

**Syllabus and Course Scheme**  
**Academic year 2018-19**



# **University of Kota**

**FACULTY OF EDUCATION**

## **SYLLABUS**

**Integrated Programme of**

**B.Sc.-B.Ed.**

**Examination Part- III (2019)**

**Four Years Integrated Course**  
**Scheme of B.Sc.-B.Ed. III Year**

Theory Paper	Course Code	Title of the Paper	Evaluation			Total
			External	Internal	Practical	

I	B.Sc.- B.Ed. 16	Elementary Computer Application (Compulsory)*	100	-	-	100
II	B.Sc.-B.Ed. 17	Language Across the Curriculum	80	20	-	100
IV	B.Sc.-B.Ed- 18(G-A)	Guidance and Counseling in School	80	20	-	100
V VI & VII	B.Sc.-B.Ed 19, 20 & 21 (G-B)	<b>Content (PCB &amp; PCM Group)(Select any Three)</b> 1. Chemistry(I,II,III) 2. Botany (I,II,III) 3. Zoology(I,II,III) 4. Physics (I,II,III) 5. Mathematics(I,II,III)	50+50+50 50+50+50 50+50+50 50+50+50 66+66+46	- - - - -	50 50 50 50 22	200 200 200 200 200
VIII	B.Sc.-B.Ed. 22(a,b)	Pedagogy of a School Subject (part-1) , Ist & IInd Year(candidate shall be required to offer any two papers from the following for part-1 & other for part-2). 1. General Science 2. Biology Physics 3. Chemistry 4. Mathematics 5. Physics	80	20		100
<b>Practicum</b>	B.Sc.-B.Ed. 23	<b>Special Training Programme</b> • Micro Teaching(5 Skills) • Simulated Teaching(5 Lessons) • Practice Lesson during Internship Teaching(4 Weeks 15 Lessons) • Observation of Teaching of Peer Group(5) • Technology Based Lessons(2 Lessons) • Criticism Lesson			10 10 50 05 10 15	100
		<b>Final Lesson</b>	<b>100</b>			100
						1100

\* ELIGIBILITY CRITERIAN ON PASSING MARKS BUT MARKS SHALL NOT BE INCLUDED IN DIVISION

# B.Sc.B.Ed. 16

## ELEMENTARY COMPUTER APPLICATIONS

Scheme:

Duration : 2 Hrs.

M.M.Pass Marks: 36

Theory : 100

**Multiple Questions-100 and Q.P. of four series for theory.** Each question shall carry 1 mark, with no negative marking. As such, 1 mark shall be awarded for the correct answer in each question. Note:

1. The marks secured in this paper shall not be counted in awarding the division to a candidate.
2. The candidate has to clear compulsory paper in four chances.
3. Non appearing or absent in the examination of compulsory paper will be counted a chance.

### Syllabus for compulsory paper of “Elementary Computer Applications”

1. **Introduction to Information Technology:** evolution and generation of computers, types of computers, micro, mini, mainframe and super computer, Architecture of a computer system: CPU, ALU, Memory (RAM, ROM families), cache memory, input/output devices, pointing devices. Development of Super Computers in India “PARAM”: History, Characteristics,  
  
Strength, Weakness and basic Architecture.
2. **Number system:** (Binary, octal, decimal and hexadecimal) and their inter-conversions, character codes (ASCII, EBCDIC and Unicode). Logic gates. Boolean Algebra, machine, assembly and high level language including 3 GL and 4 GL.
3. **Concept of Operating system:** types of operating systems, need of OS, batch processing, multi-processing, Single user & Multi user OS, distributed and time sharing operating systems, Process and memory management concept, Introduction to Unix, Linux, Windows, Windows NT systems and their simple commands.
4. **Internet:** Concepts, email services, world wide web, web browsers, search engines. Exploring various Citizen-centric services of Govt. of India such as Income Tax Services, Passport Seva, Ticket Booking(IRCTC & RSRTC), National Voters Service Portal, LPG service.
5. **Word processing packages:** standard features like tool bar, word wrap, text formatting, paragraph formatting. Effects to text, Mail-merge.
6. **Presentation packages:** Slide creation, slide shows, adding graphics, formatting, customizing and printing custom and animation.

7. **Computer networking:** Type of networks, LAN, MAN and WAN, concept of bridges and routers, gateways and modems. ISDN and leased lines, Teleconferencing and videoconferencing.
8. **Multimedia Technology:** Introduction, framework for multimedia devices, image compression standards, JPEG, MPEG and MIDI formats.
9. **Database Management Systems:** Data, field and records, information database, creation of a database file, insertion, deletion and updating of records, modifying structure, editing and browsing of records, searching, sorting and indexing of records, retrieving of records and report generation. Data processing in government organizations.
10. **E-commerce:** Concept of e-commerce, benefits and growth of e-commerce, security considerations and hazards of virus and other security risks, anti-virus software, electronic payment system. E-Commerce: An Indian perspective, Digilocker, attendance.gov.in, mygov.in, Swachh Bharat Mission, E-Hospital, National Scholarship portal, E-Sampark, UID, various modes of Digital payment of govt. of India.

**Note:** The theory Q. P. will carry 100 multiple choice questions of 1 mark each. Question paper of four series shall be printed. Duration of Question Paper shall be of two hours.

# **B.Sc.B.Ed. 17**

## **LANGUAGE ACROSS THE CURRICULUM**

### **Objectives:**

The student teacher will be able:

- To understand children's language background for effective teaching and learning.
- To create sensitivity to the language diversity that exists in the classroom
- To be familiar with theoretical issues, and to develop competence in analyzing current school practices and coming up with appropriate alternatives.
- To enhance the theoretical understanding of multilingualism in the classroom.
- To understand the nature of classroom discourse and develop strategies for using oral language in the classroom in a manner that promotes learning in the subject area.
- To understand the nature of reading comprehension in the content area and writing in specific content areas.
- To understand interplay of language and society.
- To understand function of language and how to use it as a tool.
- To understand language and speech disorder and make remedial measures too.

### **Unit-I : Language and Society:-**

1. Language – Introduction, types, components, linguistic skills and interrelationship between language and literacy.
2. Relationship of language and society: Identification, power and discrimination.
3. Nature of multilingualism: Managing multilingualism in classroom
4. Constitutional status of languages: Hindi, English, Regional languages
5. Language policy in Education

### **Unit- II : Language development**

1. Theories of language development and its implementation in teaching, psychological basis of language.
2. The home language and school language and teaching learning process, the power dynamics of the standard language as the school language Vs. home language on dialects.
3. Deficit theory and discontinuity theory of language and teaching –

learning process.

### **Unit-III : Language acquisition**

1. Understanding Hindi alphabets & it's logical & simple classification
2. Language acquisition and cognitive development, Learning languages with fun
3. Culture acquisition through language.

### **Unit-IV : Classroom and Language:-**

1. Understanding the nature of classroom, discourse, strategies for using and language in the classroom to promote learning in the subject area.
2. Tools for learning: Dictionary, Discussion, Natural exposition, Word puzzles
3. The nature of questioning in the classroom, Types of questions and teacher control.

### **Unit-V : Development of Reading and writing**

1. Nature of reading comprehension in the content area (Informational reading), nature of expository texts vs. narrative texts, transactional texts vs reflective texts.
2. Scheme theory, text structures , know how of examining content area of texts books.
3. Strategies for reading text book, children, note making, summarizing, making reading writing connections.
4. Process writing: Analyse children's writing to understand their conception, writing with a sense of purpose, writing to learn and understand.

### **Practicum/Field Work**

1. Narrate your first experience of first day for internship programme.
2. Collect a literary style poem of any language and critically analyse it diagnoses speech defects of primary level student and make a remedial strategy.
3. Prepare a list of at least 10 proverb of any language and interpret their cultural significance.
4. Collect a literary style poem of any language and analyse it.

### **Evaluation Procedure**

100 Marks

Any two practicum & one test

10=10 = 20 Marks

(Covering Unit I to V)

**Reference**

1. Agnihotri, R.K. (1995). Multilingualism as a classroom resource. In K. Heugh, A Siegruhn, & P. Pluddemann (Eds.) Multilingual education for South Africa 9pp. 3-&). Heinemann Educational Books.
2. Anderson, R.C. (1984). Role of the Reader's Schema in comprehension, learning and memory. In R. C. Anderson, J. Osborn, & R.J. Tierney (Eds.), Learning to read in American Schools: Basad readers and Content texts. Psychology Press.
3. Eller, R.G. (1989). Johnny can't talk, either: The perpetuation of the deficit theory in classrooms. *The Reaing Teacher*, 670-674.
4. Erlwanger, S. H. (1973). Benny's conception of rules and answers in IPI Mathematics. *Journal of children's Mathematical Behavior*, 1(2), 7-26 University of Kota, Kota 30
5. Grellet, f. (1981). Developing reading skills: A practical Gude to reading comprehension exercises. Cambridge University Press.
6. Ladson-Billings. G. (1995). Toward a Theory of Culturally Relevant Pedagogy. *American Educational research journal*. 32(3), 465-491.
7. NCERT. (2006d) Position Paper National Focus Group on teaching of Indian language (NCF- 2005). New Delhi: NCERT.
8. Sankhla, Arjun Singh, (2013) Hindi Bhasha Shikshan aur Praveenta, Arihant Shiksha Prakashan Jaipur.
9. Thwaite, A. & Rivalland, J.(2009) How can analysis of classroom Taks help teachers reflect on their practices? *Australian Journal of Language and Literacy*, the 32(1) 38

# **B.Sc.B.Ed. 18**

## **GUIDANCE AND COUNSELLING IN SCHOOL**

**MARKS- 100**

### **OBJECTIVES:-**

The course will enable the student teachers to –

- Understand the concept, need and meaning of guidance.
- Get acquainted with the principles, issues, problems and procedure of guidance.
- Develop understanding about the role of school in guidance.
- Understand the various areas, tools and techniques in guidance.
- Understand the concept, need and meaning of counseling.
- Get acquainted with the principles and process of counseling.
- Understand the tools and techniques in counseling.

### **UNIT 1. GUIDANCE IN SCHOOL**

- Concept, Need and Meaning of Guidance.
- Principles of Guidance.
- Procedure of Guidance (steps).
- Issues and problems of Guidance.
- Role of school in Guidance.

### **UNIT 2. AREAS, TOOLS AND TECHNIQUES IN GUIDANCE.**

- Personal, Educational and vocational Guidance.
- Tools :- Records of students.
- Rating scale.
- Psychological tests.
- Questionnaire and Inventories.
- Techniques in Guidance (a) Observation, (b) Interview, (c) Sociometry.

### **UNIT 3. COUNSELLING IN SCHOOL**

- Concept, Need and Meaning of Counseling.
- Principles of Counseling.
- Counseling Process and Role.
- Directive, Non-Directive and Eclectic counseling.
- Qualities and role of a school counselor.

### **UNIT 4. TOOLS AND TECHNIQUES IN COUNSELING**



- Individual counseling and Group counseling.
- Lectures, discussions and Dramatics as techniques in counseling.
- Importance of follow-up in counseling.
- Counseling for the children with special needs.
- Counseling for parents.

## **UNIT 5. GUIDANCE AND COUNSELING FOR SPECIAL NEEDS**

### **POPULATION GUIDANCE OF CHILDREN WITH SPECIAL NEEDS**

- Problems and needs.
- Guidance of the gifted and creative students.
- Guidance of under achiever.
- Slow learning and first generation learners.
- Guidance of learning disabled, Drug addicts and alcoholics.
- De addiction centers, Career resource centre.
- Evaluation of counseling, Need for research and reforms in guidance and counseling.

### **Tasks and Assignments**

- |               |          |
|---------------|----------|
| 1. Class Test | 10 Marks |
| 2. Any one    | 10 Marks |

- Interview of a school counselor.
- Visit to a guidance or counseling centre and write a report.
- Administration of an individual test and preparing a report.

