दुर्ग विश्वविद्यालय, दुर्ग (छ.ग.)

पाठ्यक्रम

परीक्षा – 2018–19

बी.एससी.बी.एड. भाग–3

B.Sc. B.Ed. Part-3

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				
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 difuculty 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.

आधार पाठ्यक्रम
हिन्दी भाषा
प्रथम प्रश्न पत्र पूर्णांक – 75

।। सम्प्रेषण कौशल, हिन्दी भाषा और सामान्य ज्ञान।।

आधार पाठ्यक्रम की संरचना और अनिवार्य पाठ्य पुस्तके–हिन्दी भाषा एवं समसामयिकी– का संयोजन इस तरह किया गया है कि सामान्य ज्ञान की विषय वस्तु – विकासशील देशों की समस्याओं के माध्यम और साथ–साथ हिन्दी भाषा का ज्ञान और उसमें सम्प्रेषण कौशल अर्जित किया जा सके । इसी प्रयोजन से व्याकरण की अन्तर्वस्तु को विविध विधाओं की संकलित रचनाओं और सामान्य ज्ञान की पाठ्य सामग्री के साथ अन्तर्गुम्फित किया गया है । अध्ययन अध्यापन के लिए परी पुस्तक की पाठ्य सामग्री है और अभ्यास के लिये विस्तृत प्रश्नावली है । यह प्रश्नपत्र भाषा का है अतः पाठ्य सामग्री का व्याख्यत्मक या आलोवचनात्मक अध्ययन अनेक्षित नहीं है । पाठ्यक्रम और पाठ्य सामग्री का संयोजन निम्नलिखित पांच इकाईयों में किया जाता है । प्रत्येक इकाई को दो भागो मे विभक्त किया गया है ।

इकाई– 1

1. भारत माता : सुमित्रानंद पंत, परशुराम की प्रतीज्ञा : रामधारी सिंह दिनकर, बहुत बड़ा सवाल : मोहन राकेश, संस्कृति और राष्ट्रीय एकीकरण : योगेश अटल।
2. कथन की शैलियां : रचनागत उदाहरण और प्रयोग।

इकाई– 2

1. विकासशिल देशों की समस्यायें, विकासात्मक पुनर्विचार, और प्रौद्योगिक एवं नगरीकरण ।
2. विभिन्न संरचनाएं।

इकाई– 3

1. आधुनिक तकनीकी सभ्यता, पर्यावरण प्रदूषण तथा धारणीय विकास।
2. **कार्यालयीन पत्र और आलेख।**

इकाई– 4

1. जनसंख्या : भारत के संदर्भ में और गरीबी तथा बेरोजगारी ।
2. अनुवाद।

इकाई– 5

1. उर्जा और शक्तिमानता का अर्थशास्त्र।
2. घटानाओं , समारोहों आदि का प्रतिवेउन और विभिप्प प्रकार के निमंत्रण–पत्र।

मुल्यांकन योजना : प्रत्येक इकाई से एक–एक प्रश्न पूछा जायेगा । प्रत्येक प्रश्न में आंतरिक विकल्प होगा। प्रत्येक प्रश्न के 15 अंक होगें । प्रत्येक दो–दो खंड (क्रमंशः 'क' और 'ख' में) विभक्त है, इसलिए प्रत्येक प्रश्न के भी दो भाग, कौशल से संबद्ध प्रश्न के अंक 7 होगे। इस प्रकार पूरे प्रश्न पत्र के पूर्णांक 75 होंगे।

PART - II

ENGLISH LANGUAGE M.M. 75

The question paper for B.A./B.Sc./B.Com./B.H.Sc. 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.

CHEMISTRY

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

PAPER - I

INORGANIC CHEMISTRY M.M. 33

UNIT-I METAL-LIGAND BONDING IN TRANSITION METAL COMPLEXES

Limitations of valence bond theory, an elementary idea of crystal field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal field parameters.

Thermodynamic and kirietic aspects of metal complexes.

A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, subsititution reactions of square planar complexes.

UNIT-II MAGNETIC PROPERTIES OF TRANSITION METAL COMPLEXES

Types of magnetic behaviour, methods of determining magnetic susceptibility, spin only formula, L-S coupling, correlation of μ s and μ 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 d1 and d2 states, discussion of the electronic spectrum of complexion.

UNIT-III ORGANOMETALLIC CHEMISTRY

Definition, nomenclature and classification of organo metallic compounds. Preparation, properties, bonding and applications of alkyls and aryls of Li, Al, Hg, Sn, & Ti, A brief account of metal-ethylenic complexes and homogeneous hydrogenation, monouclear carbonyls and nature of bodning in metal carbonyls.

UNIT-IV BIOINORGANIC CHEMISTRY

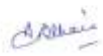
Essential and trace elements in biological processes, metalloporphyrins with special reference to hemoglobin and myoglobin. Biological role of alkali and alkaline earth metals with special reference to Ca^{21}, nitrogen fixation.

UNIT-V HARD AND SOFT ACIDS AND BASES (HSAB) 07 HRS.

Classification of acids and bases as hard and soft. Perason's HSAB concept, acid-base strength and hardness and softness. Symbiosis Silicones and PhosphazenesSilicons and phosphazenes as examples of inorganic polymers, nature of bonding in triphosphazenes.

