

**Semester VIII**  
**B. Sc. B. Ed. (CBCS) Semester- VIII**  
**GROUP D: DISCIPLINE SPECIFIC ELECTIVE (DSE)**  
**Semester VIII**

**PHY 402: PHYSICS: ATOMIC, MOLECULAR AND NUCLEAR PHYSICS**

Time: 3 Hours

Max. Marks: 100

Credits- 4

Theory: 60, Internal: 20, Practical: 20

NOTE FOR PAPER SETTER FOR THEORY EXAMINATION

- i) Paper setter will set 9 questions in all, out of which students will be required to attempt 5 questions.
- ii) Q.No. 1 will be compulsory and will carry 12 marks. There will be atleast 4 short-answer type questions selected from the entire syllabus.
- iii) Two long answer type questions will be set from each of the four units, out of which the students will be required to attempt one question from each unit. Long-answer type questions will carry 12 marks each.
- iv) All questions will carry equal marks.

**Objectives:** The student teacher will be able to:

- Understand the fundamental concepts of Atomic, Molecular and Nuclear Physics.
- Develop the concepts of transitions between various energy levels.
- Understand the source of energy in nuclear reactors and stars.
- Solve the problems related to Atomic, Molecular and Nuclear Physics.
- Establish the link between theory and experiments.

**Course Contents**

**Unit I: Atomic Physics**

Spectra of hydrogen, Frank-Hertz experiment and discrete energy states, Stern Gerlach experiment, deuteron and alkali atoms, spectral terms, doublet fine structure, screening constants for alkali spectra for s,p,d and f states, selection rules, L-S and J-J couplings, Atoms in a magnetic field, Zeeman effect, Zeeman splitting.

Weak spectra: continuous X-ray spectrum and its dependence on voltage, Duane-Hunt law, Characteristics of X-rays, Moseley's law, doublet structure of X-ray spectra, X-ray absorption spectra.

**Unit II: Molecular Physics**

Discrete set of electronic energies of molecules, quantisation of vibrational and rotational energies, determination of internuclear distance, pure rotational and rotational-vibrational spectra, Dissociation limit for the ground and other electronic states, transition rules for pure vibrational and electronic vibrational spectra.

Raman effect, Stokes and anti-Stokes lines, complimentary character of Raman and infrared spectra, experimental arrangements for Raman spectroscopy.

Spectroscopic techniques: Sources of excitation, prism and grating spectrographs for visible, UV and IR, absorption spectroscopy, double beam instruments, different recording systems.

### **Unit III: Accelerators**

Ion sources, Cockcroft-Walton high voltage generators, Van deGraaff generators, Drift tube, Linear accelerators, Wave guide accelerators, Magnetic focusing in Cyclotron, Synchrocyclotron, Betatron, The electromagnetic induction Accelerator, Electron synchrotron, Proton Synchrotron.

**Detectors:** Interaction of charged particles and neutrons with matter, working of nuclear detectors, Geiger-Muller counter, proportional counter and scintillation counter, cloud chambers, spark chamber, emulsions.

### **Unit IV: Nuclear Fission and Nuclear Fusion**

**Nuclear Fission:** Theory of Nuclear Fission, Liquid Drop Model, Shell Model, Barrier Penetration-Theory of Spontaneous Fission, Nuclear Fission as a source of Energy, The Nuclear Chain reaction, Condition of controlled Chain Reaction, The Principle of Nuclear Reactors, Classification of Reactors, Power of Nuclear Reactors, Critical size of Thermal Reactors, The Breeder Reactors, Reprocessing of spent fuel, Radiation hazards and Fission products poisoning.

**Nuclear Fusion:** The sources of stellar energy, The Plasma: The 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

**Structure of Nuclei:** Structure of nuclei, basic properties (angular momentum, magnetic moment, Quadrupole moment and binding energy), deuteron binding energy, p-p and n-p scattering and general concepts of nuclear forces. Beta decay, range of alpha particles, Geiger-Nuttall law, Gamow's explanation of alpha decay, gamma decay, continuous and discrete spectra.

**Elementary Particles:** Classification of Elementary Particles, Fundamental interactions, Unified Approach (basic ideas), The Conservation laws, Quarks (basic ideas), Charmed and Colour Quarks, Higgs Boson, Large Hadron Collider.

#### **Suggested Readings:**

1. H.S. Mani and G.K. Mehta, Introduction to Modern Physics, Affiliated East West Press Pvt. Ltd. New Delhi, 1998.
2. A Beiser, Prospective of Modern Physics
3. H E White, Introduction to Atomic Physics
4. Barrow, Introduction to Molecular Physics
5. T A Littlefield and N Thorley, Atomic and Nuclear Physics (Engineering Language Book Society)
6. H A Enge, Introduction to Nuclear Physics (Addison- Wesley)

7. Eisenberg and Resnik, Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles (John Wiley)
8. D P Khandelwal, Optics and Atomic Physics, (Himalaya Publishing, Bombay, 1988)
9. Rajkumar, Atomic and Molecular Physics (Campus Books International, 2003)
10. C Banwell, Fundamentals of Molecular Spectroscopy (McGraw Hill Education, 2017)

### Practicals

<b>Distribution of Marks for End Semester Practical Examination</b>	
<b>Activity</b>	<b>Marks</b>
Experiments	10
Viva Voce	5
Record	5
<b>Total Marks</b>	<b>20</b>

**All the following experiments are to be done. Few more experiments may be set at the institutional level.**

1. To study the voltage distribution along LC transmission line when its output terminals are open, short and terminated by characteristics impedance. Find attenuation constant, phase constant and propagation constant also for a given line.
2. To study the effect of feedback on transistor amplifier in terms of its frequency response and voltage amplification
3. To determine the value of Rydberg's constant with the help of plane transmission grating.
4. To study the following applications of an operational amplifier (i) Differentiator (ii) Integrator.
5. To study the following applications of an operational amplifier (i) adder (ii) Subtractor.
6. Determine the absorption coefficient of a given solution. Also study the concentration dependence of absorption coefficient.