### **References:-**

1. Anastasi A, Differential Psychology, New Youk: Macmillan Co, 1996
2. Arbuckle Dugland, Guidance and Counselling in the classroom, Allyn & Bacon Inco, 1985.
3. Baqrki. B.G., Mukhopadhyaya. B., Guidance and Counselling; A Manual, New Delhi: Stanley Publishers, 1990.
4. Crow & Crow, An introduction to Guidance, New Delhi: Eurasia Publishing House, 1992.
5. Freeman E.S., Theory and Practice of Psychological Testing, New Delhi: Henry Holt 1992.
6. Jones. A.J., Principles of Guidance, New Delhi: McGrew Hills Publishers, 1970.
7. Kochhar S.K., Educational and vocational Guidance in secondary schools, New Delhi, sterling publishers Pvt. Ltd., 1990.
8. Kolher. S.K., Educational and Vocational Guidance, New Delhi: Practice Hall India Ltd., 1995.
9. NCERT, Guidance and Counseling in Indian Education, New Delhi: NCERT, 1978.

# B.Sc.B.Ed. 19,20&21

## Chemistry

### Paper-I : Inorganic Chemistry

**Duration: 3 Hrs.**

**Max. Marks: 50**

Note: The question paper will contain three sections as under –

**Section-A :** One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part.

Total marks : 05

**Section-B :** 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words.

Total marks : 25

**Section-C :** 04 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted.

Total marks : 20

#### **Unit-I 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, theoretical basis of hardness and softness, electronegativity and hardness and softness.

#### **Unit-II 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.

**Magnetic Properties of Transition Metal Complexes:** Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula, L-S coupling, correlation of  $n_s$  and  $n_{eff}$  and values, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes.

### Unit-III Electronic Spectra of Transition Metal Complexes:

Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series, Orgel-energy level diagram for  $d^1$  and  $d^2$  states, discussion of the electronic spectrum of  $[(Ti(H_2O)_6)]^{3+}$  complex.

**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.

### Unit IV Organometallic Chemistry:

Definition, nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyl and aryls of Li, Al, Hg, Sn and Ti. A brief account of metal ethylenic complexes and homogeneous hydrogenation. mononuclear carbonyls and the nature of bonding in metal carbonyls.

### Unit-V Bioinorganic Chemistry:

Essential and trace elements in biological processes. metalloporphyrins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to  $Ca^{+2}$  and  $Mg^{+2}$ . Nitrogen fixation.

**Silicones and Phosphazenes:** Silicones and phosphazenes as examples of inorganic polymers. nature of bonding in triphosphazenes.

#### Books Suggested :

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 Inorganic Chemistry* B.Douglas. D.McDaniel and J.Alexander, John Wiley.
4. *Inorganic Chemistry*. D.E. Shriver P.W. Atkins and C.H. Langfor, Oxford.
5. *Inorganic Chemistry*, W.W. Porterfield Addison Wesley.
6. *Inorganic Chemistry*, A.G. Sharpe. ELBS.
7. *Inorganic Chemistry*, G.L. Miessler and D.A. Tarr, Prentice Hall.
8. *Group Theory and Its Chemical Applications* : P. K. Bhattacharya
9. *Inorganic Chemistry: J. E. Huysse, Principles of Structure & Reactivity*, 3<sup>rd</sup> Ed.
10. *Selected Topics in Inorganic Chemistry* : W. U. Malik, G. D. Tuli and R. Madan
11. *Principles of Inorganic chemistry* : D. Banerje
12. *Modern Aspect of Inorganic Chemistry* : H. J. Emeleus and A. G. Sharpe

## Paper-II : Organic Chemistry

**Duration: 3 Hrs.**

**Max. Marks: 50**

Note: The question paper will contain three sections as under –

**Section-A :** One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part.

Total marks : 05

**Section-B :** 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words.

Total marks : 25

**Section-C :** 04 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted.

Total marks : 20

### **Unit-I Spectroscopy:**

**Nuclear Magnetic Resonance (NMR) Spectroscopy:** Nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constant, areas of signals. Interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromoethane, ethyl acetate, toluene and acetophenone. Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and PMR spectroscopic techniques.

### **Unit-II Organometallic Compounds:**

Organomagnesium Compounds: The Grignard reagents-formation, structure and chemical reactions. Organozinc Compounds: Formation and chemical reactions.

Organolithium compounds: Formation and chemical reactions. Organosulphur compounds: Nomenclature, structural features, methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides and sulphaguanidine.

### **Unit-III Heterocyclic Compounds:**

Introduction, Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.

Introduction to condensed five and six-membered heterocycles. Preparation and reactions of indole, quauinoline and isoquinoline with special reference to Fisher-Indole synthesis, Skraup's synthesis and Bischler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.

## Unit-IV Organic Synthesis via Enolates:

Acidity of  $\alpha$ -hydrogens. alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate. Alkylation of 1,3-dithianes. Alkylation and acylation of enamines  
**Carbohydrates:** Classification and nomenclature. monosaccharides: mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses, configuration, erythro and threo diastereomers, conversion of glucose into mannose, formation of glycosides, ethers and esters, determination of ring size, cyclic structure of D(+) glucose, mechanism of mutarotation, structure of ribose and deoxyribose. An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

## Unit-V Amino Acids, Peptides, Proteins and Nucleic Acids:

Classification, structure and stereochemistry of amino acids. Acid-base behaviour, isoelectric point and electrophoresis. Preparation and reactions of  $\alpha$ -amino acids. Structure and nomenclature of peptides and proteins. Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical peptide synthesis, solid phase peptide synthesis. Structures of peptides and proteins, Levels of protein structure, Protein denaturation/renaturation.

**Nucleic Acids:** Introduction. constituents of nucleic acids. Ribonucleosides and ribonucleotides. The double helical structure of DNA.

**Fats, Oils and Detergents:** Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value, soaps, synthetic detergents, alkyl and aryl sulphonates. **Synthetic Polymers:** Addition or chain-growth polymerization. Free radical vinyl polymerization, ionic vinyl polymerization, Ziegler-Natta polymerization and vinyl polymers. Condensation or step growth polymerization. Polyesters, polyamides, phenol formaldehyde resins, urea formaldehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers.

**Synthetic Dyes:** Colour and constitution (electronic concept), classification of dyes. Synthesis of methyl orange, Congo red, malachite green, crystal violet, phenolphthalein, fluorescein, alizarin and Indigo.

### Books Suggested :

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. Mukerji, S.P. Singh and RP. Kappor, Wiley Eastern Ltd. (New Age International)*

5. *Organic Chemistry, F.A. Carey, McGraw Hill, Inc.*
6. *Introduction to Organic Chemistry. Streitwieser, Heathcock and Kosover. Macmillan.*
7. *Organic Chemistry (Vol. I & II) : S. M. Mukherji, S. P. Singh and R. P. Kapoor, Wiley Eastern Ltd.*
8. *A Text Book of Organic Chemistry (Vol. I & II) : K. S. Tiwari, S. N. Mehrotra & N. K. Vishnoi*
9. *Organic Chemistry : M. K. Jain and S. Sharma*
10. *A Text Book of Organic Chemistry (Vol. I & II) : O. P. Agarwal*
11. *A Text Book of Organic Chemistry : R. K. Bansal*
12. *Organic Chemistry (Vol. I & II) : I. L. Finar*
13. *Organic Reaction and Their Mechanisms : P. S. Kalsi*
14. *Introduction of Petrochemicals : Sukumar Maiti,*
15. *Organic Chemistry : P. L. Soni*
16. *A Text Book of Organic Chemistry: V. K. Ahluwalia and Maduri Foyal, Narosa Publishing House Pvt. Ltd.*

### Paper-III : Physical Chemistry

Duration: 3 Hrs.

Max. Marks: 50

Note: The question paper will contain three sections as under –

**Section-A :** One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part.

Total marks : 05

**Section-B :** 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words.

Total marks : 25

**Section-C :** 04 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted.

Total marks : 20

#### Unit-I Elementary Quantum Mechanics:

Black-body radiation, Planck's radiation law, photoelectric effect, heat capacity of solids, Bohr's model of hydrogen atom (no derivation) and its defects. Compton effect.

Luis De Broglie hypothesis, Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box. Schrodinger wave equation for H-atom. separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.

## Unit-II Molecular Orbital Theory:

Basic ideas, criteria for forming MO from AOs, construction of MO's of  $H_2^+$  ion by LCAO, calculation of energy level from wave functions, physical picture of bonding and anti-bonding wave functions, concept of  $\sigma$ ,  $\sigma^*$ ,  $\pi$ ,  $\pi^*$  orbitals and their characteristics. Hybrid orbitals- $sp$ ,  $sp^2$ ,  $sp^3$ . calculation of coefficients of AO's used in these hybrid orbitals. Introduction to valence bond model of  $H_2$ , comparison of MO and VB models.

## Unit-III Spectroscopy:

Introduction, electromagnetic radiation, spectrum, basic features of different spectrometers, statement of the Born-Openheimer approximation, degrees of freedom. **Rotational Spectrum:** Diatomic molecules, energy levels of a rigid rotator (semi-classical principles), selection rules, spectral intensity, using population distribution (Maxwell-Boltzmann distribution) determination of bond length, qualitative description of non-rigid rotator, isotope effect.

**Vibrational (Infrared) Spectrum:** Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies. effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.

**Raman Spectrum:** Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.

**Electronic Spectrum:** Concept of potential energy curves for bonding and anti-bonding molecular orbitals, qualitative description of selection rules and Frank-Condon principle. qualitative description of  $\sigma$ ,  $\pi$  and n MO their energy levels and the respective transitions.

## Unit-IV Photochemistry:

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

## Unit-V Physical Properties and Molecular Structure:

Optical activity, polarization (Cauchy-Mossotti equation), orientation of dipoles in an electric field, dipole moment, induced dipole moment, measurement of dipole moment-temperature method and refractivity method. Dipole moment and structure of molecules. Magnetic properties-paramagnetism, diamagnetism and ferromagnetics.

**Solutions, Dilute Solutions and Colligative Properties:** Ideal and non-ideal solutions, methods of expressing concentrations of solutions, activity and activity coefficient.

**Dilute Solutions:** Colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, determination of molecular weight from osmotic pressure. Elevation of boiling point and depression in freezing point. Experimental methods for determining various colligative properties. Abnormal value and abnormal molar mass, degree of dissociation and association of solutes.

### Books Suggested :

1. *Physical Chemistry*, G.M. Barrow. International Student Edition, McGraw Hill.
2. *Basic Programming with Application*, V.K. Jain. Tata McGraw Hill.
3. *Computers and Common Sense*. R Hunt and Shelly, Prentice Hall.
4. *University General Chemistry*, C.N.R Rao, Mac Millan.
5. *Physical Chemistry*, R.A. Alberty, Wiley Eastern Ltd.
6. *The elements of Physical Chemistry*, P.W. Atkins, Oxford.
7. *Physical Chemistry Through problems*, S.K. Dogra and S. Dogra, Wiley Eastern Ltd.
8. *Principles of Physical Chemistry* : B. R. Puri Sharma and M. S. Pathania
9. *A Text Book of Physical Chemistry* : A. S. Negi and S. C. Anand
10. *A Text Book of Physical Chemistry* : Kundu and Jain

## Paper-IV : Chemistry Practical

Laboratory Course :	120 Hrs. (4 Hrs. /Week)
Practical Examination	5 Hrs.
Min. Pass Marks: 18	Max. Marks: 50



### Distribution of Marks :

(i)	Inorganic Chemistry Experiment (two experiments) -	14 (7+7)
(ii)	Organic Chemistry Experiment (two experiments) -	14 (7+7)
(iii)	Physical Chemistry Experiment	- 12
(iv)	Practical Record (for regular students only)	- 05
(v)	Viva-voce (for regular students)	- 05

### Inorganic Chemistry

#### Synthesis and Analysis

- Preparation of sodium trioxalato ferrate (III).  $\text{Na}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$  and determination of its composition by permagnometry.
- Preparation of Ni-DMG complex  $[\text{Ni}(\text{DMG})_2]$ .
- Preparation of copper tetraammine complex  $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$ .
- Preparation of cis-and trans-bisoxalatodiaquachromate (III) ion.

