GURU KASHI UNIVERSITY

Bachelors of Science

(B.Sc. B.Ed.)

Session: 2024-25

Department of Education

GRADUATE ATTRIBUTES OF THE PROGRAMME: The Graduates in B.sc B.Ed will be applying the knowledge of Teacher Education, mathematics and science fundamentals to the solution of complex physical problems; identify, formulate, research literature, and analyses complex problems reaching substantiated conclusions using first principles of mathematics, natural sciences; design solutions for complex science related problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations; create, select, and apply appropriate techniques, resources, teaching pedagogy.

Program Learning Outcomes: After completion of the program, the students will be able to:

1. Apply the knowledge of Teacher Education, pedagogy, foundations of education to understand the interdisciplinary courses. The solution of complex teacher education problems.
2. Acquire the knowledge with facts and figures related to various subjects in pure sciences.
3. Identify, analyze, evaluate and apply information scientifically to solve problems.
4. Enhance critical thinking and analytic reasoning to employ critical thinking in understanding the concepts in every area of Math, physics and chemistry to analyze the results.
5. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
6. Learn the laboratory skills needed to design safely and interprets different instruments with an understanding of the limitations.
7. Develop flair by participating in various social and cultural activities in environmental context, and demonstrate the knowledge of, and need for sustainable development.

Course Structure of the B.Sc. B.Ed.

Semester –I						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credit**
BNM116	Probability and Statistics	Compulsory Foundation	2	0	0	2
BNM103	Mechanics	Core	4	0	0	4
BNM101	Inorganic Chemistry	Core	4	0	0	4
BNM102	Matrix and Co-ordinate Geometry	Core	4	0	0	4
BED102	Childhood and Growing Up	Core	4	0	0	4
BNM113	Mechanics Lab	Skill Based	0	0	2	1
BNM104	Inorganic Chemistry Lab	Skill Based	0	0	2	1
BNM118	ICT Skills in Education	MD	3	0	0	3
Discipline Elective (Any one of the following)						
BNM108	Condensed Matter Physics	Discipline Elective-I	3	0	0	3
BNM109	Waves & Oscillation					
BNM115	Medical Physics					
BNM111	Radiation Physics					
Total			**24**	**0**	**4**	**26**

Semester-II						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credit**
BNM212	Electricity &Magnetism	Core	4	0	0	4
BNM201	Physical Chemistry	Core	4	0	0	4
BED201	Learning & Teaching	Core	4	0	0	4
BNM213	Real Analysis	Core	4	0	0	4
BNM214	Electricity & Magnetism Lab	Skill Based	0	0	2	1
BNM205	Physical Chemistry Lab	Skill Based	0	0	2	1
Discipline Elective (Any one of the following)						
BNM208	Differential Equations	Discipline Elective-II	3	0	0	3
BNM203	Linear Algebra					
BNM222	Mathematical Methods					
BNM211	Number Theory					
Value Added Course (For other departments also)						
BNM223	Environmental Science and Sustainability	Value Added Course	2	0	0	2
BNM299	XXX	MOOC	0	0	0	2
Total			**21**	**0**	**4**	**25**

Semester-III						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credit**
BNM315	Thermodynamics & Statistical Physics	Core	4	0	0	4
BNM301	Organic Chemistry	Core	4	0	0	4
BED412	Contemporary India & Education	Elective Foundation	3	0	0	3
BNM317	Thermodynamics & Statistical Physics Lab	Skill Based	0	0	2	1
BNM306	Organic Chemistry Lab	Skill Based	0	0	2	1
BNM321	MATLAB Programming	Skill Based	2	0	0	2
BNM322	MATLAB Programming Lab	Skill Based	0	0	2	1
BNM323	Instrumentation in Physics	Skill Based	2	0	0	2
BNM324	Instrumentation in Physics Lab	Skill Based	0	0	2	1
Discipline Elective (Any one of the following)						
BNM307	Complex Analysis	Discipline Elective- III	3	0	0	3
BNM308	Linear Programming Problem					
BNM309	Riemann Integration & Series of Functions					
BNM326	Discrete Mathematics					
BNM399	XXX	MOOC	0	0	0	2
Open Elective						
XXX	XXX	IDC	2	0	0	2
Total			**20**	**0**	**8**	**26**

Open Elective (For other departments)						
OEC002	Basic Mathematics	IDC	2	0	0	2
OEC027	Physics for competitive exams					
OEC008	Chemistry in Everyday Life					

Semester-IV						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credit**
BNM415	Nuclear and Particle Physics	Core	4	0	0	4
BNM402	Abstract Algebra	Core	4	0	0	4
BED205	Assessment for Learning	Core	4	0	0	4
BNM417	Nuclear and Particle Physics Lab	Skill Based	0	0	2	1
BNM424	Digital Literacy	Elective Foundation	3	0	0	3
BNM425	Basics of Translation	MDC	3	0	0	3
Discipline Elective (Any one of the following)						
BNM426	Pharmaceutical Chemistry	Discipline Elective- IV	3	0	0	3
BNM427	Conductance, Electrochemistry & Functional Group Organic Chemistry					
BNM428	Polymer Chemistry					
BNM429	Pesticide Chemistry					

Value Added Course (For other departments also)						
BNM421	Life Skills	Value Added Course	2	0	0	2
Total			**23**	**0**	**2**	**24**

Semester-V						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credit**
BNM528	Modern Physics	Compulsory Foundation	2	0	0	2
BNM529	Spectroscopy	Core	4	0	0	4
BNM530	Calculus	Core	4	0	0	4
BNM531	Spectroscopy Lab	Skill Based	0	0	2	1
BNM518	Numerical Methods	Skill Based	2	0	0	2
BNM532	Modern Physics Lab	Skill Based	0	0	2	1
BAD526	Health, yoga and Physical Education	Elective foundation	3	0	0	3
BNM599	XXX	MOOC	0	0	0	2
Pedagogical Skill Courses						
Xxx	Pedagogy of School Subject-I	Skill Enhancement	3	0	0	3
Xxx	Pedagogy of School Subject-II	Skill Enhancement	3	0	0	3
Total			**21**	**0**	**4**	**25**
Pedagogy of School Subject Groups-I and II (Select any two of the following)						

Course Code	**Courses Title**
BED136 BED145 BED146	Pedagogy of English Pedagogy of Mathematics Pedagogy of Science

Semester-VI						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credit**
BNM605	Fluid Mechanics	Core	4	0	0	4
BNM616	Organic Synthesis	Core	4	0	0	4
BNM617	Project in Physics/Chemistry/Mathematics	Skill Based	0	0	6	3
BED134	School Management and Administration	Elective Foundation	3	0	0	3
BAD602	Pre-Internship- (4 weeks)	Technical Skill	0	0	0	2
BNM610	IT Skills for Chemists	Skill Based	2	0	0	2
BNM611	IT Skills for Chemists Lab	Skill Based	0	0	2	1
BNM618	Organic Synthesis Lab	Skill Based	0	0	2	1
Pedagogical Skill Courses						
XXX	Pedagogy of School Subject-I	Skill Enhancement	3	0	0	3
XXX	Pedagogy of School Subject-II	Skill Enhancement	3	0	0	3
Total			**19**	**0**	**10**	**26**

Pedagogy of School Subject Groups-I and II (Select any two of the following)	
Course Code	**Courses Title**
BED232	Pedagogy of English
BED241	Pedagogy of Mathematics
BED242	Pedagogy of Science

Semester 7th						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credits**
BAD701	School Internship (16 weeks)	Teaching Skill	0	0	0	16
BAD702	Research Project (Community Engagement)	Research Skill	0	0	0	4
Total			**0**	**0**	**0**	**20**

Semester 8th						
Course Code	**Course Title**	**Type of Course**	**L**	**T**	**P**	**Credits**
BAD810	Knowledge and Curriculum	Core	4	0	0	4
BAD801	Gender, School and Society	Core	4	0	0	4
BAD803	Creating Inclusive Schools	Elective Foundation	3	0	0	3
BAD804	Reading and Reflecting on Texts	Technical Skill	0	0	4	2
BAD811	Art in Education	Ability Enhancement	3	0	0	3
Discipline Electives (Select any two of the following)						
BAD805	Understanding Discipline and Subject	Discipline Elective	3+3	0	0	6
BAD807	Guidance and Counselling					
BAD808	Distance and Open Learning					
Value Added Courses						
BAD809	Value Education	VAC	2	0	0	2
Total			**22**	**0**	**4**	**24**
Grand Total			**150**	**0**	**36**	**196**

Evaluation Criteria for Theory Courses

A. Continuous Assessment: [25 Marks]
   CA-1 Surprise Test (Two best out of three) - (10 Marks)
   CA-2 Assignment(s) (10 Marks)
   CA-3 Term paper/Quiz/Presentation (05 Marks)

B. Attendance (05 marks)

C. Mid Semester Test: [30 Marks]

D. End-Term Exam: [40 Marks]

Evaluation Criteria for Practical Courses

The syllabus of subject is divided into five experiments, each experiment is of 20 marks (10 lab performance, 5 viva, 5 lab record) - Total marks 100

Semester -I

Course Title: Probability and Statistics
Course Code: BNM116

L	T	P	Credit
2	0	0	2

Total Hours: 30

Learning Outcomes: On successful completion of this course, the successful students will be able to:

1. Describe the Probability and its distributions and basic laws of total probability and compound probability in statistics.
2. Categorize appropriate sampling processes and testing of hypothesis based on them.
3. Recall the methods of classifying and analyzing data relative to single variable and multiple variables.
4. Distinguish between the practical purposes of a large and a small sample.

Course Content

UNIT I **8 hours**

Sample space and events, algebra of events, axiomatic approaches, conditional probability, basic laws of total probability and compound probability, Byes' theorem, Independence.

UNIT II **7 hours**

Discrete and continuous random variables, mathematical expectation, variance, moment about a point, central moment, moment generating function, Binomial, Poisson, Normal and Rectangular distributions.

UNIT III **8 hours**

Two-dimensional random variables, joint distribution functions, marginal distributions, covariance, linear regression and correlation, rank correlation, least square method of fitting regression lines.

UNIT IV **7 hours**

Sampling, random sampling, large sample tests of means and proportion. T-student, (chi square)
and F distributions (without derivation) and testing of hypothesis based on them.
2x

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, E team Teaching, Flipped Teaching, Quiz, Open talk, Problem Analysis.

Suggested Readings:-

- *Irwin Miller and Marylees Miller,(1975).John E. Freund's Mathematical Statistics with Applications, Pearson Education.*
- *Robert V. Hogg, Allen Craig Deceased and Joseph W. McKean,(2002). Introduction to Mathematical Statistics, Pearson Education*
- *Sheldon M. Ross, (2009). Introduction to probability and statistics for engineers and scientists, Elsevier Academic Press.*
- *Goon, A.M., Gupta and M.K., Das Gupta, (1991). Fundamental of Statistics. Vol 1. World , B. Press. Calcutta.*

Course Title: Mechanics
Course Code: BNM103

L	T	P	Credit
4	0	0	4

Total Hours: 60

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Define the various coordinate systems, its applications, Michelson Morley experiment, Einstein's postulates of theory of relativity
2. Demonstrate the fundamental forces of nature, concept of center mass, central forces and the motion of particle under central force and to determine the turning points of orbit.
3. Determine the phenomena of collisions and idea about center of mass and laboratory frames and their correlation
4. Derive the frames of reference, Coriolis forces and its applications and effect of rotation of earth on gravity.

Course Content

UNIT -I **15 Hours**

Dynamics of Rigid Body: Cartesian and spherical polar co–ordinate systems, area, volume, velocity and Acceleration in these systems. Equation of motion of a rigid body, moment of inertia, radius of gyration, theorems of parallel and perpendicular axes, Principle Axes and Euler's equations, moments of inertia of a ring, disc, rectangular beam, hollow and solid cylinder.

UNIT -II **15 Hours**

Inverse Square Law Forces : Central forces, Equation of motion under central force , Force between a Point Mass and Spherical shell. Force between a Point

Mass and Solid Sphere; Orbits, equation of orbit, turning points, eccentricity. Two-body problem - reduced mass, Kepler Laws.

UNIT -III **15 Hours**

Relativity: Inertial frame of reference. Galilean transformation. Effect of rotation of earth on 'g'. Foucault's pendulum and its equation of motion. Fictitious Forces, Velocity and Acceleration in Rotating coordinate systems. Michelson-Morley Experiment, Basic postulates of special relativity, Lorentz transformations. Length contraction, Time dilation, Twin Paradox, Variation of mass with velocity

UNIT -IV **15 Hours**

Elastic and Inelastic Scattering: Types of Scattering and conservation laws, Laboratory and centre of mass system equivalent one body problem. Elastic collision in Lab. and C.M. systems, velocities, angles, and energies, cross section of elastic scattering, Rutherford scattering.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, E team Teaching, Flipped Teaching, Quiz, Open talk, Problem analysis.

SUGGESTED READINGS:-

- *Berkeley, Mechanics, Volume. I, C. Kittle.*
- *Daniel Kleppner& Robert J. Kolenkow, An Introduction to Machines Tata McGraw-Hill.*
- *R.G. Takwale & P.S. Puranik, Introduction of Classical Mechanics Tata McGraw-Hill.*
- *R.H. Good, Basic Concepts of Relativity, East-West Press, New Delhi.*
- *S.P. Puri, Special Theory of Relativity, Asia Publishing House, Bombay.*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs*

Course Name: Inorganic Chemistry
Course Code: BNM101

L	T	P	Credit
4	0	0	4

Total Hours: 60

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Predict geometries and shapes of various molecules.
2. Analyze electron gain enthalpy, trends of electron gain enthalpy
3. Differentiate between ionic and covalent bonds.
4. Evaluate the physical and electronic properties of solid-state materials.

Course Content

UNIT-I **15 Hours**

Atomic Structure: Idea of de Broglie matter waves, Heisenberg uncertainity principle, atomic orbitals, Schrodinger wave equation, significance of, Ψ and , Ψ^2, quantum numbers, radial and angular wave functions and probability distribution curve, shapes of s, p, d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configurations of the elements and ions. Normal and Orthogonal wave function, Atomic radii, Ionic and crystal radii, covalent radii.

Chemical Periodicity: Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table. Atomic radii, Ionic and crystal radii, covalent radii
Ionization enthalpy, Successive ionization enthalpies, Electron gain enthalpy and its trend in periodic table.
Electronegativity and its scales, Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity

UNIT-II **15 Hours**

Chemistry of Noble gases: Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.

Chemical Bonding – I: Covalent Bond-Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. BeF_2 , BF_3, CH_4, PF_5, SF_6, IF_7, $Sncl_2$, BF_4, PF_6-, $SnCl_6$.

UNIT-III **15 Hours**

Chemical Bonding – II: Covalent Bond: Valence shell electron pair repulsion (VSEPR) theory to NH_3, H3O+, SF_4, CIF_3, ICI_2^-,H_2O and ICI_2^+, MO theory, homonuclear (elements and ions of 1st and 2nd row), diatomic molecules, multicenter bonding in electron deficient molecule (Boranes) percentage ionic character from dipole moment and eIectronegativity difference.

UNIT-IV **15 Hours**

Ionic Solids:- Concept of close packing, Ionic structures, (NaCl type, Zinc blende, Wurzite, CaF2, and antifluorite), radius ratio rule and coordination number, Limitation of radius ratio rule, efficiency of packing lattice defects, semiconductors, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarizability of ions, Fajan's rule. Metallic bond-free electron, valence bond and bond theories.

Weak Interactions: Hydrogen bonding, van der Walls forces and London Forces.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, ted talks, E team Teaching, Flipped Teaching, Quiz, Open talk, Case analysis

SUGGESTED READINGS:-

- *Lee, J.D. Concise (1991).Inorganic Chemistry, ELBS.*
- *Atkins, P.W. & Paula, J., (2016) Physical Chemistry, Oxford Press, 2006.*
- *Day, M.C. and Selbin, J., (2015) Theoretical Inorganic Chemistry, ACS Publications.*
- *J.E. Huheey, E.A. Keiter, R.L. Keiter, (1999) Inorganic Chemistry, Pearson Education, Singapore.*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs*

Course Title: Matrices and Coordinate Geometry
Course Code: BNM102

L	T	P	Credit
4	0	0	4

Total Hours: 60

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Grasp the basics of Matrices and coordinate geometry including applied aspect for enhancing quantitative skills and pursuing higher mathematics and research as well.
2. Develop a wide-ranging application of the subject and enlarge the knowledge of matrices for solving linear homogeneous and non-homogeneous system of equations.
3. Equip themselves with necessary analytic and technical skills by applying the principles of geometry.
4. Acquire the standard concepts and tools at an intermediate to advance level of geometrical techniques.

Course Content

UNIT I **18 hours**

Matrix introduction, matrix operations with their properties, symmetric, skew-symmetric, Hermitian and skew- Hermitian matrices, idempotent, nilpotent, involuntary, orthogonal and unitary matrices, singular and non-singular matrices, elementary operations on matrices, adjoint and inverse of a matrix, singular and non-singular matrices, Trace of a matrix.

UNIT II **15 hours**

Rank of a matrix, elementary transformations of a matrix, elementary matrices, rank of the sum and product of two matrices, inverse of a non-singular matrix through elementary row transformations, equivalence of matrices.
Solutions of a system of linear equations, condition of consistency and nature of the general solution of a system of linear non homogeneous equations.

UNIT III **15 hours**

Circle: General equation of circle, circle through intersection of two lines, Tangents and Normals, Chord of contact, pole and polar, pair of tangents from a point, equation of chord in terms of midpoint, angle of intersection and orthogonality
Parabola: General equation of Parabola, Properties of Parabola, parametric representation of Parabola, tangents, normal

UNIT IV **12 hours**

Ellipse: Properties of ellipse, parametric representation of ellipse, tangents and normals. **Hyperbola:** Properties of hyperbola, parametric representation of hyperbola, asymptotes of hyperbola, Conjugate hyperbola, tangents and normals.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, E team Teaching, Flipped Teaching, Quiz, Open talk, Problem Analysis.

Suggested Readings:-

- *Hari Kishan, (2008), A Textbook of Matrices, Atlantic Publishers.*
- *Fuzhen Zhang, (1999), Matrix Theory- Basic Results and Techniques, Springer.*
- *Shanti Narayan, P.K. Mittal, (2010), A Textbook of Matrices, S Chand & Company.*
- *T.M. Apostal, (1974),Vol. I, John Wiley & Sons Inc.*
- *Ajit Kumar and S. Kumaresan, (2019), A Basic Course in Real Analysis, CRC Press.*
- *S. Balachandra Rao & C. K. Shantha, (1992), Differential Calculus, New Age Publication.*
- *H. Anton, I. Birens and S. Davis, (2007), Calculus, John Wiley and Sons, Inc.*
- *G.B. Thomas and R.L. Finney, (2010), Calculus, Pearson Education.*
- *P.K. Jain and Khalil Ahmad: A Text Book of Analytical Geometry of two Dimensions, Wiley Eastern Ltd. 1994.*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs*

Course Title: Childhood and Growing Up
Course Code: BED102

L	T	P	Credits
4	0	0	4

Learning Outcomes **Total Hours: 60**

After completion of this course, the learner will be able to:

1. summarize theoretical perspectives and stages of human development
2. justify the causes of individual differences among individuals
3. comprehend different methods and techniques for the assessment of personality, intelligence
4. explore the influences of family, school and society on the growth and development and creativity of the child

Course Content

Unit I **16 Hours**

Concept of human Growth, Development and Maturation, Principles and Factors affecting human growth and development

Stages of Childhood & Adolescence period, Dimensions of Individual development: Physical, Cognitive, Language, Affective, Social, Moral and their inter-relationship, Individual differences in growth and development

Unit II **16 Hours**

Relevance & applicability of Various Theories of Development: Erickson (Psycho-Social), Piaget (Cognitive), Kohlberg (Moral Development) & Vygotsky (Socio-Cultural Theory). Role of Home, School and Society in cognitive, affective and conative development

Unit III **14 Hours**

Intelligence: Meaning, Theories (Howard Gardner's theory of multiple intelligence, Guilford's SOI) and its Measurement, Dealing with Gifted & backward children, Concept of Emotional Intelligence

Personality: Concept and Theories of Personality (Kretschmar, Jung, Eysenck) Factors responsible for shaping and Assessment of Personality

Unit IV **14 Hours**

Concept of creativity, difference between creativity and intelligence, Identification of creative child Techniques and methods of fostering creativity: brain storming, problem solving Group discussion, play way, quiz etc. Concept and dimensions of well-being and factors affecting well-being.

Transactional Mode

Open Talk, Panel Discussions, Collaborative Teaching, Case Analysis, Dialogue, Group Discussion, Demonstration, Project Based Learning, E-Monitoring, Quiz.

Suggested Readings

- Virk, J.K., Gill, R., Vats, A. (2022). Childhood and Growing Up. Twenty first century Publication.
- Meece, J S ECCLES, J. L (2010). Hand book of research on 12 School, Schooling and Human development New York, Routledge.
- Obert, S. Feldman-(2009). Understanding Psychology Tata McGrawHill
- Santrock. J.W (2007). Adolescence, Tata McGraw Hill Publishing Company NewYork.
- Hurlock, E.B (2006). Developmental Psychology-A Life Span Approach. Tata M. GrawHill Publishing Company New York.
- Santrock. J.W (2006). Child Development, Tata McGraw Hill Publishing Company New York.

- Hurlock, E.B (2006). Developmental Psychology-A Life Span Approach. Tata M. GrawHill Publishing Company New York.
- Santrock. J.W (2006). Child Development, Tata McGraw Hill Publishing Company New York.

Web Sources

- https://www.google.co.in/books/edition/childhood_and_growing_up/ tqajdwaaqbaj?hl=en&gbpv=1&printsec=frontcover
- https://www.learningclassesonline.com/2020/10/childhood-and-growing- up.html
- https://www.pupilstutor.com/2021/05/childhood-and-growing-up-pdf.html

Course Title: Mechanics Lab
Course Code: BNM113

L	T	P	Credit
0	0	2	1

Total Hours: 15

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Demonstrate conceptual understanding of fundamental physics principles.
2. Communicate physics reasoning in oral and in written form.
3. Solve physics problems use qualitative and quantitative reasoning including sophisticated mathematical techniques.
4. Use experimental, conceptual and theoretical methods

Course Content

List of Practical's:

1. Measurements of length (or diameter) using Vernier caliper, screw gauge and travelling microscope.
2. To study the random error in observations.
3. To determine the height of a building using a Sextant.
4. To study the motion of the spring and calculate (a) Spring constant and, (b) g.
5. To determine the Moment of Inertia of a Flywheel.
6. To determine g and velocity for a freely falling body using Digital Timing Technique.
7. To determine Coefficient of Viscosity of water by Capillary Flow Method (Poiseuille s method).
8. To determine the Young's Modulus of a Wire by Optical Lever Method.
9. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
10. To determine the elastic Constants of a wire by Searle's method.
11. To determine the value of g using Bar Pendulum.
12. To determine the value of g using Kater s Pendulum.

Note: Each student is required to perform at least ten experiments.

Transaction Mode- Video Based Teaching, Collaborative teaching, Project based learning, E-team teaching, Group discussion, E team Teaching, Flipped Teaching, Quiz, Open talk, Problem Analysis.

SUGGESTED READINGS:-

- *G. L. Squires, Practical Physics ,Cambridge University Press.*
- *Napier Shaw and Richard Glazebrook, Practical Physics, Nabu Press.*
- *C.L. Arora ,(2010), Practical Physics, S. Chand &Co.*

- *R.S. Sirohi,(2012), Practical Physics, , WileyEastern.*

Course Title: Inorganic Chemistry Lab

Course Code: BNM104

L	T	P	Credits
0	0	2	1

Total Hours: 15

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Perform experimental practice of quantitative volumetric analysis.
2. Develop laboratory skills in analyzing samples of different solutions.
3. Determine of the concentration or the mass of the minimum formula from the titrated chemical material composing a pure liquid or a solution.
4. Learn the main objective of volumetric analysis to determine the concentration of a substance in a given sample.

Course Content

List of Practical's:

(A) Titrimetric Analysis

(i) Calibration and use of apparatus

(ii) Preparation of solutions of different Molarity/Normality of titrants.

(B) Acid-Base Titrations

(i) Estimation of carbonate and hydroxide present together in mixture.

(ii) Estimation of carbonate and bicarbonate present together in a mixture.

(iii) Estimation of free alkali present in different soaps/detergents.

(C) Oxidation-Reduction Titrimetry

(i) Estimation of Fe(II) and oxalic acid using standardized KMnO4 solution.

(ii) Estimation of oxalic acid and sodium oxalate in a given mixture.

(iii) Estimation of Fe(II) with K2Cr2O7 using internal (diphenylamine, anthranilic acid) and external indicator.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, ted talks, E team Teaching, Flipped Teaching, Quiz,Open talk, Case analysis.