**GROUP D: DISCIPLINE SPECIFIC ELECTIVE (DSE)**

**Semester VIII**

**CHM 402: CHEMISTRY: ADVANCE CHEMISTRY-II**

Time: 3 Hours

Max. Marks: 100

Credits- 4

Theory: 60, Internal: 20, Practical: 20

NOTE FOR PAPER SETTER FOR THEORY EXAMINATION

- i) Paper setter will set 9 questions in all, out of which students will be required to attempt 5 questions.
- ii) Q.No. 1 will be compulsory and will carry 12 marks. There will be atleast 4 short-answer type questions selected from the entire syllabus.
- iii) Two long answer type questions will be set from each of the four units, out of which the students will be required to attempt one question from each unit. Long-answer type questions will carry 12 marks each.
- iv) All questions will carry equal marks.

**Objectives:**

- Evaluate the utility of UV/VIS spectroscopy as a qualitative and quantitative method.
- Understand Chemistry of Biomolecules.
- The knowledge about Spectral & Magnetic properties of Transition Metal complexes.
- Understand the Bioinorganic Chemistry, Geochemical effect on the distribution of metals.
- Learn chemistry of Amino Acids, Peptides, Proteins and Nucleic Acids

**Course Contents**

**Unit I: Spectroscopy-II**

**Electromagnetic Spectrum: Absorption Spectra**

- (A) **Ultraviolet (UV) absorption spectroscopy** – absorption laws (Beer-Lambert law), molar absorptivity, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones. Woodward Fieser rules for calculation of absorption maxima in dienes and  $\alpha, \beta$  unsaturated carbonyl compounds.
- (B) **Infrared (IR) absorption spectroscopy** – molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, fingerprint region, characteristic absorption of various functional groups and interpretation of IR spectra of simple organic compounds.
- (C) **Nuclear magnetic resonance (NMR) spectroscopy**: Proton magnetic resonance (<sup>1</sup>H NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, area of signals and proton counting, splitting of signals, spin-spin coupling and coupling constant, interpretation of NMR spectra of

simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1, 1, 2-tribromoethane, ethyl acetate, toluene and acetophenone.

- (D) Problems pertaining to the structure elucidation of simple organic compounds using UV, IR and NMR spectroscopic techniques.

### **Unit II: Chemistry of Biomolecules**

- (A) Classification and nomenclature. Monosaccharide, Configuration of monosaccharides. Mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Erythro and threodiastereomers. Structure of glucose including ring size determination and cyclic structure. Conversion of glucose into mannose. Formation of glycosides, ethers and esters. Mechanism of mutarotation.
- (B) Structure of ribose and deoxyribose. Introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

### **Unit III: Spectral & Magnetic properties of Transition Metal complexes**

- (A) **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<sup>1</sup> to d<sup>9</sup> states, discussion of the electronic spectrum of [Ti(H<sub>2</sub>O)<sub>6</sub>]<sup>3+</sup> complex ion.
- (B) **Magnetic Properties of Transition Metal Complexes:** Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula, L-S coupling, correlation of  $\mu_s$  and  $\mu_{eff}$  values, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes.

### **Unit IV: Bioinorganic Chemistry**

Metal ions present in biological systems, classification of elements according to their action in biological system. Geochemical effect on the distribution of metals. Sodium / Potassium pump,

carbonic anhydrase and carboxypeptidase. Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine, Cisplatin as an anti-cancer drug. Iron and its application in bio-systems, Haemoglobin, Myoglobin; Storage and transfer of iron.

**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 and proteins. Primary and secondary structures of proteins. Protein denaturation/renaturation.

Nucleic acids: introduction, Constitution of nucleic acids, Ribonucleosides and ribonucleotides. The double helical structure of DNA.

### **Suggested Readings:**

1. Sharma Y. R. elementary organic spectroscopy: principles and chemical applications paperback.
2. Mehta and Mehta, Organic chemistry, PHI

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3. Donald L. Pavia Gary M. Lampman George S. Kriz James A. Vyvyan, Introduction to Spectroscopy, 5<sup>th</sup> Edition.
4. Bahl B. S.&BahlArun 5000 Solved Problems In Organic Chemistry, S. Chand Publishing.
5. Madan R. L., Chemistry for Degree Students B.Sc. 3<sup>rd</sup> Year S. Chand Publishing.
6. NafisHaider S, Fundamental of Organic Chemistry, S. Chand Publishing.
7. Pradeep. T. Nano: The Essentials; Understanding Nanoscience and Nanotechnology. Tata McGraw-Hill Education Pvt. Ltd., New Delhi.
8. Kenneth J. Klabunde and Gleb B. Sergeev Nanochemistry (Second Edition)
9. Bandyopadhyay, A. K. Nano Materials. New Age International Publishers, New Delhi
10. P.T. Anastas and J.C. Warner, Green Chemistry: Theory and Practice. Oxford University Press.
11. Lancaster M. Green Chemistry: Introductory Text. Royal Society of Chemistry (London).
12. Ryan M.A. and Tinnesand M. Introduction to Green Chemistry. American Chemical Society (Washington).
13. Cann M. C. and Connelly M. E. Real world cases in Green Chemistry, American Chemical Society (Washington).
14. Cann M. C. and Umile T. P. Real world cases in Green Chemistry (Vol 2) American Chemical Society (Washington)
15. Ahluwalia, V.K., Kidwai, M. New Trends in Green Chemistry, 2004
16. Inorganic Polymers by Stone and Graham.

**Practicals**

<b>Distribution of Marks for End Semester Practical Examination</b>	
<b>Activity</b>	<b>Marks</b>
Experiments	10
Viva Voce	5
Record	5
<b>Total Marks</b>	<b>20</b>

**Note: The students should be given exposure of any research labs and instrumentation center/ reputed university lab/industry/ government labs of northern region.**

**1. Organic Chemistry**

- a. Two stage preparation: *p*-nitroacetanilide from Aniline and *p*-Bromoacetanilide from Aniline.
- b. Determination of Iodine value of an oil/fat.
- c. Separation of two component mixture using water or NaHCO<sub>3</sub> solution & identification of the two components. Preparation of one derivative.
- d. Green synthesis:

**2. Physical Chemistry**

**a. Colorimetry**

- i. Determination of formula of complex by Job's method.
- ii. Verification of Beer – Lambert law for KMnO<sub>4</sub>/K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub> and determine the concentration of the given solution of the substance.