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. McDaniel and J. Alexander, John Wiley
4. Inorganic Chemistry, D.E. Shriver, P.W. Atkkins and C.H. Langford, Oxford.
5. Inorganic Chemistry, W.W. Porterfield, Addison-Wesley.
6. Inorganic Chemistry, A.G. Sharp, ELBS.
7. Inorganic Chemistry, G.L. Miessler and D.A. Tarr, Prentice Hall.
8. Advanced Inorganic Chemistry, Satyas Prakash.
9. Advanced Inorganic Chemistry, Agarwal & Agarwal.
10. Advanced Inorganic Chemistry, Puri & Sharma, S. Naginchand
11. Inorganic Chemistry, Madan, S. Chand & Co.
12. Adhunik Akarbanic Rasayan, A.K. Shrivastav & P.C. Jain, Goel Pub.
13. Ucchattar Akarbanic Rasayan, Satya Prakash & G.D. Tuli, Shyamlal Prakashan
14. Ucchattar Akarbanic Rasayan, Puri & Sharma.



PAPER - II

ORGANIC CHEMISTRY M.M. 33

UNIT-I A. O RGANICMETALLIC COMPOUNDS

Organomegenesiumcompounds : Grignard reagents-formation, structure andchemical reactions. Organozinc compounds: formation and chemical reactions.

Organolithium compounds : formation and chemical reactions.

B. Organosulphur Compounds

Nomenclature, structural features, methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine.

Organic Synthesis via Enolates

Active methylene groupalkylation of diethylmalonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate : the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate.

UNIT-II BIOMOLECULES

A. Carbohydrates :

Configration of monosaccharides, threo and erytho diastereomers. Formation of glycosides ethers and esters Determination of ring size of monosaccharides. Cyclic structure of D(+) glucose. Structure of ribose and deoxyribose. An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

B. Proteins and Nucleic acids

Classification and structure of protein levels of protein structure, protein Denaturation / renaturation, Constituents of amino acids Ribonucleicsids and ribouncleotieds, double helical structure of DNA.

UNIT-III A. Synthetic Polymers

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-IV SPECTROSCOPY

A. Mass spectroscopy: mass spectrum fragmentation of functional groups.

B. InfraRed Spectroscopy: IR absorption Band their position and intensity,Identification of IR spectra.

C. UV-Visible Spectroscopy: Beer Lambert's law, effect of Conjugation max Visible spectrum and colour.

D. Anthocyanin as natural colouring matter (Introduction only)

E. Application of Mass, IR, UV-Visible Spectroscopy to organic molecules.

UNIT-V **A. NMR Spectroscopy:** Introduction to NMR. Shielding and Number of signal inPMR, Chemical shift and characteristic values, spiltting of Signals and Coupling constant. Application to organic molcules.

B. ^{13}**CMR Spectroscopy:** Principal & Application.

C. Magnetic Resonance Imaging (MRI)- Introductory idea.

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-Eastern(New-Age)
5. Organic Chemistry, F.A. Carey, McGraw Hill
6. Introduction to Organic Chemistry, Streiweisser, Heathcock and Kosover, Macmillan
7. Organic Chemistry, P.L. Soni
8. Organic Chemistry, Bahi & Bahl
9. Organic Chemistry, Joginder Singh
10. Carbanic Rasayan, Bashi & Bahi
11. Carbanic Rasayan, R.N. Singh, S.M.I. Gupta, M.M. Bakodia & S.K. Wadhwa
12. Carbanic Rasayan, Joginder Singh.
13. Carbanic Resayan, P.L., Soni.
14. Corbanic Rasayan, Bhagchandani, Sahitya Bhawan Publication.
15. Rasayan Vigyan, Bhatnagar, Arun Prakashan.

PAPER - III
PHYSICAL CHEMISTRY

UNIT-I QUANTUM MECHANICS

Black body radiation, Plank's radiation law, photoelectric effect, Compton effect. DeBroglie's idea of matter waves, experimental verification Heisenberg's uncertainty principle, Sinosoidal wave equation, Operators : Hamiltonian operator, angular momentum operator, laplacian operators postulate of quantum mechanics Eigen values, Eigen function. Schrodinger time independed wave equation physical
Significance of and . Applications of Schrodinger wave equation: particle in one dimensional box Hydrogenation (separation into three equation's) radial wave function and angular wave function.

UNIT-II QUANTUM MECHANICS-II

Quantum mechanical approach of molecular orbit theory; basic idea criteria for forming M.O and A.O, LCAO approximation, formation of H^{2+} ion, calculation of energy levelsfrom wave functions bonding and antibonding wave functions concept ofandorbitals and their characteristics, Hybrid orbital : SP, SP^2, SP^3, Calculation of coefficients Ad^s used in these hybrid orbitals. Introduction to valence bond model of H^2, Comparison of M.O. and V.B. model, Huckle theory, application of huckel theory to ethane propene etc.

UNIT-III SPECTROSCOPY-I

A. Introduction, characterization of electromagenetic radiation, regions of the spectrum, representation of spectra width and intensity of spectral transition, rotational spectra of calculated diatomic molecules, energy level of rigid rotator, selection rule, determination of bond length qualitative description of non - rigid rotator isotopic effect.

B. Vibrational spectra - Fundamental vibrational and their symmetry, vibrating diatomic molecules, enegy levels of simple harmonic oscillator. Selection Rule, Pure vibrational Spectrum, determination of force constant, diatomic vibrating operator. Anhormonic Oscillator.

C. Raman Spectra : Concept of polarizability, quantum theory of Raman spectra stokes and anti stokes lines pure rotational and vibrational Raman spectra,

Application of Raman spectra stokes and anti stokes lines, pure rotational and vibrational Raman apectra, Applications of Raman spectra.

UNIT-IV SPECTROSCOPY-II

A. Electronic Spectra: Electronic Spectra of diatonic molecule, Frank London principle, types of electronic transitions. Applications of electronic spectra.