#### Instrumentation

- Colorimetry - Job's method and Mole-ratio method.
- Adulteration - Food stuff.
- Effluent analysis - water analysis.
- Solvent Extraction - Separation and estimation of Mg(II) and Fe(II)
- Ion Exchange Method - Separation and estimation of Mg(II) and Zn(II)

#### Volumetric Analysis

- Iodimetric & Iodimetric titrations.

### Organic Chemistry

Two experiments one from each section:

#### Section-A

##### Laboratory Techniques:

**(i) Steam Distillation:**

- Naphthalene from its suspension in water.
- Clove oil from Clove
- Separation of o-and p-nitrophenols

**(ii) Column Chromatography:**

- Separation of fluorescein and methylene blue.
- Separation of leaf pigments from spinach leaves.
- Resolution of racemic mixture of (Z)-mandelic acid.

**Qualitative Analysis:**

Analysis of an organic mixture containing two solid components using water,  $\text{NaHCO}_3$ ,  $\text{NaOH}$  for separation and preparation of suitable derivatives.

**Section-B**

**Synthesis of Organic Compounds**

- Acetylation: Salicylic acid, aniline, glucose and hydroquinone.
- Benzoylation: Aniline and phenol.
- Aliphatic Electrophilic Substitution: Preparation of Iodoform from ethanol and acetone.
- Aromatic Electrophilic Substitution:
  - Nitration:  
  
Preparation of m-dinitrobenzene,  
Preparation of p-nitroacetanilide
  - Halogenation :  
  
Preparation of p-bromoacetanilide  
Preparation of 2,4,6-tribromophenol.
- Diazotization/coupling: Preparation of methyl orange and methyl red.
- Oxidation: Preparation of benzoic acid from toluene.
- Reduction: Preparation of aniline from nitrobenzene and m-nitroaniline from m-dinitrobenzene.
- R and S configuration of optical isomers.

- E and Z configuration of geometrical isomers.
- Conformational analysis of cyclohexanes and substituted cyclohexanes.

### Section-C

Organic estimation: Amino group, phenolic group, carboxylic acid group and glucose.

## Physical Chemistry

### Electrochemistry

- 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.
- To determine the ionization constant of a weak acid conductometrically.
- To titrate potentiometrically the given ferrous ammonium sulphate solution using  $\text{KMnO}_4$  /  $\text{K}_2\text{Cr}_2\text{O}_7$  as titrant and calculate the redox potential of  $\text{Fe}^{2+}/\text{Fe}^{3+}$  system on the hydrogen scale.
- To verify law of refraction of mixtures for e.g. of glycerol and water) using Abbe's refractometer.
- To determine the specific rotation of a given optically active compound.

### Molecular Weight Determination

- Determination of molecular weight of a non-volatile solute by Rast method / Beckmann freezing point method.
- Determination of the apparent degree of dissociation of an electrolyte (e.g. NaCl) in aqueous solution at different concentrations by ebulliscopy.

### Colorimetry

- To verify Beer-Lambert law  $\text{KMnO}_4$  /  $\text{K}_2\text{Cr}_2\text{O}_7$  and determine the concentration of the given solution of the substance.

**Books Suggested (Laboratory Courses):**

1. *Vogel's Qualitative inorganic analysis, revised, SveWa, Orient Longman.*
2. *Vogel's Text Book of Quantitative Inorganic Analysis (revised), J. Bassentt. RC. Deney G.H. Jeffery and J.*

Mendham. ELBS.

3. *Standard methods of chemical Analysis. W.W. Scott. The technical Press.*
4. *Experimental Inorganic Chemistry, W.G. Palmer, Cambridge.*
5. *Handbook of Preparative Inorganic Chemistry. Vol I & II, Braver, Academic Press.*
6. *Inorganic Synthesis, McGraw Hill.*
7. *Experimental Organic Vol I & II, P.R Singh, D.S. Gupta and K.S. Bajpai, Tata McGraw Hill.*
8. *Laboratory manual in Organic Chemistry, RK. Bansal, Wiley Eastern.*
9. *Vogel's Text Book of Practical Organic Chemistry, B.S. Furniss, A.J. Hannaford, V.Rogers, P.W.G. Smith and A.R Tatchell, ELBS.*
10. *Experiments in General Chemistry, C.N.R Rao and U.c. Agarwal, East-West Press.*
11. *Experiments in Physical Chemistry, RC. Das and B.Behra, Tata McGraw Hill.*
12. *Advanced Experimental Chemistry, Vol I Physical, J.N. Gurtu and R Kappor, S Chand & Co.*
13. *Selected Experiments in Physical Chemistry, N.G. Mukerjee, J.N. Ghose & Sons.*
14. *Experiments in Physical Chemistry, J.C. Ghosh, Bharati Bhavan.*
15. *Practical Chemistry: Giri Bajpai and Pandey, S. Chand & Co. Ltd., New Delhi*

## **Chemistry Practical Examination**

### **Inorganic Chemistry:**

Synthesis an analysis of one of the four syntheses given in the syllabus.

1. Separation and estimation of Mg (II) and Fe (II) by solvent extraction method. Or  
Separation and estimation of Mg (II) and Fe(II) by ion exchange method.

### **Organic Chemistry:**

ynthesis of one of the six organic preparations

1. Analysis of an organic mixture containing two solid components using water, NaHCO<sub>3</sub>, NaOH an preparation of suitable derivatives.

Or

Column chromatography techniques:

Perform one of the three column chromatography experiments.

### **Physical Chemistry:**

1. Perform one of the nine physical chemistry experiments given in the syllabus.

## Botany

### Scheme:

Paper	Nomenclature	Duration	Max. Marks	Min. Marks
Paper-I	PLANT PHYSIOLOGY & BIOCHEMISTRY	3 Hrs.	50	
Paper-II	ECOLOGY & PHYTOGEOGRAPHY	3 Hrs.	50	54
Paper-III	BIOTECHNOLOGY & UTILIZATION OF PLANTS	3 Hrs.	50	
Practical (One)		5 Hrs.	50	18

### Paper – I - PLANT PHYSIOLOGY AND BIOCHEMISTRY

**Duration 3 hrs.**

**Max. Marks 50**

**Note:** The question paper will contain three sections as under –

Section-A :	One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part.	Total marks : 05
Section-B :	10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words.	Total marks : 25

Section-C : 04 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted. Total marks : 20

### **Unit – 1**

Plant water relations : importance of water to plant life, physical properties of water diffusion and osmosis, absorption, transport of water and transpiration.

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

Transport of organic substances : Mechanism of phloem transport source sink relationship, factors affecting translocation.

### **Unit – II**

Photosynthesis : Significance, historical aspects, photosynthetic pigments, action spectra and enhancement effects, concept of two photo systems, z-scheme. Photophosphorylation, C-3 & C-4 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.

Basics of enzymology : Discovery and nomenclature characteristics of enzymes, concept of enzyme, apo enzyme and cofactors, regulation of enzyme activity, mechanism of action.

### **Unit – IV**

Nitrogen and lipid metabolism : Biology of nitrogen fixation, importance of nitrate reductase and its regulation, ammonium assimilation, structure and function of lipids, fatty acid

biosynthesis,  $\alpha$  &  $\beta$  oxidation, saturated and un saturated fatty acids, storage and mobilization of fatty acids.

### Unit – V

Growth and Development : Definitions, phases of growth and development, kinetics of 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, plants hormones auxins, gibberellins, cytokinins, abscissic acid, ethylene, history of their discovery, biosynthesis and mechanism of actions photomorphogenesis, phytochromes and cytochromes, their discovery, physiological role and mechanism of action.

## Paper – II - ECOLOGY AND PHYTOGEOGRAPHY

**Duration 3 hrs.**

**Max. Marks 50**

**Note:** The question paper will contain three sections as under –

Section-A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in

20 words for each part.

Total marks : 05

Section-B : 10 questions, 2 questions from each unit, 5 questions to be attempted, taking

one from each unit, answer approximately in 250 words. Total marks : 25

Section-C : 04 questions (question may have sub division) covering all units but not more

than one question from each unit, descriptive type, answer in about 500 words,

2 questions to be attempted.

Total marks : 20

### Unit – I

Plant 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.

### Unit – II

Morphological, anatomical and physiological responses of plants to water: hydrophytes, xerophytes and halophytes, temperature, light (heliophytes and sciophytes) and salinity.

### **Unit – III**

Community ecology : Community characteristics, (analytical and synthetic). Ecological succession. (Hydoasere, lithosere, psammosere) , concept of climax.

### **Unit – IV**

Ecosystems : structure, abiotic and biotic components, food chain, food web, ecological pyramids, energy flow, biogeochemical cycles carbon, water, nitrogen and phosphorus.

### **Unit – V**

Biogeographical regions of India, vegetation types of India: Forests and grassland with particular reference to Rajasthan. Environmental pollution – Air, Water and Soil. WWF, Chipko movement, green house effect. Introduction to Climate change, Carbon sequestration, energy and environment, clean development mechanism (CDM).

## **Paper – III - BIOTECHNOLOGY AND UTILIZATION OF PLANTS**

**Duration 3 hrs.**

**Max. Marks 50**

**Note:** The question paper will contain three sections as under –

Section-A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. Total marks : 05

Section-B : 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words. Total marks : 25

Section-C : 04 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, answer in about 500 words,

2 questions to be attempted.

### **Unit – I Biotechnology**

Genetic Engineering : Tools and techniques of recombinant DNA technology, cloning vectors; genomic and C-DNA library, transposable element, techniques of gene mapping and chromosome walking, genetic transformation and production of bioactive molecules Basic



concept of metabolic engineering, improvement of biosynthesis and accumulation of bioactive immobilization, elicitation, transgenic plants.

## Unit – II

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.

## Unit – III Utilization of Plants

**Food Plants** : Rice, wheat, maize, bajra, potato, sugarcane, (History origin & distribution), morphology, climate & soil, cultivation, preparation improved varieties, user & crop protection.

**Vegetable Oils** : Groundnut, mustard and coconut, volatile oils, Fatty oils, classification of vegetable oils, History, origin and distribution, extraction of vegetable oils, Morphology of plant, cultivation varieties.

## Unit – IV

**Fibers** : Cotton and Jute, classification of fibers, History and origin, Important fibers and their source, Distribution, Types, Climate and Soils. Cultivation, processing, characters, Improved varieties.

General account of sources of firewood, timber and bamboos. Structure and characters of wood, Important source of Timber wood, characters, plantation of fire wood, Botanical characteristics of bamboo, climate and soil, uses, diseases and insect pests.

Rubber & Hydrocarbon yielding plants – Calotropis. Euphorbia, History of Rubber, properties of Rubber, Types of Rubber, cultivation of plant, extraction and processing, uses.

## Unit – V

**Spices** : General account Clove, black pepper, Dalchini, Cardamon.

**Medicinal Plants:** General account, Withania, Rauwolfia, Cinchona, Azadirachta & Aloe, Ephedra, Taxus, Chlorophytum.

**Beverages** : Tea and Coffee.

## Practical Exam.

## Marks Distribution

S.No.	Distribution of Marks	Regular
1.	a. Plant Physiology	08
	b. Phytochemical test	03
2.	Ecology	
	a. Adaptation Study	02
	b. Field Work (Quadrat Study)	03
	c. Soil / Water Test	02
3.	a. Biotechnology exercise	05
	b. Utilization of plants	03
4.	Spots 5x3	15
5.	Viva-Voce	05
6.	Record	04
	(Including specimens of economic plants)	
		<b>50</b>

## Botany      Practical

Time: 5 Hrs.