**b. Polarimetry**

- i. Determination of the specific rotation of a given optically active compound and determination of the concentration of given solution of an optically active substance

**c. Solvent Extraction**

- i. Separation and estimation of Mg (II) and Zn (II)

**d. Ion Exchange Method**

- i. Separation and estimation of Mg (II) and Zn (II)

**e. Chromatography**

- i. To determine R<sub>f</sub> value of individual and mixture of amino acid by thin layer chromatography (TLC).
- ii. Separation, Isolation and Analysis of the Different Components in a Mixture.
- iii. Method of separation of green leaf pigment, mixture of inorganic, vitamins, colors of flowers etc. separation of α, β, γ carotene from carrot.

**f. Refractometry and Polarimetry**

- i. To verify law of refraction of mixture (e.g of glycerol and water) using Abbe's refractrometer.
- ii. To determine the specific rotation of a given optically active compound.

**g. UV spectrophotometer**

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- i. Record the UV spectrum of p-nitrophenol (in 1:4 ethanol:water mixture). Repeat after adding a small crystal of NaOH. Comment on the difference, if any.
- ii. Record the U.V. spectrum of a given compound (acetone) in cyclohexane (a) Plot transmittance versus wavelength. (b) Plot absorbance versus wavelength.

**GROUP D: DISCIPLINE SPECIFIC ELECTIVE (DSE)**  
**Semester VIII**  
**ZOO 402: ZOOLOGY: MOLECULAR GENETICS, BIOTECHNOLOGY AND  
INSTRUMENTATION**

Time: 3 Hours  
Credits- 4

Max. Marks: 100  
Theory: 60, Internal: 20, Practical: 20

NOTE FOR PAPER SETTER FOR THEORY EXAMINATION

- i) Paper setter will set 9 questions in all, out of which students will be required to attempt 5 questions.
- ii) Q.No. 1 will be compulsory and will carry 12 marks. There will be atleast 4 short-answer type questions selected from the entire syllabus.
- iii) Two long answer type questions will be set from each of the four units, out of which the students will be required to attempt one question from each unit. Long-answer type questions will carry 12 marks each.
- iv) All questions will carry equal marks.

**Objectives:**

To enable students to comprehend the modern concepts and applied aspects of Molecular Genetics, Biotechnology and instrumentation.

**Course Contents**

**Unit I: Nucleic Acids: RNA & DNA**

- Nucleic acids: DNA- Structure, forms, chemical composition functions and units of DNA, Genetic Code
- RNA: Genetic RNA, non-genetic RNAs (mRNA, tRNA, and rRNA) – Structure and functions.
- Replication of DNA
- Gene mutation : nature of mutation, types of mutation and causes of mutation
- DNA repair: mismatch repair, direct repair, base-excision, nucleotide-excision repair and other types of DNA repair. Genetic diseases and faulty DNA repair.

**Unit II: Genetic Engineering**

- Gene expression: Transcription and translation of prokaryotes and eukaryotes.
- Regulation of gene expression in prokaryotes (Lac and tryptophan operon)
- Genetic engineering : Gene cloning
  - i. Cloning vectors
  - ii. Restriction endonucleases, staggered and blunt ended cuts, ligation and example.
  - iii. Recombinant DNA technology
- Gene amplification

- i. cDNA library
- ii. Genomic library and
- iii. Polymerase chain reaction
- Applications of recombinant DNA technology – DNA finger printing, human gene therapy, ethical concerns and cloning. Human Genome Project.

**Unit III: Tissue Culture**

- Animal Cell, Tissue and organ culture. History of animal Cell & organ culture requirements. Characteristics of animal cell culture. Culture media (Natural & Synthetic).
- Sterilization of glassware, equipment isolation of animal tissue; sometic cell fusion, hybridoma technology.
- Elementary idea of bio informatics, genomics, proteomics

**Unit IV: Microscopy**

- Microscopy : Principle structure and function of simple and compound microscope
- Spectrophotometry: Principle of spectrophotometer, structure of simple & UV visible spectrophotometer. Principles of Chromatography.
- Principles of electrophoresis, separation technique of proteins and DNA.
- Principles of Centrifugation, simple, Gradient & Ultracentrifuge.
- General Principle & functions of instrument related to ECG, EEG, CT scanning and Sonography.

**Suggested Readings:**

1. Molecular Biology of the Cell, Alberts al, 5<sup>th</sup>ed, Garland Science 2008
2. Molecular Biology of the Gene Watson Baker et al, 7<sup>th</sup>ed, Pearson 2014.
3. Biochemistry , Molecular Biology and Genetics 5<sup>th</sup>ed, Lippincott Williams and Wilkinson, 2013
4. Biochemistry D Voet & JG Voet, Wiley 2011.
5. Immunology , Kuby 7<sup>th</sup>ed, Owen Punt Stenford McMillan, 2013
6. Fundamentals of Biochemistry , JL Jain , S Chand Pub 2014
7. Essentials of Molecular Biology 2<sup>ed</sup>, David Freifelder, Panima Publishing N Delhi 1996.
8. Genetics and Biotechnology, Dr KC Soni Hindi Edition, College book centre Chaura Rasta Jaipur.
9. Microbiology and biotechnology, Dr KC Soni Hindi Edition, College book centre Chaura Rasta Jaipur.
10. Biochemistry and Molecular Biology, K Wilson & J Walker, 7<sup>th</sup> Cambridge 2010.
11. Animal Cell Culture – A practical approach, Ed, John, R.W. Masters IRL Press
12. Gunther S. Stent, Molecular Genetics, MacMillian Publishing Co Inc.
13. R.W. Old and S.B. Primorse: Principle of gene manipulation: An introduction to genetic engineering.
14. R.A. Meyers (Ed) : Molecular Biology and Biotechnology .( VCH Publishers )