B. Photo-chemistry: Interaction of radiation with matter, difference between thermal and photochemical processes. Laws of photochemistry. Grothus-Drapper law,Stark-Elinstein law, Jablonski diagramπ depicting various process occurring in theexcited state, qualitative description of fluorescence, occurring in the excited state, qualitative descripiton of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing), quantum yield photosensitized reactions energy transfer processes (simple examples).

UNIT-V

A. Thermodynamics

Energy refered to absolute zero, third law of therodynamics Test of III law of thermodynamics Nerst heat theorem application and limitation of Nerst heat theorem.

B. Physical properties and molecular structure : polarization of molecules, {Classius-Mosotti equation. orientation of dipoles in an electric field. Dipol moment, induced dipole moment, measurement of dipole moment. Temperature methods and refractivity methods. Dipole moment and molecular structure.

C. Magnetic Properties: Parmagenetism diamagnetism, ferromagnetism. Determination of magnetic susceptibility, elucidation of molecular structure.

REFERENCE BOOKS:

1. Physical Chemistry, G.M. Barrow, International student edition, McGaw Hill
2. Basic programming with application, V.K. Jain, Tata McGraw-Hill
3. Computers & Common sense, R. Hunt & Shelly, Prentice-Hall
4. University general chemistry, C.N.R. Rao, Macmillan.
5. Physical Chemistry, R.A. Alberty, Wiley Eastern
6. The elements of Physical Chemistry, P.W. Atkin, Oxford
7. Physical Chemistry through problems, S.K. Dogra & S. Dogra, Wiley Eastern
8. Physical Chemistry, B.D. Khosla
9. Physical Chemistry, Puri & Sharma
10. Bhoutic Rasayan, Puri & Sharma
11. Bhoutic Rasayan, P.L. Soni
12. Bhoutic Rasayan, Bahl & Tuli

PAPER-IV
LABORATORY COURSE 180 Hrs.

Inorganic Chemistry

Synthesis Analysis

(a) Preparation of Sodium trioxalato ferrate (III), $Na_3[Fe(C_2O_4)_3]$ and determination of its composition by permanganometry.

(b) Preparation of Ni-DMG complex, $[Ni(DMG)_2]$

(c) Preparation of copper tetraammine complex, $[Cu(NH_3)_4]SO_4$.

(d) Preparation of cis-and trans-bioxalato diaqua chromate (III) ion.

Gravimetric Analysis

Analysis of Cu as CuSCN or CuO, Ni as $Ni(DMG)_2$, Ba as $BaSO_4$ and Fe as Fe_2O_3

Organic Chemistry

Laboratory Techniques

A Steam Distillation

Napthalene from its suspension in water Clove oil from cloves

Separation of ortho and para-nitrophenols.

B Column Chromatography

Separation of fluorescein and methylene blue Separation of

leaf pigments from spinach leaves

Resolution of recemic mixture of (+,-) mandelic acid.

Qualitative Analysis

Analysis of an organic mixture containing two solid components using water, $NaHCO_3$, NaOH for separation and preparation of suitable derivatives.

Synthesis of Organic Compounds

(a) Acetylation of salicylic acid, aniline, glucose and hydroquinone. Benzoylation of aniline and phenol.

(b) Aliphatic electrophilic substitution- Preparation of iodoform form ethanol and acetone.

(c) Aromatic electrophilic substitution-Nitration-

Preparation of m-dinitrobenzene, p-nitroacetanilide

Halogenation- Preparation of p-bromoacetanilide, 2,4,6 tribromophenol

(d) Diazotization/Coupling- Preparation of methyl orange and methyl red

(e) Oxidation- Preparation of benzoic acid from toluene

(f) Reduction- Preparation of aniline from nitrobenzene, m-nitroaniline from m-dinitrobenzene.

Physical Chemistry

Electrochemistry

(a) To determine strength of given acid conductometrically using standard alkali solution.

(b) To determine solubility and solubility product of a sparingly soluble electrolyte conductometrically.

(c) To study saponification of ethyl acetate conductometrically.

(d) Determine the ionization constant of a weak acid conductometrically.

(e) To titrate potentionmetrically the given ferrous ammonium sulphate using $KMnO_4/K_2Cr_2O_7$ as titrant and calculate the redox potential of Fe^{2+}/Fe^{3+} system on the hydrogen scale. **Refractometry and Polarimetry**

(a) To verify law of refraction of mixtures (e.g. of glycerol and water) using Abbe's refractometer.

(b) To determine the specific rotation of a given optically active compound.

Molecular Weight Determination

(a) Determination of molecular weight of a non-volatile solute by Rast method/Beckmann freezing point method.

(b) Determination of the apparent degree of dissociation of an electrolyte (e.g., NaCl) in aqueous solution at different concentrations by ebullioscopy.

Colorimetry

To verify Beer-Lambert law for $KMnO_4$/ $K_2Cr_2O_7$ and determine the concentration of the given solution of the substance.

REFERENCE BOOKS :

1. Vogel's qualitative Analysis, revised, Svehla, Orient Longman
2. Standard methods of chemical analysis, W.W. Scott, The Technical Press
3. Experimental Organic Chemistry, Vol. I & II, P.R. Singh, D.S. Gupta and K.S. Bajpai, tata McGraw Hill.
4. Laboratory Manual in Organic Chemistry, R.K. Bansal, Wiley Eastern
5. Vogel's Text Book of Practical Organic Chemistry, B.S. Furnis, A.J. Hannaford, V. Rogers, P.W.G. Smith and A.R. Tatchel, ELBS
6. Experiments in general chemistry, C.N.R. Rao & U.C. Agrawal
7. Experiments in Physical Chemistry, R.C. Das & Behra, Tata McGraw Hill
8. Advanced Practical Physical Chemistry, J.B. Yadav, Goel Publishing House.