Maximum Marks: 50

Minimum Marks: 18

### Physiology:

1. To study the permeability of plasma membrane using different concentration of organic solvents.
2. To study the effect of temperature on permeability of plasma membrane.
3. To study of effect of toxic substances on permeability of plasma membrane.
4. To demonstrate the phenomenon of the osmosis by the use of potato osmometer.
5. To study the phenomenon of plasmolysis and deplasmolysis using Tradescantia / Rhoeo discolor leaves and different concentrations of sugar.
6. To study the protoplasmic streaming (In Hydrilla / vallisnaria)
7. To demonstrate the rate of transpiration by use of potometers (Ganong's/Farmers)
8. To study the relative rate of transpiration from the leaf surfaces of the different plants using cobalt chloride paper.
9. To demonstrate that oxygen is evolved during the photosynthesis by inverted funnel method.
10. To demonstrate that light is necessary for photosynthesis.
11. To demonstrate the effect of different wavelengths of light during the photosynthesis.
12. To demonstrate the carbon-dioxide, light, water and chlorophyll are essential for photosynthesis by moll's experiment.
13. To compare the rate of photosynthesis under different condition by using wilmott's bubbler.
14. comparison of the rate of respiration (R.Q.) of various plant parts or substrates with the help of Ganong's respirometer.
15. Separation of chlorophyll pigments by the paper chromatography.

### **Biochemistry:**

1. To study the activity of catalase, peroxidase dehydrogenase enzymes in plant tissues.

2. Phytochemical test for starch, sugars, protein, fats, tannins, Anthocyanin.

### **Biotechnology :**

1. Introduction of the instruments/techniques laminar air flow/ sterile bench and autoclave
2. Preparation of M.S and P.D.A. culture media, slant preparation.
3. Demonstration of inoculation techniques, aseptic transfer of explants and microbial transfer technique
4. Demonstration of the technique of micropropagation by using different explants e.g., axillary buds, shoot meristem

### **Ecology:**

1. To determine minimum size of quadrat for phytosociological studies of herbaceous plants.
2. To determine frequency of the herbaceous species by quadrat method.
3. To determine density and abundance of the herbaceous flora by quadrat method.
4. Soil analysis/Field test
  - (a) Soil Texture
  - (b) Soil moisture
5. To determine water holding capacity of soil of grass land or wood land
6. To determine the pH of given soil samples.
7. To demonstrate the presence of carbonate and chloride in different water samples/soil samples.

### **Ecological adaptations:**

8. Morphological & Anatomical adaptations in some hydrophytes & xerophytes: (Specimens/slides/section cutting) Hydrilla, Typha, Eichhornia, opuntia, Euphorbia, Capparis, Casurin, Nerium, Calotropis
9. Ecological instruments and their working

### **Economic Botany:**

1. Microchemical tests for – Lignin, Cellulose, Cutin, Suberin, Starch, Sugar, Protein and Oil in plant tissues.
2. Microscopic examination of starch grains of wheat, maize Rice and Potato.

#### Utilization of plants

13. Food plants – Wheat, Maize, Rice, Potato, Sugarcane
14. Fibres – Cotton, Jute
15. Vegetable oils – Ground nut, mustard and coconut
16. A general account of the fire wood, timber yielding plants and Bamboos
17. Spices and condiments – Clove, Black pepper, Cinnamon, Cardamom.
18. Medicinal Plants – Rauwolfia, Withania, Cinchona, Papaver, Ocimum, Datura, Ephedra, Taxus, Aloe, Azadirachta
19. Beverages – Tea, Coffee
20. Rubber – Ficus elastica, Hevea

Viva-Voce

## ZOOLOGY

Paper	Duration	Max.Marks	Min. Marks
I. Animal Diversity(Part-III , Vertebrates) and Evolution	3 Hours	50	18
II. Mammalian Physiology and Immunology	3 Hours	50	18
III. Developmental Biology	3 Hours	50	18
Practical	5 Hours	50	18

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# PAPER-I: ANIMAL DIVERSITY

## (PART-III:VERTEBRATES) AND EVOLUTION

**Duration: 3 Hours**

**M.M: 50**

The question paper comprises of three sections , 'A', 'B' and 'C'

Section-A: The candidates will attempt all the ten parts of Q. No.1 (consisting of two questions from each unit) in about 20 words (1/2 X 10 = 5 marks).

Section- B: The candidates will attempt five questions, selecting one question from each unit, answer in about 250 words (5 X 5 = 25 marks).

Section-C: The candidates will attempt any two questions out of four, answer in 500 words (10 X 2 = 20 marks).

### UNIT-I Cyclostomata and Pisces

- Origin, ancestry and diversity of vertebrates.
- Cyclostomata: Classification and characters with suitable examples. *Petromyzon*: General morphology and Ammocoete larva.
- Pisces-I: Classification and characters with suitable examples; differences between cartilagenous and bony fishes; *Latimaria*; Dipnoans.
- Pisces-II: General morphology of *Scoliodon* and *Labeo rohita*; types of scales and caudal fin; electric organs, air bladder; aquatic adaptations in fishes.
- Pisciculture: Introductory knowledge of Pisciculture; important fresh water and marine fishes as food.

### UNIT-II Tetrapoda

- Amphibia: Classification and characters with suitable examples, adaptations for amphibious life, neoteny and paedogenesis.
- Reptilia: Classification and characters with suitable examples, difference between lizards and snakes, identification of poisonous and non- poisonous snakes, biting mechanism in snakes, snake venom; Dinosaurs, *Sphenodon*.
- Aves: General classification and characters with important examples; difference between Ratitae and Carinatae; flight muscles, flight mechanism, flight adaptations, perching mechanism, migration, *Archaeopteyx* as a connecting link.

- Mammalia-I: Classification and characters with suitable examples; oviparity; ovoviviparity and viviparity in mammals.
- Mammalia-II: Dentition; adaptive radiation; convergent evolution of placental and Australian mammals.

### **UNIT-III Comparative Anatomy of Vertebrates-I**

Comparative anatomy of the following organ systems of *Scoliodon*, *Rana*, *Uromastix / Varanus*, *Collumba* and *Oryctolagus*:

- Integument and integumentary derivatives.
- Alimentary canal and accessory digestive glands.
- Respiratory organs.
- Heart, aortic arches and their evolution.
- Comparative structure and evolution of urinogenital system (pro, meso and metanephric kidney and genital ducts in males and females).

### **UNIT-IV Comparative Anatomy of Vertebrates-II**

Comparative anatomy of the organ systems of *Scoliodon*, *Rana*, *Uromastix / Varanus*, *Collumba* and *Oryctolagus* and miscellaneous:

- Brain and cranial nerves, evolution of brain, spinal cord and ANS.
- Osteology: Girdles, limb bones, ribs and sternum; jaw suspension in vertebrates.
- Comparative anatomy of eye.
- Membranous labyrinth; sound production; hearing; Echolocation in bats.
- Parental care in vertebrates.

### **UNIT-V Evolution**

- Basics and origin of life: Definition, pre-darwinian theories of evolution; Oparin-Haldane concept of origin of life; Miller-Urey experiment; molecular evolution of RNA, proteins and DNA; characters of coacervates.
- Micro-evolution: Work and theories of Lamarck, Weisman and Darwin; theory of natural selection of Darwin and Wallace, industrial melanism, DDT resistance in mosquitoes; neo-darwinism.

- Evidences of evolution: Various evidences favouring evolution: Homology, analogy, vestigial organs; palaeontological, embryological, biogeographical and biochemical evidences; adaptive radiations, mimicry.
- Genetic basis of evolution and speciation :  
Hardy-Weinberg law, gene frequency, genetic drift, factors affecting Hardy-Weinberg law, Founder effect, bottle neck effect, Sewall -Wright effect; speciation; role of various isolating mechanisms in speciation.
- Macro-evolution: Geological time scale and imperfection of geological record, types of fossils and fossilization, continental drift, extinction, replacement; human evolution.

## **PAPER-II: MAMMALIAN PHYSIOLOGY AND IMMUNOLOGY**

**Duration: 3 Hours**

**M.M: 50**

The question paper comprises of three sections , 'A', 'B' and 'C'

- Section-A: The candidates will attempt all the ten parts of Q. No.1 (consisting of two questions from each unit) in about 20 words (1/2 X10 = 5 marks).
- Section- B: The candidates will attempt five questions, selecting one question from each unit, answer in about 250 words (5 X 5 = 25 marks).
- Section-C: The candidates will attempt any two questions out of four, answer in 500 words (10 X 2 = 20 marks).

### **UNIT-I Physiology**

- Digestion:
  - a. Nutrients: Carbohydrates, lipids, proteins, vitamins.



- b. Digestive enzymes and hormones of GIT.
  - c. Digestive mechanism: Mechanical and chemical digestion.
  - d. Absorption and assimilation of end products of digestion.
  - e. Balanced diet, malnutrition (PEM), obesity; endoscopy.
- Respiration:
    - Aerobic and anaerobic respiration.
    - Structure of respiratory organs.
    - Mechanism and regulation of breathing.
    - Transport of O<sub>2</sub> and CO<sub>2</sub>.
    - Respiratory disorders: Emphysema, asthma, occupational disorders, spirometry.

## **UNIT-II Physiology**

### 2. Circulation:

Circulatory fluids: Blood, lymph; blood cells; structure of haemoglobin.

Blood circulation through heart, arteries, arterioles, capillaries, venules and veins.

Cardiac cycle and its regulation.  
Blood clotting mechanism, blood pressure.

Cardiac disorders, ECG, heart transplantation (an introductory idea).

### 3. Excretion:

Excretory products: NH<sub>3</sub>, urea, uric acids, amino acids.  
Structure of kidney, nephron; mechanism of urine formation; micturition.

Autoregulation, counter-current mechanism, renin-angiotensin system.

Accessory excretory organs: Skin, liver, lungs etc.

Excretory disorders, dialysis, Kidney transplant.

## **UNIT-III -Physiology**

### 16. Muscle and Neural Physiology:

Structure of smooth, skeletal and cardiac muscles; myofibrils.

Isotonic and isometric contraction of muscles, sliding- filament theory of muscle contraction; relaxation of muscle fibres; Properties of muscles (muscle twitch, fatigue, summation, treppe, tetanus, rigor mortis), myopathy.

Kinds of neuron, structure of myelinated and nonmyelinated nerve fibres.

Origin and propagation of nerve impulse through different types of neurons and synapse.

Reflex action, types.

17. Sensory Physiology:

Tactile receptors, pain receptors, thermoreceptors, chemoreceptors.

Structure of human eye; image formation and colour vision.

Eye disorders, lenses used in eye care.

Structure of human ear, mechanism of hearing, kinds of deafness.

EEG, MRI, CT-scan, mental health (epilepsy, neurosis, psychosis).

## **UNIT-IV- Immunology**

2. Basics of Immunity:

Types of immunity: Active, passive, innate and acquired immunity.

Antigens and antibodies.

Types of antibodies and their structure.

Interferons, cytokines (haptens ).

Mechanism of reactions: Precipitation, agglutination, neutralisation, opsonisation.

3. Cells and Organs in Immunity:

Humoral and cell- mediated immunity.

B and T cells.

Lymphocytes: Helper, killer, memory and suppressor cells.

Complement system, secondary lymphoid organs; tonsils, adenoids, thymus, bone marrow,

bursa fabricus, macrophages.

Antigen - antibody reaction.

## **UNIT-V- Immunology**

### 2. Immune disorders and techniques:

Basic idea of immune disorders.

Auto-immune diseases

AIDS, mechanism of HIV infection.

Monoclonal antibodies and their production.

Applications of monoclonal antibodies; ELISA.

### Vaccines and Transplants:

Vaccination and immunisation.