SUGGESTED READINGS:-

- *Vogel, A.I. (2018) A Textbook of Quantitative Inorganic Analysis, ELBS.*
- *Marr. G and Rocket, B. W. (1999) B. W. Practical Inorganic Chemistry, University Science Books. Lee, J.D. Concise (1991).Inorganic Chemistry, ELBS.*

- *Suggested digital platform: NPTEL/SWAYAM/MOOCs*

- *Interact English Lab Manual for Undergraduate Students,. Orient BlackSwan.*
- *Raman, Meenakshi and Sangeetha Sharma. Professional Communication. Oxford University Press: Oxford.*
- *S. Hariharanetal. Soft Skills. MJP Publishers.*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs*

Course Title: ICT Skills in Education
Course Code: BNM118

L	T	P	Credit
3	0	0	3

Total Hours: 45

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Appreciate the scope of ICT for improving the personal productivity and professional competencies
2. Develop skills of interaction in the classroom and electronic teaching portfolio.
3 use internet efficiently to access remote information, communicate and collaborate with others.
4. Describe social, economic, security and ethical issues associated with the use of ICT.

Course Content

UNIT I **12 Hours**

Educational Technology: Concept & Objectives, Forms of Educational Technology, Multisensory Instruction, Challenges for Educational Technology. Concept of Communication and Class Interaction, Elements, Process & Types of Communication.

UNIT II **11 Hours**

ICT in Education: Importance and need of ICT in Education, scope of ICT, Teaching Learning Process, Publication Evaluation, Research and administration, Challenges in Integrating ICT in School Education.

UNIT III **11 Hours**

ICT Integration in Teaching Learning Process: Approaches to Integrating ICT

in Teaching Learning Process, Project Based Learning (PBL), Co-Operative Learning, Collaborative Learning, ICT and Constructivism: A Pedagogical Dimension.

UNIT IV **11 Hours**

ICT for Professional Development: Electronic Teaching Portfolio, Assistive Technology for Children with Special Needs, ICT for Personal & Professional Development: Tools & Opportunities, Open Education Resources: Concept & Significance.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, E-team Teaching, Flipped Teaching, Quiz, Open talk, Problem Analysis

SUGGESTED READINGS:-

- *Agarwal J.P. (2013), Modern Educational Technology. Black Prints, Delhi.*
- *Barton,R.(2004), Teaching Secondary Science with ICT. McGraw Hill International.*
- *Bhaskar Rao (2013), Samachara Prasara Sankethika vidya Shastramu, Masterminds, Guntur.*
- *Cambridge, D. (2010), E-Portfolios for Lifelong Learning and Assessment. John Wiley and Sons.*
- *Costantino, P.M et al. (2006), Developing a professional teaching portfolio: a guide for success. Pearson Publishers.*
- *Denis, Kim, Sen and Morin (2000), Information Technology – The breaking Wave. Tata McGraw-Hill Publishing Company Limited.*

Course Title: Condensed Matter Physics

Course Code: BNM108

L	T	P	Credit
3	0	0	3

Total Hours: 45

Learning Outcomes: On completion of this course, the successful students will be able to:

1. List the crystal structures in one, two and three dimensional and structures of bravais lattices.
2. Define the different techniques and methods for crystal structure analysis and to find out the packing fractions of different structures.
3. Describe the interior of the substances using X-ray diffraction in crystals and reciprocals of SC, BCC and FCC.
4. Test theoretical basis of experimental material science and technology, structures of diamond and NaCl.

5. Solve problems of Crystal planes, Miller indices, Laue equations and Brillouin zones.

Course Content

UNIT I **12 Hours**

Crystal structure: General definitions of Lattice, basis and primitive cell, Symmetry operations for a two dimensional crystal. Bravais lattices in two and three dimensions, Index system for crystal planes, Structure of common lattice types (scc, fcc, bcc, hcp, diamond, NaCl, CsCl&Zns structures). Reciprocal Lattice, Brillouin zones, atomic form factor, structure factor of simple structures.

UNIT II **11 Hours**

Lattice Vibrations : Dynamics of monatomic and diatomic linear chains, optical and acoustic modes, concept of phonons, inelastic scattering of photons and neutrons by phonons, density of states (one & Three dimensions) Einstein and Debye models of heat capacity, thermal expansion.

UNIT III **11 Hours**

Magnetic Properties of Matter: Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langevin Theory of dia– and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss.

UNIT IV **11 Hours**

Dielectric Properties of Materials: Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility. Polarizability. Clausius Mosotti Equation. Classical Theory of Electric Polarizability Langevin-Debye equation. Complex Dielectric Constant.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, E team Teaching, Flipped Teaching, Quiz, Open talk, Problem Analysis

SUGGESTED READINGS:-

- *C. Kittel(2003), Introduction to Solid State Physics (Wiley Eastern).*
- *M.L. Cohen and S. Louie, Fundamentals of Condensed Matter Physics,*
- *B. D. Cullity, Magnetism and Magnetic Materials, Wiley-IEEE Press.*
- *Chaikin and Lubensky ,Principles of Condensed Matter Physics, Cambridge University Press.*
- *S.H. Patil (1985), Elements of Modern Physics TMGH.*
- *Puri and Babbar(1998), Solid State Physics, MGH Co.*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs*

Course Title: Waves & Oscillations
Course Code: BNM109

L	T	P	Credit
3	0	0	3

Total Hours 45

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Demonstrate the different types of the waves and their nature, electromagnetic waves & its spectrum.
2. Differentiate periodic motions & simple harmonic motions with examples like Torsion pendulum, Compound Pendulum, Damped Simple harmonic motion, Electrical Oscillations.
3. Solve for the solutions and describe the behavior of a damped and driven harmonic oscillator in both time and frequency domains.
4. Deliver the general equation of wave motion in general and TM waves in stretched strings and longitudinal waves in gases.

Course Content

UNIT I **12 Hours**

Simple Harmonic Oscillations: Simple harmonic motion, Equation of SHM, Differential equation and solution of SHM. Applications of SHO: Compound pendulum, Electrical Oscillations, Torsion Pendulum, Transverse Vibrations of a mass on a string, composition of two perpendicular SHMs of same period.

UNIT II **11 Hours**

Damped Harmonic Oscillations: Decay of free Vibrations due to damping, types of damping, Determination of damping coefficients – Logarithmic decrement, relaxation time and Q-factor. Electromagnetic damping.

UNIT III **11 Hours**

Forced Harmonic Oscillations: A forced oscillator, Transient and Steady State Oscillations, velocity versus driving force frequency, Resonance, power supplied to forced oscillator by the driving force. Q-factor of a forced oscillator.

UNIT IV **11 Hours**

Waves in Physical Media: Types of waves, Transverse and longitudinal waves, wave length, period, angular frequency, Wave motion in one dimension, Transverse waves on a string, longitudinal waves on a rod.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, E team Teaching, Flipped Teaching, Quiz, Open talk, Problem Analysis

SUGGESTED READINGS:-

- *S.P. Puri,, (2005), Text Book of Vibrations and Waves, Macmillan India Ltd.*
- *H.J. Pain, ELBS & John Wiley,(2012), Physics of Vibrations and Waves, London.*
- *Edward C. Jordan and K.G. Balmain,(2013), EM Waves and Radiating Systems, Prentice Hall.*
- *A.P. French,(2008), Vibrations and Waves, Arnold Heinemann India, New Delhi.*
- *P.K. Ghosh,(2018), The Mathematics of Waves and Vibrations, McMillan India.*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs*

Course Title: Medical Physics
Course Code: BNM115

L	T	P	Credit
3	0	0	3

Total Hours 45

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Understand physics behind the working of various organs of human body.
2. Comprehend principles behind the working of components used in Radiography industry.
3. Differentiate between the Conventional and digital radiography techniques.
4. Analyze the thermal regulation of human body.

UNIT I **11 Hours**

Basic Anatomical Terminology: Standard Anatomical Position, Planes. Familiarity with terms like- Superior, Inferior, Anterior, Posterior, Medial, Lateral, Proximal and Distal. Mechanics of the body: Skeleton, forces, and body stability. Muscles and dynamics of body movement.

UNIT II **11 Hours**

Physics of Locomotors Systems: Joints and movements, Stability and Equilibrium. Energy household of the body: Energy balance in the body, Energy consumption of the body, Heat losses of the body, Thermal Regulation. Pressure system of body: Physics of breathing, Physics of cardiovascular system.

UNIT III **11 Hours**

Acoustics of the body: Nature and characteristics of sound, Production of speech, Physics of the ear, Diagnostics with sound and ultrasound. Optical system of the body: Physics of the eye. Physics of the nervous system.

UNIT IV **12 Hours**

Physics of Diagnostic and Therapeutic Systems: Electromagnetic spectrum, production of x-rays, x-ray spectra, Bremsstrahlung, Characteristic x-ray, x-ray tube design, x-ray tube rating, quality and intensity of x-ray. X-ray generator circuits, types of X-Ray Generator.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, E team Teaching, Flipped Teaching, Quiz, Open talk, Problem Analysis.

SUGGESTED READINGS:

- *J.R. Cameron and J.G. Skofronick,Medical Physics, Wiley*
- *Curry, Dowdey and Murry –Lippincott, Christensen's Physics of DiagnosticsRadiology: Williams and Wilkins.*
- *Irving P. Herman, Physics of the human body, SpringerPublishers.*
- *Bushberg, Seibert, Leidholdt and Boone Lippincot, The essential physics of Medical Imaging: Williams and Wilkins.*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs*

Course Title: Radiation Physics
Course Code: BNM111

L	T	P	Credit
3	0	0	3

Total Hours 45

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Understand properties of ionizing radiation and their applications
2. Explain the fundamental principles and working of dosimeters
3. Analyze the effects of radiations on human body
4. Learn the basics of radiation shielding and its applications.

Course Content

UNIT I **12 Hours**

Ionizing Radiations and Radiation Quantities: Types and sources of ionizing radiation, Absorbed dose and its measurement; Bragg Gray Principle, Radiation dose UNITs- rem, rad, Gray and Sievert dose commitment..

UNIT II **11 Hours**

Dosimeters: Pocket dosimeter, films, solid state dosimeters such as TLD, SSNTD, chemical detectors and neutron detectors, simple numerical problems on dose estimation.

UNIT III **11 Hours**

Radiation Effects and Protection: Biological effects of radiation at molecular level, Permissible dose to occupational and non-occupational workers, safe handling of radioactive materials.

UNIT IV **11 Hours**

Radiation Shielding: Thermal and biological shields, shielding requirement for medical, industrial and accelerator facilities, shielding materials.

Transaction Mode- Video Based Teaching, Collaborative teaching, Project based learning, E-team teaching, Group discussion, E team Teaching, Flipped Teaching, Quiz, Open talk, Problem Analysis.

SUGGESTED READING:

- *Knoll G.F, Radiation Detection and Measurements, Wiley Publishers.*
- *Herman Cember, Introduction to Health Physics, Pergamon Press*
- *Attix F H et al,Radiation Dosimetry, Academic Press.*
- *Ronald L. Kathren, Radiation Protection, Adam Hilger Ltd. International PublishersServices*
- *Merril Eisenbud, Environmental Radioactivity, Academic Press, Orlando.*
- *James E Turner, Atoms, Radiation & Radiation Protection, Pergamon Press, 1986.*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs*

Semester –II

Course Title: Electricity and Magnetism
Course Code: BNM212

L	T	P	Credit
4	0	0	4

Total Hours 60

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Explain and differentiate the vector (electric fields, Coulomb's law) and scalar (electric potential, electric potential energy) formalisms of electrostatics.
2. Apply the principles of magneto statics to the solutions of problems relating to magnetic field and magnetic potential, boundary conditions and magnetic energy density.
3. Analyze different problems in electromagnetism using mathematical methods involving vectors and simple differential and integral calculus, both analytically and numerically
4. Have a rudimentary grasp on how experimental equipment related to electricity and magnetism can be used.

Course Content

UNIT I **15 Hours**

Vector calculus : Basic ideas of Vector Calculus, Scalar & vector fields, Gradient of a vector field, Line, Surface and Volume integrals of a vector and their physical significance, Flux of a vector field, combination of grad, div & curl, Gradient, Divergence, curl and their physical significance, Stroke's theorem, Gauss's divergence theorem.

UNIT II **15 Hours**

Electrostatics : Coulomb's Law for point charges and continuous distribution of charges, electric field due to dipole, line charge, ring and sheet of charge. Electric field lines, Gauss's Law and its differential form.

UNIT III **15 Hours**

Electric Potential: Potential as line integral of field, potential difference, Gradient of a scalar function, Derivation of the field from the potential, potential of a charge distribution, uniformly charged disc. Force on a surface charge, energy associated with an electric field, Gauss's theorem and differential form of Gauss's law, Laplacian and Laplace's equation, Poisson's equation.

UNIT IV **15 Hours**

Magnetostatics: Brief overview of Magnetic fields and forces, magnetic force on a current carrying wire. Torque on a current loop, Biot-Savart law .Field due to infinite wire carrying steady current, field of rings and coils. Magnetic field due to a solenoid, Force on parallel current carrying wires. Ampere's circuital law and its applications to infinite hollow cylinder, solenoid and toroid. Magnetic vector potential and its expression.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, E team Teaching, Flipped Teaching, Quiz, Open talk, Problem Analysis

SUGGESTED READINGS:-

- *Arthur F. Kipp, Fundamentals of Electricity and Magnetism, Tata McGraw Hill.*
- *E.M. Purcell, Electricity and Magnetism, Berkeley Physics Course, Vol. II*
- *David Griffith, Introduction to Classical Electrodynamics, Prentice Hall.*
- *A.S. Mahajan& A.A. Rangwala, Electricity & Magnetism, Tata McGraw Hill.*
- *W.J. Duffin, Electricity & Magnetism, 4th Edition, Tata McGraw Hill.*
- *Edward C. Jordan and K. G. Balmain, EM Waves and Radiating Systems, Prentice Hall.*
- *Suggested digital platform: NPTEL/ SWAYAM/ MOOCs*

Course Title: Physical Chemistry
Course Code: BNM201

L	T	P	Credit
4	0	0	4

Total Hours: 60

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Recognize the different states of matter.
2. Differentiate the real and ideal gases on the basis of states of matter.
3. Demonstrate the kinetic properties of gases and its practical usage in day to day life.
4. Evaluate the states of matter necessary for industrial purposes.

Course Content

UNIT-I **15 Hours**

Gaseous state: Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path and viscosity of gases, including their temperature and pressure dependence, relation between mean free path and coefficient of viscosity, calculation of σ from η;

variation of viscosity with temperature and pressure. Maxwell distribution and its use in evaluating molecular velocities and average kinetic energy, law of equipartition of energy, degrees of freedom and molecular basis of heat capacities.

UNIT II **15 Hours**

Behaviour of real gases: Deviations from ideal gas behaviour, compressibility factor, Z, and its variation with pressure for different gases. Reasons of deviation from ideal behaviour. van der Waals equation of state, its derivation and application in explaining real gas behaviour, Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical state, relation between critical constants and van der Waals constants, law of corresponding states.

UNIT III **16 Hours**

Liquid state: Qualitative treatment of the structure of the liquid state; Radial distribution function; physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity, Explanation of cleansing action of detergents. Temperature variation of viscosity of liquids and comparison with that of gases, Qualitative discussion of structure of water.

UNIT IV **14 Hours**

Solid state: Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method. Analysis of powder diffraction patterns of NaCl, CsCl and KCl. Defects in crystals. Glasses and liquid crystals.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, ted talks, E team Teaching, Flipped Teaching, Quiz, Open talk, Case analysis

SUGGESTED READINGS:-

- *Peter Atkins, P., & De Paula, J. (2014). Atkins' physical chemistry. OUP Oxford.*
- *Martin, W. R., Davidson, A. S., & Ball, D. W. (2016). Journal of Chemical Education.*
- *Ball, D. W. (2007). Physical Chemistry Thomson Press, India.*
- *Castellan, G. W. (2004 Physical Chemistry 4th Ed. Narosa).*
- *Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009).*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs*

Course Title: Learning and Teaching

Course Code: BED201

L	T	P	Credits
4	0	0	4

Total Hours: 60

Learning Outcomes

After Completion of this course, the Learner will be able to:

- analyze the concept of learning in the educational context.
- apply the perspectives of learning and motivation in the learning process
- evaluate different models of teaching
- reflect upon various concepts of teaching

Course Content

Unit I **14 Hours**

Learning and Teaching: Meaning, concept and principles, relationship between teaching and learning, Equitable and Inclusive Education: Learning for All (NEP: 2020)

Dimensions of individual development: physical, cognitive, language, affective, social and moral, their inter-relationships and implications for teachers (relevant ideas of Piaget, Erikson and Kohlberg)

Socio-cultural factors influencing cognition and learning, Facilitating holistic development (for self and society)

Unit II **14 Hours**

Implicit knowledge and beliefs about learning (demystifying misconceptions) Perspectives on human learning: behaviourist, cognitivist, information- processing view, social-constructivist

Principles, relevance and applicability of human leaning in different learning situations (drawing selectively on the ideas of Skinner, Piaget, Vygotsky) Role of learner in various learning situations, as seen in different theoretical perspectives

Role of teacher in teaching-learning situations: transmitter of knowledge, model, facilitator, negotiator, co-learner

Unit III **16 Hours**

Teaching: Concept, nature, and theories/approaches (Behavioristic, Cognitivist, Constructivist)

Models of Teaching: Concept Attainment; Inquiry Training; Advance Organizer model, inductive teaching model

Reflective teaching: concept and strategies for making teachers reflective practitioners, teaching as profession; professional ethics for teachers

Unit IV **16 Hours**

Pedagogy: Concept, principles and techniques of pedagogy

Simulated Teaching, Micro Teaching: meaning, concept and its application in teaching learning process, Case Analysis: Analysis of teachers of effective teaching

Transactional Mode

Panel Discussions, Cooperative Teaching, Dialogue, Group Discussion, Demonstration, Project Based Learning, E-Monitoring, Quiz, Simulation, Lecture- cum-Demonstration, Seminars

Suggested Readings

- Dr. Usha Rao, (2018). Advanced Educational Psychology Himalaya Publication House New Delhi-2018
- Chauhan S S, (2017). Advanced Educational Psychology, Vikas Publishing House Ltd. New Delhi
- Sandra Goss Lucas, Douglas A. Bernstein (2014). Teaching Psychology: A Step-By-Step Guide, Second Edition. Psychology press: New York.
- Cooper, Hilary (2014). Professional studies in primary education sage.
- Chauhan, S.S. (2014). Innovation in teaching learning process, Noida vikas publishing house private Ltd.
- Aggarawal J C, (2014). Essentials of Educational Psychology, Vikas Publishing House Ltd. New Delhi
- Charles E Skinner (2012). Educational Psychology P H I Learning Pvt. Ltd.- New
- Woolfolk, A. (2012), Educational Psychology, 12/E. Pearson publisher: New Delhi.

- Walia, J. S. (2011). Technology of Teaching, Jalandhar: Ahim paul publishers.

Course Title: Real Analysis
Course Code: BNM213

L	T	P	Credit
4	0	0	4

Total Hours: 60

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Recognize bounded, convergent, divergent, Cauchy and monotonic sequences and to calculate their limit superior, limit inferior, and the limit of a bounded sequence.
2. Apply the ratio, root, alternating series and limit comparison tests for convergence and absolute convergence, comparison test, Cauchy's root Test, ratio Test, Rabbe's of an infinite series of real numbers.
3. Equipped with the knowledge of improper integrals, and their convergences, convergence and uniform convergence of sequences and series of functions for further applications in the relevant fields.
4. Utilize the analytic and technical skills necessarily at practical field and analyse the real analysis for further higher studies.

Course Content

UNIT I **15 hours**

Continuity and Differentiability of functions: Continuity of functions, Uniform continuity, Differentiability, Taylor's theorem with various forms of remainders. Integration: Riemann integral-definition and properties, inerrability of continuous and monotonic functions, Fundamental theorem of integral calculus, Mean value theorems of integral calculus.

UNIT II **15 hours**

Sequence and Series: Sequences, theorems on limit of sequences, Cauchy's convergence criterion, infinite series, series of non-negative terms, Absolute convergence, tests for convergence, comparison test, Cauchy's root Test, ratio Test, Rabbe's Logarithmic test, De Morgan's Test, Alternating series, Leibnitz's theorem.

UNIT III **15 hours**

Improper Integrals: Improper integrals and their convergence, Comparison test, Dritchlet's test, Absolute and uniform convergence, Weierstrass M-Test, Infinite integral depending on a parameter.

UNIT IV **15 hours**

Uniform Convergence: Point wise convergence, Uniform convergence, Test of uniform convergence, Weierstrass M-Test, Abel's and Dritchlet's test, Convergence and uniform convergence of sequences and series of functions.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, E team Teaching, Quiz.

Suggested Readings:-

- *Walter Rudin, (1976), Principle of Mathematical Analysis (3rd edition) McGraw-Hill Kogakusha, International Student Edition.*
- *Bartle, Robert G., & Sherbert, Donald R. (2015). Introduction to Real Analysis (4th ed.). Wiley India Edition. New Delhi.*
- *T. M. Apostol, (1985), Mathematical Analysis, Narosa Publishing House, New Delhi.*
- *S. C. Malik and Savita Arora, (2012), Mathematical Analysis , New Age International Pvt. (Ltd).*
- *Bilodeau, Gerald G., Thie, Paul R., & Keough, G. E. (2010). An Introduction to Analysis (2nd ed.). Jones and Bartlett India Pvt. Ltd. Student Edition. Reprinted 2015.*

Course Title: Electricity and Magnetism Lab
Course Code: BNM214

L	T	P	Credit
0	0	2	1

Total Hours: 15

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Demonstrate conceptual understanding of fundamental physics principles.
2. Communicate physics reasoning in oral and in written form.
3. Solve physics problems use qualitative and quantitative reasoning including sophisticated mathematical techniques.
4. Use experimental, conceptual and theoretical methods

Course Content

1. To study the characteristics of a RC Circuit.
2. To compare capacitances using De Sauty's bridge.
3. Measurement of field strength and its variation in a solenoid.
4. To verify the Thevenin and Norton theorems.
5. To verify the Superposition, and Maximum power transfer theorems.
6. To determine self-inductance of a coil by Anderson's bridge.
7. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q And (d) Band width

8. To study the response curve of a parallel LCR circuit and determine its a Anti resonant frequency and (b) Quality factor Q
9. To determine e/m ratio of electron by long and short solenoid methods.
10. To study C.R.O as display and measuring device by reading sine and square waves.
11. To determine the capacity of a capacitor by discharging through voltmeter.
12. To find the capacity of a capacitor using flashing and quenching of a neon lamp.
13. To determine the intensity of earth's magnetic field using tangent galvanometer.

Note: Each student is required to perform at least ten experiments.

Transaction Mode- Video Based Teaching, Collaborative teaching, Project based learning, E-team teaching, Group discussion, E team Teaching, Flipped Teaching, Quiz, Open talk, Problem Analysis.

SUGGESTED READINGS:

- *G. L. Squires, Practical Physics, Cambridge University Press.*
- *Napier Shaw and Richard Glazebrook, Practical Physics, Nabu Press.*
- *C.L. Arora, Practical Physics, S. Chand &Co.*
- *R.S. Sirohi, Practical Physics, Wiley Eastern.*

Course Title: Physical Chemistry Lab-II

Course Code: BNM205

L	T	P	Credits
0	0	2	1

Total Hours: 15

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Determine Surface tension of different liquids.
2. Prepare Buffer Solution of different pH value.
3. Study the effect of pH on addition of acid and base.
4. Analyze the viscosity of different solutions at different concentration.

Course Content

List of Practical's:

1. **Surface tension measurements.**
   a. Determine the surface tension by (i) drop number (ii) drop weight method.

b. Study the variation of surface tension of detergent solutions with concentration.

2. Viscosity measurement using Ostwald's viscometer.

a. Determination of viscosity of aqueous solutions of (i) polymer (ii) ethanol and (iii) sugar at room temperature.
b. Study the variation of viscosity of sucrose solution with the concentration of solute.

3. Indexing of a given powder diffraction pattern of a cubic crystalline system.

4. pH metry

a. Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures.
b. Preparation of buffer solutions of different pH
   i. Sodium acetate-acetic acid
   ii. Ammonium chloride-ammonium hydroxide.
c. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base.
d. Determination of dissociation constant of a weak acid.

Note: Each student is required to perform at least ten experiments.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, ted talks, E team Teaching, Flipped Teaching, Quiz,Open talk, Case analysis.

SUGGESTED READINGS:-

- *Khosla, B. D.; Garg, V. C. & Gulati, (2011) A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi.*
- *Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. (2003) Experiments in Physical Chemistry 8th Ed.; McGraw-Hill: New York.*
- *Halpern, A. M. & McBane, G. C. (2003) Experimental Physical Chemistry 3rd Ed.; W.H. Freeman & Co.: New York.*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs.*

Course Title: Differential Equations

Course Code: BNM208

L	T	P	Credit
3	0	0	3

Total Hours: 45

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Familiarize with various methods of solving differential equations of first and second order and to have qualitative applications
2. Solve various working rule for finding solution of linear differential equations with constant coefficients.
3. Evaluate solution using homogeneous linear equations or Cauchy-Euler equations, linear differential equations of second order with variable coefficients, initial and boundary value problems.
4. Discuss the applications of real world problems using ordinary differential equations.

UNIT I **10 hours**

Introduction of Differential equations, Order and Degree of Differential Equations, Complete primitive (general solution, particular solution and singular solutions), Existence and uniqueness of the solution dy/dx= f(x,y).