8 Hrs. **PRACTICALEXAMINATION** **M.M.50.**

Five experiments are to be performed.

1. Inorganic - Two experiments to be performed.

Gravimetric estimation compulsory carrying 08 marks. (Manipulation 3 marks). Anyone experiment from synthesis and analysis carrying 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) carrying 04 marks.

3. Physical-One physical experiment carrying 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.

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PHYSICS

Objectives :

Present course is aimed to provide ample knowledge of basics of Physics which are relevant to the understanding of modern trends in higher physics.

The first paper is aimed at preparing the back ground of modern physics which includes the relativistic and quantum ideas mainly councerned with atomic, molecular and nuclear physics. It consistutes an essential pre-requisite for better understanding of any branch of physics.

The second paper is mainly concerned with Solid State Physics, Solid State Devices and Electronics. This course is quite important from the applicational aspects of modern electronic devices. It also forms the basis of advance electronics including communication technology to be covered at higher level.

The experiments are based mostly on the contents of the theory papers so as to provide comprehensive insight of the subject.

Scheme of Examination :

1. There shall be two theory papers of 3 hours duration each and one practical paper of 4 hours duration. Such paper shall carry 50 marks.
2. Each theory paper will comprise of 5 units. Two questions will be in each unit and the student will have the choice to answer one out of the two.
3. Numerical problems of about 30 percent will compulsorily be asked in each theory paper.
4. In practical paper each student has to perform two experiments during examination.
5. Practical examination will be of 4 hours duration. The distribution of practical marks will be as follows.

   Experiments : 15 + 15 = 30, Viva-voce

   :10 Internal Assessment - 10.

PAPER - I

RELATIVITY, QUANTUM MECHANICS, ATOMIC MOLECULAR AND NUCLEAR PHYSICS.

UNIT-I Reference systems, inertial frames, Galilean invariance and conservation laws, propogation of light, Michelson-Morley experiment, search for ether.

Postulates for the special theory of ralativity, Lorentz tranformations, length contraction,time dilation, velocity additon theorem, variation of mass with velocity, mass-energy equivalence, particle with zero rest mass, Compton effect.

UNIT-II Origin of the quantum theory : Failure of classical physics to explain the phenomena such as black-body spectrum, photoelectric effect.

Wave-particle duality and uncertainty principle: de Broglie's hypothesis for matter waves: the concept of wave and group velocities, evidence for diffraction & interference of particles, experimental demonstration of mater waves. Davisson and Germer's experiment.

Consequence of de Broglie's concepts, quantisation in hydrogen atom, energies of a particle in a box, wave packets.Consequence of the uncertainty relation : gamma ray microscope, diffraction at a slit.

UNIT-III Quantum Mechanics: Schrodinger's equation. Postulatory basis of quantum mechanics,operators, expectation values, 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.

Hydrogen atom : natural occurrence of n, and m quatum numbers, the related physical quantities.

UNIT-IV 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 elctronic energies of moleculers, quantisation of vibrational and rotational energies, determination of internuclear distance, pure rotatinal 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-V Interaction of charged particles and neutrons with mater, working of nuclear detectors, G-M counter, proportional counter and scintillation counter, cloud chambers, spark chamber, emulsions.

Structure of nuclei, basic properties (, μ Q and binding energy), deuteron binding energy, p-p and n-p scattering and general concepts of nuclear forces, Beta decay, range of alpha particle Geiger-Nuttal law. Gamow's explanation of beta decay, alpha decay and continuous and discrete spectra.

Nuclear reactions, channels, compound nucleus, direct reaction (concepts). Shell model & liquid drop model, fission and fusion (concepts), energy production in stars by p-p and carbon cycles (concepts).

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 Physic"
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 Resnik, "Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles" (John Wiley)
9. D.P. Khandelwal, "Optics and Atomic Physics", (Himalaya Publishing House, Bombay, 1988).

PAPER-II

SOLID STATE PHYSICS, SOLID STATE DEVICES AND ELECTRONICS

UNIT-I 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-II Free electron model of a metal, Solution of one dimensional Schrodiner equation in a constant potential. Density of states. Fermi Energy, Energy bands in a solid (Kronig-Penny model without mathematical details). 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-III Intrinsic semiconductors, carrier concentration in thermal equlibrium, Fermi level,Impurity semiconductor, doner and acceptor levels, Diode equation, junctions, junction breakdown, Depletion width and junction capacitance, abrupt junction, Tunnel diode, Zener diode. Light emmitting diode, solar cell, Bipolar transistors, pnp and npn transistors, characteristics of transistors, different configurations, current amplification factor, FET.

UNIT-IV Half and full wave rectifier, rectifier efficiency ripple factor, Bridge rectifier, Filters,Inductor filter, T and N filters, Zener diode, regulated power supply.Applications of transistors.Bipolar Transistor as amplifier.

Single stage and CE small signal amplifiers, Emitter followers, Transistoras power amplifier, Transistor as oscillator, Wein-Bridge Oscillator and Hartley oscillator.

UNIT-V Introduction to computer organisation, time sharing and multi programming systems, window based word processing packages, MS Word.

Introduction to C programming and application to simple problems of arranging numbers in ascending / descending orders : sorting a given data in an array, solution of simultaneous euation.