Surface antigens; vaccines; hepatitis vaccine, attenuation (oral polio vaccine).

Antivenoms.

Organ transplants: Various types of transplant ( allograft, xenograft, autograft).

Major histocompatibility complex.

## **PAPER-III: DEVELOPMENTAL BIOLOGY**

**Duration: 3 Hours**

**M.M: 50 Marks**

The question paper comprises of three sections, 'A', 'B' and 'C'

Section-A: The candidates will attempt all the ten parts of Q. No.1 (consisting of two questions from each unit) in about 20 words (1/2 X 10 = 5 marks).

Section- B: The candidates will attempt five questions, selecting one question from each unit, answer in about 250 words (5 X 5 = 25 marks).

Section-C: The candidates will attempt any two questions out of four, answer in 500 words (10 X 2 = 20 marks).

## **UNIT-I- Basics of Embryology**

- Histoical perspective and scope of developmental biology.
- General idea of asexual reproduction (fission, budding, gemmule formation, metagenesis,

polyembryony etc.).

- c. An introduction to animal development in sexually reproducing animals.
- d. Development of sex and its success over asexual reproduction.
- e. Neuroendocrine regulation of reproductive organs; estrous and menstrual cycles.

### **UNIT-II - Gametogenesis and fertilization**

- a. Gametogenesis: Definition; structure of gametes (sperm and egg).
- b. Spermatogenesis and oogenesis.
- c. Types of eggs; detailed structure of amphibian, avian and mammalian egg.
- d. Fertilization: Events of fertilization, polyspermy and preventing mechanism.
- e. Significance of fertilization; parthenogenesis; evolution of viviparity.

### **UNIT-III - Cleavage and Gastrulation**

- a. Cleavage, creating multicellularity; definition of embryonic cleavage, morula; blastula, patterns and planes of cleavage; blastulation, types of blastula.
- b. Types of gastrulation mechanisms.
- c. Fate maps (with suitable examples); cell lineage.
- d. Reorganization of embryonic cells, gastrulation in amphibians, birds and mammals.
- e. Morphogenetic cell movements and their significance in gastrulation.

### **UNIT-IV- Induction, Differentiation, Organogenesis and Regeneration**

- a. Embryonic induction, organizers, competence.
- b. Mechanism of cellular differentiation; sex determination during development. Government rules against sex determination during pregnancy.
- c. Neurula formation, growth and organogenesis.
- d. Elementary idea of molecular aspects of developmental biology; cell interaction in embryonic development.
- e. Regeneration: types and mechanism. Senescence and ageing.

### **UNIT-V- Embryonic adaptations**

- a. Role of jelly in amphibian spawn; cleidoic eggs; viviparity.
- b. Salient features of development of frog/toad; amphibian metamorphosis and its endocrine regulation.

- c. Extraembryonic membranes in chick, salient features of development of chick upto 72 hours of incubation.
- d. Placentation in mammals: Definition, types; classification on the basis of morphology and histology; functions of placenta.
- e. Changes in foetal circulation and respiration during birth in a mammal.

## **Zoology - Practical**

### **1. Study of museum specimens / models / chart / photograph:**

*Petromyzon, Myxine/Bdellostoma, ammocoete larva, Acipenser, Amia, Lepidosteus, Labeo, Clarius, Anguilla, Hippocampus, Exocoetus, Echeuis, Protopterus, Ichthyophis, Proteus, Ambystoma, axolotl larva, Siren, Alytes, Hyla, Chelone, Testudo, fresh water tortoise, Sphenodon, Hemidactylus, Phrynosoma, Draco, Chamaelion, Eryx, Hydrophis, Naja, Vipera, Bungarus, Cocodylus, Alligator, Archaeopteryx, Pavo cristatus, Psittacula,*

*Collumba, Mylvus, great Indian bustard, saras crane, vulture, crow, Ornithorhynchus, Tachyglossus, Macropus, bat, Loris, Manis, Herpestes, Erinaceous.*

**2. Permanent slides:**

Mammalian Histology: V. S. skin, T.S. spinal cord, stomach, duodenum, ileum, rectum, pancreas, liver, lung, kidney, bone, cartilage, testis, ovary, placenta, pituitary gland, V. S. eye; striated muscle fibre.

**3. Dissection:** Through Chart / Model / Photograph / CD.

*Any bony fish* : External features, general anatomy, afferent and efferent branchial vessels, brain, cranial nerves, eye ball, its muscles and innervation, internal ear, urinogenital system.

**4. Permanent mounting:**

Cycloid scales, striated, nonstriated and cardiac muscle fibres, filoplume, blood film.

**5. Osteology:**

A comparative study of articulated and disarticulated (original / artificial) bones of frog, *Varanus*, fowl and rabbit.

**6. Developmental Biology:**

Study of development of chick: Whole mounts and sections of 18 to 72 hour's embryo.

Histological study of development of frog/toad : Egg, early cleavage, blastula, gastrula, neurula and different stages of tadpole. Study of spermatogenesis, oogenesis, fertilization and metamorphosis of frog/toad. Development of mammalian embryo through charts/models.

**7. Physiology:**

- a. Demonstration of catalase and ptyalin enzyme activity.
- b. Haematocrit value.
- c. RBC counting.

- d. WBC counting.
- e. Differential counting.
- f. Haemoglobin percentage.

**Note:** Animals used in practical are subject to the condition that these are not banned under the Wild Life Protection Act.

**Scheme of distribution of marks:**

1. Major Dissection	- Through Chart / Model / Photograph / CD	07
2. Minor Dissection	- Through Chart / Model / Photograph / CD	04
3. Preparation		04
4. Exercise in Developmental Biology		04
5. Physiology		05
6. Spots (10 )		15
7. Record		05
8. Viva-voce		06
		50

# PHYSICS

Scheme:

Three Papers	Min. Pass Marks 54	Max.Marks 150
Paper-I	3hrs. Duration	Max 50 Marks
Paper-II	3hrs. Duration	Max 50 Marks
Paper-III	3hrs. Duration	Max 50Marks
Practical 5 hrs. Duration	Min. Pass Marks 18	Max. Marks 50

40% weightage will be given to problems and numericals.

## Paper-I Solid State Physics

Duration:3 hrs.

Max.Marks  
:50

Note: The question paper will contain three sections as under –

Section-A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. Total marks: 05

Section-B : 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from

each unit, answer approximately in 250 words. Total marks: 25 Section-C :04 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted.

Total marks: 20

### Unit-I

**Crystal Binding and Crystal Structure** : Crystal bonding, ionic bond, binding energy of ionic crystal, determination of the repulsive exponent, covalent bonding, metallic bonding, molecular or Vander Waal's bonding, hydrogen bonding, Space lattice and Crystal structure, reciprocal lattice,



Bravais lattice, Miller indices and crystal structure, Spacing of planes in Crystal Lattice, Atomic Packing, Simple cubic structure, Face centered cubic structure, Hexagonal closed packed structure, Perovskite structure, X-ray diffraction and Bragg's law, Laue pattern.

## **Unit-II**

**Thermal Properties of Solids**, Concepts of Thermal Energy and Phonons, Internal Energy and Specific Heat, The Various theories of Lattice specific Heat of Solids, The Einstein Model, Vibrational Modes of Continuous Medium, Debye Model, Electronic Contribution of the internal Energy to the Specific Heat of Metals, Thermal Conductivity of the Lattice.

## **Unit-III**

**Band Theory of Solids**, Formation of bands, Periodic Potential of a solid, Wave function in a Periodic Lattice and Bloch Theorem, Number of States in the Band, Kronig Penny model, Velocity of the Bloch electrons and Dynamical effective mass, Momentum, Crystal Momentum and Physical Origin of the Effective Mass, Negative Effective Mass and Holes, The distinction between metals, insulators and intrinsic semiconductors.

## **Unit-IV**

**Electrical Conductivity**, Drude-Lorentz Theory of Electrical Conductivity, Boltzmann Transport Equation, Sommerfeld Theory of Electrical Conductivity, Mathiessen's Rule, Thermal Conductivity and Wiedemann-Franz's Law, The Hall Effect.

**Superconductivity**, Introduction, Meissner's effect, The Isotope Effect and Electron-Phonon Interaction, The Effect of the Superconductivity Transition on properties, Special Features of

Superconducting Materials, London's equation, Flux Quantization, Qualitative discussion of BCS Theory of Superconductivity, Cooper Pairs, Applications of Superconductors, Josephson Junction.

### **Unit-V**

**Magnetic Properties**, Origin of Atomic Magnetism, Dynamic of Classical Dipole in Magnetic field, Magnetic Susceptibility, Phenomenon of Diamagnetism, Paramagnetism, Paramagnetism of Ionic Crystal, Ferromagnetism, Temperature Dependence of saturation of Spontaneous Magnetization, The Paramagnetic Region, The nature of ferromagnetism, Nature and Origin of Weiss Molecular Field, Heisenberg's Exchange Interaction, Quantum Theory of Ferromagnetism, Relation between  $J_0$  (Exchange Integral) and  $I$  (Weiss Constant), Ferromagnetism Domain.

## **Paper-II Nuclear Physics**

Duration:3 hrs.

Max. Marks:50

Note: The question paper will contain three sections as under –

Section-A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. Total marks : 05

Section-B : 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words. Total marks: 25 Section-C :04 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted.

Total marks : 20

### Unit-I

**Nuclear Properties:** Rutherford's scattering and Nucleus model of atom, Properties of Nuclei, Mass, Charge, Estimation of charge density, size, density, spin, parity, statistics, magnetic dipole moment, Electric Quadrupole Moment, Mass Defect and systematics of Binding energy, Constituents of nucleus, Discovery of neutron and proton- neutron hypothesis, Nuclear potential, Nuclear Force, Liquid drop model, Semi Empirical Mass formula and its applications; 1. Alpha decay, 2. Mass Parabola, 3. Mirror Nuclei, Nuclear Mass measurements, Aston's Mass Spectrograph, Double Focussing Mass Spectrograph and Doublet method.

### Unit-II

**Nuclear Fission:-** The Discovery of Nuclear Fission, The Energy Release in Fission, Mass and Energy distribution of fission products, Neutron emission in fission, Energetics of Spontaneous fission, Bohr Wheeler theory and Quantum effects, Neutron induced fission, Fission cross-section and threshold, Nuclear Fission as a source of Energy, The Nuclear Chain Reaction, condition of controlled chain Reaction, The principal of Nuclear Reactors, classification of Reactors, Typical Reactors, Power of Nuclear Reactor, Critical size of Thermal Reactors, The Breeder Reactor, Reprocessing of the Spent Fuel, Physical, Chemical and Biological effects of nuclear radiations, Radiation hazards.

### Unit-III

**Nuclear Fusion:** Nuclear Fusion reactions, The sources of stellar Energy, The problems of controlled nuclear fusion, The plasma-Fourth State of the Matter, fusion Reaction, Energy Balance and Lawson Criterion, Magnetic Confinement of Plasma. Classical plasma Losses from the Magnetic Container, Anomalous Losses, Turbulence and plasma Instabilities, The Laser fusion Problem, fusion Reactor:

**Elementary particles:** Classification of Elementary Particles, Quantum Numbers, Fundamental Interactions, Unified approach (Basic ideas), The conservation Laws, Quarks Basic idea of color and quark confinement.

## Unit-IV

**Accelerators** : Ion sources, Cock-Craft-Walten High Voltage Generators, Van De- Graff Generators, Drift Tube Linear Accelerators, Wave Guide Accelerator, Magnetic Focussing In cyclotron, Synchrocyclotron, Betatron, the Electromagnetic Induction Accelerator, Electron Synchrotron, Proton Synchrotron.

## Unit –V

**Particle and Radiation Detectors:** Ionisation Chamber, Region of Multiplicative Operation, Proportional Counter, Geiger-Muller Counter, Cloud Chamber.