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15. Genetics – Analysis and Principles- Robert J. Brooker , McGraw Hill
16. Principles of Cell and Molecular Biology –L.J Kleinsmith& V.M Kish, Harper Collins College Publisher.
17. Molecular Cell Biology 7<sup>th</sup> Ed, 2013- Lodish, Berk, Matsudaira, Kaiser Kriegar, Scott, Zipursky, Darnell, W.H Freeman And Co.
18. Bioinformatics, Sharma Munjal and Shankar, 2012 Rastogi Publications , Gangotri , Shivaji Road, Meerut-25002
19. Biotechnology – BD Singh ( Hindi Ed) , Kalyani Publisher B1/292, Ludhiana, -141008 Punjab

**Practicals**

<b>Distribution of Marks for End Semester Practical Examination</b>	
<b>Activity</b>	<b>Marks</b>
Experiments	10
Viva Voce	5
Record	5
<b>Total Marks</b>	<b>20</b>

**Course Contents:**

1. Study of DNA in the *Drosophila*'s salivary gland chromosomes.
2. Isolation of genomic DNA
3. Molecular separations by chromatography, electrophoresis, precipitation etc.
4. Isolation of milk protein from the milk sample.
5. Separation of serum from blood by using centrifuge
6. Separation of plasma from blood by centrifugation.
7. Separation of biomolecules by paper and gel chromatography.
8. Preparation and use of culture media for microbes.
9. Preparation and use of culture media for animal tissues.
10. Media preparation media sterilization and inoculation.
11. Cell culture techniques- Design and functioning of tissue culture laboratory, cell proliferation measurements, culture media preparation and cell harvesting methods.
12. Isolation and staining of bacteria.
13. Determination of pH value of different water samples, blood urine and saliva.
14. Qualitative tests for carbohydrates.
15. Qualitative test for proteins.
16. Qualitative test for lipids.
17. Effects of temperature on the activity of enzyme.
18. Chart, model, Power point/multimedia presentation preparation related to evidence of evolution Human /Horse evolution, Geographical time scale etc.
19. Students are expected to visit different laboratories (RRL, CSIR, ICMR, Science centers etc).

**GROUP D: DISCIPLINE SPECIFIC ELECTIVE (DSE)**

**Semester VIII**  
**BOT 402: BOTANY: MOLECULAR BIOLOGY, BIOCHEMISTRY AND BIOTECHNOLOGY**

Time: 3 Hours  
Credits- 4

Max. Marks: 100  
Theory: 60, Internal: 20, Practical: 20

NOTE FOR PAPER SETTER FOR THEORY EXAMINATION

- i) Paper setter will set 9 questions in all, out of which students will be required to attempt 5 questions.
- ii) Q.No. 1 will be compulsory and will carry 12 marks. There will be atleast 4 short-answer type questions selected from the entire syllabus.
- iii) Two long answer type questions will be set from each of the four units, out of which the students will be required to attempt one question from each unit. Long-answer type questions will carry 12 marks each.
- iv) All questions will carry equal marks.

**Objectives:** After completion of this course the student teachers will be able to::

- Understand the structure and functions of biological macromolecules;
- Understand and appreciate the importance of nucleic acid and gene research in modern times;
- Understand the tools and techniques of biotechnology, the processes involving gene manipulation and their applications.
- Understand the tools, techniques and applications of plant tissue culture.

**Course Contents**

**Unit I: Genetics**

- Discovery, brief history of DNA and RNA. (i) DNA: types, molecular structure, characteristics, structural properties and functions. Satellite and repetitive DNA, mitochondrial and plastid DNA, plasmid, DNA damage and repair, replication of DNA in prokaryotes and eukaryotes. (ii) RNA: Types, structure, characteristics, structural properties and functions, Role of RNAs in proteinsynthesis.
- Gene expression: Structure of gene, transfer of genetic information, genetic code,
- Gene structure and regulation in prokaryotes, operon concept – lac and tryptophan operon.

**Unit II: Nitrogen & Protein Metabolism**

- Nitrogen Metabolism: Forms of nitrogen, cellular conversion of nitrates to ammonium ions, assimilation of  $\text{NH}_4^+$  ions physiology and biochemistry of biological nitrogen fixation, amino acids – nature, classification, structures, synthesis of amino acids – reduction amination and transamination.
- Proteins – classification, structure – primary, secondary, tertiary and

quaternary.

- Protein synthesis, transcription, translation, regulation of gene expression in prokaryotes and eukaryotes
- Enzymes: Nomenclature, types and mechanism of action

### **Unit III: Complex Molecules: Carbohydrates & Lipids**

- Carbohydrates: Introduction, classification, chemical structures of mono, oligo and polysaccharides, synthesis and breakdown of sucrose and starch.
- Lipids: Introduction, classification, chemical structures, saturated and unsaturated fatty acids, synthesis and breakdown of fatty acids,  $\beta$ -oxidation.

### **Unit IV: Biotechnology and Bioinformatics**

- Tools and techniques for DNA recombinant technology, cloning vectors, brief account of genomics and c-DNA library, interferons, transposable elements, PCR.
- Applications of Biotechnology – function, definition and applications, brief account of DNA finger printing, *Agrobacterium* – mediated gene transfer, achievements in crop improvement, transgenic plants.
- Brief account of recent advances in Plant bio-technology; products of biotechnology
- Brief account of Bioinformatics – genomics, proteomics.