BOOKS RECOMMENDED :

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. Computer fundamental : balaguara Swami

PRACTICALS

MINIMUM 16 (Sixteen) Out of the following or similar experiment of equal standard :

1. Determination of Planck's constant
2. Determination of e/m by using Thomson's tube
3. Determination of e by Millikan's method
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 gra's
7. Study of Zeeman effect for determination of 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 measuement of magnetic field
16. Specific resistance and energy gap of a semiconductor
17. Characteristics of transistor
18. Characteristics of a tunnel diode
19. Study of voltage regulation system
20. Study of a regulated power supply

21. Study of lissajous figures using a CRO
22. Study of VTVM
23. Study of RC and TC coupled amplifiers
24. Study of AF and RF oscillators
25. Find roots of f(x)=0 by using Newton-Raphson method
26. Find roots of F(x)=0 by using secant method
27. Integration by Simpson rule
28. To find the value of V at
31. String manipulations
32. Towers of Honoi (Nonrecursive)
33. Finding first four perfect numbers
34. Quadratic interpolation using Newton's forward-difference formula of degree two.

TEXT AND REFERENCE BOOKS:

1. B.G. Strechman ; "Solid State Electronic Devices". II Edition (Prentice-Hall of India, New Delhi, 1986)
2. W.D. Stanley ; "Electronic Devices, Circuits and Applications" (Prentice Hall, New Jersey, USA, 1988)
3. S. Lipschutsz and A Poe ; "Schaum's Outline of Theory and Problems of Programming with Fortran" (McGraw-Hill Book Co. Singapore, 1986)
4. C Dixon ; "Numerical Analysis"

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MATHEMATIS

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

REAL ANALYSIS

UNIT-I 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-II 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's tests. Frullani's integral. Integral as a function of a parameter. Continuity, derivability and integrability of an integral of a function of a parameter.

COMPLEX ANALYSIS

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

METRIC SPACES

UNIT-IV Definition and examples of metric spaces. Neighbourhoods, Limit points, Interiorpoints, 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-V 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.

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 & J.W. Brown, Complex Variables and Applications, 5*" Edition, McGraw-Hill, NewYork, 1990.
8. MarkJ. Ablowitz & 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, Inroductin to Topology and Modern Analysis, McGraw-Hill, 1963.

PART - II
ABSTRACT ALGEBRA

UNIT-I Group-Automorphisms, inner automorphism. Automorphism groups and their compu-tations, 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 [x1, x2 ..... xn]Modules, Submodules, Quotient modules, Homomorphism and Isomorphism theorems.

UNIT-III Definition and examples of vector spaces. Subspaces. Sum and direct sum ofsubspaces, Linear span. Linear dependence, independence and their basic properties.

Basis. Finite dimensional vector spaces. Existence theoremfor bases. Invariance of the number of elements of a basis set. Dimension. Existence of complementary subspace of a 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 lineartransformations. 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, 2"" Editon, Prentice Hall. Englewood Cliffs, New Jersey, 1971.
7. S.K. Jain, A. Gunawardena & 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.

PAPER - III - (OPTIONAL)
(I) PRINCIPLES OF COMPUTER SCIENCE

UNIT-I **Data Storage -** Storage of bits. Main Memory. Mass Storage. Coding Information ofStorage. 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 Evolutionof Operating System. OperatingSystem 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 Roleof 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 computableFunction. 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.

PAPER - III - (OPTIONAL)
(II) DISCRETE MATHEMATICS

UNIT-I **Sets and Propositions -** Cardinality. Mathematical Induction, Principle of Inclusionand 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. Pathsand Circuits. Shortest Paths. Eulerian Paths and Circuits. Travelling Salesman Problem. Planner Graphs.

TREES.

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

UNIT-IV **1 Recurrence Relations and Recursive Algorithms -** Linear Recurrence Relations withConstant 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 andComplemented Lattices. Boolean Lattices and Boolean Algebras. Boolean Functions and Expressions. Prepositional Calculus. Design and Implementation of Digital Networks. Switching Circuits.

REFERENCES :

C.L. Liu, Elements of Discrete Mathematics, (Second Edition), McGraw Hill, International Edition, Computer Science Series, 1986.

PAPER - III - (OPTIONAL)

(III) APPLICATION OF MATHEMATICS IN FINANCE AND INSURANCE

Application of Mathematics in Finance:

UNIT-I **Financial Management** - An overview. Nature and Scope of Financial Management.

Goals of Financial Management and main decisions of financial management. Difference between risk, speculation and gambling.

Time value of Money-Interest rate and discount rate. Present value and future valuediscrete case as well as continuous compounding case. Annuities and its kinds.

UNIT-II Meaning of return. Return as Internal Rate of Return (IRR). Numerical Methods like Newton RaphsonMethod to calculate IRR. Measurement of returns under uncertainty situations. Meaning of risk. Difference between risk and uncertainty. Types of risks. Measurement of risk. Calculation of security and Portfolio Risk and Return-Markowitz Model. Sharpe's Single Index Model Systematic Risk and Unsystematic Risk.

UNIT-III Taylor series and Bond Valuation. Calculation of Duration and Convexity of bonds.Financial Derivaties - Futures. Forward. Swaps and Options. Call and Put Option. Call and Put Parity Theorem. Pricing of contingent claims through Arbitrage and Arbitrage Theorem.

Application of Mathematics in Insurance

UNIT-IV Insurance Fundamentals - Insurance defined. Meaning of loss. Chances of loss, peril,hazard, and proximate cause in insurance. Costs and benefits of insurance to the society and branches of insurance-life insurance and various types of general insurance. Insurable loss exposuresfeature of a loss that is ideal for insurance. Life Insurance Mathematics - Construction of Mortality Tables. Computation of Premium of Life Insurance for a fixed duration and for the whole life.

UNIT-V Determination of claims for General Insurance - Using Poisson Distribution and Negative Binomial Distribution-the Polya Case.

