomolecules, Surface Chemistry, etc.); Facts, concepts, principles, laws and theories- their characteristics in context of Physical Science (citing examples for each); Physical Science for environment, health, peace, equity; Physical Sciences and society; Contribution of eminent scientists- Isaac Newton, Dalton, Neils Bohr, De Broglie, J. C. Bose, C. V. Raman, Albert Einstein, etc.

Unit - II: Aims and Objectives of Physical Science

Developing scientific attitude and scientific temper, Nurture the natural curiosity, aesthetic senses and creativity in Science (secondary stage)/ Physics and Chemistry (higher secondary stage); Acquire the skills to understand the method and process of Science/Physical Science that lead to exploration, generation and validation of knowledge in Science/Physical Science; Relate Science/Physics and Chemistry education to the environment (natural environment, artifacts and people) and appreciate the issues at the interface of science, technology and society; Imbibe the values of honesty, integrity,

cooperation, concern for life and preservation of environment, Solving problems of everyday life; Know the facts and principles of Science/Physics and Chemistry and its applications consistent with the stages of cognitive development of learners, (e.g. Mechanics, Heat, Electricity, Magnetism, Light, Acid, Bases and Salts, Thermodynamics, Metallurgy, Physical and Chemical Changes, Nature and States of Matter, etc.); Specific objective of different content areas in science/physics and chemistry.

Unit - III: Exploring Learners

Motivating learners to bring his/her previous knowledge gained in science/physics and chemistry through classroom/environment/parents and peer group; Cultivating in teacher-learner the habit of listening to child; Generating discussion, involving learners in teaching-learning process; Encouraging learners to raise questions, appreciating dialogue amongst peer group; Encouraging learners to collect materials from local resources (soil, water, etc.) and to develop/fabricate suitable activities in science/ physics and chemistry (individual or group work); Role of learners in negotiating and mediating learning in Science/Physical Science.

Unit - IV: School Science Curriculum (Physical Science)

Trends in Science curriculum; Consideration in developing learner-centred curriculum in Physical Science; Analysis of Science/Physics and Chemistry syllabi and textbooks of NCERT and States (at upper primary, secondary and higher secondary stage); Analysis of other print and non-print materials used in various states in the area of Physical Science.

Unit - V: Approaches and Strategies of Learning Physical Science

Pedagogical shift from Science as fixed body of knowledge to process of constructing knowledge, scientific method- observation, enquiry, hypothesis, experimentation, data collection, generalisation (teacher-educator will illustrate each taking examples from specific contents of Science/Physics and Chemistry, such as Solutions, Colloids, Chemical Equilibrium, Electrochemistry, Mechanical and Thermal Properties of Matter, Reflection, Refraction, Wave Optics etc.); Communication in Science/Physical Science, Problem solving, investigatory approach, concept mapping, collaborating learning and experiential learning in Science/Physics and Chemistry (teacher-learner will design learning experiences using each of these approaches), facilitating learners for self-study.
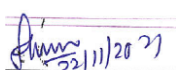
Suggested Readings:

1. Mohan, Radha (2004): lnnovative Science Teaching. Prentice Hall of India, New Delhi.
2. New UNESCO Source Book for Science Teaching (1978). Oxford & IBH, New Delhi.
3. Sharma, R.C. & Shukla C.S. (2002): Modern Science Teaching. Dhanpat Rai Publishing Company, New Delhi.
4. Sood, K.J. (1989): New Directions in Science Teaching. Kohli Publishers, Chandigarh.
5. Vaidya, N. (1996): Science Teaching for the 21st Century. Deep & Deep Publications, New Delhi.
6. Gupta S.K. (1983): Technology of Science Education. Vikas Publishing House Pvt Ltd,

Delhi.

7. Dr. Shoti Shivendra Chandra: Contemporary Science Teaching.
8. R.A. Yadav & Siddiqui: Teaching of Science.
9. All NCERT Science Text Books from class IX to XII.
10. S.K. Mangal: Teaching of Physical Science.
11. Prof. S.K. Tyagi: Teaching of Physical Sciences.
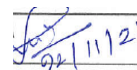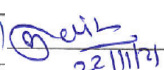12. Dr. A.K. Kulshrestha: Teaching of Physical Sciences.

TEACHING REFLECTIVE LOG FORMAT

(This is to be completed daily during the week you teach)

Objectives for day:

Materials for day:

Instructional Strategies used (explain how the strategies were implemented):

What I did well:

What my students did well:

What I didn't do so well:

What my students didn't do so well:

What I would keep the same:

What I would Change:

What did I learn about teaching today? (If you had to modify your lesson to help students, briefly explain here)

SCORE SHEET FOR REFLECTION LOG ON FOCUS LESSON

(To be filled by the trainee, based on student reflection)

Name of the Trainee:

Duration: **Class:**   **Section:**

Unit of teaching:

S.No.	CRITERION ON STUDENT RESPONSE	0	1	2	3	4
1	Ability to identify specific and/or varied instructional strategies.					
2	Examples to support the strategy.					
3	Connectivity across disciplines.					
4	Ability to identify learning styles.					
5	Examples to reflect according to learning styles.					
6	Ability to display personal reflections					
7	Examples reflected in support of personal reflection					
8	Group conformity					
9	Contribution to activity/strategy					
10	Acceptance in group/solo activity or Strategy					

Any other remarks by the trainee:

Mentor's Remarks:

Mentor's Signature   **Trainee's**
Signature

<u>MENTOR'S EVALUATION REPORT OF TRAINEE</u>

Name of the Trainee: ……………………………………………………………

Period of Evaluation: From…………………………**to**……………………..

Focus Lesson No.: ……………………

Subject: ………………………………..

S.NO.	CRITERION	0	1	2	3	4
I	INSTRUCTIONAL STRATEGIES USED-					
1	Are appropriate for the topic/topics.					
2	Has scope for learner engagement.					
3	Has suitability of learning materials.					
4	Assess learner's understanding throughout the Lesson.					
5	Has effective displays.					
6	Are consistent with the objectives.					
II	LEARNER'S (LEARNING STYLES) IN CLASS-					
7	Identification of personalities and talents of learners					
8	Identification of learning styles of learners.					
9	Ensuring learner participation.					
10	Identification of learner's pace.					
III	LEARNING ENVIRONMENT-					
11	Learners are motivated, appreciated and involved.					
12	Learners are relaxed and confident.					
13	Management of classroom.					
14	Teacher-Student relationship					
15	Class control					
16	Overall performance					

Strengths of the Trainee:

(May use separate papers for detailed report)

Areas of Improvement:

(May use separate papers for detailed report)

Sign of Mentor with Name

Weekly Reflective Diary Format

We learn by doing and reflecting on what we do. (John Dewey)

Use this template to record your observations weekly. This document will be turned in every Monday following each week in the field. The weeks you teach will have a different format to follow. Please note that your document will be longer than one page.

Name:
Date:

Analyze your observations to identify specific teaching and learning strategies you observed involving the classroom teachers and their students. You may include your behavior if you are involved in the teaching process. Include more than one strategy.

Instructional Strategies (Include more than one strategy)	Specific example describing how the strategy was implemented

Learning Styles observed	Specific examples how the learner was supported through instructional delivery

1. What have you learned about teaching this week?
2. What have you observed/learned about students and their learning this week?

Theory base observed	Specific example from classroom to apply/support theory

Personal Reflection: Reflect specifically on something you observed and connect to personal opinions.