UNIT II **12hours**

Differential equations of first order and first degree, Separation of variables, Homogeneous linear Equations, Exact Equations, Integrating Factor, Linear Equation, Equation of First order but not of first degree

UNIT III **11 hours**

Linear differential equations with constant coefficients, Complementary function, Particular integral, Working rule for finding solution of linear differential equations with constant coefficients, Homogeneous linear equations or Cauchy-Euler equations

UNIT IV **12 hours**

Simultaneous differential equations, Differential equations of the form dx/P= dy/Q= dz/R where P, Q, R are functions of x, y, z. Exact differential equations,

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, E team Teaching, Flipped Teaching, Quiz, Open talk, Problem Analysis.

SUGGESTED READINGS:-

- *G.F. Simmons, (2002), Differential Equations with Application and Historical Notes, Tata –McGraw Hill.*
- *B. Rai, D.P. Choudhary & H. J. Freedman, (2002), A Course of Ordinary Differential Equations, Narosa.*
- *Ian N. Snedden, (2013), Elements of Partial Differential Equations, Dover Publication.*
- *L.E. Elsgolts, (1970), Differential Equation and Calculus of variations, University Press of the Pacific.*
- *M. D. Raisinghania, (2018), Ordinary and Partial Differential Equations, S Chand. Rudin, W., Principles of Mathematical Analysis, McGraw-Hill (2013).*
- *Malik, S.C. and Arora, S., Mathematical Analysis, Wiley Eastern (2010).*

Course Title: Linear Algebra

Course Code: BNM203

L	T	P	Credit
3	0	0	3

Total Hours: 45

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Compute with the characteristic polynomial, eigen values, eigenvectors, and eigen spaces, as well as the geometric and the algebraic multiplicities of an eigen value and apply the basic diagonalization result.
2. Build the concrete structure of modern algebra with the basic concepts of Group, abelian group, subgroup etc. and with their properties.
3. Explore the concepts for understanding and analyzing more advanced topics like Conjugate subgroups, Invariant sub groups, Quotient group, Homomorphism and Isomorphism on groups etc. for strong grip on modern algebra.
4. Create an understanding of rings, various types of rings, characteristic of a ring, field, skew field etc. on the previous concepts of groups.

Course Content

UNIT I **10 hours**

Eigen values and Eigen vectors: Eigen vectors and Eigen values of a matrix, product of characteristic roots of a matrix and basic results on characteristic roots, nature of the characteristic roots of Hermitian, skew-Hermitian, unitary and orthogonal matrices, characteristic equation of a matrix, Cayley-Hamilton theorem and its use in finding inverse of a matrix.

UNIT II **12 hours**

Definition of a group with examples and simple properties, Abelian group, Finite and infinite group, Order of a finite group, General properties of groups,

Composition table for finite groups. Order of an element of a group, Group homomorphism, Isomorphism on groups, theorems on subgroups, Coset decomposition, Cayley's theorem, Cyclic group, generating system of group.

UNIT III **11 hours**

Normal subgroups, Simple group, Conjugate elements, Normalizer of an element of a group, Class equation of a group, Centre ofa group, Conjugate subgroups, Invariant sub groups, Quotient group, Homomorphism and Isomorphism on groups, Kernel of a Homomorphism and related theorems.

UNIT IV **12 hours**

Rings, Various types of rings, Rings with unity, Rings without zero divisors, Properties of rings, Sub rings. Ideals, Quotient rings, Principal ideals, Maximal ideals, Prime ideals, Principal ideal domains, Characteristic of a ring.
Integral domain, Field, Skew field etc., Field of quotients of an integral domain, Embedding of an integral domain in a field, Factorization in an integral domain, Divisibility, Units, Associates, Prime and irreducible elements, Unique Factorization Domain, Euclidean rings.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, E team Teaching, Quiz.

Suggested Readings:-

- *Friedberg, Stephen H., Insel, Arnold J., & Spence, Lawrence E. (2003). Linear Algebra (4th ed.). Prentice-Hall of India Pvt. Ltd. New Delhi.*
- *Hadley, G, (2002), Linear Algebra, Narosa Publishing House, New Delhi.*
- *Hoffman and Kunze, (1972),Linear Algebra, Prentice Hall of India, New Delhi.*
- *H. Helson, (1994),Linear Algebra, Hindustan Book Agency, New Delhi.*
- *Dutta, K. B. (2004), Matrix and Linear Algebra, Prentice Hall of India.*

Course Title:-Mathematical Methods

Course Code: BNM222

L	T	P	Credit
3	0	0	3

Total Hours: 45

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Learn and practice Integral Transforms, Volterra and Fredholm integral equations.

2. Understand the basic concepts of Laplace transforms of elementary functions, First Shifting Theorem, Second Shifting Theorem, Initial-Value Theorem, Final-Vlue Theorem.
3. Understand the method of reduction of Inverse Laplace transforms using partial fractions, Convolution etc.
4. Apply Fourier Transforms, properties of Fourier Transforms, Inverse Fourier transforms methods.

Course Content

UNIT I **12 Hours**

Integral Transforms: Definition, Kernel. Integral Equations, Definition, Volterra and Fredholm integral equations. Solution by separable kernel, Neumann's series resolvent kernel and transform methods.

UNIT II **12 Hours**

Laplace Transforms: Definition, Existence theorem, Linearity property, Laplace transforms of elementary functions, First Shifting Theorem, Second Shifting Theorem, Initial-Value Theorem, Final-Value Theorem, The Laplace Transform of derivatives, integrals and Periodic functions.

UNIT III **11 Hours**

Inverse Laplace transforms: Inverse Laplace transforms of simple functions, Inverse Laplace transforms using partial fractions, Convolution, Solutions of differential and integro-differential equations using Laplace transforms. Dirichlet's condition.

UNIT IV **10 Hours**

Fourier Transforms: Fourier Complex Transforms, Fourier sine and cosine transforms, Properties of Fourier Transforms, Inverse Fourier transforms.

Transaction Mode- Lecture, Demonstration, Video Based Teaching, Collaborative teaching, Group Discussion, E team Teaching, Quiz.

Suggested Readings:-

- *I.N. Sneddon, (1974),The use of Integral Transforms, Tata Mc Graw Hill, Publishing Company Ltd, New Delhi, 1974.*
- *R.P. Kanwal, (1971), Linear integral equations theory and techniques, Academic Press, New York.*
- *C.M. Bender and S.A. Orszag, (1978), Advanced mathematical methods for scientists and engineers, McGraw Hill, New York.*
- *J. H. Davis, (2004), Methods of Applied Mathematics with a MATLAB Overview, Birkhäuser, Inc.,Boston, MA.*
- *Murry R. Spiegal: Laplace Transform (SCHAUM Outline Series), McGraw-Hill.*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs.*

Course Title: Number Theory

Course Code: BNM211

L	T	P	Credit
3	0	0	3

Total Hours: 45

Learning Outcomes: On successful completion of this course, the successful students will be able to:

1. Define and interpret the concepts of divisibility, congruence, the greatest common divisor, prime, and prime-factorization.
2. Express the concepts and results of divisibility of integers effectively and solve challenging problems related to Chinese remainder theorem effectively.
3. Apply the Law of Quadratic Reciprocity and other methods to classify numbers as primitive roots, quadratic residues, and quadratic non-residues.
4. Demonstrate the logics and methods behind the major proofs in Number Theory and Describe the properties of prime numbers.

Course Contents

UNIT I **11 hours**

Introduction, Divisibility, The Division Algorithm, GCD and LCM, The Euclidean Algorithm, Primes and their properties, Infinitude of primes.

UNIT II **12 hours**

The Fundamental Theorem of Arithmetic, The Prime Number Theorem (statement only). Congruence - Definition and properties of it, Solutions of Congruence, Euler's phi function.

UNIT III **10 hours**

Fermat's Theorem, Euler's Theorem, Wilson's Theorem, The Chinese remainder Theorem, Multiplicative property of Euler's phi function, Primitive Roots.

UNIT IV **12 hours**

Quadratic Reciprocity, Quadratic Residues, The Legendre Symbol and its properties, Lemma of Gauss, The Gaussian Reciprocity Law, The Jacobi symbol. Arithmetic functions $\mu(n)$, $d(n)$, $\sqrt{(n)}$, $\sigma\alpha(n)$, Mobious inversion formula.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, E team Teaching, Flipped Teaching, Quiz, Open talk, Problem Analysis.

Suggested Readings:-

- *G. H. Hardy and E. M. Wright, (2008). An Introduction to Theory of Numbers, Oxford University Press, 6th Ed ,*
- *I. Niven, H. S. Zuckerman and H. L. Montgomery, (2004). An Introduction to the Theory of Numbers, John Wiley and Sons, (Asia) 5th Ed., 107*
- *H. Davenport, (1999). The Higher Arithmetic, Camb. Univ. Press, 7th edition,*
- *David M. Burton, (2007). Elementary Number Theory, Tata McGraw Hill, 6th Edition,*
- *Hardy, G. H., and Wright, E. M., (1979). An Introduction to the Theory of Numbers, 5th Edition, Clarendon Press (Oxford),*

Course Title: Environmental Science and Sustainability
Course Code: BNM223

L	T	P	Credit
2	0	0	2

Total Hours: 30

Learning Outcomes: On successful completion of this course, the successful students will be able to:

1. Understand the various environmental challenges faced by world.
2. Create a sense of how to be more responsible towards the environment.
3. Analyze fundamental knowledge of environmental science and its importance in the present day context.
4. Develop strategies for the development of environmental degradation.

Course Content

UNIT I **8 Hours**

Environmental Science: Nature, Scope and importance of environmental Science. Climate change, causes, societal impacts, adaptation. Sustainable development and living.

UNIT II **7 Hours**

Environmental Degradation: Causes and consequences of land degradation. Exploitation of surface and ground water. Air pollution: anthropogenic causes, impact on health, agriculture, climate, hydrology.

UNIT-III **8 Hours**

Sustainability And Management: Definition and concepts of Sustainable development, Integration of: a. Economic, Social and Environmental sustainability, b. Biodiversity and c. Availability of natural resources in

development. Critical review of drawbacks in traditional (based on economics) evaluation development, Cost benefit analysis.

UNIT-IV **8 Hours**

Sustainable Practices: Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles : Carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio economic and technological change.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, E team Teaching, Flipped Teaching, Quiz, Open talk, Problem Analysis.

Suggested Readings:-

- *Rieuwerts, J, (2015), the Elements of Environmental Pollution, Routledge Taylor & Francis Group.*
- *Hill, MK. (2010) Understanding Environmental Pollution, Cambridge University Press.*
- *Tyler Miller, G. Jr (2010), Advantage Series: Sustaining the Earth - An Integrated Approach 10th Edition. Thomson/Brooks Cole.*
- *Mary Ann Curran (2010), Environmental life cycle assessment. McGraw – Hill, New York.*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs.*

Semester III

Course Title: Thermodynamics and Statistical Mechanics
Course Code: BNM315

L	T	P	Credit
4	0	0	4

Total Hours: 60

Learning Outcomes: At the end of the course, the students are able to:

1. Explain the concept of the entropy and randomness, distribution of four distinguishable particles in two compartment of equal size.
2. Differentiate Carnot cycle and their efficiency of conversion of heat into work and vice versa.
3. Demonstrate the Concept of macro states microstates, thermodynamic probability and Effects of constraints on the system.
4. Examine in depth about statistical distribution and have basic Ideas about Maxwell Boltzmann, Bose-Einstein and Fermi Dirac Statistics and their applications.

Course Content

UNIT I **15 Hours**

Thermodynamics: Laws of Thermodynamics, Carnot cycle, Carnot's theorem. Entropy as a thermodynamic variable, Principle of increase of entropy. Thermodynamic scale of temperature; its identity with perfect gas scale, impossibility of attaining absolute zero. Change of entropy along a reversible path in a P.V. diagram, Entropy of a perfect gas, Equation of state of an ideal gas from simple statistical consideration, Heat death of the universe.

UNIT II **15 Hours**

Maxwell's thermodynamical relations: Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy. Derivation of Maxwell's thermodynamical relations, Cooling produced by adiabatic stretching, Adiabatic compression, Change of internal energy with volume, specific heat at constant pressure and constant volume, Expression for Cp -Cv , Kinetic Theory of Gases : Change of state and Clayperon equation, Thermodynamical treatment of Joule-Thomson effect, Use of Joule-Thomson effect.

UNIT III **15 Hours**

Kinetic Theory of Gases Distribution of Velocities: Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas and its Experimental Verification. Mean,

RMS and Most Probable Speeds. Degrees of Freedom. Law of Equipartition of Energy (No proof required). Specific heats of Gases. Molecular Collisions. Mean Free Path. Collision Probability. Estimates of Mean Free Path. Transport Phenomenon in Ideal Gases: (1) Viscosity, (2) Thermal Conductivity and (3) Diffusion. Brownian Motion and its Significance.

UNIT IV **15 Hours**

Statistical Physics: Concept of macro states and microstates, thermodynamic probability, Effects of constraints on the system, distribution of n particles in two compartments, Distribution of distinguishable n particles in k compartments of unequal sizes. Phase space and its division into elementary cells, Three kinds of statistics.

Transaction Mode- Lecture, Demonstration, Project Method, Co-Operative learning, Seminar, Group discussion, Team teaching, Tutorial, Problem solving, E-tetam teaching, Self-learning.

SUGGESTED READINGS:

- *M.W. Zemansky, Richard Dittman,Heat and Thermodynamics, McGraw-Hill.*
- *Carl S. Helrich, Modern Thermodynamics with Statistical Mechanics, Springer.*
- *Sears & Salinger, Thermodynamics, Kinetic Theory & Statistical Thermodynamics, Narosa Publications.*
- *S.J. Blundell and K.M. Blundell,Concepts in Thermal Physics, Oxford University Press*
- *Thermal Physics, S. Garg, R. Bansal and Ghosh, 2nd Edition, 1993, Tata McGraw-Hill Publishers.*
- *R.K. Pathria ,Statistical Mechanics, Oxford University Press.*
- *F. Reif ,Statistical Physics, Berkeley Physics Course, Tata McGraw-Hill.*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs*

Course Title: Organic Chemistry
Course Code: BNM301

L	T	P	Credit
4	0	0	4

Total Hours: 60

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Describe the need of studying hybridization and its relevance to the organic molecules.
2. Predict about the various shapes of organic molecules.

3. Demonstrate the physical properties of organic molecules
4. Analyze and reproduce accepted mechanisms of organic reactions including all intermediates and resonance structures.

Course Content

UNIT I **15 Hours**

Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties.

Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strength.

Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges; Electrophiles and Nucleophiles; Nucleophlicity and basicity; Types, shape and their relative stability of Carbocations, Carbanions, Free radicals and Carbenes

Introduction to types of organic reactions and their mechanism: Addition, Elimination and Substitution reactions. 2 . Mechanism of Organic Reactions

UNIT II **15 Hours**

Stereochemistry: Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis–trans and, syn-anti isomerism E/Z notations with C.I.P rules. Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Distereoisomers, meso structures, Racemic mixture and resolution. Relative and absolute configuration: D/L and R/S designations. Cycloalkanes.

UNIT III **15 Hours**

Chemistry of Aliphatic Hydrocarbons

A. Carbon-Carbon sigma bonds Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation -relative reactivity and selectivity.

B. Carbon-Carbon pi bonds: Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations.

Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition), mechanism of oxymercuration-demercuration, hydroborationoxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation (oxidation). 1,2-and 1,4-addition reactions in conjugated dienes and, Diels-Alder reaction; Allylic and benzylic bromination and mechanism, e.g. propene, 1-butene, toluene, ethyl benzene.

Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions. Hydration to form carbonyl compounds, Alkylation of terminal alkynes.

C. Cycloalkanes and Conformational Analysis Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis of alkanes: Relative stability: Energy diagrams of cyclohexane: Chair, Boat and Twist boat forms; Relative stability with energy diagrams.

UNIT IV **15 Hours**

Aromatic Hydrocarbons Aromaticity: Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of the groups.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, ted talks, E team Teaching, Flipped Teaching, Quiz, Open talk, Case analysis

SUGGESTED READINGS:-

- *Morrison, R. N. & Boyd, R. N.(2010)Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).*
- *Finar, I. L.(2005)Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).*
- *Finar, I. L. Organic Chemistry(2009) (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).*
- *Eliel, E. L. &Wilen, S. H. (2008)Stereochemistry of Organic Compounds; Wiley: London, 1994.*
- *Kalsi, P. S. (2016)Stereochemistry Conformation and Mechanism; New Age International, 2005.*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs*

Course Title: Contemporary India and Education
Course Code: BED412

L	T	P	Credits
3	0	0	3

Total Hours: 45

Learning Outcomes

After Completion of this course, the Learner will be able to:

- develop an understanding of ideals, values and diversities

in Indian education to be applied in teaching and learning
- analyze the issues and policy frameworks in education
- interpret the Indian constitution in the context of education
- justify the recommendations of commissions

Course Content

Unit I **16 Hours**

Education (Indian and Western): Concept, need, and aims of education

Driving forces of Indian Society: Social, economic, political, historical, and geographical influences; unified and diversified forces promoting national integration. Impact of liberalization, privatization, globalization, and stratification on education in India. Accreditation for Higher education institution in contemporary education system – NAAC, NIRF and World Ranking Systems (QS, THE) and Overview, objectives, and impact on higher education

Unit II **16 Hours**

Educational Policies: NEP-1986 and NEP-2020, Programme of Action-1992, National Curriculum Framework for Teacher Education (NCFTE)- 2009, Right to Education Act-2009

Brief historical background of education in India with special reference to:

Salient features of education in Vedic Period

Education during Buddhist period

Education during Muslim period

Salient features of education during the British period:

Chapter Act-1813

Macaulay's Minutes (1835)

Woods's Dispatch (1854)

Gokhale Bill (1912)

Sargent Report (1944)

Contemporary Education Policies: Dimensions and implications of current educational policies and reforms

Unit III **14 Hours**

Constitutional provisions of India in relation to education, including Fundamental Rights and Duties, Directive Principles of State Policy

Concept of social diversity at the level of individual, caste, religion, minorities, languages, tribes, etc.

Measures to promote equality of opportunities through educational programs for special groups, socially disadvantaged groups, and women

Unit IV **14 Hours**

Major recommendations of key educational commissions:

Secondary Education Commission (1952-1953)

Indian Education Commission (1964-66)

Major educational programs: Sarva Shiksha Abhiyan (SSA)

Rashtriya Madhyamik Shiksha Abhiyan (RMSA).

NAAC and NIRF: The role and impact of these frameworks on improving educational quality and standards

World Ranking Systems: Analysis of Indian institutions in global rankings and strategies for improvement.

Transactional Mode

Open Talk, Panel Discussions, Collaborative Teaching, Case Analysis, Dialogue, Group Discussion, Demonstration, Project Based Learning, E-Monitoring, Quiz

Suggested Readings

- Dewey, J. (1916). *Democracy and education: An introduction to the philosophy of education*. Macmillan.
- Krishnamurthy, P. (2010). *Educational reforms in India: An overview*. Sage Publications.
- Kumar, K. (2013). *The ideological development of education in India*. Routledge.
- Naik, J. P. (2006). *Educational planning in India*. Allied Publishers.

- Tilak, J. B. G. (2010). *Globalization and education: Perspectives from India*. Routledge.
- Shah, K. (2012). *Liberalization, privatization, and globalization: Effects on education in India*. Springer.
- Nair, P. R. (2016). *Accreditation in higher education: A comprehensive approach*. Routledge.
- Patel, A. (2018). *Quality assurance in higher education*. Sage Publications.
- Rao, V. K. (2021). *Educational policies and their impact: NEP 2020 and beyond*. Sage Publications.
- Government of India. (1992). *Programme of Action 1992*. Ministry of Human Resource Development.
- Sharma, K. L. (1999). *Education in ancient India: A historical perspective*. Northern Book Centre.
- Pandey, S. K. (2008). *The history of education in India*. National Book Trust.
- Gupta, S. (2004). *Education in ancient and medieval India*. Academic Publishers.
- Kaur, K. (2002). *Education under British rule*. Ashish Publishing House.
- Chandhoke, N. (2018). *The Indian Constitution and its amendments*. Sage Publications.
- Singh, A. (2014). *Constitutional provisions and educational rights in India*. Oxford University Press.
- Singh, S. (2012). *Diversity and education in India: An overview*. Oxford University Press.
- Kumar, N. (2011). *Educational programs for disadvantaged groups*. Springer.
- Government of India. (1953). *Report of the Secondary Education Commission (1952-53)*. Ministry of Education.
- Government of India. (1966). *Report of the Indian Education Commission (1964-66)*. Ministry of Education.
- MHRD. (2001). *Sarva Shiksha Abhiyan: The Indian Education Program*. Ministry of Human Resource Development.
- MHRD. (2009). *Rashtriya Madhyamik Shiksha Abhiyan*. Ministry of Human Resource Development.

- Nair, P. R. (2016). *Quality assurance and accreditation in higher education*. Routledge.
- Patel, A. (2018). *World university rankings and institutional improvement*. Sage Publications.

Course Title: Thermodynamics and Statistical Mechanics Lab
Course Code: BNM317

L	T	P	Credit
0	0	2	1

Total Hours: 15

Learning Outcomes: At the end of the course, the students are able to:

1. Understand the depth knowledge of Thermodynamics and Statistical Mechanics.
2. Demonstrate skills and competencies to conduct wide range of scientific experiments.
3. How to apply the concepts and laws of thermodynamics to solve problems in thermodynamic systems such as gases,
4. Heat engines and Make connections between applications of general statistical theory in various branches of physics.

Course Content

1. To determine Mechanical Equivalent of Heat, J, by Callender and Barne's constant flow method.
2. To determine the Coefficient of Thermal Conductivity of Cu by Searle's Apparatus.
3. To determine the Coefficient of Thermal Conductivity of Cu by Angstrom's Method.
4. To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's disc method.
5. To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT).
6. To study the variation of Thermo-emf of a Thermocouple with Difference of Temperature of its Two Junctions.
7. To calibrate a thermocouple to measure temperature in a specified Range using Null Method.
8. Computational analysis of the behavior (any three) of a collection of particles in a box that satisfy Newtonian mechanics and interact via the Lennard-Jones potential, varying the total number of particles N and the initial conditions:
    a. Study of local number density in the equilibrium state (i) average; (ii) fluctuations.
    b. Study of transient behavior of the system (approach to equilibrium)
    c. Relationship of large N and the arrow of time.

L	T	P	Credits
0	0	2	1

   d. Computation of the velocity distribution of particles for the system and comparison with the Maxwell velocity distribution
9. Single particle levels (e.g., 2 level, 3 level, etc.) and a finite number of non-interacting particles N under Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein statistics:
   a. Volume Cv, depend upon the temperature, total number of particles N and the spectrum of single particle states.
   b. Ratios of occupation numbers of various states for the systems considered above.
   c. Computation of physical quantities at large and small temperature T and comparison of various statistics at large and small temperature T.
10. Plot Planck's law for Black Body radiation and compare it with Raleigh-Jeans Law at high temperature and low temperature.
11. Plot Specific Heat of Solids (a) Dulong-Petit law, (b) Einstein distribution function, (c) Debye distribution function for high temperature and low temperature and compare them for these two cases.

Transaction Mode- Video Based Teaching, Collaborative teaching, Project based learning, E-team teaching, Group discussion, E team Teaching, Flipped Teaching, Quiz, Open talk, Problem Analysis.

SUGGESTED READINGS:

- *G. L. Squires, Practical Physics ,Cambridge University Press.*
- *Napier Shaw and Richard Glazebrook, Practical Physics, Nabu Press.*
- *C.L. Arora ,(2010), Practical Physics, S. Chand &Co.*
- *R.S. Sirohi,(2012), Practical Physics, , Wiley Eastern.*

Course Name: Organic Chemistry Lab

Course Code: BNM306

Total Hours:15

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Apply the fundamentals of acid/base equilibria, including pH calculations, buffer behavior for performing acid/base titrations.
2. Use General periodicity patterns of (organic/inorganic) molecules, and the ability to design.
3. Estimation of ferrous and ferric by dichromate method.

4. Identifications and separation of constituents' of a mixture or organic compounds by thin layer chromatography.

Course Contents

List of Practical's:

A. Laboratory Techniques

1. Determination of acetic acid in commercial vinegar using NaOH,
2. Alkalinity of water sample.
3. Determination of alkali content of antacid.
4. Estimation of calcium content in chalk as calcium oxalate by permanganometry.
5. Estimation of hardness of water by EDTA.
6. Estimation of ferrous and ferric by dichromatemethod.
7. Estimation of copper using sodium thiosulphate.

B. Thin Layer Chromatography

1. Determination of R, values and identification of organic compounds.
2. Separation of green leaf pigments (spinach leaves may be used).
3. Prepration and Separation of 2,4-dinitrophylhydrazones of acetone, benzophenone cyclohexanone using toluene and light petroleum(40:60).
4. Separation of a mixture of dyes

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, ted talks, E team Teaching, Flipped Teaching, Quiz, Open talk, Case analysis.