**Cosmic Rays:** Discovery of Comic Rays, Nature of Cosmic Rays, soft and hard component variation in cosmic rays-

16. Latitude Effect
17. East-West Asymmetry Directional Effect

Altitude Effect.

Detection of cosmic Ray particles, Origin of Cosmic Rays

## Paper III - Elementary Quantum Mechanics and Spectroscopy

Duration:3 hrs.

Max. Marks:50

Note: The question paper will contain three sections as under –

Section-A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part. Total marks : 05

Section-B : 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words. Total marks: 25 Section-C :04 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted.

Total marks : 20

## UNIT – I

**Experimental Evidence of Quantum Theory:** limitations of classical theory to explain, specific heat of solids, Black Body Radiation, Planck's quantum hypothesis and qualitative discussion of radiation law, photoelectric effect, Compton effect, Matter Waves, De Broglie relation, Davison Germer experiment, electron interference experiment, Uncertainty principle (i) Position & moments

3. Energy & Time (iii) Angular displacement and momentum. its application such as (i) Non existence of electron in nucleus, (ii) Ground state energy of H-atom, (iii) Ground state energy of harmonic oscillator (iv) Natural width of spectral lines.

## UNIT-II

**Schrodinger's Wave Mechanics:** Schrodinger's equation, Its need and justification, time dependent and time independent forms, physical significance of the wave function and its interpretation, probability current density. Operators in quantum mechanics, Definition of an operator, linear and Hermitian operators, State function, Expectation value of dynamical variables, position momentum and energy, Fundamental postulates of quantum mechanics, Eigenfunction and eigen values, Degenracy. Orthogonality of eigenfunction, Commutation relations, Ehrenfest's theorem and complementarity wave packet, group and phase velocities, Principle of superposition, construction of one dimensional wave packet, its momentum representation, (Fourier transform), Gaussian wave packet its momentum representation (Fourier transform) Gaussian wave packet, Diffraction at a single slit, Uncertainty principle.

## UNIT – III

**Simple solution of Schrodinger's Equation:** Time independent Schrodinger equation and stationary state solution, Boundary and continuity conditions on the wave function, particle in one

dimensional box, Eigenfunction and eigenvalues, discrete energy levels, generalisation to three dimensions and degeneracy of levels. Potential steps and rectangular potential barrier, calculation of reflection and transmission coefficient. Qualitative discussion of the application to alpha decay, Square well potential problem calculation of transmission coefficient and resonant scattering (Ramsauer–Townsend effect).

#### UNIT – IV

**Bound state problems :** Particle in one dimensional infinite potential well and finite depth potential well–energy eigen–values and eigenfunction, transcendental equation and its solution, Simple harmonic oscillator (one dimensional case) and qualitative discussion of its eigenfunctions, energy eigenvalues. Zero point energy, parity symmetric and antisymmetric wave functions with graphical representation. Schrodinger equation for a spherically symmetric potential, Schrodinger equation for a one electron atom in spherical coordinates, separation of variables, Orbital angular momentum and quantization spherical harmonics, energy levels of H–atom, Shapes of  $n = 1$  and  $n = 2$  wave functions, Average value of radius of H–atom

#### UNIT – V

**Applications of Quantum Theory to Atomic Spectroscopy :** Quantum features of spectra of one electron atoms, Frank–Hertz experiment and discrete energy states, Stern and Gerlach experiment, spin and magnetic moment, Spin orbit coupling and qualitative explanation of fine structure, Atoms in magnetic field Zeeman splitting, Stark Effect.

**Molecular Spectroscopy:** Qualitative features of molecular spectra, Rigid rotator discussion of energy, eigenvalues and eigenfunction, rotational energy levels of diatomic molecules, Rotational spectra, vibrational energy levels of diatomic molecules, vibrational spectra, vibrational rotational spectra.

#### PHYSICS PRACTICAL

**Duration 5 hrs. Min. Pass Marks 27 Max.Marks 75** The college may set a few experiments more at their level at par with the standard of B.Sc. Part III Total number of experiments to be performed by the students during the session should be 16 selecting any eight from each section.

## Section –A

4. Determination of Planck's constant by photo cell (retarding potential method using optical filters, preferably five filters).
5. Determination of Planck's constant using solar cell.
6. Determination of Stefan's constant.
7. Study of the temperature dependence of resistance of semiconductor (four probe method).
8. Study of Iodine spectrum with the help of grating and spectrometer using ordinary bulb light.
9. Study of the characteristics of a GM counter and verification of inverse square law for the same strength of a radioactive source.
10. Study of  $\beta$ - absorption in a foil using GM counter.
11. To find the magnetic susceptibility of a paramagnetic solution using Quinck's method. Also find the ionic molecular susceptibility of the ion and magnetic moment of the ion in terms of Bohr magneton.
12. Determination of coefficient of rigidity as a function of temperature using torsional oscillators (resonance method).
13. Study of polarization by reflection from a glass plate with the help of Nicol prism and photo cell and verification of Brewster's law of Malus.
14.  $e/m$  measurement by Helical method.
5. Measurement of magnetic field using ballistic galvanometer and search coil study of variation of magnetic field of an electromagnet with current .
6. Measurement of electronic charge by Millikan's oil drop method.
8. Study of a R-C transmission line at 50 Hz.
9. Study of a L-C transmission line (i) at fixed frequency (ii) at variable frequency.
10. Study of resonance in an LCR circuit (using air core inductance and damping by metal plate). (i) at fixed frequency by varying C and (ii) by varying frequency.
11. (i) Recovery time of a junction diode and point contact diode.  
(ii) Recovery time as a function of frequency of operation and switching.
12. Design a Zener regulated power supply and study the regulation with various loads.
13. Study the characteristic of field effect transistor (FET) and design and study amplifier of finite gain .

14. Study the frequency response of transistor amplifier and measure the input and output impedances (frequency response with change of value of R and C components).
15. Design and study of an R-C phase shift oscillator.
16. Study voltage multiplier circuit to generate high voltage D.C. from A.C.
17. Using discrete components, study OR, AND, NOT logic gates compare with TTL integrated circuits IC's.
18. Applications of operational amplifier as (minimum two of the following exercises) :  
 (i) Inverter (ii) Non-Inverter (iii) Differentiator (iv) Integrator.

**Experiments:-** Two experiments each of 20 marks in which the distribution of marks is as follows.

a.	Figure and Formula	:	6 marks
b.	Observation and calculation	:	12 marks
c.	Result (with unit) and precaution	:	2 marks
2.	Record	:	05 marks
3.	Viva-Voce	:	05 marks
<b>Total</b>		<b>:</b>	<b>50 marks</b>

## MATHEMATICS

### Paper - I – LINEAR ALGEBRA AND COMPLEX ANALYSIS

Time duration : 3 Hrs

Max Marks : 66

**Note :** Each question paper will contain three sections as under –

Section-A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part.

Total marks : 5

Section-B : 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words.



Total marks : 35

Section-C : 04 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted.

Total marks : 26

### **Unit I (Linear Algebra)**

Definition and examples of a vector space, Subspace of a vector space, Linear combination and Linear span, Linear dependence and independence of vectors, direct sums of subspaces.

### **Unit II (Linear Algebra)**

Basis and dimension of finitely generated spaces. Quotient space, Linear transformation, Rank and nullity of linear transformation.

### **Unit III (Linear Algebra)**

Characteristic values and characteristic vectors of matrices and .

### **Unit IV (Complex Analysis-I)**

Complex numbers as ordered pairs. Geometric representation of complex numbers. Stereographic projection, Limit, Continuity and differentiability of a complex valued function. Analytic functions. Cauchy-Riemann equations. Harmonic functions. Determination of conjugate function.

### **Unit V (Complex Analysis-II)**

Mapping or Transformation, Isogonal and conformal mappings necessary and sufficient conditions for a conformal mapping. Mobious Transformation, Fixed points, Cross ratio, Inverse points, Mapping

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by elementary functions. Mapping  $w = \frac{z-i}{z+i}$ , the inverse transformation  $z = \sqrt{\frac{w+1}{w-1}}$

**References:**

1. Shanti Narayan : A course of Mathematical Analysis, S.Chand & Co., New Delhi
2. Shanti Narayan : Theory of functions of a complex variable, S.Chand & Co., New Delhi
3. Mullick, Arora: Mathematical Analysis, New Age Publications Delhi
4. Churchill & Brown - Complex Analysis, Tata Mcgraw Hill
5. I. N. Herstien, Topics in Linear Algebra, Wiley Eastern.
6. S. Lang, Linear Algebra
7. Sharma & Vashistha, Linear Algebra, Krishna Prakashan Mandir, Meerut.

**Paper - II Mathematical Statistics and Linear programming**

Time duration : 3 Hrs

Max Marks : 66

**Note :** Each question paper will contain three sections as under –

Section-A : One compulsory question with 10 parts, having 2 parts from each unit, short answer in 20 words for each part.

Total marks : 5

Section-B : 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words.

Total marks : 35

Section-C : 04 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted.

**NOTE : Non programmable Scientific Calculator is allowed in this paper**

### **Unit I**

Central moments, First four central moments in terms of raw moments and vice-versa. Karl-Pearson's Beta and Gamma coefficients. Measure of skewness and kurtosis. Random experiment. Sample space, Event, Types of events, Probability and Conditional probability of an event. Independent events, Theorems of compound and total probabilities, Baye's Theorem and its simple applications.

### **Unit II**

Random variable, discrete and continuous random variables, Probability distribution of a discrete random variable, Probability density function of a continuous random variable. Distribution functions, Mathematical expectation of a random variable and of a function of random variable, Moments and Moment generating function, Cumulant generating function and cumulants, Characteristic functions.

### **Unit III**

Discrete and continuous distributions with properties : Bernouli, Binomial, Poisson and Normal.

### **Unit IV**

Linear programming, Variables , Objective function, Constraints and Mathematical form of a LPP. Graphical method of solution of two variable linear programming problems. Line and line segment in the Euclidean space  $R_n$ , Convex set, Hyperplane convex combination, Convex polyhedron, Extreme point of a convex set. Basic solution of a system of linear equations. Slack and surplus variables. Standard form of a LPP. Feasible solution, BFS and optimal BFS of a LPP. Replacement of basis vector. Improved BFS. Unbounded solutions, Conditions of optimality. Simplex algorithm, Artificial variable, Charne's Big M-method.

### **Unit V**

Dual and primal. Problem Standard form of a primal problem. Formation of dual of a standard primal problem. Fundamental theorem of duality. Solution of a LPP by solving its dual by simplex method. Assignment problems.



Section-B : 10 questions, 2 questions from each unit, 5 questions to be attempted, taking one from each unit, answer approximately in 250 words.

Total marks : 25

Section-C : 04 questions (question may have sub division) covering all units but not more than one question from each unit, descriptive type, answer in about 500 words, 2 questions to be attempted.

Total marks : 14

### **Unit - I**

Principles of C Programming : Algorithms, Flowcharts, Constants, Variables, Data type, Declaration of storage class, assigning values of variables, symbolic constant. Operators and Expressions. Common I/O operators decision making, branching and loops : if, if-else, Nested if-else, WHILE, DO, for loop, while statement, switch-case statement.

Array : One dimensional, Two dimensional. Initialization of two dimensional arrays.

### **Unit - II**

User defined function in C: function declaration, calling a function, Category of function, nesting of functions recursion, Pointers.

Operators : forward difference , backward difference, Shift E, Inverse shift  $E^{-1}$ , Differentiation D, Central -Difference , Mean difference , Central sum , Divided difference, Inter relation between various operators, Forward and backward difference table. Factorials notation.

### **Unit - III**

Interpolation with equal and unequal intervals, Central difference interpolation, inverse interpolation.

### **Unit - IV**

Numerical differentiation and Numerical –Integration: Trapezoidal rule, Weddle rule, Simpson’s rules, Gauss quadrature formula.