### **Suggested Readings:**

1. Lea, P.J. and R.C. Leegood, 1999, Plant Biochemistry and Molecular Biology, John Wiley & Sons, England.
2. Lehninger, A.B., Principles of Biochemistry, CBS Publishers and Distributors, New Delhi.
3. Srivastava, H.S. 2005, Plant Physiology, Biochemistry and Biotechnology, Rastogi Publications, Meerut.
4. Jain, J.L. 1994, Fundamentals of Biochemistry, Sultanchand & Co., New Delhi.
5. Old, R.W. and S.B. Primrose, 1989, Principles of Gene Manipulation, Blackwell Scientific Publication, Oxford, UK.
6. Lodish, H., A. Berk, S.L. Zipursky, P. Matsudaiva, D. Baltimore, and J. Darnell, 2000. Molecular Cell biology, W.H. Freeman & Co., New York.
7. Alberts, B., D. Bray, J. Lewis, M. Raff, K. Roberts and I.O. Watson, 1999, Molecular Biology of Cell, Garland Publishing Co., Inc., New York.
8. Malacinski, G.M., 2005, Essentials of Microbiology (4<sup>th</sup> Ed.). Narosa Publishing House, New Delhi.
9. Cell and Molecular Biology (8<sup>th</sup> Ed.) E.D.P. De Robertis and EMF De Robertis Lippencott Williams & Wilkins

### **Practicals**

<b>Distribution of Marks for End Semester Practical Examination</b>
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<b>Activity</b>	<b>Marks</b>
Experiments	20
Viva Voce	5
Record	5
<b>Total Marks</b>	<b>30</b>

**All the following experiments are to be done. Few more experiments may be set at the institutional level.**

- Basic requirements of a tissue culture laboratory: (a) Common Glassware, (b) test tubes, culture tubes and screw-capped tubes, (c) Petridish (d) Pipette (e) Pasteur pipette (f) Erlenmeyer flask (g) Volumetric flask (h) Cleaning glassware (i) Inoculation needle and inoculation loop (j) Bunsen burner (Spirit-lamp)(k) Water baths (l). Autoclaves (m) Laminar air flow (n) Incubator (o) Hot air oven (p) Colony counter (q) pH meter (r) Electric balance (s) Spectrophotometer (t) Centrifuge (u) Binocular Microscope.
- Method of using balance
- Preparation of temporary cotton plugs.
- Preparation of permanent cotton plugs.
- Preparation of culture media
- Preparation of liquid medium (broth)
- Preparation of solid media (PDA medium and plates)
- Preparation of agar slants.
- Methods of sterilization
- To test for the presence of carbohydrates, proteins and lipids.

**GROUP D: DISCIPLINE SPECIFIC ELECTIVE (DSE)**  
**Semester VIII**

**MTH 402: MATHEMATICS: NUMERICAL ANALYSIS**

Time: 3 Hours

Max. Marks: 100

Credits- 4

Theory: 60, Internal: 20, Practical: 20

**NOTE FOR PAPER SETTER FOR THEORY EXAMINATION**

- i) Paper setter will set 9 questions in all, out of which students will be required to attempt 5 questions.
- ii) Q.No. 1 will be compulsory and will carry 12 marks. There will be atleast 4 short-answer type questions selected from the entire syllabus.
- iii) Two long answer type questions will be set from each of the four units, out of which the students will be required to attempt one question from each unit. Long-answer type questions will carry 12 marks each.
- iv) All questions will carry equal marks.

**Objectives:**

At the end of course, learner will be able to apply concepts of Numerical methods in solving problems related to real life situation.

**Unit I:**

Error - its sources, propagation and analysis, Root finding for nonlinear equations (Transcendental and Algebraic equations): Bisection method, Regula-Falsi method, Newton Raphson's method order of convergence, Iterative method.

**Unit II:**

Numerical solution of system of linear equations, direct methods- Gauss elimination method, Gauss-Jordan method, the matrix inversion method, Iterative methods: Gauss-Jacobi Method, Gauss Siedel method.

**Unit III:**

Differences: forward, backward, central, Relation between difference and derivatives, Differences of polynomials, Newton's formula for forward and backward interpolation. Divided differences and simple differences, Newton's general interpolation formula, Lagrange's interpolation formula, Error in interpolation.

**Unit IV:**

Numerical differentiation and numerical integration- Newton's Cotes Quadrature formula, Gauss Quadrature formula, Trapezoidal, Simpson's & Weddle's rules, Numerical solution of first and second order differential equations, Taylor's series approximation, Euler's Method, Picard's Method, Runge-Kutta Method.

**Suggested Readings:**

1. An Introductory Methods in Numerical Analysis: S.S. Sastri, P.H.I, New Delhi, 4<sup>th</sup> edition 2005.
2. Numerical Analysis: J.L. Bansal, J.P.N. Ojha, JPH, Jaipur, 1991.
3. An Introduction to Numerical Analysis: Kendall E. Atkinson, John Wiley, New York, 2<sup>nd</sup> edition 2001.

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4. Computer Based Numerical Methods and Statistical Techniques: P.K. De, CBS Publication, New Delhi, 1<sup>st</sup> edition 2006.

**Group D: Discipline Specific Elective (DSE)**  
**Semester VIII**

**DSE 402: ONE PROJECT IN PHYSICS / CHEMISTRY / MATHEMATICS /  
BOTANY / ZOOLOGY**

**Credits: 6**

**Marks: 100**

Students will select the topics of Project in consultation with concerned subject teacher in Semester VI and they will work for the Project from Semester VI to VIII. Final Project Report will be submitted by the student-teacher in the Semester VIII for its evaluation. Evaluation of the Project will be done out of the 100 marks as per the distribution given below:

<b>Distribution of Marks for the Project Evaluation</b>		
<b>Activity</b>	<b>Max. Marks</b>	<b>Min. Marks</b>
Project Report	70	28
Viva Voce	15	6
Presentation	15	6
<b>Total Marks</b>	<b>100</b>	<b>40</b>

**Semester VIII**

**PEVE 402: VISION OF EDUCATION IN INDIA-ISSUES AND CONCERNS**

Time: 3 Hours

Max. Marks: 100

Credits- 4

Theory: 80, Internal: 20

**NOTE FOR PAPER SETTER FOR THEORY EXAMINATION**

- i) Paper setter will set 9 questions in all, out of which students will be required to attempt 5 questions.
- ii) Q.No. 1 will be compulsory and will carry 16 marks. There will be atleast 4 short-answer type questions selected from the entire syllabus.
- iii) Two long answer type questions will be set from each of the four units, out of which the students will be required to attempt one question from each unit. Long-answer type questions will carry 16 marks each.
- iv) All questions will carry equal marks.