SUGGESTED READINGS:-

- *AI, V. Furniss BS. Hannaford AJ. Smith PWG. Tatchell AR. (2007) Vogel's Textbook of Practical Organic Chemistry, 920.*
- *Ahluwalia, V. K., & Aggarwal, R. (2001). Comprehensive practical organic chemistry: preparation and quantitative analysis. Universities Press.*
- *Ahluwalia, V. K., &Dhingra, S. (2004). Comprehensive Practical Organic Chemistry: Qualitative Analysis. Universities Press.*

Course Title: MATLAB Programming
Course Code: BNM321

L	T	P	Credit
2	0	0	2

Total Hours: 30

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Implement loops, branching, control instruction and functions in MATLAB programming environment.
2. Program curve fitting, numerical differentiation and integration, solution of linear equations in MATLAB and solve electrical engineering problems.
3. Understand implementation of ODE using ode 45 and execute Solutions of nonlinear equations and DFT in MATLAB.
4. Simulate MATLAB Simulink examples.

Course Content

UNIT I **8 Hours**

Introduction to MATLAB: Overview of MATLAB and its applications, MATLAB environment: Command Window, Workspace, Editor, and Help, Basic arithmetic operations and variables.

UNIT II **7 Hours**

MATLAB arrays: vectors, matrices, and multidimensional arrays: Array operations: indexing, slicing, and reshaping, Generating arrays: linspace, logspace, and meshgrid.

UNIT III **8 Hours**

MATLAB Programming Basics: MATLAB scripts and functions, Control flow statements: if-else, for loops, and while loops, Writing and debugging MATLAB code.

UNIT IV **7 Hours**

Plotting and Visualization: Introduction to plotting: plot, scatter, and bar, Customizing plots: labels, titles, colors, and markers, Plotting multiple data sets and subplots.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, E team Teaching, Quiz, Problem Analysis.

SUGGESTED READINGS:

- *Brian R. Hunt et al.(2006), A Guide to MATLAB - for Beginners and Experienced Users", 2nd Ed., Cambridge University Press.*
- *Stephen J. Chapman(2009), Essentials of MATLAB Programming, Cengage Learning.*
- *David McMahon(2007), MATLAB Demystified", The McGraw-Hill Companies.*
- *Holly Moore(2012), MATLAB for Engineers, Pearson Education.*

Course Title: MATLAB Programming Lab
Course Code: BNM322

L	T	P	Credit
0	0	2	1

Total Hours: 15

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Implement loops, branching, control instruction and functions in MATLAB programming environment.
2. Program curve fitting, numerical differentiation and integration, solution of linear equations in MATLAB and solve electrical engineering problems.
3. Understand implementation of ODE using ode 45 and execute Solutions of nonlinear equations and DFT in MATLAB.
4. Simulate MATLAB Simulink examples.

Course Content

1. Basic Operations: Perform arithmetic operations like addition, subtraction, multiplication, and division on scalar, vector, and matrix inputs.
2. Plotting: Plot simple graphs like straight lines, parabolas, and circles using the plot() function.
3. Matrix Manipulation: Learn basic matrix manipulation techniques like transposition, matrix multiplication, and inversion.
4. Function Writing: Write your own MATLAB functions to perform specific tasks, such as calculating the factorial of a number or finding the roots of a quadratic equation.
5. Data Visualization: Import data from a file (e.g., CSV) and visualize it using different types of plots like histograms, scatter plots, and bar charts.
6. Numerical Integration: Use MATLAB's built-in functions for numerical integration to approximate definite integrals.
7. Differential Equations: Solve ordinary differential equations (ODEs) using MATLAB's ODE solvers and visualize the solutions.
8. Signal Processing: Explore basic signal processing techniques like filtering, Fourier transforms, and convolution.
9. Image Processing: Perform simple image processing tasks like resizing, rotating, and applying filters to images using MATLAB's Image Processing Toolbox.

10. GUI Development: Create simple graphical user interfaces (GUIs) using MATLAB's App Designer to interact with your MATLAB code more intuitively.

SUGGESTED READINGS:

- *Brian R. Hunt et al.(2006), A Guide to MATLAB - for Beginners and Experienced Users", 2nd Ed., Cambridge University Press.*
- *Stephen J. Chapman(2009), Essentials of MATLAB Programming, Cengage Learning.*
- *David McMahon(2007), MATLAB Demystified", The McGraw-Hill Companies.*
- *Holly Moore(2012), MATLAB for Engineers, Pearson Education.*

Course Title: Instrumentation in Physics

Course Code: BNM323

L	T	P	Credit
2	0	0	2

Total Hours: 30

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Familiarize and analyze the signal accordance to accuracy, precision, sensitivity, resolution, errors etc.
2. Use and measure frequency, phase etc. of the signal with CRO.
3. Acquire purpose, scope and concepts of signal generator and wave analyzer.
4. Understand different types of bridges and their construction to find unknown values.

UNIT I **8 Hours**

Multimeter and Voltmeter: Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance. Advantage over conventional multimeter for voltage measurement.. Principles of voltage, measurement (block diagram only). Specifications of an electronic Voltmeter/Multimeter and their significance.

UNIT II **7 Hours**

Cathode Ray Oscilloscope: Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), brief discussion on screen phosphor, visual persistence

& chemical composition. Time base operation, synchronization. Front panel controls. Special features of dual trace, Introduction to digital oscilloscope.

UNIT III **7 Hours**

Signal Generators and Analysis Instruments: Block diagram, explanation and specifications of low frequency signal generators. pulse generator, and function generator. Brief idea for testing, specifications. Distortion factor meter, wave analysis. Impedance Bridges & Q-Meters: Block diagram of bridge. working principles of basic(balancing type) RLC bridge. Specifications of RLC bridge. Block diagram & working principles of a Q- Meter. Digital LCR bridges.

UNIT IV **8 Hours**

Digital meters : Characteristics of a digital meter. Working principles of digital voltmeter. Block diagram and working of a digital multimeter. Working principle of time interval, frequency and period measurement using universal counter/ frequency counter.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, E team Teaching, Quiz, Problem Analysis.

SUGGESTED READINGS :

- *B L Theraja ,A text book in Electrical Technology , S Chand and Co.*
- *S. Salivahanan , Electronic Devices and circuits.*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs*

Course Title: Instrumentation in Physics Lab

Course Code: BNM324

L	T	P	Credit
0	0	2	1

Total Hours :15

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Familiarize and analyze the signal accordance to accuracy, precision, sensitivity, resolution, errors etc.
2. Use and measure frequency, phase etc. of the signal with CRO.
3. Acquire purpose, scope and concepts of signal generator and wave analyzer.
4. Understand different types of bridges and their construction to find unknown values.

Course Content

1. To observe the loading effect of a multimeter while measuring voltage across a low resistance and high resistance.
2. To observe the limitations of a multimeter for measuring high frequency voltage and currents.
3. To measure Q of a coil and its dependence on frequency, using a Q-meter.
4. Measurement of voltage, frequency, time period and phase angle using CRO.
5. Measurement of time period, frequency, average period using universal counter/ frequency counter.
6. Measurement of rise, fall and delay times using a CRO.
7. To measure unknown frequency using CRO.
8. Measurement of distortion of a RF signal generator using distortion factor meter.
9. Measurement of R, L and C using a LCR bridge/ universal bridge.
10. To study Lissajous figures to know about the phase difference between the two signals and the ratio of their frequencies.
11. To configure the function generator to output a 10Vpp, 1 KHz sinusoidal wave.
12. Observe the wave forms of different frequency by using Function generator and draw its diagram measure the amplitude and frequency & calculates average & R.M.S. Values, frequency, Time Periods using CRO.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, E team Teaching, Flipped Teaching, Quiz, Open talk, Problem Analysis.

SUGGESTED READINGS:

- *G. L. Squires, Practical Physics ,Cambridge University Press.*
- *Napier Shaw and Richard Glazebrook, Practical Physics, Nabu Press.*
- *C.L. Arora ,(2010), Practical Physics, S. Chand &Co.*
- *R.S. Sirohi,(2012), Practical Physics, , Wiley Eastern.*

Course Title: Complex Analysis

Course Code: BNM307

L	T	P	Credit
0	0	0	3

Total Hours: 45

Learning Outcomes: On successful completion of this course, the successful students will be able to:

1. Acquire the basic ideas of analysis for complex functions in complex variables with visualization through relevant practical situations.

2. Understand the significance of differentiability of complex functions leading to the understanding of Cauchy-Riemann equations.
3. Evaluate the contour integrals and understand the role of Cauchy-Goursat theorem and the Cauchy integral formula.
4. Expand some simple functions as their Taylor and Laurent series, classify the nature of singularities, find residues and apply Cauchy Residue theorem to evaluate integrals.

Course Content

UNIT I **12 Hours**

Analytic Functions and Cauchy-Riemann Equations: Functions of complex variable, Mappings; Mappings by the exponential function, Limits, Theorems on limits, Limits involving the point at infinity, Continuity, Derivatives, Differentiation formulae, Cauchy-Riemann equations, Sufficient conditions for differentiability; Analytic functions and their examples.

UNIT II **10 Hours**

Elementary Functions and Integrals: Exponential function, Logarithmic function, Branches and derivatives of logarithms, Trigonometric function, Derivatives of functions, Definite integrals of functions, Contours, Contour integrals and its examples, Upper bounds for moduli of contour integrals,

UNIT III **12 Hours**

Cauchy's Theorems and Fundamental Theorem of Algebra: Antiderivatives, Proof of antiderivative theorem, Cauchy-Goursat theorem, Cauchy integral formula; An extension of Cauchy integral formula, Consequences of Cauchy integral formula, Liouville's theorem and the fundamental theorem of algebra.

UNIT IV **11 Hours**

Series and Residues: Convergence of sequences and series, Taylor series and its examples; Laurent series and its examples, Absolute and uniform convergence of power series, Uniqueness of series representations of power series, Isolated singular points, Residues, Cauchy's residue theorem, residue at infinity; Types of isolated singular points, Residues at poles and its examples.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, E team Teaching, Quiz, Problem Analysis.

Suggested Readings:-

- *Brown, James Ward, & Churchill, Ruel V. (2014). Complex Variables and Applications (9th ed.). McGraw-Hill Education. New York.*
- *Bak, Joseph & Newman, Donald J. (2010). Complex analysis (3rd ed.). Undergraduate Texts in Mathematics, Springer. New York.*

- *Zills, Dennis G., & Shanahan, Patrick D. (2003). A First Course in Complex Analysis with Applications. Jones & Bartlett Publishers, Inc.*
- *Mathews, John H., & Howell, Rusell W. (2012). Complex Analysis for Mathematics and Engineering (6th ed.). Jones & Bartlett Learning. Narosa, Delhi. Indian Edition.*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs.*

Course Title: Linear Programming Problem
Course Code: BNM308

L	T	P	Credit
0	0	0	3

Total Hours: 45

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Describe the origin, Scope, development of Operations Research and use the scientific methods of Operation research.
2. Interpret the dual variables and perform sensitivity analysis in the context of economics problems as shadow prices, imputed values, marginal values, or replacement values and explain the concept of complementary slackness and its role in solving primal/dual problem pairs,
3. Define how to formulate an LPP with linear constraints and identify a problem in your locality, formulate it as an LPP and solve.Prove basic set equalities
4. Explain, how to maximize the profit, minimize the cost, minimize the time in transportation problem. For example, travelling salesman problem, Assignment problems.

Course Content

UNIT I **12 Hours**

Operations Research (OR) and its Scope, Modeling in OR, Scientific Method in Operations Research, Linear Programming: Definition, mathematical formulation, standard form, Solution space, solution – feasible, basic feasible, optimal, infeasible, multiple, redundancy, degeneracy, Solution of LP Problems - Graphical Method, Simplex Method.

UNIT II **12 Hours**

Transportation Problem, Basic feasible solution using different methods (North-West corner, Least Cost, Vogel's Approximation Method), Optimality Methods, Unbalanced transportation problem, Degeneracy in transportation problems, Assignment Problem, Hungarian Method for Assignment Problem.

UNIT III **11 Hours**

Artificial variable techniques- Two Phase Method; Big M Method, Special cases in LPP. Finding Inverse of a matrix using Simplex method, Solving system of linear equations using Simplex method.

UNIT IV **10 Hours**

Duality: Definition of the dual problem, Primal-dual relationships, Economic Interpretation of Duality, Dual simplex Method.

Transaction Mode- Video Based Teaching, Collaborative teaching, Project based learning, E-team teaching, Group discussion, E team Teaching, Flipped Teaching, Quiz, Open talk, Problem Analysis.

Suggested Readings:-

- *Sharma, J. K. (2016). Operations research: theory and applications. Trinity Press, an imprint of Laxmi Publications Pvt. Limited*
- *J. K. Sharma, (2012). Operations Research – Problems and Solutions, Macmillian Pub.*
- *G. Hadly (1975). Linear Programming, Narosa Publishing House*
- *A. H. Taha, (25005). Operations Research – An Introduction. Prentice HaLL.*
- *Hillier and Lieberman, (2017). Introduction to Operations Research, McGraw Hill*

Course Title:-Riemann Integration & Series of Functions

Course Code: BNM309

L	T	P	Credit
3	0	0	3

Total Hours: 45

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Learn about some of the classes and properties of Riemann integrable functions, and the applications of the Fundamental theorems of integration.
2. Know about improper integrals including, beta and gamma functions.
3. Learn about Cauchy criterion for uniform convergence and Weierstrass M-test for uniform convergence.
4. Approximate transcendental functions in terms of power series as well as, differentiation and integration of power series.

Course Content

UNIT I **12 Hours**

Riemann Integration Definition of Riemann integration, Inequalities for upper and lower Darboux sums, Necessary and sufficient conditions for the Riemann integrability, Definition of Riemann integration by Riemann sum and equivalence

of the two definitions, Riemann integrability of monotone functions and continuous functions, Properties of Riemann integrable functions, Definitions of piecewise continuous and piecewise monotone functions and their Riemann integrability, intermediate value theorem for integrals, Fundamental theorems (I and II) of calculus, and the integration by parts.

UNIT II **10 Hours**

Improper Integral Improper integrals of Type-I, Type-II and mixed type, Convergence of beta and gamma functions, and their properties.

UNIT III **13 Hours**

Sequence and Series of Functions Pointwise and uniform convergence of sequence of functions, Theorem on the continuity of the limit function of a sequence of functions, Theorems on the interchange of the limit and derivative, and the interchange of the limit and integrability of a sequence of functions. Pointwise and uniform convergence of series of functions, Theorems on the continuity, derivability and integrability of the sum function of a series of functions, Cauchy criterion and the Weierstrass M-test for uniform convergence.

Unit IV **10 Hours**

Power Series Definition of a power series, Radius of convergence, Absolute convergence (Cauchy–Hadamard theorem), Uniform convergence, Differentiation and integration of power series, Abel's theorem.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, E team Teaching, Flipped Teaching, Quiz, Open talk, Problem Analysis.

Suggested Readings:-

- *Bartle, Robert G., & Sherbert, Donald R. (2015). Introduction to Real Analysis (4th ed.). Wiley India Edition. Delhi.*
- *Denlinger, Charles G. (2011). Elements of Real Analysis. Jones & Bartlett (Student Edition). First Indian Edition. Reprinted 2015.*
- *Ghorpade, Sudhir R. & Limaye, B. V. (2006). A Course in Calculus and Real Analysis. Undergraduate Texts in Mathematics, Springer (SIE). First Indian reprint.*
- *Ross, Kenneth A. (2013). Elementary Analysis: The Theory of Calculus (2nd ed.). Undergraduate Texts in Mathematics, Springer.*

Course Title:-Discrete Mathematics

Course Code: BNM326

L	T	P	Credit
3	0	0	3

Total Hours: 45

Learning Outcomes After completion of this course, the learner will be able to:

1. Acquire knowledge in simple mathematical modeling.
2. Study advance courses in mathematical modeling, computer science, statistics, physics, chemistry etc.
3. Apply discrete mathematics concepts to analyze and design data structures and algorithms.
4. Collaborate effectively in solving complex mathematical problems and communicate solutions clearly and rigorously.

Course Content

UNIT I **12 hours**

Sets, relations, Equivalence relations, partial ordering, well ordering, axiom of choice, Zorn's lemma, Functions, cardinals and ordinals, countable and uncountable sets, statements, compound statements, proofs in Mathematics, Truth tables, Algebra of propositions, logical arguments, Well-ordering property of positive integers, Division algorithm, Divisibility and Euclidean algorithm, Congruence relation between integers, modular arithmetic, Chinese remainder theorem, Fermat's little theorem.

UNIT II **11 hours**

Principles of Mathematical Induction, pigeonhole principle, principle of inclusion and exclusion Fundamental Theorem of Arithmetic, permutation combination circular permutations binomial and multinomial theorem, Recurrence relations, generating functions, generating function from recurrence relations.

UNIT III **11 hours**

Matrices, algebra of matrices, determinants, fundamental properties, minors and cofactors, product of determinant, adjoint and inverse of a matrix, Rank and nullity of a matrix, Systems of linear equations, row reduction and echelon forms, solution sets of linear systems, applications of linear systems, Eigen values, Eigen vectors of a matrix.

UNIT IV **11 hours**

Graph terminology, types of graphs, subgraphs, isomorphic graphs, Adjacency and incidence matrices, Paths, Cycles, and connectivity, Eulerian and Hamiltonian paths, Planar graphs. Transaction Mode- Lecture, Demonstration, Project Method, Co-Operative learning, Seminar, Group discussion, Team teaching, Tutorial, Problem solving, E-team teaching, Self-learning.

Suggested Readings:-

- *Edgar G. Goodaire and Michael M. Parmenter, Discrete Mathematics with Graph Theory, 3rd Ed., Pearson Education (Singapore) P. Ltd., Indian Reprint, 2005.*
- *Kenneth Rosen Discrete mathematics and its applications Mc Graw Hill Education 7th edition.*
- *V Krishna Murthy, V. P. Mainra, J. L. Arora, An Introduction to Linear Algebra, Affiliated East-West Press Pvt. Ltd.*
- *J. L. Mott, A. Kendel and T.P. Baker: Discrete mathematics for Computer Scientists and Mathematicians, Prentice Hall of India Pvt Ltd, 2008.*

Course Title: Basic Mathematics

Course Code: OEC002

L	T	P	Credit
2	0	0	2

Total Hours: 30

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Define sets and functions with related concepts.
2. Define the concept of functions and relations.
3. Express an argument using logical notation and determine if the argument is or is not valid
4. Prove basic set equalities Demonstrate the ability to write and evaluate a proof.
5. Relate the concept of Arithmetic progression and Geometric progression and their sum.
6. Explain the description of algebraic properties of complex numbers.
7. Explore the theory of Matrices and Determinants.

Course Content

UNIT I **8 Hours**

Sets: Basic Definitions, subsets, power set, set operations. Ordered pairs, Cartesian product of sets. Functions and Relations: Definition of relation, domain, co-domain and range of a relation. Binary relations, equivalence relations, partition. Function as a special kind of relation from one set to another. Domain, co-domain and range of a function. Composition, inverse. Real valued function of the real variable, constant, identity, Polynomial, rational, Functions. Activity: Students will try to find the applications of functions and relations.

UNIT II **7 Hours**

Sequence and series, Arithmetic Progression (A.P), Arithmetic Mean (A.M), Geometric Progression (G.P), general term of a G.P, sum of n terms of a G.P. Arithmetic and Geometric series, infinite G.P. and its sum. Geometric mean (G .M), relation between A.M and G.M. Activity: Students will solve some problems related to these sequences and series.

UNIT III **8 Hours**

Need for complex numbers, especially $\sqrt{-1}$, to be motivated by inability to solve every Quadratic equation. Brief description of algebraic properties of complex numbers. Argand plane and polar representation of complex numbers, Statement of Fundamental Theorem of Algebra, nth roots of Unity. Activity: Students will solve some problems related to the complex number.

UNIT IV **7 Hours**

Matrices and types of matrices, Operations on Matrices, Determinants of Matrix and Properties of Determinants, Minors and Cofactor and Adjoint of a square matrix, Singular and non-singular Matrices, Inverse of a Matrix, Eigenvalues and Eigenvectors, Cayley Hamilton theorem.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, E team Teaching, Flipped Teaching, Quiz, Open talk, Problem Analysis.

Suggested Readings:-

- *E. Kreyszig. (1990).Advanced Engineering Mathematics.9th edition, John Wiley & Sons.*
- *E.Kreyszig. (2002).Advanced Engineering Mathematics. 9th edition, John Wiley & Sons.*
- *G. B. Thomas and R. L. Finney. (2015). Calculus and Analytic Geometry. 11th edition, Pearson India.*
- *R. K. Jainand S.R.K. Iyengar. (2002). Advanced Engineering Mathematics.8th Edition, Narosa Publications.*

L	T	P	Credit
2	0	0	2

Course Title: Physics for Competitive Exams
Course Code: OEC027

Total Hours: 30

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Demonstrate their knowledge of the basic scientific principles and fundamental concepts and skills of the field.
2. Solve problems utilizing scientific reasoning, quantitative methods, and acquired knowledge and skills.
3. Demonstrate knowledge of the basic physics, and technological advancements.
4. Apply knowledge of linear motion, forces, energy, and circular motion to explain natural physical processes and related technological advances.

Course Content

UNIT I **8 Hours**

Introduction to Physics, The Universe: Stars, Sun, Asteroids: In a nutshell, The Solar System and Satellites, S.I. UNITs of Measurement, Motion and Mechanics, Laws of Motion, Fundamental Forces in nature, rotation and revolution of the earth, Work, Energy & Power, Gravitation.

UNIT II **7 Hours**

Light and electromagnetic radiations, Refraction of Light , Reflection of light from Spherical Mirrors, Reflection of Light, Refraction of light by Spherical Lenses, Refraction of light through a glass prism, The Human Eye and its defects, Electromagnetism, Sound: Doppler Effect and Echo

UNIT III **10 Hours**

Electricity & Magnetism, Electric current, resistance of a conductor, Magnetic effect of electric current. Thermal Expansion of Solids, Liquids and Gases, Mechanical Properties of Fluids, Radioactivity ,Nuclear Fission and Fusion, Atomic Theories, Modern physics .

UNIT IV **5 Hours**

Various Scientific Instruments, First in Space, Important Inventions, recent phenomenon in the news, Nobel Prize winners and their achievements, ISRO, DRDO, Ministry of Science & Technology.

Transaction Mode- Lecture, Demonstration, Project Method, Co-Operative learning, Seminar, Group discussion, Team teaching, Tutorial, Problem solving, E-team teaching, Self-learning.

SUGGESTED READINGS:

- *How Things Work: The Physics of Everyday Life, 3rd edition, by Louis A. Bloomfield, Wiley, 2006.*
- *B.B. Laud (2002), Lasers and Non-linear Optics, New Age Pub.*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs.*

Course Title: Chemistry in Everyday Life
Course Code: OEC008

L	T	P	Credit
2	0	0	2

Total Hours: 30

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Explore the various air pollutant and its control measures.
2. Differentiate between different types of soaps based on properties like lather formation and cleaning effect.
3. Analyze the strategies of eco-friendly polymers.
4. Evaluate the kinetics, mechanism of condensation polymerization & methodology used of control molecular weight of polymers.

Course Content

UNIT I **7 Hours**

Air pollution: Air pollutants, prevention and control, Greenhouse gases and acid rain; Ozone hole and CFC's; Photochemical smog and PAN; Catalytic converters for mobile sources; Bhopal gas tragedy; Control measures.

UNIT II **8 Hours**

Polymers in everyday life: Types and classification of polymers. Source and general characteristics of natural and synthetic polymers; Typical examples of polymers used as commodity plastics, textiles, electronic and automobile components, medical and aerospace materials; Problems of plastic waste management; Strategies for development of environmental friendly polymers.

UNIT III **7 Hours**

Detergents- pollution aspects, eutrophication; Pesticides and insecticides- pollution aspects; Heavy metal pollution; Solid pollutants - treatment and disposal; Treatment of industrial liquid wastes; Sewage and industrial effluent treatment; Composition of soil - inorganic and organic components in soil- micro and macro nutrients

UNIT IV **8 Hours**

Fertilizers: Classification of Fertilizers- Straight Fertilizers, Compound/Complex Fertilizers, Fertilizer Mixtures. Manufacture and general properties of Fertilizer products- Urea and DAP. Ceramics: General properties, porous and non-porous wares; Manufacturing process, extrusion, turning, drying, and decoration

Transaction Mode- Lecture, Demonstration, Project Method, Co-Operative learning, Seminar, Group discussion, Team teaching, Tutorial, Problem solving, E-team teaching, Self-learning

SUGGESTED READINGS:-

- *Swaminathan and Goswamy(2006)Handbook on Fertilizer Technology, 6 th ed. 2001, FAI.*
- *J. R. Fried(2007)Polymer Science and Technology, (Prentice Hall).*
- *P. Atkins and J. de Paula(2002)Physical Chemistry –-7 th Ed., Oxford University Press.*

Semester -IV

Course Title: Nuclear and Particle Physics
Course Code: BNM415

L	T	P	Credit
4	0	0	4

Total Hours: 60

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Analyze the ideas of basics of nucleus, Constituents of nucleus and their intrinsic properties, Qualitative facts about size, mass, density, and energy.
2. Explain about the general properties of nuclei, nuclear forces and detectors, radioactive decay and nuclear reactions.
3. Examine the liquid drop model. Semi-empirical mass formula, Conditions of nuclear stability, Fermi gas model. Nuclear shell modelto explain the nucleus structure
4. Categorize the different types of the radioactive decay and kinetics of nuclear reactions.