Determination of the amount of Claims in General Insurance - Compound Aggregate claim model and its properties, and claims of reinsurance. Calculation of a compound claim density function. F-recursive and approximate formulae for F.

REFERENCES :

1. Aswath Damodaran, Corporate Finance - Theory and Practice, John Wiley & Sons Inc.
2. John C. Hull, Options, Futures, and Other Derivatives, Prentice-Hall of Indian Private Limited.
3. Sheldon M. Ross, An Introduction to Mathematical Finance, Cambridge University Press.
4. Mark S. Dorfman, Introduction to Risk Management and Insurance, Prentice Hall, Englwood Cliffs, New Jersey.
5. C.D. Daykin, T. Pentikainen and M. Pesonen, Practical Risk Theoryfor Actuaries, Chapman & Hall.

PAPER - III - (OPTIONAL)

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

(IV) PROGRAMMING IN C AND NUMERICAL ANALYSIS (Thoury & Practical)

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 Formulasusing 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 (GuassElimination, 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, Lanezos' Method.

UNIT-IV Ordinary Differential Equations : Euler Method, Single-step Methods, Runge-Kutta'sMethod, Multi-step Methods, Milne-Simpson Method, Methods Based on NumericalIntegration, 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.

Unit-V Monte Carlo Methods Random number generation, congruential generators, statistical tests of pseudo-random numbers.

Random variate generation, inverse tranform method, composition method, acceptancerejection 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 intergration.

REFERENCES :

1. Henry Mullish& Herbert L. Cooper, Spirit of C : An Introductionto Modern Programming, Jaico Publishers, Bombay.
2. B.W. Kernighan and D.M. Ritchie. The C Programming Language 2"d 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 Anasysis, 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 C function seriessum () to calculate the sum of series : $1+X+1/2! X^2+1/3! X^3+..... 1/n! X^n$
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, sub 1, sub2, sub3, sub4 and total.
14. Write a program in C to copy one string to another using pointers. (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.

PAPER - III - (OPTIONAL)

(V) MATHEMATICAL MODELLING

(The Process of Applied mathematics.

UNIT-I Setting up first-order differential equations - Qualitative solution sketching. Difference and differential equation growth models.

UNIT-II Single-species population models. Population growth-An age structure model. The spread of Technological innovation.

UNIT-III Higher-order linear models- A model for the detection of diabetes. Combat modes.

Traffic models - Car-following models. Equilibrium speed distributions.

UNIT-IV Nonlinear population growth models. Prey-Predator models. Epidemic growth models.Models from political science - Proportional representation-cumulative voting, comparison voting.

UNIT-V Applications in Ecological and Environmental subject areas- Urban waste water management planning.

REFERENCES :

1. Differential equation models, Eds. Martin Braun, C.S. Coleman, D.A. Drew.
2. Political and Related Models, Steven. J. Brams, W.F. Lucas, P.D. Straftin (Eds.)
3. Discrete and System models, W.F. Lucas, F.S. Roberts, R.M. Thrall.
4. Life Science Models, H.M. Roberts & M. Thompson.

All volumes published as modules in applied Mathematics, Springer-Verlag, 1982.

5. Mathematical Modelling by J.N. Kapur, New Age International, New Delhi.

BOTANY

PAPER-I

PLANT PHYSIOLOGY, BIOCHEMISTRY AND BIOTECHNOLOGY

UNIT-I Plant-water relations : Importance of water to plant life ; physical properties of water; diffusion and osmosis; absorption, transport of water and transpiration ; physiology of stomata.

Mineral nutrition : Essential macro and micro-elements and their role ; mineral uptake; deficiency and toxicity symptoms.

UNIT-II Transport of organic substances : Mechanism of phloem transport ; source-sink relationship ; factors affecting translocation.

Basic of enzymology : Discovery and nomenclature ; characteristics of enzymes ; concept of holoenzyme apoenzyme, coenzyme and cofactors ; regulation of enzyme activity, mechanizm of action.

Photosynthesis : Significance ; historical aspects ; photosynthetic pigments ; action spectra and enhancement effects ; concept of two photosystems; Z-scheme ; photo-phosphorylation ; Calvin cycle ; C4 pathway ; CAM plants ; photorespiration.

UNIT-III Respiration : ATP - the biological energy currency ; aerobic and anaerobic respiration;Kreb's cycle, electron transport mechanism (chemi-osmotic theory) ; redox potential; oxidative phosphorylation ; pentose phosphate pathway.

Nitrogen and lipid metobolism : Biology of nitrogen fixation ;importance of nitrate reductase and its regulations ; ammonium assimilation ; structure and function of lipids; fatty acid biosynthesis ; Beta-oxidation ; saturated and unsaturated fatty acids; storage and mobilization of fatty acids.

UNIT-IV Growth and development : Definitions ; phases of growth and development ; kineticsof growth, seed dormancy, seed germination and factors of their regulation ; plant movements ; the concept of photoperiodism ; physiology of flowering ; florigen concept; biological clocks ; physiology of senescence, fruit ripening ; plant hormones auxins, gibberellins, cytokinins, abscisic acid and ethylene, history of their discovery, biosynthesis and mechanism of action; photomorphogenesis ; phytochromes and cryptochromes, their discovery, physiological role and mechanism of action.

UNIT-IV Genetic engineering : Tools and techniques of recombinant DNA technology ; cloningvectors ; genomic and cDNA library ; transposable elements ; techniques of gene mapping and chromosome walking.

Biotechnology : Functional definition ; basic aspects of plant tissue culture ; cellular totipotency, differentiation and morphogenesis ; biology of Agrobacterium ; vectors for gene delivery and marker genes ; salient achievements in crop biotechnology.