**Objectives of the Course:** On completion of the course, the student teacher will be able to:

- Understand determinants of the purposes and processes of education.
- Understand the role of education as an agency of social transformation.
- Reflect critically on concerns and issues of contemporary Indian schooling.
- Develop their insight as future concerns of education.
- Analyze development of education in light of socio, economic, political and cultural development.

**Course Contents**

**Unit I: Vision of Indian Education and Indian Thinkers**

- Aims and purposes of education drawn from the ancient intellectual tradition of India
- Communities, Religion, State and Market as the determinants of purpose and process of Education
- An overview of salient features of the philosophy and practice of education by
  - Swami Vivekanand: Humanistic Approach
  - Rabindranath Tagore: Liberationist pedagogy
  - M. K. Gandhi: Basic education or Education for self sufficiency
  - Aurobindo Ghosh: Integral Education
  - J. Krishnamurthi: Education for individual and social transformation

**Unit II: Contemporary Indian Schooling: Concerns and Issues**

- Constitutional interventions for universalization of education and RTE Act 2009
- Constitutional provisions on education that reflect National ideals (Democracy, Equality, Liberty, Secularism and Social justice)

- Equality of Educational Opportunity:
  - Meaning of equality of educational opportunity and constitutional provisions
  - Prevailing nature and forms of inequality, including dominant and minor groups and related issues
  - Inequality in schooling: Public and private schools, rural-urban Schools, single teachers' schools and many other forms of inequalities in school systems and the processes leading to disparities
- Issues of Quality and Equity in schooling (with specific reference to girl child, weaker section and differently abled children), Variations in school quality
- Idea of 'common school' system

**Unit III: Future Concerns and changing scenario in Education**

- Impact of globalization, liberalization and privatization on Indian society and education
- Rights and Scheme for education of Girl Child
- Education for National Integration and International Understanding
- Citizenship education, Education for Sustainable Development of society
- ICT In School Education- National Repository of Open Educational Resources (NROER)

**Unit IV: Education and Development- An Interface**

- Emerging trends in the interface between:
  - political process and education
  - economic developments and education
  - Socio- cultural changes and education
  - Skill development with reference to vocational education
  - Educational development through community participation (Govt. and Non- Govt. Agencies)

**Modes of Learning Engagement:**

- Sourcing and studying relevant portions of documents relevant to the themes.
- Presentations based on readings (including original writing of at least one educational thinker).
- Conduct surveys of various educational contexts (e.g. Schools of different kinds) and make interpretative presentations based on these.
- Study writings on analysis of education-development interface and make presentations.
- Group discussions, debates and dialogue on the themes.

**Practicum:**

- Preparing an assignment on Constitutional Provisions on Education.
- Preparing a brief summary of Educational writers/books contributed by any of the Indian Thinkers.
- Reporting on Practice of Rights of the Child with special reference to Girl Child.
- Comparative analysis of different types of schools.
- Conducting surveys and presentations based on aforesaid units.

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- Interpretation of field studies and experiences in terms of the course themes
- Comprehension of ideas of thinkers and presenting them in groups.
- Extent of innovative ideas and sensitivity in visualizing project on 'peace' or 'environmental concerns'

**Suggested Readings:**

1. Agrawal, J.C. & Agrawal S.P. (1992). Role of UNESCO in Educational. New Delhi. Vikas Publishing House.
2. Anand, C.L. et.al. (1983). Teacher and Education in Emerging in Indian Society. New Delhi. NCERT.
3. Govt. of India (1986). National Policy on Education. New Delhi. MHRD.
4. Govt. of India (1992). Programme of Action (NPE). New Delhi. MHRD.
5. Mani, R.S. (1964). Educational Ideas and Ideals of Gandhi and Tagore. New Delhi. New Book Society.
6. Manoj Das (1999). Sri Aurobindo on Education. New Delhi. National Council for Teacher Education.
7. Mistry, S.P. (1986). Non-formal Education-An Approach to Education for All. New Delhi. Publication.
8. Mohanty, J. (1986). School Education in Emerging Society. sterling Publishers.
9. Mukherji, S.M. (1966). History of Education in India. Baroda. Acharya Book Depot.
10. Naik, J.P. & Syed, N. (1974). A Student's History of Education in India. New Delhi. MacMillan.
11. NCERT (1986). School Education in India – Present Status and Future Needs. New Delhi. NCERT.
12. Ozial, A.O. 'Hand Book of School Administration and Management'. London. Macmillan.
13. Radha Kumud Mookerji (1999). Ancient Indian Education (Brahmanical and Buddhist). New Delhi . Cosmo Publications.
14. Sainath P. (1996). Everybody loves a good drought. New Delhi. Penguin Books.
15. Salamatullah. (1979). Education in Social context. New Delhi. NCERT.
16. Sykes, Marjorie (1988). The Story of Nai Talim. Wardha. Naitalim Samiti.
17. UNESCO (1997). Learning the Treasure Within.
18. Vada Mitra. (1967). Education in Ancient India. New Delhi. Arya book Depot.
19. National Policy on Education (1986). Ministry of HRD. New Delhi. Department of Education.
20. NCERT (2002). Seventh All India School Education Survey. New Delhi. NCERT.
21. UNESCO. (2004). Education for All. The Quality Imperative. EFA Global Monitoring Report. Paris.

**GROUP E: PROFESSIONAL EDUCATION COURSES (PEC)**

**II: Enhancing Professional Capacities (EPC)**

**Semester VIII**

**EPCPE 402: PEACE ORIENTED VALUE EDUCATION**

Time: 1.5 Hours

Max. Marks: 50

Credits- 2

Theory: 40, Internal: 10

**NOTE FOR PAPER SETTER FOR THEORY EXAMINATION**

- i) Paper setter will set 9 questions in all, out of which students will be required to attempt 5 questions.
- ii) Q.No. 1 will be compulsory and will carry 08 marks. There will be atleast 4 short-answer type questions selected from the entire syllabus.
- iii) Two long answer type questions will be set from each of the four units, out of which the students will be required to attempt one question from each unit. Long-answer type questions will carry 8 marks each.
- iv) All questions will carry equal marks.