Course Content

UNIT I **15 Hours**

Nuclear Properties: Constituents of nucleus and their intrinsic properties, Qualitative facts about size, mass, density, energy, charge. Binding energy, angular momentum, magnetic moment and electric quadruple moments of the nucleus, Average binding energy and its variation with mass numbers. Properties of nuclear forces and saturation, Assumptions of liquid drop model. Semi-empirical mass formula, Conditions of nuclear stability, Fermi gas model. Nuclear shell model. Experimental evidence of magic numbers and its explanation.

UNIT II **15 Hours**

Radioactivity decays: Modes of decay and successive radioactivity. Alpha emission. Electron emission, Positron emission. Electron capture, Gamma-ray emission, Internal conversion, Qualitative discussion of alpha, beta and gamma spectra, Geiger-Nuttal rule, Neutrino hypothesis of beta decay, Evidence of existence of neutrinos. Nuclear reactions: Reaction cross section, Conservation laws. Kinematics of nuclear reaction, Q value and its physical significance, Compound nucleus.

UNIT III **15 Hours**

Radiation interaction with matter: Energy loss due to ionization (Bethe Block formula), Bremsstrahlung, Pair production, Radiation loss by fast electrons. Electron – positron annihilation. Particle Accelerators: Cyclotron. Betatron, Qualitative discussion of Synchrotron, Collider machines and linear accelerator.

Radiation Detectors: Ionization chamber, Proportional counter, GM counter, Scintillation counter, Solid state detectors.

UNIT IV **15 Hours**

Elementary particles: masses of elementary particles, Decay modes, Classification of these particles, types of interactions. Conservation laws and quantum numbers, Concepts of isospin. Strangeness, Parity, Charge conjugation. Antiparticles, Gell Man method, Decay and strange Particles. Particle symmetry, Introduction to quarks and qualitative discussion of the quark model.

Transaction Mode- Lecture, Demonstration, Project Method, Co-Operative learning, Seminar, Group discussion, Team teaching, Tutorial, Problem solving, E-team teaching, Self-learning.

SUGGESTED READINGS:-

- *Kaplan(2003), Nuclear Physics, Addision-Wiley Pub. Co. Inc.*
- *Bucham(1965), Nuclear Physics, Indian Ed.*
- *M.R. Bhiday and V.A. Joshi(2002) , An Introduction to Nuclear Physics, Orient Longman.*
- *D.C. Tayal (2001), Introductory Nuclear Physics, Himalaya Pub.*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs*

Course Title: Abstract Algebra
Course Code: BNM402

L	T	P	Credit
4	0	0	4

Total Hours: 60

Learning Outcomes: On successful completion of this course, the successful students will be able to:

1. Define the concepts of group, ring, field, and will be able to readily give examples of each of these kinds of algebraic structures.
2. Define the concepts of coset and normal subgroup and to prove elementary propositions involving these concepts.
3. Define the concept of subgroup and will be able to determine (prove or disprove), in specific examples, whether a given subset of a group is a subgroup of the group.
4. Define and work with the concepts of homomorphism and isomorphism. Content

UNIT I **15 Hours**

Normal and subnormal series of group, composition series of group, Jordan-holder theorem.

UNIT II **15 Hours**

Solvable and Nilpotent groups, Field & subfield definition & Examples, Extension fields, Algebraic extensions, Separable and Inseparable extensions Normal extension, Perfect fields

UNIT III **15 Hours**

Class equation of finite group, Cauchy's theorem for finite groups, Sylow Theorem, Wilson's Theorem, Lagrange's Theorem.

UNIT IV **15 Hours**

Polynomial Ring R[x] over a Ring R in an indeterminate X, Primitive polynomial. The ring of Gaussian integers as an Euclidean domain, Fermat's Theorem, Unique Factorization domain.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, E team Teaching, Flipped Teaching, Quiz, Open talk, Problem Analysis.

Suggested Readings:-

- *Friedberg, Stephen H., Insel, Arnold J., & Spence, Lawrence E. (2003). Linear Algebra (4th ed.). Prentice-Hall of India Pvt. Ltd. New Delhi.*
- *J. B. Fraleigh, (2003), A first course in Abstract Algebra, Addison-Wiley.*
- *I.N. Herstein, (2006), Topics in Algebra, John Wiley & Sons.*
- *Thomas W Hungerford, (1990), Abstract Algebra–An Introduction, Sauders College Publishing.*
- *Joseph A Gallian, (2016), Contemporary Abstract Algebra, Brooks/Cole Cengage Learning.*
- *V. K. Khanna and S. K. Bhambri, (2014), A course in Abstract Algebra, Vikas Publishing House Pvt (Ltd).*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs.*

Course Title: Assessment for Learning

Course Code: BED205

L	T	P	Credits
4	0	0	4

Total Hours: 60

Learning Outcomes

After Completion of this course, the Learner will be able to:

- differentiate between assessment of learning and assessment for learning
- critically analyze the techniques of assessment at different domains ofteaching

- apply different statistical applications for interpretation and reporting ofstudent's performance
- examine emerging practices and issues in assessment

Course Content

Unit I **15 Hours**

Assessment of learning and assessment for learning: Meaning, measurement, tests, examination, principles and types of evaluation, Distinction between and their inter-relationships. Purposes and objectives of Assessment – for placement, providing feedback, grading promotion, certification, diagnosis of learning difficulties, Norm referenced and criterion referenced testing, teacher made and standardized tests, essay type, objective type and objective based tests.

Unit II **15 Hours**

Steps of construction of a test: Planning (Blue Print), Preparation, Try Out and Evaluation, Characteristics of a good tool of evaluation: Validity, Reliability, Objectivity and Usability.

Techniques of Assessment: Use of Projects, Assignments, Work Sheets, Practical work, Performance based activities, Seminars and Reports as assessment devices.

Unit III **15 Hours**

Scoring Procedure - manual and electronic, development of Rubrics Analysis and Interpretation of Students' Performance, Processing test performance, calculation of percentages, frequency distribution, percentile Rank, measures of central tendency, graphical representations and interpreting performance. Place of marks, grades and qualitative descriptions, Role of Feedback in Improving learning and learners' development.

Unit IV **15 Hours**

Existing Practices: Semester system, CCE, Grading and Choice Based Credit System, issues and problems in existing practices, Marking vs. Grading, Objectivity vs. Subjectivity

Non-Detention Policy, the menace of coaching, Policy Perspectives on Assessment: NCF (2009), NPE 2023.

Emerging Practices in Assessment: Standard Based Assessment, Online, Computer, Based and Open Book Examinations

Transactional Mode

Video based Teaching, Panel Discussions, Collaborative Teaching, Cooperative Teaching, Demonstration, Project Based Learning, Quiz, Simulation, Lecture -cum- Demonstration, Seminars

Suggested Readings

- S. K. Mangal, (2017). Assessment of Learning, Publisher, Shipra, ISBN, 9386262355, 9789386262356; Length, 137 pages.
- Ronald Jay Cohen, Mark, E. Swerdlik and Medhe M. Kumtheker (2014) Psychological testing and Assessment, Mc Graw Hill Education (India) Private limited.
- Asthana Bipin (2011). Measurement and Evaluation in Psychology and Education. Agrwal Publications, Agra.

- GOI (2011) Sarva Shiksha Abhiyan-Framework for implementation based on the right of children to free and Compulsory Education Act,2009. GOI Retrieved from http:// www. upefa.com/upefaweb/admin/myuploads/SSA_frame_work_revised_9.6.201 1 Pdf.
- Asthana Bipin (2011). Measurement and Evaluation in Psychology and Education. Agrwal Publications, Agra
- Sharma, R.A. (2010). Essentials of Measurement in Education and Psychology. R. Lall Book Depot, Meerut.
- Thorndike R. L and Thorndike Christ Tracy (2010). Measurement and

Evaluation in Psychology and Education. PHI Learning Private Limited, New Delhi.

Web Sources

- https://www.learningclassesonline.com/2020/10 /assessment-for- learning.html
- https://www.google.com/search?q=rubrics&rlz=1C1FKP E_enIN1045IN1046 &biw=994&bih=452&ei=0YWWZPvILoyxoATT
- https://www.tnteu.ac.in/pdf/assesment.pdf
- https://www.slideshare.net/abubashars/assessment s-for-learning-bed- second-year-notes

Course Title: Nuclear and Particle Physics Lab
Course Code: BNM417

L	T	P	Credit
0	0	2	1

Total Hours: 15

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Gain hands-on experience in handling nuclear detectors.
2.Collect and analyze data and verify some results that they learn in theory.

3.Build the foundation to carry out research in the field of nuclear physics, nuclear reactions and applied nuclear physics.
4. Design the experiments themselves under the supervision.

Course Content

1. To determine the Dead Time of a G.M. Counter.
2. Absorptions of Beta Particles in Matter.
3. To Study Beta Particle Range and Maximum Energy.
4. Source Strength of a Beta Source.
5. Window Thickness of a G.M. Tube.
6. To Investigate the Statistics of Radioactive Measurements.
7. Study of Poisson Distribution.
8. Study of Gaussian Distribution.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, E team Teaching, Flipped Teaching, Quiz, Open talk, Problem Analysis.

SUGGESTED READINGS:

- *G. L. Squires, Practical Physics ,Cambridge University Press.*
- *Napier Shaw and Richard Glazebrook, Practical Physics, Nabu Press.*
- *C.L. Arora ,(2010), Practical Physics, S. Chand &Co.*
- *R.S. Sirohi,(2012), Practical Physics, , Wiley Eastern.*

Course Name: Digital Literacy
Course Code: BNM424

L	T	P	Credit
3	0	0	3

Total Hours: 45

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Develop an understanding of the digital world and its impact on society.
2. Enhance skills for navigating digital technologies effectively and responsibly.
3. Learn to critically evaluate digital information for accuracy, credibility, and relevance.
4. Gain proficiency in digital communication tools and platforms.

Course Content

UNIT I **12 Hours**

Introduction to Digital Literacy: Defining digital literacy and its importance in the modern world. Historical overview of digital technologies and their evolution. Digital divide: understanding disparities in access to and use of technology.

Navigating the Digital Landscape: Understanding the internet and its structure. Web browsers, search engines, and online resources. Evaluating website credibility and reliability.

UNIT II **12 Hours**

Information Literacy and Digital Communication: Strategies for effective online research and information retrieval. Assessing the credibility and bias of digital sources. Citation and plagiarism in the digital age. Email etiquette and effective communication in digital environments. Social media platforms and online networking. Digital storytelling and multimedia communication.

UNIT III **11 Hours**

Privacy and Data Protection: Best practices for creating strong passwords and protecting personal information. Recognizing common online threats, such as phishing and malware. Cybersecurity measures for safe internet browsing and data protection. Understanding digital footprints and online privacy risks. privacy settings and controls on social media and other online platforms.

UNIT IV **11 Hours**

Ethical Considerations in the Digital Age: Intellectual property rights and copyright laws. Ethical implications of digital surveillance and data mining. Digital activism and ethical uses of technology for social change. Critical Thinking in Digital Environments: Recognizing misinformation, fake news, and digital propaganda. Fact-checking strategies and tools for verifying information online. Analyzing bias and perspective in digital media.

TRANSACTION MODE: Lecture, Demonstration, Project Method, Co Operative learning, Seminar, Group discussion, Team teaching, Tutorial, Problem solving, E-team teaching, Self-learning.

SUGGESTED READINGS:

- *Paul Glister (1998), Digital Literacy: An Introduction to the World of Computers, John Wiley & Sons.*
- *John Parker (1998), Digital Literacy Unpacked, Facet Publishing House.*
- *Renne Hobbs (2011), Digital and Media Literacy: Connecting Culture and Classroom, Sage Publishers.*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs.*

L	T	P	Credit
3	0	0	3

Course Name: Basics of Translation
Course Code: BNM425

Total Hours: 45

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Develop the skills of translation among the learners through practice in the translation of various types of texts
2. Develop the skills of practicing translators and enhance their competence.
3. Translate texts and speeches from English to Punjabi.
4. Appreciate the cultural and linguistic diversity of their environment.

Course Content

UNIT I **10 Hours**

Introduction: Meaning, Nature and Scope of Translation, Relevance of Translation in the age of Globalization, Literal Translation and trans-creation, Duties and Responsibilities of a Translator, Limitations of Translation.

UNIT II **11 Hours**

Phrase Structure in English and Punjabi: Understanding Sentence Structure in English and Punjabi, using Dictionaries and Thesaurus in Translation, Translation of Registers and Technical Terms, Translation of sample non-literary and technical passages and texts like scientific, sociological, political speeches and philosophical texts.

UNIT III **12 Hours**

Theories and Trends in Translation: Historical Theories of Translation in Past Classics and Canons, Modern Theories in Translation: Impact of Technology, Multiple Intelligence and Corporate world on modern theories of translation, Changing trends and ideas in translation. Difference in Theoretical and Pragmatic Translations: Difficulties and Solutions in Translation.

UNIT IV **11 Hours**

New Possibilities and Strategies in Translation: Significance of Synonyms and Accuracy levels in Translation. Translation in Social Media and Literature: A Comparative glance. Translation in Re-Scripting for different audience or readers: Purpose Oriented Translation in Children's Literature and Instructional Education. Importance of Translation as Original Writing: Significance of reaching out in Target Language and Departure from Source Language.

TRANSACTION MODE: Lecture, Demonstration, Project Method, Co Operative learning, Seminar, Group discussion, Team teaching, Tutorial, Problem solving, E-team teaching, Self-learning.

SUGGESTED READING:

- *Cronin, Michael. (2003). Translation and globalization. London: Routledge.*
- *Gouadee (2007), D. Translation as a Profession. John Benjamins Publishing*
- *Shastri, Pratima dave (2012), Fundamental Aspects of Translation. PHI Learning, New Delhi.*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs.*

Course Name: Pharmaceutical chemistry
Course Code: BNM426

L	T	P	Credit
3	0	0	3

Total Hours: 45

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Describe the various pharmaceutical drugs, their application and synthesis.
2. Study the action and discovery, the structure activity and drug targets.
3. Differentiate antimicrobial drugs, antibacterial, antifungal, antiviral, antimalarial etc.
4. Analyze fermentation and such related methods to produce products at industrial levels.

Course Content

UNIT I **15 Hours**

Drugs & Pharmaceuticals: Drug discovery, design and development; Basic Retrosynthetic approach; Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, anti inflammatory agents (Aspirin, paracetamol, lbuprofen); antibiotics (Chloramphenicol)

UNIT-II **10 Hours**

Antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol; Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir), Central Nervous System agents (Phenobarbital, Diazepam), Cardiovascular (Glyceryl trinitrate), antilaprosy (Dapsone), HIV-AIDS related drugs (AZT- Zidovudine)

UNIT-III **10 Hours**

Fermentation: Aerobic and anaerobic fermentation; Production of ethyl alcohol and citric acid; Antibiotics; Penicillin, Chloromycetin and Streptomycin; Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C

UNIT-IV **10 Hours**

Preparation of Aspirin and its analysis; Preparation of magnesium bisilicate (Antacid)

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, ted talks, E team Teaching, Flipped Teaching, Quiz, Open talk, Case analysis

SUGGESTED READINGS:-

- *Patrick, G. L. (2013). An introduction to medicinal chemistry. Oxford university press.*
- *Singh, H., & Kapoor, V. K. (2005). Medicinal and Pharmaceutical Chemistry. VallabhPrakashan.*
- *Foye, W. O. (1974). Principles of medicinal chemistry. Lea &Febiger.*
- Suggested digital platform: NPTEL/SWAYAM/MOOCs

Course Name: Conductance, Electrochemistry and

Functional Group Organic Chemistry

Course Code: BNM427

L	T	P	Credit
3	0	0	3

Total Hours: 45

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Calculate conductance of strong and weak electrolyte.
2. Derive Nearnst equation for calculation of e.m.f of cell.
3. Recognize the importance of electrochemistry in various fields.
4. Predict the activity of various functional group in synthesis of oganic compounds and in various reactions .

Course Content

UNIT-I **12 Hours**

Conductance

Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes; Kohlrausch law of independent migration of ions.

Transference number and its experimental determination using Hittorf and Moving boundary methods; Ionic mobility. Applications of conductance measurements: determination of degree of ionization of weak electrolyte, solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt. Conductometric titrations (only acid-base)

UNIT-I **11 Hours**

Electrochemistry

Reversible and irreversible cells; Concept of EMF of a cell;; Measurement of EMF of a cell. Nernst equation and its importance; Types of electrodes; Standard electrode potential; Electrochemical series. Thermodynamics of a reversible cell, calculation of thermodynamic properties: ΔG, ΔH and ΔS from EMF data.

Calculation of equilibrium constant from EMF data; Concentration cells with transference and without transference; Liquid junction potential and salt bridge; pH determination using hydrogen electrode and quinhydrone electrode; Potentiometric titrations -qualitative treatment (acid-base and oxidation-reduction only)

UNIT-III **10 Hours**

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure

Amines and Diazonium Salts

Amines (Aliphatic and Aromatic): (Upto 5 carbons)

Preparation: from alkyl halides, Gabriel's Phthalimide synthesis,Hofmann Bromamide reaction; Reactions*:* Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO_2, Schotten: Baumann Reaction; Electrophilic substitution (case aniline): nitration, bromination, sulphonation

Diazonium salts: *Preparation:* from aromatic amines.Reactions:conversion to benzene, phenol, dyes.

UNIT IV **12 Hours**

Amino Acids, Peptides and Proteins:

Preparation of Amino Acids: Strecker synthesis using Gabriel's phthalimide synthesis. Zwitterion, Isoelectric point and Electrophoresis

Reactions of Amino acids: ester of –COOH group, acetylation of $–NH_2$ group, complexation with Cu^{2+} ions, ninhydrin test; Overview of Primary, Secondary,

Tertiary and Quaternary Structure of proteins; Determination of Primary structure of Peptides by degradation Edmann degradation (N-terminal) and C–terminal (thiohydantoin and with carboxypeptidase enzyme); Synthesis of simple peptides (upto dipeptides) by N-protection (t-butyloxycarbonyl and phthaloyl) & C-activating groups and Merrifield solid-phase synthesis

Carbohydrates: Classification, and General Properties, Glucose and Fructose (open chain and cyclic structure), Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in monosaccharides. Structure of disacharrides (sucrose, cellobiose, maltose, lactose) and polysacharrides (starch and cellulose) excluding their structure elucidation.

SUGGESTED READINGS:-

- *G. W. Castellan: Physical Chemistry 4th Ed. Narosa (2004).*
- *J. C. Kotz, P. M. Treichel, J. R. Townsend, General Chemistry, Cengage Learning India Pvt. Ltd.: New Delhi (2009).*
- *B. H. Mahan: University Chemistry, 3rd Edn. Narosa (1998).*
- *R. H. Petrucci, General Chemistry, 5th Edn., Macmillan Publishing Co.: New York (1985).*
- *Morrison, R. T. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).*
- *Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).*
- *Finar, I. L. Organic Chemistry (Volume 2), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).*
- *Nelson, D. L. & Cox, M. M. Lehninger's Principles of Biochemistry 7th Ed., W. H. Freeman.*
- *Digital platform: NPTEL/SWAYAM/MOOCs*

Course Name: Polymer Chemistry
Course Code: BNM428

L	T	P	Credit
3	0	0	3

Total Hours: 45

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Distinguish between addition and condensation polymers.
2. Calculate average degree of polymerization.
3. Determine of molecular weight of polymers.
4. Analyze Physical, thermal, Flow & Mechanical Properties of different polymers.

Course Content

UNIT-I **15 Hours**

Introduction and history of polymeric materials: Different schemes of classification of polymers, Polymer nomenclature, Molecular forces and chemical bonding in polymers, Texture of Polymers.

Functionality and its importance: Criteria for synthetic polymer formation, classification of polymerization processes, Relationships between functionality, extent of reaction and degree of polymerization.

Kinetics of Polymerization: Mechanism and kinetics of step growth, radical chain growth, ionic chain (both cationic and anionic) and coordination polymerizations, Mechanism and kinetics of copolymerization, polymerization techniques.

UNIT-II **10 Hours**

Crystallization and crystallinity: Determination of crystalline melting point and degree of crystallinity, Morphology of crystalline polymers, Factors affecting crystalline melting point.

Nature and structure of polymers- Structure Property relationships

Determination of molecular weight of polymers(Mn, Mw, etc) by end group analysis, viscometry, light scattering and osmotic pressure methods. Molecular weight distribution and its significance. Polydispersity index.

UNIT-III **11 Hours**

Glass transition temperature (Tg) and determination of Tg, Free volume theory, WLF equation, Factors affecting glass transition temperature (Tg).

Polymer Solution – Criteria for polymer solubility, Solubility parameter, Thermodynamics of polymer solutions, entropy, enthalpy, and free energy change of mixing of polymers solutions, Flory- Huggins theory, Lower and Upper critical solution temperatures.

UNIT-IV **09 Hours**

Properties of Polymers (Physical, thermal, Flow & Mechanical Properties)

Brief introduction to preparation, structure, properties and application of the following polymers: poly(vinyl chloride), poly(vinyl acetate) and related polymers, acrylic polymers, fluoro polymers, polyamides and related polymers. Phenol formaldehyde resins, polyurethanes, silicone polymers, polydienes, Polycarbonates, Conducting Polymers, [polyacetylene, polyaniline, poly(p-phenylenesulphidepolypyrrole, polythiophene)].

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, ted talks, E team Teaching, Flipped Teaching, Quiz, Open talk, Case analysis

SUGGESTED READINGS:-

- *G. Odian(2014)Principles of Polymerization, John Wiley.*
- *F.W. Billmeyer,(2017) Text Book of Polymer Science, John Wiley.*
- *P. Ghosh,(2019)Polymer Science & Technology, Tata Mcgraw-Hill.*
- *R.W. Lenz,(2019)Organic Chemistry of SyntheticHigh Polymers.*
- *Digital platform: NPTEL/ SWAYAM/ MOOCs.*

Course Name: Pesticide Chemistry
Course Code: BNM429

L	T	P	Credit
3	0	0	3

Total Hours: 45

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Discuss on chemical composition and nutritional quality of various field and horticultural crops.
2. Acquire the skills on quality monitoring of crops and pesticides through Practices.
3. Impart the knowledge on agrochemicals viz., fertilizers and pesticides
4. Analyze the importance of pesticides and insecticides along with their chemical composition.

Course Content

UNIT-I **10 Hours**

General introduction to pesticides (natural and synthetic), benefits and adverse effects

UNIT-II **10 Hours**

Changing concepts of pesticides, structure activity relationship

UNIT-III **10 Hours**

Synthesis and technical manufacture and uses of representative pesticides in the following classes: Organochlorines (DDT, Gammexene,); Organophosphates (Malathion, Parathion); Carbamates (Carbofuran and carbaryl); Quinones (Chloranil), Anilides (Alachlor and Butachlor)

UNIT-IV **15 Hours**

1 To calculate acidity/alkalinity in given sample of pesticide formulations as per BIS specifications.
2 Preparation of simple organophosphates, phosphonates and thiophosphates.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, ted talks, E team Teaching, Flipped Teaching, Quiz, Open talk, Case analysis

SUGGESTED READINGS:-

- *R. Cremlyn (2018) Pesticides, John Wiley.*
- *Digital platform: NPTEL/SWAYAM/MOOCs*

Course Title: Life Skills
Course Code: BNM421

L	T	P	Credit
2	0	0	2

Total Hours 30

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Define and Identify different life skills required in personal and professional life
2. Explain the basic mechanics of effective communication and demonstrate these through presentations
3. Use appropriate thinking and problem solving techniques to solve new problems
4. Take part in group discussions and understand the basics of teamwork

Course Content

UNIT I **7 Hours**

Overview of Life Skills: Meaning and significance of life skills, Life skills identified by WHO: Self- awareness, Empathy, Critical thinking, Creative thinking, Decision making, problem solving, Effective communication, interpersonal relationship, coping with stress, coping with emotion.

UNIT II **8 Hours**

Self-awareness: definition, need for self-awareness; Coping With Stress and Emotions, Human Values, tools and techniques of SA: questionnaires, journaling, reflective questions, meditation, mindfulness, psychometric tests, feedback.

UNIT III **7 Hours**

Stress Management: Stress, reasons and effects, identifying stress, stress diaries, the four A's of stress management, techniques, Approaches: action-oriented, emotion oriented, acceptance- oriented, resilience, Gratitude Training

UNIT IV **8 Hours**

Coping with emotions: Identifying and managing emotions, harmful ways of dealing with emotions, PATH method and relaxation techniques. Self-Confidence, Character, Spirituality, Avoiding Procrastination, Sense of Engineering Ethics.

TRANSACTION MODE: Lecture, Demonstration, Project Method, Co Operative learning, Seminar, Group discussion, Team teaching, Tutorial, Problem solving, E-team teaching, Self-learning.