PAPER-II
ECOLOGY AND UTILIZATION OFPLANTS

UNIT-I Plants and environment : Atmosphere (gaseous composition), water (properties of water cycle), light (global radiation, photosynthetically active radiation), temperature, soil (development, soil profiles, physico-chemical properties), and biota.

Morphological, anatomical and physiological responses of plants to water (hydro-phytes and xerophytes), temperature (thermoperiodicity), light (photoperiodism, heliophytes and sciophytes) and salinity.

UNIT-II Community Ecology : Community characteristics, frequency, density, cover, life forms biological spectrum ; ecological succession.
Ecosystems : Structure, abiotic and biotic components ; food chain, food web,ecological pyramids, energy flow ; biogeochemical cycles of carbon, nitrogen and
phosphorus.

UNIT-III Population ecology : Growth curves ; ecotypes ; ecads.
Biogeographical regions of India.
Vegetation types of India : Forests and grasslands.

UNIT-IV Utilization of Plants
Food plants : Rice, wheat, maize, potato, sugercane.
Fibres : Cotton and jute.
Vegetable oils : Groundnut, mustard and coconut
General account of sources of firewood, timber and bamboos.

UNIT-V Spices : General account.
Medicinal plants : General account
Beverages : Tea and coffee.
Rubber.

PRACTICAL SCHEME	**M.M. 50**
01. Physiology	08
02. Ecology	08
03. Utilization of Plants	05
04. Biochemistry / Biotechnology	05
05. Spotting (1-5 spots)	10
06. Project work	04
07. Viva V.	05
08. Sessional	05
	50

Suggested Laboratory Exercises

1. To study the permeability of plasma membrance using different concentrations of organicsolvents.
2. To study the effect of temperature on permeability of plasma membrane.
3. To prepare the standard curve of protein and determine the protein content in unknown samples.
4. To study the enzyme activity of catalase and peroxidase as inflenced by pH and temperature.
5. Comparison of the rate of respiration of various plant parts.
6. Separation of chloroplast pigment by solvents method.
7. Determinig the osmotic potential of vacuolar sap by plsmolytic method.
8. Determining the water potental of any tuber.
9. Separation of amino acids in a mixtue by paper chromatography and their identification by comparison with standards.
10. Bioassay of auxin, cytokinin, GA. ABA and ethylene using appropriate plant material.
11. Demonstration of the technique of micropropagation by using different explants, e.g. axillary buds, shoot meristems.
12. Demonstration of the technique of anther culture.
13. Isolation of protoplasts from different tissues using commercially available enzymes.
14. Demonstration of root and shoot formation from the apical and basal portion of stem segments in liquid medium containing different hormones.

Suggested Laboratory Expercises (Ecology)

1. To determine minimum number of quadrats required for reliable estimate of biomass in grasslands.
2. To study the frequency of herbaceous species in grassland and to compare the frequency distribution with Raunkair's Standard Frequency Diagram.
3. To estimate importance Value Index for grassland species on the basis of relative frequency, relative density and relative biomass in protected and grazed grassland.
4. To measure the vegetation cover of grassland through point frame method.
5. To measure the aboveground plant biomass in a grassland.
6. To determine Kemp's constant for dicot and monocot leaves and to estimate the leaf area index of a grassland community.
7. To determine diversity indices (richness, Simpson, Shannon-Wiener) in grazed and protected grassland.
8. To estimate bulk density and porosity of grassland and woodland soils.
9. To determine moisture content and water holding capacity of grassland and woodland soil.
10. To study the vegetation structure through profile diagram.
11. To estimate transparency, pH and temperature of different water bodies.
12. To measure dissolved oxygen content in polluted and unpolluted water samples.
13. To estimate salinity of different water samples.
14. To determine the percent leaf area injury of different leaf samples collected around polluted sites.
15. To estimate dust holding capacity of the leaves of different plant species.

PRACTICAL

Suggested Laboratory Exercises (for Utilization of Plants)

1. Food Plants : Study of the morphology, structure and simple microchemical tests of the food storing tissues in rice, wheat, maize, potato and sugarcane, Microscopic exmaination of starch in these plants (excepting sugarcane)
2. Fibres : Study of cotton flowers, sectioning of the cotton ovules/developing seeds to trace the origin and development of cotton fibres. Microscopic study of cotton and test for cellulose, Sectioning and staining of jute stem to show the location and development of firbres. Microscopic structure. Test for lignocellulose.
3. Vegetable oils : Study of hand sections of groundnut, mustard and coconut and staining of oil droplets by Sudan III and Sudan Black.

4. Field visits : To study sources of firewood (10 plants), timber-yielding trees (10 trees) and bamboos. A list to be prepared mentioning special features.
5. Spices : Examine black pepper, cloves, cinnamon (hand sections) and opened fruits of cardamom and describe them briefly.
6. Preparation of an illustrated inventory of 10 medicinal plants used in indigenous systems of medicine or allopathy : Write their botanical and common names, parts used and disease/disorders for which they are prescribed.
7. Beverages : Cut Sections of boiled coffee beans and tea leaves to study the characterstic structural features.
8. Rubber : Collect illustrative materials of Hevea brasillensis ; morphology of the plant and tapping practices, history of rubber. List the many uses of rubber.

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ZOOLOGY

Paper-I

Ecology, Environmental-biology ; Toxicology ; Microbiology and Medical Zology.