**Objectives:** After completion of the course, student-teachers will be able to:-

- Understand the importance of peace education.
- Analyse the factors responsible for disturbing peace.
- Appreciate the role of peace in life.
- Develop insight of understanding of concept of Indian values according to time, space and situation.
- Scientifically analyse values in Indian culture and tradition.
- Develop positive attitude about Indian human values
- Understand the Indian values according to Shradhhaand logic.
- Understand the co-ordination with Indian values and life style.
- Analyse the ethical, artistic and pleasant values.
- Analyse absolute values in globalization and universlization.
- Develop the teaching learning method for adoption and assimilation in life value.
- Explain fundamental aims and values that provide the intellectual basis of contemporary education policy and practice.
- Engage with issues in a manner that makes them sensitive to promote certain educational values while marginalizing others.
- Explore the meaning of Ethics and values.
- Understand the process of value education.

**Unit I: Importance of Peace**

- Aims, objectives and importance of Peace Education.
- Barriers- Psychological, Cultural, Political
- Factors responsible for disturbing Peace: Unemployment, terrorism, Exploitation, Suppression of individuality, complexes.
- Characteristics of good textbook, evaluation of textbook, analysis of text book from peace education perspective.

**Unit II: Nature and sources of values, Classification of values**

- Meaning, concept need and importance of values and ethics.
- Personal and Social values
- Intrinsic and extrinsic values on the basis of personal interest and social good.
- Social, moral, spiritual and democratic values on the basis of expectation of society and one's self inspiration.
- Identification of Analysis of emerging issues involving value conflicts
- Design and development of instructional material for nurturing values.

**UNIT III: Values in religious scriptures**

- Bhagwad gita-Nishkam Karma, Swadharma, Laksagrah and Stithpragya.
- Bible – Concept of truth, compassion, forgiveness
- Dhamnipada- Astangmarg, Aryastyaand Madhyamarg
- Gurugranth Sahib- Concept of Kirath, Sungat, Pangat & Jivanmukti
- Quran–Concept of spiritual and moral values (adah, raham & theory of justice) & social responsibilities.

**UNIT IV: Methods and Evaluation of Value Education**

- Traditional Methods: Story Telling, Ramleela, Tamasha, street play and folk songs.
- Practical Methods: Survey, role play, value clarification, Intellectual discussions.
- Causes of value crisis: material, social, economic, religious evils and their peaceful solution.
- Role of school- Every teacher as teacher of values, School curriculum as value laden.
- Moral Dilemma (Dharmasankat) and one's duty to wards self and society

**Practicum/Field Work (Any two of the following):**

- Preparation of a report on school programmes for promotion of peace.
- Observation of classroom situation and identification of factors promoting peace.
- Analyse morning assembly programme of a school from the point of view of value education.
- Analysis of a text book of a school subject from the point of view of values hidden.
- Practice of role- play in two situations and preparation of report.
- Report on value conflict resolution in a situation.

**Suggested Readings:**

1. अवस्थी शशि—प्राचीन भारतीय समाज, हिन्दी माध्यम कार्यान्वयन निदेशालय|दिल्ली विश्वविद्यालय, दिल्ली 1993
2. उर्वशी, सरती –नैतिक शिक्षा एवं बालविकास, प्रभात प्रकाशन, चावडीबाजार, दिल्ली , 1979
3. काणेपी.बी. – धर्मशास्त्री काइतिहास, उ.प्र. हिन्दीसंस्थान, हिन्दी भवन,महात्मा गाधीमार्ग, लखनऊ।
4. गुप्तानत्थूलाल—मूल्यपरकशिक्षा पद्धति, जयकृष्ण अग्रवाल, महात्मागाधीमार्ग, अजमेर 1989
5. गोयनकाजयदयाल—महत्वपूर्णशिक्षा, गीताप्रेस गोरखपुर।
6. पाण्डेय गोविन्दचन्द्र—मूल्य मीमांसा—राजस्थानहिन्दीग्रन्थअकादमी, तिलकनगर, जयपुर, 1973।
7. प्रसहस्रबुद्धे: जीवन मूल्य, सुरुचि साहित्य, केशवकृंज, झण्डेवालान, नईदिल्ली,

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8. भारती धर्मवीर—मानवमूल्य औरसाहित्य, भारतीय ज्ञानपीठ, काशी, 1972
9. मानवसेवासंघ, वृंदावन—मानवता के मूलसिद्धान्त 1981
10. मिश्रणविणनिवास— अध्यापन, भारतीय दृष्टि, एनसीटीई, नईदिल्ली 1988
11. विमलकुमार—मूल्य मीमांसा, राजकमलप्रकाशन, दिल्ली
12. AcharyaMahaprija : TowardsInnerHarmony, NewDelhi,B. Jain Publishers, 1999
13. Dutt,N.K.andRuhelaS.P.:HumanValuesandEducation,SterlingPublishersPvt.Ltd ., NewDelhi,
14. Gandhi K.L.: Value Education, GyanPublishingHouse, NewDelhi, 1993
15. Gupta,NathuLal:ValueEducation:TheoryandPractice:JaikrishanAgarwal,MahatmaGandhi Road,Ajmer – 2000
16. I.A.Lolla:ValueCertification:AnadvancedHandbookfortrainersandTeachers,Calif, UniversityAssociatePress, KrischanBoum, Howard 1977
17. PremKripal: Value in Education, NCERT, NewDelhi 1981
18. Rajput, J.S. (2001).Values in Education, NewDelhi, SterlingPublishers, 2005
19. RokeachM.: The Nature ofHumanValues, The FreePress , NewYork 1973
20. SharmaR.S.: The Monk who sold his Ferrari, Mumbai, JaicoPublishingHouse, 2003
21. Swami RagunathAnand: Eternal ValuesforaChangingSociety, BVB Bombay1971.
22. Gupta, K. M. (1989). Moral Development of School Children Gurgaon: Academic Press.
23. Krishnamurthy, J. (2000). Education and the Significance of Life. Pune: KFI.
24. Dhokalia, R. P. (2001). External Human Values and World Religious. New Delhi: NCERT.
25. Sheshadri, C., Khadere, M. A., &Adhya, G. L. (ed.) (1992). Education in Value. New Delhi: NCERT, London, Allen and Unwin.
26. Singh, R. N. (ed.) (2003). Analytical study of Sikh Philosophy, Commonwealth Publishers: New Delhi- 02.
27. Khan Masood Alia (ed.) (2006). Islamic Thought and its Philosophy. Commonwealth Publishers: New Delhi- 02.
28. Khan, IntakhabAlam (2007). Peace, Philosophy and Islam, Academic Excellence.Delhi- 31.