SUGGESTED READINGS:-

- *Shiv Khera, You Can Win, Macmillan Books, New York.*
- *Braun K. Mitra, Personality Development & Soft Skills, Oxford Publishers, Third impression.*
- *ICT Academy of Kerala, Life Skills for Engineers, McGraw Hill Education (India) Private Ltd.*
- *Caruso, D. R. and Salovey, The Emotionally Intelligent Manager: How to Develop and Use the Four Key Emotional Skills of Leadership, John Wiley & Sons.*
- *Kalyana, Soft Skill for Managers, First Edition; Wiley Publishing Ltd.*
- *Larry James, The First Book of Life Skills, First Edition, Embassy Books.*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs.*

Semester V

Course Title: Modern Physics
Course Code: BNM528

L	T	P	Credit
2	0	0	2

Total Hours: 30

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Comprehend Blackbody radiation, Ultraviolet catastrophe, Photoelectric effect and Compton Effect and being aware how quantum theory emerged
2. Explain the need for quantum mechanical formalism and basic principles of wave mechanics and some problems of mechanics.
3. Demonstrate about wave properties of particles, De Broglie waves and its implications on the uncertainty principle.
4. Derive Schrodinger's equation for spherical symmetric potential, complete solution of hydrogen atom and able to solve numerical problems related to these topics.

Course Content

UNIT I **7 Hours**

Foundation of Quantum Mechanics: Brief introduction to need and development of quantum mechanics, Spectral radiation – Planck's law. Photoelectric effect, Compton's effect (quantitative) experimental verification. Limitations of old quantum theory.

UNIT II **8 Hours**

Wave Particle Duality: de Broglie's, properties of matter waves. Phase and group velocities and relation between them. Heisenberg's uncertainty principle. Interpretation of Wave Function Probability and probability current densities in three dimensions, Normalization. Linearity and Superposition Principles. Expectation values of position and momentum. Wave Function of a Free Particle.

UNIT III **7 Hours**

Time independent Schrodinger Wave Equation: Time independent Schrodinger equation in one, two and three dimensions. Particle in a one dimensional box with finite walls. Two dimensional square with infinite walls. Three dimensional rectangular box with infinite walls. Isotropic Harmonic oscillator, Degeneracy.

UNIT IV **8 hours**

Quantum theory of hydrogen-like atoms: time independent Schrodinger equation in spherical polar coordinates; separation of variables for second order partial differential equation; angular momentum operator & quantum numbers; Radial wave-functions from Frobenius method; shapes of the probability densities for ground & first excited states; Orbital angular momentum quantum numbers l and m; s, p, d shells.

Transaction Mode: Lecture/Demonstration/Project Method/ Co Operative learning/ Seminar/Group discussion/Team teaching /Tutorial/Problem solving/E-team teaching/Self-learning.

SUGGESTED READINGS:-

- *Sakurai, Jun John, and Jim Napolitano.* Modern Quantum Mechanics. *Cambridge University Press*
- *V.K. Thankappan(2000), Quantum Mechanics, McGraw Hill Pub. Co. Delhi*
- *P.M. Mathews and K. Venkatesan (2002), A Text Book of Quantum Mechanics, Tata McGraw Hill Pub. Co. Delhi,.*
- *J .L. Powell and B. Crasemann(1997), Quantum Mechanics,Narosa Pub. House, N.Delhi.*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs.*

Course Name: Spectroscopy
Course Code: BNM529

L	T	P	Credit
4	0	0	4

Total Hours: 60

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Differentiate different types of spectroscopic techniques.
2. Derive the laws of photochemistry.
3. Verify Lambert-Beer's law.
4. Separate the molecular energies into translational, rotational, vibration and electronic components.

Course Content

UNIT-I **15 Hours**

Spectroscopy and its importance in Chemistry Wave-particle duality, Link between spectroscopy and quantum chemistry, Electromagnetic radiation and its interaction with matter, Types of spectroscopy, Difference between atomic and

molecular spectra. Born Oppenheimer approximation: Separation of molecular energies into translational, rotational, vibrational and electronic components

UNIT-II **16 Hours**

Postulates of quantum mechanics, quantum mechanical operators, free particle, Particle in a 1-D box (complete solution), quantization, normalization of wave functions, concept of zero-point energy

Rotational Motion: Schrödinger equation of a rigid rotator and brief discussion of its results (solution not required), Quantization of rotational energy levels
Microwave (Pure rotational) spectra of diatomic molecules. Selection rules, Structural information derived from rotational spectroscopy.

UNIT-III **16 Hours**

Vibrational Motion: Schrödinger equation of a linear harmonic oscillator and brief discussion of its results (solution not required). Quantization of vibrational energy levels, Selection rules, IR spectra of diatomic molecules. Structural information derived from vibrational spectra, Vibrations of polyatomic molecules, sGroup frequencies. Effect of hydrogen bonding (inter- and intramolecular) and substitution on vibrational frequencies.

Electronic Spectroscopy: Electronic excited states. Free Electron model and its application to electronic spectra of polyenes. Colour and constitution, chromophores, auxochromes, bathochromic and hypsochromic shifts.

UNIT-IV **13 Hours**

Photochemistry: Laws of photochemistry. Lambert-Beer's law, Fluorescence and phosphorescence, Quantum efficiency and reasons for high and low quantum yields. Primary and secondary processes in photochemical reactions, Photochemical and thermal reactions, Photoelectric cells

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, ted talks, E team Teaching, Flipped Teaching, Quiz, Open talk.

SUGGESTED READINGS:-

- *Morrison, R. T., & Boyd, R. N. (2012). Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd.).*
- *Finar, I. L. (2007). Organic Chemistry, Vol-1, Dorling Kindersley (India) Pvt).*
- *Solomons, T. G. (1980). Organic Chemistry. New York Chichester Brisbane Toronto.*

Course Title: Calculus

Course Code: BNM530

L	T	P	Credit
4	0	0	4

Total Hours: 60

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Recall the idea of derivative, rules of differentiation, test for concavity and convexity and understand the concept of p-r equation.
2. Demonstrate the concepts of curvature, radius of curvature, center of curvature and apply the concepts to solve problems.
3. Analyze the rules of identifying asymptotes, employ the same to find quadrature, length of an arc, Improper integrals and their convergence such as Comparison tests, Absolute and conditional convergence, Abel's and Dirichlet's tests.
4. Explain the hyperbolic functions and compare it with circular functions, trigonometric functions, inverse trigonometric functions and their applications.

Course Content

UNIT I **15 hours**

Successive differentiation, Asymptotes, Multiple points, Tests for concavity and convexity, points of inflexion, Tracing of curves in Cartesian, Curvature, radius of curvature, center of curvature.

UNIT II **15 hours**

Integration of hyperbolic and inverse hyperbolic functions, Reduction Formulae, application of definite integral to find quadrature, length of an arc.

UNIT III **15 hours**

Improper integrals and their convergence, Comparison tests, Absolute and conditional convergence, Abel's and Dirichlet's tests,

UNIT IV **15 hours**

Limits of sequence of numbers. Theorems for calculating limits of sequences, Infinite Series, Bounded and Monotonic sequences, Cauchys convergence criterion. Series of non-negative terms. Comparison tests. Cauchys' Integral test. Ratio tests. Alternating series. Absolute and conditional convergence. Lebnitz

Theorem, Convergence of Taylor Series, Error Estimates. Applications of Power Series.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, E team Teaching, Flipped Teaching, Quiz, Open talk, Problem Analysis.

Suggested Readings:-

- *George B. Thomas, Maurice D. Weir and Joel R. Hass, (2014). Thomas'Calculus, 12thEd., Pearson Education, New Delhi,*
- *Joseph L. Taylor, (2012). Foundations of Analysis, Pure and Applied Undergraduate Texts, 18, American Mathematical Society, Providence, RI,*
- *Shanti Narayan, (2001). Integral Calculus, S. Chand and Company Ltd. 4. M.J. Strauss, G.L. Bradley and K. J. Smith, (2007). Calculus, 3rd Ed., Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi.*
- *R. Courant and F. John, (1989). Introduction to Calculus and Analysis (Volumes I & II), Springer-Verlag, New York, Inc.*

Subject: Numerical Methods

Course Code: BNM518

L	T	P	Credit
2	0	0	2

Total Hours: 30

Learning Outcomes: On successful completion of this course, the successful students will be able to:

1. Characterize the basic concepts of operators like Solution of algebraic and transcendental equations: Bisection method, False position method, Fixed-point iteration method.
2. Solve problems using Newton forward formula and Newton backward formula and its convergence.
3. Derive Gauss's formula and Stirling's formula using Newton forward formula and Newton backward formula.
4. Calculate Simpson's 1/3, 3/8 rules using Trapezoidal rule and evaluate the summation of series finite difference techniques

Course Content

UNIT I **10 Hours**

Solution of algebraic and transcendental equations: Bisection method, False position method, Fixed-point iteration method, Newton's method and its

convergence, Solution of system of non-linear equations by Iteration and Newton-Raphson method.

- To Find The Roots Of Non-Linear Equation Using Bisection Method.
- To Find The Roots Of Non-Linear Equation Using Newton's Method.
- Curve Fitting By Least – Square Approximations.
- To Solve The System Of Linear Equations Using Gauss - Elimination Method.

UNIT II **8 Hours**

Finite difference operators and finite differences, Interpolation and interpolation formulae: Newton's forward and backward difference, Central difference: Sterling's and Bessel's formula, Lagrange's interpolation formula and Newton's divided difference interpolation formula, Hermite interpolation. Program in C/C++ for Newton's forward and backward formula, Newton's divided difference formula

- To Solve The System Of Linear Equations Using Gauss - Seidal Iteration Method.
- To Solve The System Of Linear Equations Using Gauss - Jorden Method.
- To Integrate Numerically Using Trapezoidal Rule.
- To Integrate Numerically Using Simpson's Rules.

UNIT III **6 Hours**

Direct methods to solve system of linear equations: Gauss elimination method, Gauss-Jordan method, Gauss-Jacobi and Gauss-Seidal methods. The algebraic eigen value problems.

- To Find The Largest Eigen Value Of A Matrix By Power - Method.
- To Find Numerical Solution of Ordinary Differential Equations by Euler's Method.
- To Find Numerical Solution Of Ordinary Differential Equations By Runge-Kutta Method.

UNIT IV **6 Hours**

Numerical differentiation and Numerical integration by Newton cotes formulae, Trapezoidal rule, Simpson's rule, Romberg formula and their error estimation. Numerical solution of ordinary differential equations by Euler's method, Picard's method, Taylor series and Runge-Kutta methods.

Transaction Mode- Lecture, Demonstration, Project Method, Co-Operative learning, Seminar, Group discussion, Team teaching, Tutorial, Problem solving, E-team teaching, Self-learning.

- To Find Numerical Solution of Ordinary Differential Equations by Milne's Method. 13. To Find the Numerical Solution Of Laplace Equation.
- To Find the Numerical Solution Of Wave Equation.
- To Find the Numerical Solution Of Heat Equation.

Suggested Readings:-

- *B. Bradie, (2007). A Friendly Introduction to Numerical Analysis, Pearson Education, India,*
- *M. K. Jain, S. R. K. Iyengar and R. K. Jain, (2007). Numerical Methods for Scientific and Engineering Computation, New age International Publisher, India, 5th edition,*
- *C. F. Gerald and P. O. (2008). Wheatley, Applied Numerical Analysis, Pearson Education, India, 7th edition.*
- *M. Pal (2007). Numerical Analysis for scientific and engineering computation, Narosa Publication*
- *N. Ahmad (2008). Fundamental Numerical Analysis with error estimation, Anamaya Publisher.*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs*

Course Title: Spectroscopy Lab
Course Code: BNM531

L	T	P	Credit
0	0	2	1

Total Hours: 15

Learning Outcomes: On successful completion of this course, the successful students will be able to:

1. Perform experiments based on instrumentation.
2. Enhance their skills in interpreting the data.
3. Analyze the effect of structure on spectra of organic compounds.
4. Determine the concentration of Unknown in a mixture using Lambert-Beer's Law.

UV/Visible spectroscopy

I. Study the 200-500 nm absorbance spectra of $KMnO_4$ and $K_2Cr_2O_7$ (in 0.1 M H_2SO_4) and determine the λ_{max} values. Calculate the energies of the two transitions in different units (J molecule^{-1}, kJ mol^{-1}, cm^{-1}, eV).

II. Study the pH-dependence of the UV-Vis spectrum (200-500 nm) of $K_2Cr_2O_7$.

III. Record the 200-350 nm UV spectra of the given compounds (acetone, acetaldehyde, 2-propanol, acetic acid) in water. Comment on the effect of structure on the UV spectra of organic compounds.

Colourimetry

I. Verify Lambert-Beer's law and determine the concentration of $CuSO_4/KMnO_4/K_2Cr_2O_7$ in a solution of unknown concentration.
II. Determine the concentrations of $KMnO_4$ and $K_2Cr_2O_7$ in a mixture.
III. Determine the dissociation constant of an indicator (phenolphthalein).

SUGGESTED READINGS:-

- *Mendham, J. Vogel's Quantitative Chemical Analysis, Pearson, 2009.*
- *Khosla, B. D.; Garg, V. C. & Gulati, A., Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).*
- *Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. Experiments in Physical Chemistry 8th Ed.; McGraw-Hill: New York (2003).*
- *Halpern, A. M. & McBane, G. C. Experimental Physical Chemistry 3rd Ed.; W.H. Freeman & Co.: New York (2003).*
- *Advance Practical Physical Chemistry by J.B. Yadav, Goel Publication, Meerut.*
- *Practical Physical Chemistry by B. Vishwanathan and P.S. Raghvan, Viva Books Pvt. Ltd.*

Course Title: Modern Physics Lab
Course Code: BNM532

L	T	P	Credit
0	0	2	1

Total Hours: 15

Learning Outcomes: On successful completion of this course, the successful students will be able to:

1. Develop proficiency in using laboratory equipment and instruments to conduct experiments accurately and safely.
2. Gain the ability to design and execute experiments, including formulating hypotheses, controlling variables, and collecting data systematically.
3. Acquire skills in analyzing experimental data using statistical methods and software tools, interpreting results, and identifying sources of error.
4. Understand and apply the scientific method, including developing hypotheses, conducting experiments, analyzing data, and drawing conclusions

Course Content

1. Study of black body spectra

2. Determination of Planck's constant and De Broglie wavelength of

   Electrons using photoelectric experiments.

3. Determination of Rydberg's constant from hydrogen spectrum
4. Determination of charge to mass ratio of electron – Thomson's method
5. Verification of Bohr's theory – Franck – Hertz Experiment.
6. Determination of charge of electron by Millikan's oil drop method.
7. Electron Spin Resonance- Determination of 'g' factor of an electron
8. Determination of Ferromagnetic Curie temperature of a given sample
9. Studying the Energy gap of semiconductors.
10. Measurement of Hall coefficient of a semiconductor.

Course Title: Health. Yoga and Physical Education

Course Code: BAD526

L	T	P	Credits
3	0	0	3

Total Hours: 45

Course Outcomes

On the completion of the course the students will be able to

1. enhance the knowledge and understanding of mental and physical cealth as well as fitness
2. develop understanding about the nature of injuries and to take care during emergencies and provide first aid
3. acquire knowledge of common communicable diseases
4. elobarate the diet modification in the treatment of underweight and obesity

Course Content

Unit-I **10 Hours**

Physical Education: concept, aim and objectives, Modern concept of Physical Education, Need and importance of Physical Education.

Health Education: Concept and objectives of Health Education, Importance and Principles of Health Education,

School health Program: Health services, Health supervision and instructions.

Unit II **11 Hours**

Contemporary Health problems: Drug Abuse, Alcoholism, smoking-tobacco, obesity, stress.
Nutrition: Element of balanced diet, food habits, Malnutrition.

Unit III **12 Hours**

First Aid: Concept and importance of first Aid. First Aid Kit.
Posture: Meaning, Importance of Good posture, Causes of Poor Posture, Common Postural Deformities, preventive measures and remedial Exercises

Unit IV **12 Hours**

Yoga: modern concept, need, importance and principles.
Recreation: concept, importance of recreation program in school curriculum.
Communicable Diseases: Mode of transmission, common symptoms and prevention of spread of Aids, Hepatitis, Chickenpox, Typhoid.

Transactional Mode

Video based Teaching, Open talk, Panel Discussions, Mentee Meter, Collaborative Teaching, Cooperative Teaching, Case Analysis, Dialogue, Group Discussion, Role Play, Demonstration, E-Monitoring, Flipped Teaching, Quiz.

Suggested Readings

- *Dhanajoy, S., and Seema, K. (2007). Lesson planning: Teaching methods and class management in physical education. New Delhi: Khal Sahitya Kendra.*
- *Nash T.N. (2006). Health and physical education. Hydereabad: Nilkamal Publishers.*
- *Prasad, Y. V. (2006). Method of teaching physical education. New Delhi: Discovery Publishing house.*

- *Sachdeva, M. S. (2006). School organisation, administration and management. Ludhiana: Dandon Publication.*
- *Chandra, S., Sothi, and Krishnan. P. (2005). Health education and physical education. Delhi: Surject Publications.*
- *Mangal, S. K. (2005). Health and physical education. Ludhiana: Tandon Publication book market.*
- *Hedge, (1997). How to maintain good health. New Delhi: UBPSD Publishers.*
- *Kanele., B. S., and Kumar, C. P. (1996). Text book on health and physical education. Ludhiana: Kalyana Publishers.*
- *Reema, K. (1996). Physical fitness. New Delhi: Khel Sahitya Sports Publication.*
- *Dambrosa, D., and Robert, D. (1993). Prevention and treatment and running injuries. New Jersey: Slack Incorpor Road.*
- *Charles, B. A. (1992). Foundation of physical education and sport. New Delhi:B1 Publication.*
- *Eriksson, O. B. (1990). Sports medicine, health and medication. Enfield: Guninness Publishing Road.*

Course Title: Pedagogy of English

Course Code: BED136

L	T	P	Credits
3	0	0	3

Total Hours: 45

Learning Outcomes

After Completion of this course, the Learner will be able to:

- analyze the linguistic principles and structures of the English language.
- apply instructional objectives and learning outcomes in the development oflesson plans for teaching English.
- evaluate different language teaching methodologies and approaches, considering their merits, limitations, and applicability in diverse contexts.
- design and implement assessment and evaluation methods, including e-testing, for monitoring student progress and learning outcomes.

Unit I **12 Hours**

Introduction to language –Meaning, definition, functions, linguistic principles of learning language.

Structure of English language-phonological Structure-Mechanism of speech, Received Pronunciation (RP), General Indian English (GIE), phonemes vowels and consonants, Stress Intonation, Rhythm, Consonant Clusters, Minimal Pairs, their meaning and practice,

Morphological structure of English –meaning and importance – meaning of morphemes Types- free and bound: -affixes, prefixes and suffixes- derivational suffixes, verb forms, adjectives and adverbs.

Syntactic structure of English –meaning and importance -basic sentence pattern; phrases and clauses.

Unit II **13 Hours**

Objectives of teaching English –instructional objectives, classification based on Blooms Anderson taxonomy-stating of instructional objectives and learning outcomes

Lesson plan format, regular and unit lesson plan teaching of prose, objectives, and steps.

Teaching of Poetry-Objectives and steps, teaching composition-objectives, types-guided, controlled and free composition, steps in teaching guided composition, activities and exercises to develop composition, remedial work.

English language teaching situation in India and its historical background, Need and importance of teaching English, Aims-literary, cultural, utilitarian and creativity. Use of mother tongue in acquisition of English language with reference to syntax, pronunciation, spelling, tense and articles.

Unit III **10 Hours**

Bilingual method –meaning- principles-merits and limitations Direct method –meaning –principles-merits and limitations

Structural Approach-meaning, principles-criteria for selection and gradation of structures ways of teaching structures –substitution

table-its importance, types- preparation, uses and practice in relation to secondary school texts-merits and limitations

Communicative Approach –meaning, features –principles -merits and limitations, Eclectic Approach.

Suggestopedia-meaning, principles, merits and limitations

Constructivism in ELT (NCF 2005/2009): Meaning, importance, sets of five- 'E' model

Unit IV **10 Hours**

Listening: components –barrier in listening, activities to develop listening comprehension.

Speaking –components-objectives-barriers to speaking –need for correct pronunciation – activities to develop correct speech habits

Reading skills-objectives of teaching reading; Mechanics of reading; Methods of teaching reading; Types of reading, reading aloud and silently, intensive and extensive reading; Types of reading comprehension –activities to develop testing reading comprehension.

Writing –its components, objectives of teaching written expression.

Hand writing –characteristics of good hand writing –Mechanics, causes for poor handwriting ways of improving handwriting.

Steps of designing lesson plan in English for power point and multimedia applications and their advantages.

Evaluation in teaching of English. Concept of unit test, blue print, construction of objective based test (practical activity-question paper) E-testing-meaning-steps, advantages, use of E-question Bank, online tutoring and testing.

Transactional Mode

Video based Teaching, Panel Discussions, Collaborative Teaching, Dialogue, Group Discussion, Brain Storming, Demonstration, Project Based Learning, Flipped Teaching, Quiz, Simulation, Lecture-cum-Demonstration, Seminars

Suggested Readings

- *AIELTA-Voices-Journal-London*
- *Bala Subramanyan T.-Introduction to phonetics for Indian students MacMillan Publication Hyderabad*
- *Bansal R.K -Outlines of phonetics -CIEFL Hyderabad*

- *Bauruah. T.C,A hand book of English language teacher- Himalaya Publication, Calcutta.*
- *Bhatia & Bhatia-Methods of teaching English, ELT- (journal) ELTAI-Chennai. English language teaching –Journal London (ELT J).*
- *Essentials of grammar and composition in Glen Leggett C. David Mead, William Charvat Prentice Hall of India.*
- *Geetha Nagaraj-Trends in teaching of English-MacMillan publication*
- *Gimson, Introduction to pronunciation-OUP*
- *Gleason S-Descriptive linguistics-OUP*
- *GoshR. N.- History of teaching English in India- MacMillan Publication Hyderabad*
- *Krishna Swamy –Modern English grammar, Orient long lam publication, Hyderabad.*
- *Mudambadithaya. G. Teaching of English*
- *Palmer H. E.-Grammar –Oxford university press, London*
- *Pitcoder, Introduction to linguistics-CUP*
- *Stern H. H. –History of teaching of English –Oxford university press -London*
- *Strengthen in your English in Bhaskaran and Horsburjg Oxford University Press*

Course Title: Pedagogy of Mathematics

Course Code: BED145

L	T	P	Credits
3	0	0	3

Total Hours: 45

Learning Outcomes

After Completion of this course, the Learner will be able to:

- apply mathematical concepts and principles of secondary level math content
- analyze the nature of mathematics and apply Anderson's revised Bloom's taxonomy in specifying instructional objectives.
- implement the Five E model in mathematics teaching and facilitate collaborative and cooperative learning strategies.
- design unit plans with suitable

instructional and select appropriate instructional content and specify instructional objectives

Unit I **10 Hours**

Content of 6th, 7th, 8th and 9th Std. syllabus - Rational Numbers, Sets, Factorization, LCM and HCF, Division of polynomials: linear equation, simultaneous equation ratio and proportion.

Commercial mathematics, Data Handling, lines and angles; Triangles - construction and theorem on triangles, congruency of Triangles, Quadrilaterals.

Unit II **12 Hours**

Nature of mathematics, Meaning and characteristics of mathematics; mathematical reasoning, Geometric thinking (Van Hiele model); Axioms, Postulates and Theorems -converse, inverse and contra positive –proofs and different types of proofs, Difference between proof and verification. 2.2. Content categories of mathematical knowledge – Facts, Concepts, Generalizations and procedures.

Aims and objectives of teaching mathematics - Aims of teaching mathematics –disciplinary, utilitarian, cultural, social and recreational -Objectives of teaching arithmetic, algebra, geometry, trigonometry and coordinate Geometry - Anderson's revised Bloom's taxonomy of instructional objectives – specifications; task analysis

Unit III **11 Hours**

Five E model – Five stages - engage, explore, express, expand, evaluate Approaches and models of teaching mathematics – Inductor - deductive approach; Analytic – synthetic Approach; Guided discovery approach; Concept Attainment Model.

Techniques of learning mathematics – Problem solving technique, Oral work and written work, Drill work and concept mapping.

Collaborative learning and Cooperative learning strategies – learning together technique, jigsaw technique - steps.

Unit IV **12 Hours**

Preparation of unit plan, selecting the content for instruction, content analysis; stating the instructional objectives and task analysis; analyzing and selecting suitable teaching methods, strategies, techniques and models; identifying and developing teaching learning materials (including ICT), selecting suitable evaluation tools and strategies, lesson planning based on evaluation approach.

Evaluation in mathematics: Construction (steps) and use of achievement test in mathematics for summative assessment

Transactional Mode

Video-based Teaching Cooperative Teaching, Dialogue, Group Discussion, Brain Storming, Flipped Teaching, Quiz, Simulation, Lecture method, Lecture-cum- Demonstration, Seminars

Suggested Readings

- Anthony, Glende and Walshaw, Margaret(2009). Effective Pedagogyin Mathematics: Gonnet Imprimeur, 01300 Belley, France.
- Arora, S.K. (2000). How to Teach Mathematics. New Delhi: Sterling Publishers Pvt.Ltd.
- Gakhar, S.C. and Jaidka, M.L. (2003). Teaching of Mathematics. Panipat: M/s
    - N.M. Publishers.
- Hukum, Avtar Ram and Singh, V.P. (2005). A Handbook for Designing Mathematics Laboratory in Schools. New Delhi: NCERT.
- Mangal, S. K. (2007). Teaching of Mathematics. New Delhi: Arya BookDepot
- Banga, Chaman Lal (2012). Teaching of Mathematics, Shipra
- James, Anice (2005). Teaching of Mathematics, Neelkamal

Course Title: Pedagogy of Science

Course Code: BED146

L	T	P	Credits
3	0	0	3

Total Hours: 45

Learning Outcomes

After Completion of this course, the Learner will be able to:

- analyze the effects and applications of heat including the use of laboratory and clinical thermometers, explore temperature scales and conversions.
- construct the instructional revised taxonomy of educational objectives from the constructivist perspectives.
- evaluate different teaching methods and constructivist approach in teaching.
- design lesson plans based on the 5e model and lecture-demonstration method.