## **Unit - V**

Solution of equations : Bisection method, regula-falsi method and Newton- Raphson method.

Solution of ordinary differential equations : Picard's method and Euler's method.

### **Book Recommended :**

E. BALAGURUSWAMY PROGRAMMING IN ANSI C 2ed TATA Mc Graw - Hill  
Pub. N. Delhi.

### **REFERENCES :**

- |                    |  |   |
|--------------------|--|---|
| 1. SAXENA H.C. -   | FINITE DIFFERENCE AND<br>NUMERICAL ANALYSIS<br>PROGRAMMING IN ANSI C 2 <sup>nd</sup> | S.CHAND AND<br>COMPANY TATA<br>McGraw-HILL PUB. DELHI |
| 2. E.BALAGURUSWAMY |  |   |

## List of Practicals

### List of Practicals :

3. To find the sum of HARMONIC SERIES.
4. To solve the quadratic Equation.
5. Evaluation of Binomial Coefficients Using do and while loops
6. To print a grouped frequency table using switch case statements.
7. To find minimum cost of operation which consists two components using Break and continue statements.
8. To Calculate the average of numbers.
9. To show a matrix using array.
10. To sort a list and calculate its median using array , If - then - else .
11. To find the Area of curve using trapezoidal rule.
12. To copy one string into another string.
13. Writing a string using % format.
14. To form a grouped frequency table using array and for loop.
15. To calculate the standard deviation of given data using array , If and break statements.
16. to open a file and appending using pointer

# **B.Sc.B.Ed.22 (a &b)**

## **PEDAGOGY OF GENERAL SCIENCE**

### **Objectives-**

1. Student-teachers will be able to-
2. Understand General Science as an interdisciplinary area of learning.
3. Understands aims and objectives of teaching General Science at different levels.
4. Explore different ways of creating learning situations for different concepts of science:
5. Formulate meaningful inquiry episodes, problem-solving situations, investigatory and discovery learning projects based on upper primary, secondary and higher secondary stages.
6. Facilitate development of scientific attitudes in learners.
7. Examine different pedagogical issues in learning science. 6. Stimulate curiosity, inventiveness and creativity in science.
8. Develop ability to use science concepts for life skills.
9. Develop competencies for teaching, learning of science through different measures.
10. Construct appropriate assessment tools for evaluating learning of science.
11. Understands the CCE pattern of Evaluation.

### **Course Content**

#### **Unit 1: Nature of General Science as a Discipline**

Meaning, Concept, Needs of General science teaching.  
Nature and scope of General science teaching

Main discoveries and development of science (special reference to ancient India) Science as a domain of enquiry, as a dynamic and expanding body of knowledge, science as a process of constructing knowledge. Science as an interdisciplinary area of learning (Physics, chemistry, biology etc.); science for environment, health, peace & equity, science and society. Fact, concept, principles, laws and theories- their characteristics in context of general science.

Constructivist approach in learning General Science.



## **Unit 2: General science as a school subject**

Importance of General science in school curriculum.

Aims & objectives of teaching General science at secondary level. Writing objectives in behavioural terms. Bloom's taxonomy (revised).

Correlation of General Science with other School Subjects

Changing trends and goals of teaching General Science with reference to N.C.F. 2005.

Concept mapping of themes related to General Science.

## **Unit III: Methodology of Teaching and learning of General science**

Methods and devices of teaching General science at secondary level – Lecture-cum-Demonstration, Project, Problem solving, Heuristic, Laboratory method.

Techniques of teaching General Science

## **Unit IV: Pedagogical Analysis and mode of learning Engagement**

Pedagogical analysis of the Units with reference to concepts, learning outcomes, activities and learning experiences and evaluation techniques of following content at secondary level-

Physics –light, Electricity, magnetism, Gravitation, Work and Energy, Sound

Chemistry– Atom And molecules, Chemical Reactions, Acid ,Bases and Salt, Carbon and Its Compounds, metal and non-metals

Biology –Cell and its Structure, Life processes, Diversity in living organisms,

Environmental Science– Our Environment , natural resources and its management

Modes of learning engagement in General Science-

Providing opportunities for group activities and observations.

Group/Individual Presentation

Providing opportunities for sharing ideas

Teaching aids and activities in laboratory work

Reflective written assignment

### **Unit V: Assessment & Evaluation of General Science learning**

Meaning, concept and construction of Achievement test, diagnostic test and remedial teaching.

Blue print: Meaning, concept, need and construction.

Open-book tests: Strengths and limitations

Continuous and Comprehensive Evaluation (CCE) in Sciences.

Difficulties Faced by the teacher in evaluation process and suggestive measures to overcome them.

### **Practicum/Field Work-**

Any two of the following

Visit Ayurveda college/ science labs to address lauding their working process and draft a report on their contribution to prosperity.

Prepare a concept map on any theme of General Science and explain its importance for Teaching and learning.

Collect Information about Indian Cultural traditions and find out the scientific basis

or hidden concern for life and preservation of environment.

Being a Science teacher how you will remove superstitions from the Society. Report your Strategic planning.

Prepare a diagnostic test and apply it in school, after discussion with concerning teacher and give remedial measures.

### **Evaluation Procedure**

100 Marks

Any two practicum & one test

10+10=20 Marks

(Covering Unit I to V)

External Evaluation

80 Marks

### **References-**

1. Sood, J.K. (1987): Teaching Life Sciences, Kohli Publishers, Chandigarh.
2. Sharma, L.M. (1977): Teaching of Science and Life Sciences, DhanpatRai& Sons, Delhi.
3. Kulshreshtha, S.P. (1988): Teaching of Biology, Loyal Book Depot, Merrut
4. Yadav, K. (1993): Teaching of Life Science Anmol Publishers, Daryaganj, Delhi.
5. Yadav, M.S. (2000): Modern Methods of Teaching Sciences, Anmol Publishers, Delhi
6. Singh, U.K. &Nayab, A.K. (2003) : Science Education Commonwealth
7. Venkataih, S. (2001): Science Education in 21st Century, Anmol Publishers, Delhi.
8. Yadav, M.S. (Ed.) (2000): Teaching Science at Higher Level, Anmol Publishers, Delhi.
9. Edger, Marlow &Rao, D.B. (2003): Teaching Science Successfully, Discovery
10. Mangal, S.K. (1996): Teaching of Science, Arya Book Depot, and New Delhi.
11. Dave, R.H.: (1969): Taxonomy of Educational Objectives and Achievement
12. Testing, London University Press, London.
12. Sood. J.K. (1989): New Directions in Science Teaching, Kohli Publishers, Chandigarh.

# PEDAGOGY OF BIOLOGY

## Objectives-

Student-teachers will be able to:-

1. Develop insight on the meaning and nature of Biology for determining aims and strategies of teaching- learning.
2. Appreciate that science is a dynamic and expanding body of knowledge.
3. Appreciate the fact that every child possesses curiosity about his/her natural surroundings.
4. Identify and relate everyday experiences with learning of Biology.
5. Appreciate various approaches of teaching- learning of Biology.
6. Explore the process, skill in science and role of laboratory in teaching- learning.
7. Use effectively different activities / experiments/ demonstrations / laboratory experiences for teaching-learning of Biology.
8. Integrate the Biology knowledge with other school subjects.
9. Analyze the contents of Biology with respect to Content, process, skills, knowledge organization and other critical issues.
10. Perform Pedagogical analysis of various topics in Biology.
11. Develop process-oriented objectives based on the content themes/Units.
12. To understand meaning, concept and various types of assessment.

## Course Content

### Unit I: Nature of Biology as a Discipline

Meaning, Concept, Nature and Need of Biology and Biology teaching.  
Scope of Biology teaching

Historical development of Biology as a discipline. Contribution of Indian and western Biologist like HargobindKhurana, Mohinder Singh Randhawa, Salim Ali, Mendel, Darwin, and Lamark in the field of Biology

Constructivist approach in learning Biology.

## **Unit II: Biology as a school subject**

Importance of Biology in school curriculum.

Aims & objectives of teaching Biology at school level. Writing objectives in behavioural terms. Bloom's taxonomy (revised).

Correlation of Biology with other School Subjects  
Changing trends and goals of teaching Biology

## **Unit III: Methodology of Teaching and learning of Biology**

Scientific attitude and scientific temper: Nurture the natural curiosity, aesthetic senses

and creativity in biology: essential skills, methods and process that lead to exploration, Generalization and validation of scientific knowledge in Biology.

Lecture –cum Demonstration, Team teaching, Project method, Problem solving method, Inquiry approach, Programmed instruction, Investigatory approach, Concept mapping, Collaborative learning, and Experiential learning in Biology: Facilitating learners for self-study.

## **Unit IV: Pedagogical Analysis and mode of learning Engagement**

Pedagogical analysis of the Units with reference to concepts, learning outcomes, activities and learning experiences and evaluation techniques of following content at secondary and Senior Secondary level- Biology for environment and health, peace, equity, origin of life and evolution, biodiversity, Photosynthesis, Life processes and factors affecting it.

Modes of learning engagement in Biology-

- a. Observations and experiments in Biologys: interdisciplinary linkages,
- b. Providing oportunities for group activities
- c. Group/Individual Presentation
- d. Providing oportunities for sharing ideas
- e. Designing different working Models for concept formation.
- f. Teaching aids and activities in laboratory work
- g. Reflective written assignment

## **Unit V: Assessment & Evaluation in Biologys**

Meaning, concept and construction of Achievement test

Blue print: Meaning, concept, need and construction.

Construction of test items (open-ended and structured) in Biology and administration of tests.

Open-book tests: Strengths and limitations

Formative and Summative Assessment in Biology.

Continuous and Comprehensive Evaluation (CCE)

Assessment of project work in biology (both in the laboratory and in the field)

Performance based assessment: learners' record of observations, field diary, herbarium and collection of materials.

Oral presentation of learners' work in Biology, portfolio;

Developing assessment framework in Biology; assessment of experimental work in Biology.

### **Practicum/Field Work**

Any Two of the following

1. Preparation of Scrap book to show the Contribution of any two Biologist

1. Conduct any activity among students for linking child's natural curiosity with natural phenomena like weather, flora and fauna; contexts. Report your Observations.
2. Preparation/ designing programmed instruction material on any topic of Biology to facilitate learners for self –study.
3. Prepare a low cost or waste material based experiment for secondary/ senior secondary schools.
4. Prepare a plan to assess Students' Practical work in Biology.

**Evaluation Procedure**

100 Marks

Any two practicum & one test

10+10=20 Marks

(Covering Unit I to V)

External Evaluation

80 Marks

**References-**

1. Sood, J.K., 1987: Teaching Life Sciences, Kohali Publisher, Chandigarh.
2. Sharma, L.M., 1977: Teaching of Science & Life Science, Dhanpat Rai & Sons, Delhi
3. Kulshrestha, S.P., 1988: Teaching of Biology, Loyal Book Depot, Meerut
4. Yadav K., 1993: Teaching of Life Science, Anmol Publisher, Daryaganj Delhi.
5. Yadav, M.S., 2000 : Modern Methods of Teaching Science, Anmol Publishers, Delhi.
6. Singh, U.K. & Nayab, A.K., 2003: Science Education Commonwealth Publishers, Daryaganj, New Delhi
7. Venkataih, S., 2001: Science education in 21st century Anmol Publishers, Delhi
8. Yadav, M.S. (Ed.), 2000 : Teaching Science at Higher Level, Anmol Publishers, Delhi
9. Ediger, Marlow & Rao, D.B., 2003 : Teaching Science Successfully Discovery Publishing House, New Delhi
10. Mangal, S.K., 1996: Teaching of Science, Arya Book Depot, New Delhi
11. Dave, R.H., 1969 : Taxonomy of Educational objectives & Achievement Testing, London University Press, London.