**GROUP E: PROFESSIONAL EDUCATION COURSES (PEC)**  
**II: Enhancing Professional Capacities (EPC)**

**Semester VIII**  
**EPCGI 402: GENDER ISSUES IN EDUCATION**

Time: 1.5 Hours  
Credits- 2

Max. Marks: 50  
Theory: 40, Internal: 10

**NOTE FOR PAPER SETTER FOR THEORY EXAMINATION**

- i) Paper setter will set 9 questions in all, out of which students will be required to attempt 5 questions.
- ii) Q.No. 1 will be compulsory and will carry 08 marks. There will be atleast 4 short-answer type questions selected from the entire syllabus.
- iii) Two long answer type questions will be set from each of the four units, out of which the students will be required to attempt one question from each unit. Long-answer type questions will carry 8 marks each.
- iv) All questions will carry equal marks.

**Objectives of the Course:** On completion of the course, the student teacher will be able to:

- develop basic understanding and familiarity with key concepts - gender, gender perspective, gender bias, gender stereotype, empowerment, gender parity, equity and equality, patriarchy and feminism
- understand the gradual paradigm shift from women studies to gender studies and some important landmarks in connection with gender and education in the historical and contemporary period
- learn about gender issues in school, curriculum, textual materials across disciplines, pedagogical processes and its intersection with class, caste, culture, religion and region
- understand how Gender, Power and Sexuality relate to education (in terms of access, curriculum and pedagogy)

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**Unit I: Gender Issues: Key Concepts**

- Gender, Social construction of Gender.
- Gender Socialization, Gender Roles.
- Gender discrimination.

**Unit II: Structures of Gender Inequality**

- Patterns of Gender inequality in terms of caste, class and Culture.
- Patterns of violence against women: Female foeticide, Female Infanticide.
- Child marriage. Dowry, Widowhood, Female commercial sex workers, Domestic violence.
- Gender Identities and Socialization Practices in: Family, Schools, Other formal and Informal Organization.

**Unit III: Gender and Education, issues related to marginalized women**

- Gender bias in curriculum, drop out, Sex Ratio, Literacy and Recent trends in Women's education.
- Issues related to marginalized Women: ST/SC/Minorities.

**Unit IV: Gender Jurisprudences**

- The Pre-natal diagnostic Techniques Act, 1994.
- The Draft sexual Assault Law Reforms, India, 2000.
- Domestic violence Act 2005.
- Reservation for Women.
- Child marriage Act.

**Modes of Learning Engagement:**

Classroom will be interactive by sharing experiences, discussing day today happenings in the society, visiting centres and offices, showing films followed by discussions and priority will be given to student teachers throughout the transaction of the course.

**Practicum/ Tutorials:**

- Write a paper on efforts of the Central and State governments for Gender Jurisprudences.
- Prepare on any one topic from any one unit with the support of Teacher Educator and present in the classroom.
- Review one recent article on Gender Issues in Education.
- Prepare a report on recent trends in Educational development of girl child in India.
- Conduct an opinion survey for Gender Issues in Education.

**Suggested Readings:**

1. Radha Kumar (1993). The History of Doing. Zubaan.
2. Sharma, Kumud, (1989). Shared Aspirations, Fragmented Realities, Contemporary Women's Movement in India, Its Dialectics and Dilemmas. New Delhi. Occasional Paper No. 12, CWDS.
3. Maithreyi Krishna Raj, (1986). Women Studies in India – Some Perspectives. Bombay. Popular Prakasham.
4. Devaki Jain and Pam Rajput (Ed) (2003). Narratives from the Women's Studies Family. New Delhi. Recreating Knowledge, Sage.
5. Bonnie G. Smith, (2013). Women's Studies: the Basics. Routledge.
6. Rege, Sharmila (2003) (ed), Sociology of Gender. New Delhi. The Challenge of Feminist Sociological Knowledge, Sage.
7. Singh, Indu Prakash, (1991). Indian Women: The Power Trapped. New Delhi. Galaxy Pub.
8. Mohanty, Manoranjan, (2004). (eds), Class, Caste, Gender. New Delhi. Sage.
9. Census Document Karve, Irawati (1961). Hindu Society: An Interpretation Poona. Deccan College.
10. Ahuja, Ram (1993/2002). Indian Social System. Jaipur. Rawat.
11. Report of the CAGE (2005) Committee on Girl's Education and the common School System New Delhi. MHRD,
12. NCERT (2005). National Curriculum Framework. New Delhi. NCERT.

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13. NCERT (2006). Gender Issues in Education, Position Paper. New Delhi. NCERT.
14. Bhasin, Kamla (2000). Understanding Gender. New Delhi: Kali for Women.
15. Bhasin, Kamla (2004). Exploring Masculinity. New Delhi. Women Unlimited.
16. MHRD(2000). Bringing Girls Centre stage: Strategies and Interventions for Girls' Education in DPEP. New Delhi. MHRD.
17. Chakravarti, Uma (2003). Gendering Caste through a Feminist Lens, Mandira Sen for Stree, an imprint. Calcutta. Bhatkal and Sen.
18. Chanana, Karuna (1985). 'The Social Context of Women's Education in India, 1921-81, 'in New Frontiers of Education, July-September. New Delhi: 15 (3):1-36.