Unit I **12 Hours**

Heat - Meaning of heat and temperature, difference between heat and temperature, Effects and applications of heat - Laboratory and Clinical Thermometer, Temperature scales and conversions.

Light - Meaning of light, Reflection of light and laws of reflection, image formation in Concave mirror - Refraction of light, total internal reflection and its effects, Dispersion of light

Nature of Matter - States of matter, Elements, compounds and mixtures- meaning, characteristics, Separation of mixtures - Metals, non-metals, and metalloids- meaning and properties

Atom - Meaning of an atom; Structure of an atom; Dalton's theory, Rutherford-Bohr model - Chemical bonding; meaning and types

Unit II **12 Hours**

Meaning and Nature of Physical Science-Nature, process, product, facts, phenomenon, concepts, laws and theory

Scientific Method- meaning, steps (9 steps) and advantages.

Scientific Attitude- meaning, characteristics of an individual with scientific attitude, techniques of developing scientific attitude among students.

Aims and objectives of teaching physical science, differences between aims and objectives, Bloom's taxonomy of educational objectives, revised taxonomy of educational objectives(Anderson's), and NCERT objectives, meaning and writing of Learning objectives (Specifications based on revised blooms taxonomy).

Learning objectives in the constructivist perspectives.

Unit III **11 Hours**

Lecture demonstration method, Inductive-deductive method and Project method-meaning, Steps, merits and limitation

Constructivist Approach-meaning and principles - 5-E model-Engage, Explore, Explain, Elaborate and Evaluation - Collaborative approach-meaning, steps-problem, formation of groups, sharing of ideas, teacher facilitates and learning evidence and feedback -Inquiry Approach and Problem solving approach (Maier) -meaning, procedure and advantages

Unit IV **10 Hours**

Meaning of Lesson plan-importance, Evaluation approach steps, advantages Planning of laboratory work

Lesson planning based on 5E model and Lecture-demonstration method, Unit Plan-meaning, steps, format, Advantages and limitations

Meaning and importance of Achievement tests and Unit test-steps of construction of unit test (Blue print based on revised blooms taxonomy of educational objectives) and importance.

Transactional Mode

Video based Teaching, Panel Discussions, Collaborative Teaching, Cooperative Teaching, Dialogue, Group Discussion, Brain Storming, E-Monitoring, Flipped Teaching, Quiz, Simulation, Lecture -cum-Demonstration

Suggested Readings

- Das, R.C. (1992). Science Teaching in School. New Delhi: Sterling Publishing.
- Bhandula, N. (1989). Teaching of Science. Ludhiana: Parkash Brothers.

- Gerg, K.K.; Singh, Raguvir and Kaur, Inderjeet (2007). A Text book of Science of Class X, New Delhi: NCERT.
- Kohli, V.K. (2006). How to Teach Science Ambala: Vivek Publication
- Mangal, S.K. (1997). Teaching of Science New Delhi: Arya Book Depot
- Sharma, R.C. (2010). Modern Science Teaching New Delhi: Dhanpat Rai Pub. Co.
- Liversidge T., Cochrane M., Kerfoot B. and Thomas J. (2009). Teaching Science Developing as a Reflected Secondary Teacher. New Delhi: SAGE Publications India Private Limited.
- Siddiqui, N.H. and Siddiqui, M.N. (1983). Teaching of Science Today and Tomorrow. Delhi: Doaba House.
- Davar, M. (2012). Teaching of Science. New Delhi: PHI Learning Private Limited. New UNSECO Source Book for Science. France: UNSECO
- Vaidya, Narendra (1996). Science Teaching for 21st century. New Delhi: Deep and Deep pub.
- Joshi S.R. (2007). Teaching of Science. New Delhi: APH Publishing Corporation

Semester VI

Course Title: Fluid Mechanics

Course Code: BNM605

L	T	P	Credits
4	0	0	4

Total Hours: 60

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Determine the fluid pressure and use various devices for measuring fluid pressure.
2. Calculate Kinematics and use of law of conservation mass to fluid flow.
3. Apply Newtonian and non-Newtonian fluids and principles to analyze viscosity problems.
4. Use of different fluid study for similarity of flows.

Course Content

UNIT I **15 Hours**

Fluid Dynamics Kinematics, Equation of continuity: Eulerian and Lagrangian equations, Equations of Motions: Euler, Bernoulli, Lamb, Lagrange equations and Helmholtz equation of motion, Kinematics of vorticity and circulation.

UNIT II **15 Hours**

Motion in two dimensions: Stream function, Irrotational motion, Velocity and Complex potentials, Cauchy-Riemann's equations, Sources and Sinks, Doublets; Image system of a simple source and a doublet with respect to a plane and a circle, Milne-Thomson Circle Theorem, Blasius Theorem.

UNIT III **15 Hours**

Motion of circular cylinders and sphere, Vortex motion, Kinematics of Deformation: Newton's Law of viscosity, Newtonian and non-Newtonian fluids, Theory of stress and Rate of strain, Body and Surface forces. Navier-Stokes equations and energy equations, Laminar flow of viscous incompressible fluid,

UNIT IV **15 Hours**

Similarity of flows: Reynolds and other numbers. Boundary layer concept, 2-dimensional boundary layer equations, separation phenomena; boundary layer on a semi-infinite plane, Blasius solution; boundary layer thickness, Karman's Integral method Elementary concept on conformal Representation.

Transaction Mode- Lecture, Demonstration, Project Method, Co-Operative learning, Seminar, Group discussion, Team teaching, Tutorial, Problem solving, E-team teaching, Self-learning.

Suggested Readings:-

- *F. Charlton, Text book of Fluid Dynamics, CBS Publishers.*
- *J. Happel and H. Brenner, Low Reynolds Number Hydrodynamics, Kluwer Academic Publishers group (1983)*
- *N. Curle & amp; H.J. Davies, Modern Fluid Dynamics (Vol.-I), D.Van Nostrand Comp. Ltd. (London), (1964)*
- *T.C. Papanastasiou, G.C.Georgiou, A.N.Alexandrou, Viscous Fluid Flow; CRC Press (2000).*
- *W.E. Langlois, Slow Viscous flow, Macmillan, (1964)*
- *W.H. Besant and A.S. Ramsey, A Treatise on Hydrodynamics, CBS Publishers.*
- *Z.U.A. Warsi, Fluid Dynamics, CRC Press (2005).*

Course Title: Organic Synthesis
Course Code: BNM616

L	T	P	Credit
4	0	0	4

Total Hours: 60

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Acquire deep insights of synthesis of organometallic compounds through various methods.
2. Study the synthesis, reactivity, aromatic character and importance of heterocyclic compounds.
3. Outline the synthesis of carboxylic acid and epoxide.
4. Suggest reactants or sequences of reactions/reactants for compounds of study that could transform the starting material into a target product.

Course Content

UNITI **13 Hours**

Organometallic Compounds: The Grignard reagents, its synthesis, structure and chemical reactions. Organolithium Compounds: preparation and chemical reactions. Organozinc and Organo copper Compounds: Nomenclature, structural features, its synthesis and chemical reactions.

UNIT II **14 Hours**

Organic Compounds of Nitrogen: Synthesis of nitroalkanes and nitroarenes, chemical reactions of nitroalkanes; Methods of preparation of amines by reductive amination of aldehydic and ketonic compounds, Gabriel-phthalimide reaction and Hofmann bromamide reaction; Stereochemistry of amines, separation of a mixture of primary, secondary and tertiary amines.

UNIT III **15 Hours**

Heterocyclic Compounds: Principles of heterocyclic synthesis involving cyclization reactions and cycloaddition reactions; synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution and nucleophilic substitution reactions in pyridine derivatives, comparison of basicity of pyridine, piperidine and pyrrole.

UNIT IV **18 Hours**

Carboxylic Acids : Structure and bonding, acidity of carboxylic acids, effects of substituents on acid strength, Synthesis of acid chlorides, esters and amides, Reduction of carboxylic acids, Mechanism of decarboxylation. Carboxylic Acids Derivatives, structure and nomenclature of acid chlorides, esters, amides and acid anhydrides, Relative stability & reactivity of acyl derivatives, synthesis of carboxylic acid derivatives, chemical reactions, mechanisms of esterification and hydrolysis.

Ethers and Epoxides: Nomenclature of ethers and methods of their formation, chemical reaction cleavage and autoxidation, Ziesel's method. Synthesis of epoxides. Acid and base catalyzed ring opening of epoxides, orientation of

epoxide ring opening, reactions of Grignard and organo-lithium reagents with epoxides.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, ted talks, E team Teaching, Flipped Teaching, Quiz, Open talk, Case analysis.

SUGGESTED READINGS:-

- *Acheson, R. M., & Jones, B. J. (1970). Addition reactions of heterocyclic compounds. PartXLII the mechanism of the thermal rearrangement of tetraethyl 7, 9-dimethyl-9a H-quinolizine-1, 2, 3,4-tetracarboxylatetothe4H-isomer.JournaloftheChemicalSocietyC:Organic.*
- *Cotton,F.A.,Wilkinson,G.,Murillo,C.A.,Bochmann,M.,&Grimes,R.(2018). A dvanced inorganic chemistry(Vol. 6,p. 1455).New York:Wiley.*
- *Katritzky, A. R., & Rees, C. W. (1984). Comprehensive heterocyclic chemistry. Pergamum* Press.
- *Sainsbury, M. (Ed.). (1992). Aliphatic Compounds: Monocarboxylic Derivatives of Aliphatic Hydrocarbons,Their Analogues and Derivatives, Elsevier.*

Course Title: Project in Physics/Chemistry/Mathematics
Course Code: BNM617

L	T	P	Credit
0	0	6	3

Total Hours: 45

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Choose an appropriate topic for study and will be able to clearly formulate& state a research problem.
2. Compile the relevant literature and frame hypotheses for research as applicable.
3. Plan a research design including the sampling, observational, statistical and operational designs if any.
4. Arrive at logical conclusions and propose suitable recommendations on the research problem.

Guidelines for Dissertation:

The purpose of the dissertation in B.Sc NM 6thsemester is to introduce research methodology to the students. It may consist of review of some research papers, development of a laboratory experiment, fabrication of a device, working out some problem related to subject, participation in some ongoing research activity, analysis of data, etc. The work can be carried out in any thrust areas of subject(Experimental or Theoretical) under the guidance of allotted supervisor of

the department. The students must submit their dissertation in the department as per the date announced for the submission**.**
Internal assessment of the dissertation work will be carried out by respective supervisor through power point presentation given by candidates during the semester. External assessment of the dissertation work will be carried out by an external examiner (nominated by the Chairperson of the Department) through power-point presentation given by candidates. This load (equivalent to 2 Hours per week) will be counted towards the normal teaching load of the teacher.
1. Dissertation will contain a cover page, certificate signed by student and supervisor, table of contents, introduction, Objective, Literature review, methodology, results and discussions conclusion, and references.

- The paper size to be used should be A-4 size.
- The font size should be 12 with Times New Roman.
- The text of the dissertation may be typed in 1.5 (one and a half) space.
- The print out of the dissertation shall be done on both sides of the paper (instead of single side printing)
- The total no. of written pages should be between 40 to 60 for dissertation.

2. The candidate shall be required to submit two soft bound copies of dissertation along with a CD in the department as per the date announced.

3. Dissertation will be evaluated internally by the supervisor allotted to the student during the Semester.

4. The candidate will defend her/his dissertation/project work through presentation before the External examiner at the end of semester and will be awarded marks.

5. In case, a student is not able to score passing marks in the dissertation exam, he/she will have to resubmit her/his dissertation after making all corrections/improvements & this dissertation shall be evaluated as above. The candidate is required to submit the corrected copy of the dissertation in hardbound within two weeks after the viva -voce.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, ted talks, E team Teaching, Flipped Teaching, Quiz, Open talk, Case analysis.

SUGGESTED READINGS:

- *Bell, Judith (2005), Doing your research project: A Guide for First-time Researchers in Education, Health and Social Sciences, Open University Press.*
- *Guthrie, G. (2010), Basic Research Methods: An Entry to Social Science Research. Sage Publications.*

- *Mukherjee, Neela (2002), Participatory Learning and Action with 100 Field Methods. New Delhi: Concept Publication.*
- *Thomas, G. (2009), How to do your Research Project, Los Angles: Sage Publication.*
- *Wolcott, H.(1995), The Art of Field work, Alta Mira Press, Walnut Creek, CA,*

Course Title: School Management and Administration
Course Code: BED134

L	T	P	Credits
3	0	0	3

Total Hours: 45

Learning Outcomes

After Completion of this course, the Learner will be able to:

- critically analyze the operational aspects of school management
- justify the need for leadership qualities among the school teachers and students
- conduct co-curricular activities and programs
- critically analyze academic system of the school

Course Content

Unit I **12 Hours**

School as an organization: Meaning, objectives, need, scope, types and principles of school organization, administration and management

School Plant: Importance, Essential characteristics, selection of site and Maintenance of different School Components

Institutional Planning: Meaning, objectives, advantages and characteristics of Institutional planning. Preparation of an institutional plan

Unit II **12 Hours**

Leadership: Concept, Need & Development of Leadership Qualities among teachers and students

School Time Table: Importance, types and principles of time table construction

Unit III **11 Hours**

Discipline, Concept, Bases of Discipline, Causes of indiscipline and its remedial measures. Rewards and punishment as techniques of maintaining discipline

Supervision: Meaning, aims, principles, areas, types and procedures of supervision, Role of Educational Administrators (at school level, Block District, State level).

Unit IV **10 Hours**

School Records and Registers: Importance, types and essential requirements and maintenance of school records

Co-curricular Activities: Meaning, importance, principles of organizing co- curricular Activities-Morning Assembly, NSS/NCC, Fieldtrips

Transactional Mode

Video based Teaching, Open talk, Panel Discussions, Cooperative Teaching, Case Analysis, Dialogue, Group Discussion, Brain Storming, Demonstration, Project Based Learning, Quiz, Simulation, Lecture-cum-demonstration, Seminars

Suggested Readings

- Lokman Ali (2021). Educational Administration and Management (Supervision, Planning and Finance), Global Net Publication.
- Sanjay Kumar (2021). Educational Management, Administration and Leadership: Anu

Books.
- R.A. Sharma (2019). Educational Administration and Management: Anu Books Publisher.
- Shamshir Singh Dhillon (2019). Educational Administration: Management and Leadership. Gyan Geeta Prakashan.
- Sonia Goel (2017). School Leadership and Management: Paragon International Publishers.
- Sharma, S. (2005). School management and Administration. Patiala: Shaheed- E-Azam printing press.
- Sodhi, T.S. & Suri, Anaina. (2002). Management of school education. Patiala: Bawa publication.
- Bhatia, K.K. & Singh, J. (2002). Principles & Practice of school management. Ludhiana: Tandon Publication.

Course Title : Pre-Internship

Course Code : BAD602

L	T	P	Credits
0	0	0	2

Course Outcomes

On the completion of the course, the students will be able to

1. Develop conceptual understanding about Pedagogy of school subjects'environment and understand the learner, learning behavior and learning situations.
2. Validate the theoretical understanding regarding pedagogical courses and school environment.
3. Design the meaningful learning sequences to educate the different levels of learningand plan the lessons to create the situations according to the level of the learning
4. Expend the teacher's practical skills in the process of teaching and learning andarrange the resources to create conducive learning
5. Formulate the co-curricular and extra -curricular activities in the school to providesupport to curriculum

Pre -Internship

1. **Phase I** Pre-Internship for 04 Weeks in semester-II (04- Credits)

Course Details

Phase-I: - Pre-Internship for 04 Weeks in semester-II (04- Credits)

Observation of the real classroom situations (minimum of 2 schools in a rural/urban, private/govt. secondaryschool affiliated to PSEB/CBSE/ICSE etc.) and the whole school environment. Before teaching in the classroom the student teacher will observe a regular classroom in the school for weeks, to understand the school in totality, its philosophy and aims, organization and management, need of children curriculum and its transaction, assessment of teaching and learning.

1. Peer groupdiscussion.
2. Preparing the feedback and suggestion based on the observation of the real classroom situation and the whole school environment.
3. Sample demonstration/viewing different classroom situation.
4. Visit to innovative centers of pedagogy and learning, educational resourcecenters
5. Input from teacher educators
6. Context analysis andreflection.

Evaluation Criterion

Weekly Assessment: 25 marks
Lesson Plan: 5 marks
TLM: 5 marks
Observations: 5 marks
Reflective Journal: 5 marks
Regularity and Discipline; 5 marks

Course Title: IT Skills for Chemists
Course Code: BNM610

L	T	P	Credit
2	0	0	2

Total Hours: 30

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Get deep insights into computer fundamental knowledge and languages.
2. Use the simple programs for statistical analysis.
3. Draw the chemical structures using IT tools.
4. Analyze the chemical data with the help of excel software and spreadsheet.

Course Content

UNIT I **8 Hours**

Constants, variables, bits, bytes, binary and ASCII formats, arithmetic expressions, hierarchy of operations, inbuilt functions, Elements of the BASIC language, BASIC keywords and commands, Logical and relative operators

UNIT II **7 Hours**

Simple programs using these concepts, Matrix addition and multiplication, Statistical analysis, BASIC programs for curve fitting, numerical differentiation and integration.

UNIT III **7 Hours**

Introductory writing activities: Introduction to word processor and structure drawing (Chem Sketch) software. Incorporating chemical structures, chemical equations, and expressions from chemistry (e.g. Maxwell-Boltzmann distribution law, Bragg's law, Vander Waals equation, etc.) into word processing documents.

UNIT IV **8 Hours**

Handling numeric data: Spreadsheet software (Excel), creating a spreadsheet, entering and formatting information, basic functions and formulae, creating charts, tables and graphs, Incorporating tables and graphs into word processing documents.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, ted talks, E team Teaching, Flipped Teaching, Quiz, Open talk, Case analysis

SUGGESTED READINGS:-

- *Yates, P. Chemical calculations. 2ndEd. CRC Press (2007).*
- *Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman (2007) Chapters 3-5.*
- *Levie, R. de, How to use Excel in analytical chemistry and in general scientific data analysis, Cambridge Univ. Press (2001) 487 pages.*
- *Noggle, J. H. Physical chemistry on a Microcomputer. Little Brown & Co.(1985).*
- *Venit, S.M. Programming in BASIC: Problem solving with structure and style. Jaico Publishing House: Delhi (1996).*

Course Title: IT Skills for Chemists Lab
Course Code: BNM611

L	T	P	Credit
0	0	2	1

Total Hours: 15

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Explain the use of computer softwares and other statistical tools in chemical analysis.
2. Derive the mathematical relationships between different chemical variables using computational and statistical skills.
3. Analyze the chemical kinetic data using different softwares.
4. Test the simulation of chemical reactions using IT tools.

Course Content

List of Practical's

1. Excel functions LINEST and Least Squares.
2. Numerical curve fitting
3. Calculation of rate constants from concentration-time data
4. Calculation of molar extinction coefficients from absorbance data
5. Handling data from potentiometric and pH metric titrations
6. Calculation of p_{Ka} of weak acid
7. Simulation of pH metric titration curves.

Transaction Mode- Video Based Teaching, Collaborative teaching, Group Discussion, ted talks, E team Teaching, Flipped Teaching, Quiz, Open talk, Case analysis

SUGGESTED READINGS:-

- *Mortimer, R. Mathematics for Physical Chemistry. 3 rd Ed. Elsevier (2005).*
- *Yates, P. Chemical calculations. 2 nd Ed. CRC Press (2007).*
- *Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman (2007) Chapters 3-5.*
- *Levie, R. de, How to use Excel in analytical chemistry and in general scientific data analysis, Cambridge Univ. Press (2001) 487 pages.*
- *Noggle, J. H. Physical chemistry on a Microcomputer. Little Brown & Co. (1985).*
- *Venit, S.M. Programming in BASIC: Problem solving with structure and style. Jaico Publishing House: Delhi (1996).*

Course Title: Organic Synthesis Lab
Course Code: BNM618

L	T	P	Credit
0	0	2	1

Total Hours: 15

Learning Outcomes: On completion of this course, the successful students will be able to:

1. Recognize the appropriate safety measures to deal with chemicals in chemistry laboratory.
2. Separate various constituents of a mixture and their identification.
3. Determine the concentration of unknown compounds through established experiments.
4. Ascertain established facts on working through advance instruments and spectroscopic analysis.

Course Content

List of Experiments:

1. Safety Practices in the Chemistry Laboratory
2. Determination of the isoelectric pH of a protein.
3. Titration curve of an amino acid.
4. Determination of the void volume of a gel filtration column.
5. Determination of a Mixture of Cobalt and Nickel (UV/Vis spectroscopy)
6. Study of Electronic Transitions in Organic Molecules (i.e., acetone in water)
7. Potentiometric Titration of a Chloride-Iodide Mixture
8. Verify Lambert-Beer's law and determine the concentration of $CuSO_4/KMnO_4/K_2Cr_2O_7$ in a solution of unknown concentration
9. Study the 200-500 nm absorbance spectra of $KMnO_4$ and $K_2Cr_2O_7$ (in 0.1 M H_2SO_4) and determine the λmax values. Calculate the energies of the two transitions in different Units (J molecule-1 , kJ mol-1 , cm-1 , eV).
10. Study the pH-dependence of the UV-Vis spectrum (200-500 nm) of $K_2Cr_2O_7$.

SUGGESTED READINGS:-

- *Principles of Instrumental Analysis - 6th Edition by Douglas A. Skoog, F. James Holler, and Stanley Crouch (ISBN 0-495-01201-7).*
- *Instrumental Methods of Analysis, 7th Ed, Willard, Merritt, Dean, Settle.*
- *Suggested digital platform: NPTEL/SWAYAM/MOOCs.*

Course Title: Pedagogy of English
Course Code: BED232

L	T	P	Credits
3	0	0	3

Total Hours: 45

Learning Outcome

After Completion of this course, the Learner will be able to:

- analyze English language concepts and principles of secondary level English content.
- critically analyze the characteristics of textbooks used in English education, including their content, structure, and pedagogical approach.
- evaluate and enhance students' practical and experiential learning in English
- develop and enhance the qualities, skills, and competencies of English teachers

Course Content

Unit I **12 Hours**

Semantic Structure of English-meaning, components, homonyms, synonyms, Antonyms, Polysemy, connotative and denotative aspects.

Graphic structure of English-meaning, components unique features of spellings marks of punctuation, hand writing, illustrations are to be drawn from high school English textbooks.

Verbs-meaning and types-tenses and aspects.

Transformations of sentences-simple, complex and compound sentences, reported speech, active and passive voices and degrees of comparison.

Unit II **13 Hours**

Audio-aids-lingua Phone-Audio cassettes, Radio Broadcasts, Visual aids, charts, three-dimension pictures, flash cards, albums, A-V Aids-Films, Videos and multimedia, language Lab

their importance and uses in ELT. Library as a resource in teaching and learning of English.

Literary activities in language teaching-debates, elocution-group discussion- field trips, quiz, seminars and workshops and their importance.

Workbook-Nature, steps in preparation and uses.

Computer assisted learning in English, use of internet and websites, advantages of using different software in learning of English.

Steps of designing lesson plan in English for power point and multimedia applications and their advantages.

UNIT III **10 Hours**

Language curriculum, meaning and principles (with reference to NCF2005) and teaching language through literature-concept and types of literature.

School textbooks in Englih –characteristics and review of present textbooks of 9th, 10th 11th, 12th.

Work books in English, steps and uses.

Teaching of Vocabulary- Types, importance and techniques of enriching Vocabulary. Teaching of Grammar-meaning, importance types, steps in teaching functional grammar.

Techniques of teaching Spellings-Importance peculiarities, different ways of teaching of spellings, common errors and remedies.

Study skills: meaning, importance, types gathering skills, (Skimming and Scanning), (dictionary reference skills)-storage skills-note-making, note- taking, graphic presentation, browsing skills & summarization.

UNIT IV **10 Hours**

Professional competencies of an English teacher, programs for teacher empowerment workshops, seminars, conference, panel discussion and projects.

Role of NCERT, DSERT, RIE, IEFL, British Council Library, Central Institute of Indian Languages to enhance the professional development of English Language Teachers.