# PEDAGOGY OF CHEMISTRY

## Objectives-

1. Student-teachers will be able to:-
2. Gain insight on the meaning and nature of chemistry for determining aims and strategies of teaching-learning.
3. Appreciate that chemistry is a dynamic and expanding body of knowledge.
4. Appreciate the fact that every child possesses curiosity about his/her natural surroundings.
5. Identify and relate everyday experiences with learning chemistry.
6. Trace historical background of Chemistry..
7. Appreciate various approaches of teaching-learning of chemistry.
8. Analyze the contents of Chemistry with respect to Content, process, skills, knowledge organization and other critical issues.
9. Perform Pedagogical analysis of various topics in Chemistry.
10. Use effectively different activities/ demonstration/laboratory experiences for teaching-learning of chemistry.
11. Integrate chemistry knowledge with other school subjects.
12. To understand meaning, concept and various types of assessment.

## Course Content

### Unit I : Nature of Chemistry as a Discipline

Concept, Nature and Needs of Chemistry and Chemistry teaching.  
Scope of Chemistry teaching.  
Historical Background of Chemistry with special reference to India.  
Constructivist approach in learning Chemistry.

### Unit II : Chemistry as a school subject



Importance of Chemistry in school curriculum.

Aims & objectives of teaching Chemistry at school level. Writing objectives in behavioural terms. Bloom's taxonomy (revised).

Correlation of Chemistry with other School Subjects

Changing trends and goals of teaching Chemistry.

### **Unit III : Methodology of Teaching and learning of Chemistry**

Scientific attitude and scientific temper: Nurture the natural curiosity, aesthetic senses and creativity in Chemistry: essential skills, methods and process that lead to exploration: Generalization and validation of scientific knowledge in Chemistry.

Lecture –cum Demonstration, Team teaching, project method, problem solving method, Heuristic method, Group discussion, programmed instruction, Inductive- Deductive, investigatory approach, Concept mapping, Collaborative learning, and Experiential learning in chemistry: Facilitating learners for self-study.

### **Unit IV: Pedagogical Analysis and mode of learning Engagement**

Pedagogical analysis of the Units with reference to concepts, learning outcomes, activities and learning experiences and evaluation techniques of following content at secondary and Senior secondary level-Solutions, colloids, chemical equilibrium, electrochemistry, mechanical and thermal properties of matter, chemical bonding and molecular structure, periodic table, Atom and molecules, Chemical Reactions, Acid ,Bases and Salt, Carbon and Its Compounds, metal and non-metalsetc.)

Modes of learning engagement in Chemistry-

- a. Observations and experiments in Chemistry: interdisciplinary linkages,
- b. Relating knowledge to students' daily life situations.
- c. Providing opportunities for group activities and idea Sharing
- d. Group/Individual Presentation
- e. Teaching aids and activities in laboratory work
- f. Reflective written assignment

### **Unit V: Assessment & Evaluation of Chemistry learning**

Meaning, concept and construction of Achievement test, Diagnostic testing and remedial teaching.

Blue print: Meaning, concept, need and construction.  
Open-book tests: Strengths and limitations  
Continuous and Comprehensive Evaluation (CCE) in Sciences.

Assessment of project work in work in Chemistry( both in the laboratory and in the field )

Performance-based assessment; learner's record of observations, field diary,. Oral presentation of learners work, portfolio;

Developing assessment framework inChemistry; assessment of experimental work in Chemistry.

### **Practicum/Field Work-**

Any two of the following -

1. Perform Some Simple Experiment to clarify any Concept in Chemistry and to develop Observation Skills. Prepare a report of entire activity.
2. Organization of exploratory activities to develop scientific attitude and temper. Report your Experiences
3. Plan an innovation methodof teaching chemistry so as to facilitate the correlation of content with other subjects/ day to day life. Teach that lesson in class and report complete activity with your experiences.
4. Write a reflective journal on some innovative trends in Chemistry teaching and their importance in Achieving aims of teaching chemistry at different level.
5. Prepare a diagnostic test and apply it in school, after discussion with concerning teacher and give remedial measures.

## References

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# PEDAGOGY OF MATHEMATICS

## Objectives:

The students will be able to-

1. Gain insight into the meaning, nature, scope and objectives of mathematics
2. Appreciate mathematics as a tool to engage the mind of every student.
3. Understand the process of developing the concepts related to Mathematics.
4. Appreciate the role of mathematics in day to day life.
5. Learn important mathematics: mathematics more than formulas and mechanical procedures.
6. Pose and solve meaningful problems.
7. Construct appropriate assessment tools for evaluation mathematics learning.
8. Understand methods and techniques of teaching mathematics.
9. Perform pedagogical analysis of various Topics in mathematics at secondary level.
10. Understand an use I.C.T. in teaching of mathematics.
11. Understand and use continuous and comprehensive evaluation, diagnostic testing and remedial teaching in Mathematics.

## Course Contents

### Unit: I - Nature of Mathematics as a Discipline

Mathematics is not merely subject of computations skill, it is much more, it has a logical structure.

Nature of mathematics – building blocks of mathematics (Concept, objectives, variables, function & relation, symbolization)

Important processes of mathematics-estimation, approximation, understanding or visualizing pattern representation, reasoning & proof, making connections, mathematical communication.

Historical development of mathematics as a discipline Contribution of Indian and western mathematicians like Ramanujan, Aryabhata, Bhaskaracharya, Pythagoras and Euclid.

Constructivist approach in learning mathematics.

## **Unit: II - Mathematics as a School Subject**

Importance of mathematics in school curriculum.

Aims and objectives of teaching mathematics at secondary level. Writing objectives in behavioral terms. Bloom's taxonomy (revised)

Correlation of mathematics with other school subjects.

Changing trends and goals of teaching mathematics with reference of NCF 2005 Concept mapping of themes related to mathematics.

## **Unit: III Mathematics as a School Subject**

Nature of concept, concept formation and concept assimilation.

Methods of teaching mathematics at secondary level –

- a. Lecture cum demonstration
- b. Inductive-Deductive
- c. Problem Solving
- d. Project
- e. Heuristic
- f. Analytic & Synthetic

Techniques of teaching mathematics

- g. Oral work
- h. Written work
- i. Drill work
- j. Home assignment

## **Unit: IV - Pedagogical analysis and mode of learning engagement**

Pedagogical analysis of the Units with reference to concepts, learning outcomes, activities and learning experiences and evaluation techniques of following content at secondary level-

- k. Number system
- l. Measures of central tendency
- m. Congruency and similarity
- n. Trigonometrical ratios and identities
- o. Area and Volume
- p. Profit, loss and partnership
- q. Compound interest
- r. Graphical representation data

Modes of learning engagement in mathematics

- s. Providing opportunities for group activities
- t. Group/Individual Presentation
- u. Providing opportunities for sharing ideas
- v. Designing different Working Models for concept formation

(e)Teaching aids and activities in laboratory work (f) Reflective written assignments

**Unit: V Assessment & Evaluation of Mathematics learning**

Assessment of critical thinking, logical reasoning and to discourage mechanical manipulation and rote learning-

- w.Planning of evaluation mathematics
- x. Formative, Summative and predictive evaluation in mathematics
- y. Continuous and compressive evaluation (CCE) in mathematics at secondary level
- z. Diagnostic Testing, Remedial Teaching and enrichment programme for:
  - i. Gifted Learners
  - ii. Slow Learners
  - iii. Learners with Dyslaxica

- iv. Difficulties Faced by the Teacher in Teaching of Mathematics and Suggestive Measure to overcome them.

Construction of achievement test/question paper in mathematics

### **Practicum/Field Work-**

Any two of the following-

Prepare a Concept map related to any theme of Mathematics and Explain how it facilitates teaching and learning.

Prepare a project related to Mathematics and report your steps.

Prepare a power point presentation on brief history and contribution of two mathematicians.

Conduct a group activity on any topic of mathematics and report your Experiences. Observation of Mathematics class-room teaching in any secondary school and prepare a list of errors committed by students.

**Evaluation Procedure** 100 Marks

Any two practicum & one test 10+10=20 Marks

(Covering Unit I to V)

External Evaluation 80 Marks

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5. Jagadguru Swami: Vedic Mathematics, Moti Lal Banarasidas Publisher, Delhi
6. Kapur J.N. Modern Mathematics for Teachers, Arya Book Depot, New Delhi

# PEDAGOGY OF PHYSICS

## Objectives-

Student-teachers will be able to:-

1. Gain insight on the meaning, nature and scope of physics for determining aims and strategies of teaching-learning.
2. Appreciate that science is a dynamic and expanding body of knowledge;
3. Trace historical background of physics.
4. Identify and relate everyday experiences with learning physics;
5. Appreciate various approaches of teaching-learning of physics;
6. Perform Pedagogical analysis of various topics in physics.
7. Analyze the contents of physics with respect to Content, process, skills, knowledge organization and other critical issues.
8. Use effectively different activities/demonstrations/laboratory experiences for teaching-learning of physics;
9. Integrate physics knowledge with other school subjects.
10. To understand meaning, concept and various types of assessment.

## Course Content

### Unit I: Nature of physics as a Discipline

Concept, Nature and Needs of Physics teaching.

Scope of Physics teaching.

Historical Background physics with special reference to India.

Contribution of C.V. Raman, M.N. Saha, K.S.Krishnan, J.C. Bose, H.JBhabha, S. Chandra Shekhar and A.P.J. Abdul Kalam in the field of Physics.



- a. Science as a domain of enquiry, as a dynamic and expanding body of knowledge; Science as a process of constructing knowledge; physics as interdisciplinary area of learning

## **Unit II: Physics as a school subject**

Importance of Physics in school curriculum.

Aims & objectives of teaching Physics at school level. Writing objectives in behavioural terms. Bloom's taxonomy (revised).

Correlation of Physics with other School Subjects

## **Unit III: Methodology of Teaching and learning of Physics -**

Scientific attitude and scientific temper: essential skills, methods and process that lead to exploration: Generalization and validation of scientific knowledge in Physics.

Lecture –cum -Demonstration, Team teaching, project method, problem solving method, Group discussion, Programmed instruction, Inductive- Deductive, Investigatory approach, Concept mapping, Collaborative learning, and Experiential learning in Physics: Facilitating learners for self-study.

## **Unit IV: Pedagogical Analysis and mode of learning Engagement**

Pedagogical analysis of the Units with reference to concepts, learning outcomes, activities and learning experiences and evaluation techniques of following content at secondary and Senior secondary level-light, Electricity, magnetism, Gravitation, Laws of motion, Work and Energy, Sound

Modes of learning engagement in Physics -

- b. Observations and experiments in Physics: interdisciplinary linkages,
- c. Relating knowledge to students daily life situations.
- d. Providing opportunities for group activities and idea Sharing
- e. Group/Individual Presentation
- f. Designing different working Models for concept formation

- g. Teaching aids and activities in laboratory work
- h. Reflective written assignment

### **Unit V: Assessment & Evaluation of Physics learning**

Meaning, concept and construction of Achievement test,

Blue print: Meaning, concept, need and construction.

Open-book tests: Strengths and limitations

Formative and Summative Assessment in physics.

Continuous and Comprehensive Evaluation (CCE)

Assessment of project work in Physics (both in the laboratory and in the field )

Performance-based assessment; learner's record of observations, Oral presentation of learners work, portfolio;

Developing assessment framework in Physics; assessment of experimental work in Physics.

#### **Practicum/Field Work-**

Any two of the following-

1. Prepare a concept map on any topic and explain how it Facilitates Students' Learning.
2. Description and Design of an Improvised Apparatus
3. Write a reflective journal on \_Radiations and Human Health'.

Planning an out of class activity to use local resources to teach Physics and report your experiences.

4. Prepare a plan to assess Students' Practical work in Physics.

## **Evaluation Procedure**

100 Marks

Any two practicum & one test

10+10=20 Marks

(Covering Unit I to V)

External Evaluation

80 Marks

## References

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