2. Attempting one question from each unit will be compulsory. 100% chice be given.

UNIT-I (ECOLOGY)

1. Aims and scopes of Ecology.
2. Major ecosystems of the world-Brief intruduction
3. Population- Characteristics and regualtion of densities.
4. Communities and Ecosystems.
5. Biogeochemical cycles
6. Air and water pollution
7. Ecological succession

UNIT-II(ENVIRONMENTAL BIOLOGY)

1. Laws of limiting factors
2. Food chain in a freshwater ecosystem.
3. Energy flow in ecosystem-Trophic levels
4. Conservation of Natural resources
5. Environmental impact Assessment

UNIT-III (TOXICOLOGY)

1. Definition of Toxicity
2. Classification of toxicants
3. Principle of systematic toxicology
4. Toxic agents and their action- Metallic and inorganic agents
5. Animal poisons - Snake-venom, Scorpion and bee poisoning
6. Food pisoning

UNIT-IV (MICROBIOLOGY)

1. General and Applied microbiology.
2. Microbiology of Domestic water and sewage.
3. Microbiology of milk and milk products.
4. Industrial microbiology.

UNIT-V (MEDICAL MICROBIOLOGY)

1. Brief introduction to pathogenic micro-organisurs, Rickettsia, Spirochaetes and Bacteria.
2. Brief account of life-history and pathogenicity of the following pathogens with reference to man ; Prophylaxis and treatment -
   (a) Pathogenic Protozoans - Entamoeba, Trypanosoma, and Giardia
   (b) Pathogenic helminths - Schistosoma
   (c) Nematode Pathogenic parasites of man
3. Vector insects

PAPER-II

(GENETIC'S, CELL PHYSIOLOGY, BIOCHEMISTRY, BIOTECHNOLOGY AND BIOTECHNIQUES)

Note : Ateempting one question from each unit will be compulsory, 100% choice be given.

UNIT-I (GENETIC'S)

1. Linkage and Linkage maps
2. Varieties of gene expression - Multiple alleles ; lithogenesis ; Pleiotropic genes; gene interaction ; epistasis.
3. Sexchromosome systems, and sex-linkage.
4. Mutation and chromosomal alterations ; meiotic consequences.
5. Human genetics - chromosomal and single gene disorders (somatic cell genetics)

UNIT-II(CELL PHYSIOLOGY)

1. General idea about pH and Buffer.
2. Transport across membrane - cell membrane; Mitochondria andEndoplasmic reticulum.
3. Active transport and its mechanism; Active transport in Mitochondria and Endoplasmic reticulum.
4. Hydrolytic enzymes - Their chemical nature, Activation and specificity.

UNIT-III (BIOCHEMISTRY)

1. Amino acids and Peptides - Basic structure and biological function.
2. Carbohydrate and its metabolism - Glycogenesis; Gluconeogenesis; glycolysis, Glycogenolysis; Cosi-cycle.
3. Lipid metabolism - Oxidation of glycerol; oxidation of fatty acid.
4. Protein metabolism - Deamination,Transamination, Transmethylation; Biosynthesis of Protein;

UNIT-IV (BIOTECHNOLOGY)

1. Biotechnology - Scope and importance.
2. Recombinant DNA and Gene cloning.
3. Cloned genes and other tools of biotechnology.
4. Applications of biotechnology in (i) Pharmaceutical industry, and (ii) Food processing industry.

UNIT-V (BIOTECHNIQUE)

Principles and techniques about the following

1. pH meter
2. Colorimeter
3. Microscopy-Light microscopes, Phase contrast and Electron microscopes.
4. Centrifugation
5. Separation of biomolecules by chromatography, and Electrophoresis
6. Histrochemical methods for determination of Protein, Lipids, and carbohydrate

PRACTICAL WORK

The Practical work in general shall be based on syllabus prescribed in theory.

The candidates will be required to show knowledge of the following :

1. Estimation of population density, Percentage frequency, Relative density.
2. Analysis of Producers and consumers in grassland.
3. Detection of gram-negative and gram-positive bacteria.
4. Blood group detection (A,B, AB & O).
6. R.B.C., W.B.C. count.
6. Blood coagulation time.
7. Preparation of Hematin crystals from blood of rat.
8. Observation of Drosophila, wild and mutant.
9. Chromatography-Paper or gel.
10. Colorimetric estimation of hemoglobin.
11. Mitosis in onion root tip.
12. Biochemical detection of Carbohydrate, Protein and Lipid.
13. Study of Permanent slides of Parasites, based on theory paper.
14. Working Principles of pH meter, Colorimeter, centrifuge and microscopes.

SCHEDULE FOR PRACTICAL EXAMINATION

Duration : 4 Hrs.		**Max Marks : 50**	
1.	Haematological Experiment: (R.B.Cs./W.B.Cs. Counting/Blood group detection)	08	marks
2.	Ecological Experiment: (Estimation of Population Density/Frequency/relative Density)	06	marks
3.	Staining of Gram +ve and Gram -ve Bacteria/cytological experiment: Mitosis in onion root tip	05	marks
4.	Biochemical Experiment: (biochemical detection of carbohydrate/protein lipid)	06	marks
5.	Chromatography	05	marks
6.	Spotting : Study of permanent slides of Parasites: 3 Comments on working Principles of pH meter / Calorimeter / centrifuge and Microscope:	10	marks
7.	Viva Voce	05	marks
8.	Sessional:	05	marks

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B.SC. B.ED

PAPER –I

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 - II

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. 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 9^{th} NCERT

18. Mathematics for Class 10^{th} 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.

Course Outline (Part I)

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: **Total Marks 100**

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.

(Format A)

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)

(Format B)

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**

***(Format* C)**

MENTOR'S EVALUATION REPORT OF TRAINEE

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

(Format D)

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.