Transactional Mode

Video based Teaching, E–Team Teaching, Open talk, Panel Discussions, Dialogue, Group Discussion, Project Based Learning, Quiz, Simulation, Lecture-cum- Demonstration, Seminars

Suggested Readings

- *Bhatia, K.K. (2006). Teaching and Learning English as a Foreign Language New Delhi: Kalyani Publishers.*
- *Bhatia, K.K. and Kaur, Navneet (2011). Teaching and Learning English as a Foreign Language Ludhiana: Kalyani Publishers.*
- *Bindra, R. (2005). Teaching of English Jammu: Radha Krishan Anand and Co. Bisht, Abha Rani. Teaching of English in India Agra: Vinod Pustak Mandir.*
- *Damodar G, Shailaja P, Rajeshwar M. (Eds.) (2001). IT Revolution, Globalization and the Teaching of English. New Delhi: Atlantic Publishers and Distributors.*
- *Sahu, B.K. (2004). Teaching of English Ludhiana: Kalyani Publishers.*
- *Sharma, P. (2011). Teaching of English: Skill and Methods. Delhi: Shipra Publication.*
- *Raju T.N.: content cum methodology of teaching English, DSERT Publication, 2005*

Course Title: Pedagogy of Mathematics

Course Code: BED241

L	T	P	Credits
3	0	0	3

Total Hours: 45

Learning Outcomes

After Completion of this course, the Learner will be able to:

- apply mathematical concepts and principles of secondary level Math content.
- critically analyze the characteristics of textbooks used in Mathematics education, including their content, structure, and pedagogical approach.
- evaluate and enhance students' practical and experiential learning in Mathematics
- develop and enhance the qualities, skills, and competencies of Mathematics teachers

Course Content

Unit I10 Hours

Content of 9th, 10th, and 11thstd syllabus - Permutation and combination, probability, sequence and series, simultaneous equations, quadratic equations. 1

Trigonometry, co-ordinate, geometry, quadrilaterals, circles, mathematical induction, matrices.

Unit II **12 Hours**

Teaching – learning materials in mathematics

Need and importance of teaching-learning materials in mathematics; criteria for Selection of teaching-learning materials in mathematics

Preparation and use of teaching-learning materials – charts, boards, models and manipulative materials; use of black board, interactive white boards and smart boards - advantages of each of them.

Mass media – Radio, TV and newspaper - Printed materials – textbooks – need, importance and good qualities; critical Analysis of 8th, 9th, 10th and 11thstd mathematics textbooks; workbooks and Worksheets –need and importance. 2

Community and school based teaching –learning resources. - Concept and importance of community based resources - Human resources, natural resources and man –made resources.

School based resources – Mathematics lab –need and significance-equipment; Mathematics exhibitions/fairs. Mathematics library –

reference books; Mathematics club – purpose, Organization and activities;

e-resources for learning mathematics - Concept of e- resources – need and importance. Computer, internet –websites, educational CDs (multi-media), Concept of Online learning creating BLOGS.

Unit III **11 Hours**

Mathematics club, mathematics exhibition/fair, mathematics Olympiad and mathematics quiz – their importance and organizational school level.

Gifted children in mathematics – their characteristics, identification and enrichment programs.

Slow learners in mathematics - their characteristics, identification and remedial programs; learning difficulties in mathematics – discalcia, disgraphia – their remedies

Action research in mathematics – meaning and its steps.

Unit IV **12 Hours**

Qualities and skills of a mathematics teacher

Professional growth of mathematics teacher - in-service programs –orientation programs, refresher courses, seminars, workshops and projects Mathematics teacher as a reflective practitioner

Transactional Mode

Lecture-cum-demonstration, Seminars, Project Method and Problem Solving Method

Suggested Readings

- *Aggarwal, J.C, Principles, Methods & Techniques of Teaching (2nd Ed.). New Delhi: Vikas Publishing House*

Pvt. Ltd, 2001.

- *Bhasin, Sonia. Teaching of Mathematics- A Practical Approach. Mumbai: Himalaya Publishing House, 2005.*
- *Butler H., Charles & Wren F., Lynwood. The Teaching of Secondary Mathematics. New York: The Maple Press Company, 1960.*
- *Ediger, M. & Rao, D.B. Teaching Mathematics Successfully. New Delhi: Discovery Publishing House, 2000.*
- *James, Anice. Teaching of Mathematics. Hyderabad: Neelkamal Publications Pvt. Ltd, (2006).*
- *Joyce, B. & Weil. M. & Calhoun, E. Models of Teaching (8th Ed.). New Delhi: PHI Learning Private Limited, 2009.*
- *Kumar, S. & Ratnalikar, D.N. Teaching of Mathematics, New Delhi: Anmol Publications Pvt. Ltd, 2003.*
- *NCERT. National Curriculum Framework for School Education. New Delhi:*

  NCERT, 2005.

- *Anthony, Glende and Walshaw, Margaret (2009). Effective Pedagogy in Mathematics: Gonnet Imprimeur, 01300 Belley, France.*
- *Arora, S.K. (2000). How to Teach Mathematics. New Delhi: Sterling Publishers Pvt. Ltd.*
- *Gakhar, S.C. and Jaidka, M.L. (2003). Teaching of Mathematics. Panipat: M/s*
  N.M. Publishers.

- *Hukum, Avtar Ram and Singh, V.P. (2005). A Handbook for Designing Mathematics Laboratory in Schools. New Delhi: NCERT.*
- *Mangal, S. K. (2007). Teaching of Mathematics. New Delhi: Arya Book Depot*
- *N.C.E.R.T. Text Books 6th to 10th Standard.*
- *National Focus on Teaching of Mathematics.Publication Department by the Secretary, National Council of Educational Research and Training, Sri Aurobindo Marg, New Delhi 110016.*
- *Siddiqui, Hasan. Mujibul (2005). Teaching of Mathematics:*

New Delhi: A.P.HPublishing co- operation.

Websites

- *http://www.ncert.nic.in*
- *http: //rse.Sage pub.com .*
- *http: //www.edfac.unimelb.ed.ac http: //www.eric.ed.gov*
- *http://www.merga.net.auhttp://ling.Springerimages.comh ttp://www.ibe. unesco.org*

Course Title: Pedagogy of Science
Course Code: BED242

L	T	P	Credits
3	0	0	3

Total Hours: 45

Learning Outcomes

After Completion of this course, the Learner will be able to:

- analyze the science contents with daily life experiences
- critically analyze the characteristics of textbooks used in Science education, including their content, structure, and pedagogical approach.
- evaluate and enhance students' practical and experiential learning in Science
- develop and enhance the qualities, skills, and competencies of Science teachers

Course Content

Unit I **12 Hours**

Motion Circular motion- Meaning, types. Wave motion- Meaning, types- Longitudinal and Transverse waves. Projectile motion- Meaning, and derivation of equation of path.

Electromagnetic Induction (EMI) Meaning of Electromagnetic Induction, Faraday's Laws of EMI. Alternative Current-Meaning and its graphical representation. Transformer- Principle, Construction and working

Chemical Reaction: Electronic configuration; meaning and writing electronic configuration; periodic classification of elements (s, p, d, f). Chemical reaction: meaning and types. Electro chemistry: solutions-saturated and unsaturated and colloids.

Chemistry of Carbon Hydro carbons; alkanes, alkenes and alkynes-meaning and properties. Unique characteristics of carbon, Allotropic forms of carbon. Industrial organic chemistry- manufacture of ethyl alcohol.

Unit II **12 Hours**

Text Book-Characteristics of a good text book

Library resources--uses of references, journals, encyclopedias and e- resources in physical science

Improvised apparatus-meaning, importance and procedure.

Physical Science laboratory and its importance-designing of physics and chemistry laboratory, meaning designing and uses of multipurpose laboratory.

Community Resources-Meaning, uses of Human and Physical resources. Electronic Learning (e-learning) - internet, video (including animation) You-Tube and Teleconferences.

Unit III **11 Hours**

Meaning, objective, organization, and advantages of the following: Science club, Science Exhibition, Science quiz, field trips, Meaning, establishment and uses of Science Museum. Meaning, activities, and uses of science centers.

Unit IV **10 Hours**

Teaching as a Profession, Pre-service

development

Programs.

In-service

professional development Programs.

Role of reflective practices in professional development-questionnaire, Research, maintaining portfolio

Transactional Mode

Video-based Teaching, Panel Discussions, Collaborative Teaching, Dialogue, Group Discussion, Demonstration, Project Based Learning, E-Monitoring, Quiz, Simulation, Lecture-cum-Demonstration, Seminars

Suggested Readings

- *Bhatnagar A.B., Bhatnagar S.S, R. Lall Book Depot, Meerut (UP)-Teaching ofScience (2011).*
- *Chief Editor, NCERT Publication, Sri Aurobindo Marg, New Delhi 110016*
- *Pedagogy of Science-Text Book for B.Ed. (Physical Science) Part-I, 2013, ChiefEditor, NCERT Publication, Sri Aurobindo Marg, New Delhi 110016*
- *Pedagogy of Science-Text Book for B.Ed. (Physical Science) Part-II, 2013.*
- *Robert L- Scientific Experiments in Physics.*
- *Shalini Wadhva, Saroop and Sons New Delhi- Modern methods of TeachingPhysics.*
- *Sharma R.C., Dhanpat Rai Publishing Co, Pvt., Ltd., New Delhi- Modern ScienceTeaching, 2003.*
- *Vanaja. M., NeelKamal Publication PVT. Limited, Sulthan Bazar, Hyderabad–Methods of Teaching Physical Science, 2005.*
- *Zaidy S.M, Anmol Publications, New Delhi- Modern Teaching of Science, 2004.*
- *Gerg, K.K.; Singh, Raguvir and Kaur, Inderjeet (2007). A Text book of Scienceof Class X, New Delhi: NCERT.*
- *Kohli, V.K. (2006). How to Teach Science. Ambala: VivekPub.2006. Mangal,*
  S.K. (1997). Teaching of Science. New Delhi: Arya Book Depot
- *Sharma, R.C. (2010). Modern Science Teaching. New Delhi: Dhanpat Rai Pub. Co.*
- *Liversidge T., Cochrane M., Kerfoot B. and Thomas J.*

(2009). Teaching Science Developing as a Reflected Secondary Teacher. New Delhi: SAGE Publications India Private Limited.

- *Davar, M. (2012). Teaching of Science. New Delhi: PHI Learning Private Limted. New UNSECO Source Book for Science. France: UNSECO*
- *Joshi S.R. (2007). Teaching of Science. New Delhi: APH Publishing Corporation*

SEMESTER - VII

Course Title : School Internship Program

Course Code : BAD701

L	T	P	Credits
0	0	0	16

Total Hours: 240

Course Outcomes-

On the completion of the course, the students will be able to

1. develop conceptual understanding about Pedagogy of school subjects 'environment and understand the learner, learning behavior and learning situations
2. validate the theoretical understanding regarding pedagogical courses and school environment
3. design the meaningful learning sequences to educate the different levels of learning and plan the lessons to create the situations according to the level of the learning
4. formulate the co-curricular and extra -curricular activities in the school to provide support to curriculum

School based Internship

1. **Phase I School Internship – for 16 weeks (16 Credits)**
2. **Phase II** Post internship- for 1weekFinal examination in practice teaching (in actual school setting by external and internal examiners). The examination will be conducted in a flexible manner in the last two weeks of internship jointly by the qualified senior school staff members (external examiner) and teacher educators (internal examiners). Principal of the college of education will act as coordinator for the exams.

COURSE DETAILS

Phase - I: School Internship – for 16 weeks (16 Credits)

1. During internship a student teacher shall work as a regular teacher and participatein all the school activities, scholastic, including planning, teaching and assessment, interacting with school teachers, community members, parents andchildren.
2. The student teacher will be attached to a school for 1 week to observe aregular classroom with a regularteacher.
   - Observation of lessons of school teachers in concerned teaching subjects.
   - Observation of School curriculum-subject-wise

3. **Preparation of School Observation file:**

   - Philosophy of theschool
   - Vision/ aims/Objectives of theschool.
   - Organization andmanagement,
   - Fee and funds, staff salary scales/grades+ allowances, leave rules, Service rules, joining reports, relieving slipetc.
   - School Plant- detailed account of Infrastructural, Instructional and Humanresources.
   - SWOC analysis of theschool.

4. **Details of files During Internship Program:**

   1. 80 Lesson plansinelementary&secondary level classes in each subject during internship program.
   2. Distribution of 80Unit/Lesson plans in each subject will be asunder:
      - Detailed Lesson Plans:40
      - Diary format Unit/Lesson Plans:20
      - ICT Based Lesson Plans: 12
      - Test based lesson plan (by preparing blue print):4
      - Teaching models based lesson plans:4
      - Total 80+80=160 lesson Plans in both the pedagogical subjects.
      - Observation of Peer lessons: 40;
      - Observation of lessons by school teachers: 20

5. **Other files during internship Program**
   - School Observation File:
   - Action research report:

- Timetable and attendance record:
- Observation of school children in classroom as well as out of classroom, during all school activities:
- Report on Morning assembly and Co-curricular activities
- Development of audio visual aids.
- Use of school library and conducting lab work.
- Observing important occasions and celebrating important national days with school children.
- To learn evaluative techniques, developing question paper, marking papers, helping in preparing results and assigning grades.
- Learning to maintain school records and registers.

Phase II Post internship- for 1week, it involves the following activities

1. Writing reflective reports on the whole school internship program
2. Extended discussion among thestudent-teachers.
3. Presentation by student-teachers on different aspects of the teachingexperiences after theinternship.

Evaluation Program:

1. Internal Assessment in each pedagogy subject based on total reflections and involvement in School Internship Program. (50+50=100marks)
2. External Assessment: Final Skill-in-Teaching Examination in each subject. (50+50=100)

Written lessonplan	10marks
Presentation /contentdelivery	20marks
Teacher Traits & classroom behavior	10marks
Teaching aids/models/ICTused	10marks
Total	**50 marks**

Evaluation Criterion

Monthly Assessment: 25 marks

Lesson Plan: 5 marks

TLM: 5 marks

Observations: 5 marks

Reflective Journal: 5 marks

Regularity and Discipline; 5 marks

Course Title : Research Project (Community Engagement)

Course Code : BAD702

L	T	P	Credits
0	0	0	4

Total Hours: 60

Course Outcomes

On the completion of the course, the students will be able to

1. sensitized to various social problems, issues and ideas where they can contribute ina meaningfulway
2. create an environment of work culture based on mutual work, co-operation andteam work
3. develop a deep faith in dignity of labor and life of active socialinvolvement
4. develop aesthetic, creative and innovative abilities
5. work for the preservation, promotion and spread of cultural values &cultural heritage

Course Content

Cleanliness and beautification of surroundings; Participation in NSS/NCC Activities of Working in social service centers like old age home, hospitals, institutions for blind, orphan houses, any other social service center of NGO's / GO's; Helping the needy- Donating Blood/Organ Donation Awareness camps/Literacy camps/HIV awareness camps/health and hygiene awareness camps; Tree plantation or growing of ornamental plants; Identification of needy women and providing help; coaching to needy students; guidance and counseling to older people and needy children

Project report-

1. The students will maintain a project report on activities performed during community service.

Evaluation Criterion

Monthly assessment: 25 (per month)

Performance: 10 marks
Report: 5 marks
Practical Viva: 5 marks
Regularity: 5 marks

SEMESTER-VIII

Course Title: Knowledge and Curriculum

Course Code: BAD810

L	T	P	Credits
4	0	0	4

Total Hours: 60

Course Outcomes

On the completion of the course the students will be able to

1. understand the concept of modernization, multiculturalism, nationalism, universalism and secularism in curriculum
2. analyze the hidden curriculum and various frames of curriculum
3. analyze the structure of knowledge as reflected in disciplinary streams and Courses
4. develop the skills to construct curriculum

Course Content

Unit I **15 Hours**

Knowledge –Concept, nature and sources of Knowledge, Role of Teacher and Student in Construction of Knowledge
Distinction between Knowledge and skills, Knowledge and Information, Teaching and Training, Reason and Belief
Facets of Knowledge: local and universal, Concrete and abstract, Theoretical and practical, Contextual and textual. School and out of school
Concept of Modernization, Multiculturalism and Democratic Education

Unit II **12 Hours**

Education for nationalism, universalism and secularism.
Autonomy of teachers and learners – concept and barriers.
Education and values – concept, types of values, sources of values, erosion of values, ways and means of inculcation of values.

National values as enshrined in the constitution of India

Unit III **13 Hours**

Curriculum – meaning, objectives and components.
Determinants of Curriculum-Philosophical, sociological, psychological and ideological.
Relevance of curriculum, principles of curriculum construction. Meaning and concerns of 'Hidden Curriculum'
Curriculum visualized at different levels – National level, State level, School level and Classroom level.

Unit IV **20 Hours**

Approaches to curriculum development – subject centered, learner centered and community centered.
Operationalizing Curriculum into learning situations, teachers' role in generating dynamic curriculum experiences through- flexible interpretation of curricular aims, contextualization of learning and varied learning experiences.
Relationship between power, Ideology and the curriculum.

Transactional Mode

Video based Teaching, Cooperative Teaching, Case Analysis, Dialogue, Group Discussion, Demonstration, Project Based Learning, Flipped Teaching, Quiz, Simulation, Seminars

Suggested Readings

- *Butchvarov, P. (1970). The Concept of Knowledge, Evanston, Illinois: North Western UniversityPress.*
- *Chaudhary, K. (2008). A Handbook of Philosophy of Education, New Delhi: Mahamaya PublishingHouse.*
- *Dearden, R.F. (1984). Theory and Practice in Education, Routledge K Kegan &Paul.*
- *Edgarton, S.H. (1997). Translating the curriculum: Multiculturalism into the cultural studies. RoutledgePub.*
- *Rani, S., & Siddiqui, M. A. (2015). A Study of Home Environment, Academic Achievement and Teaching Aptitude on Training Success of Pre-Service Elementary Teachers of India. Journal of Education and Practice, 6(28), 91-96.*
- *National Council of Educational Research, & Training (India). (2005). National curriculum framework 2005. National Council of Educational Research and Training.*

- *Mondal, A., Saha, A., and Baidya, M. N. (2015). National curriculum framework for teacher education, 2009: A review of its perspectives and relevancies. International Journal of Applied Research, 1(9), 776-778.*
- *Sen Gupta, M. (2021). Knowledge and curriculum. PHI Learning Pvt. Ltd.*
- *Sen Gupta, M. Knowledge and curriculum. PHI Learning Pvt. Ltd., 2021.*

Course Title : Gender School and Society

Course Code : BAD801

L	T	P	Credits
4	0	0	4

Total Hours: 60

Course Outcomes

On the completion of the course, the students will be able to:

1. develop the basic understanding of gender issues and studies.
2. develop the problem solving ability and understanding to various physical and mental abuses in school andsociety
3. discuss the strategies and skills to remove gender inequality in school and society.
4. develop the potential for perspective building located in the Indian socio-cultural context.

Course Content

Unit I **13 Hours**

Conceptual foundations: Sexand Gender, Gender Equality, Gender Bias, Gender Stereotype andEmpowerment.
Gender issues in contemporary India – Nature, constitutional provisions andpolicies.

Unit II **12 Hours**

Gender bias in Schooling and in text books, curricular choices and the hiddencurriculum (teacher attitudes, classroom interaction and peer culture)
Role of education in gender sensitization – Identifying education as a catalyst agentfor genderequality.

Unit III **13 Hours**

Linkages and differences between reproductive rights and sexual rights, redressal of sexual harassment and abuse. Perspective of society towards gender inequality – Nature, causes andRemedies.

Unit IV **12 Hours**

Awareness towards gender issues – family and society as anagent. Role of media (print and electronic) in social construction ofgender.

Transactional Mode

Video based Teaching, PanelDiscussions, Collaborative Teaching, Cooperative Teaching, Dialogue, Group Discussion, Simulation, Lecture method, lecture-cum-demonstration, seminars

Suggested Readings

- *Ramachandran, Vimala. (2004). Gender and Social Equity in Education: Hierarchies of Access. New Delhi: Sage.*
- *UNESCO. (2004). EFA Global Monitoring Report: Education for All: The Quality Imperative.*
- *UNESCO. (2003). EFA Global Monitoring Report: Gender and Education for All: The Leap to equality.*
- *Ramachandran, Vimala (2009). Mid Decade Assessment towards Gender Equality in Education.Project Report, Published by NUEPA, 17- B, Sri AurobondoMarg, New Dehli – 110016*
- *NCERT (National Council of Educational Research and Training). (2006).Gender issues in Education. National Focus Group, Position Paper New Delhi, NCERT.*
- *Bandyopadhyay, Madhumita and Subrahmanian, Ramya (2008). Gender Equity in Education: A Review of Trends and Factors.Project Report.Consortium for Research on Educational Access, Transitions and Equity (CREATE), Falmer, UK.*
- *United Nations Girls' Education Initiative (UNGEI), New York, (2012). Gender Analysis in Education: A Conceptual Overview. Available at http://www.ungei.org*
- *Manjrekar, N. (2003). Contemporary Challenges to Women's Education: Towards an Elusive Goal? Economic and Political Weekly, 4577-4582*

Course Title : Creating an Inclusive Schools

Course Code : BAD803

L	T	P	Credits
3	0	0	3

Total Hours: 45

Course Outcomes

On the completion of the course, the students will be able to

1. understand concept, meaning and significance of inclusive education
2. appreciate the need for promoting inclusive practice and roles and responsibilities of the teachers, parents, peers and community
3. develop critical understanding of the recommendations of various commissions and committees towards teacher preparation for inclusive education
4. identify and utilize existing resources to promote inclusive practice

Course Content

Unit I **15 Hours**

Concept, importance and barriers of inclusive education.
Historical perspectives of inclusive education f or children with diverse needs.
Difference between special education, integrated education and inclusive education.
Children with special needs- Concept, classification and difference between impairment, disability and handicap

Unit II **10 Hours**

National Policy on education 1986, 1992 regarding special Education
Rehabilitation Council of India Act (1992)
Persons with Disabilities Act (2016)
National Policy of Disabilities (2006),

Unit III **10 Hours**

Learning disability -Concept, causes, screening & Classroom management strategies.
Mental Retardation -Concept, causes, screening & Classroom management strategies
Visual Impairment and Hearing Impairment -Concept, causes, screening & Classroom Management strategies
Locomotor Impairment & - Concept, causes, screening & Classroom management strategies

Unit IV **10 Hours**

Individualized Education Program for CWDN
Adaptations in instructional objectives, curriculum and co-curricular activities for meeting diverse needs of special children.
Role of parents, head masters and teachers in ensuring equal educational opportunities for these students.
Role of technology for inclusive education

Transactional Mode

Video based Teaching, PanelDiscussions, Collaborative Teaching, Case Analysis, Role Play, Demonstration, Project Based Learning, Lecture method, lecture-cum-demonstration, seminars

Suggested Readings

- *Bartlett, L. D., Weisenstein, G. R., and Etscheidt, S. L. (2002). Successful inclusion for educational leaders. Prentice Hall.*
- *Gartner, A. and Lipsky, D. D. (1997). Inclusion and School Reform Transferring America's Classrooms, Baltimore: P. H. Brookes Publishers.*
- *Giuliani, G. A. and Pierangelo, R. (2007). Understanding, Developing and Writing IEPs. Corwin press: Sage Publishers.*
- *Gore, M. C. (2004). Successful Inclusion Strategies for Secondary and Middle School Teachers,Crowin Press, Sage Publications.*
- *Hegarthy, S. and Alur, M. (2002). Education of Children with Special Needs: from Segregation to Inclusion, Corwin Press. Sage Publishers*
- *Karant, P. and Rozario, J. ((2003). Learning Disabilities in India.Sage Publications.*
- *Karten, T. J. (2007). More Inclusion Strategies that Work. Corwin Press, Sage Publications.*

- *King-Sears, M.(1994).Curriculum-Based Assessment in Special Edcuation.California, SingularPublications.*
- *Lewis, R. B. and Doorlag, D. (1995). Teaching Special Students in the Mainstream.4th Ed. New Jersey,Pearson*
- *Rayner, S. (2007). Managing Special and Inclusive Education, Sage Publications.*
- *Ryandak, D. L. and Alper, S. (1996). Curriculum content for Students with Moderate and SevereDisabilities in Inclusive Setting.Boston, Allyn and Bacon*
- *Sedlak, R. A.and Schloss, P.C.(1986). Instructional Methods for Students with LearningandBehaviour Problems. Allyn andBacon*
- *Stow L. and Selfe, L. (1989). Understanding Children with Special Needs. London Unwin Hyman.*
- *Turnbull, A., Turnbull, R. Turnbull, M. Shank, D. L. (1995). Exceptional Lives: Special Education inToday's Schools. 2nd Ed. New Jersey Prentice-Hall.Inc.*
- *Vlachou D. A. (1997). Struggles for Inclusive Education: An ethnographic study. Philadelphia, OpenUnive*
- *Westwood P. (2006). Commonsense Methods for Children with Special Educational N*

Course Title : Reading and Reflecting on Texts

Course Code : BAD804

L	T	P	Credits
0	0	4	2

Total Hours: 30

Course Outcomes

On the completion of the course, the students will be able to

1. develop the understanding about the ways of reading different texts.
2. read and reflect on variety of texts in different ways
3. read available texts and literaturecritically in the chosen area.
4. develop reading skills after understanding reading techniques

Course Content

Unit I **8 Hours**

Reading: Concept, Purpose and process
Types of Reading, Informative Reading, Critical Reading & Creative Reading.
Importance of Teaching Reading.

Unit II **8 Hours**

Reading comprehension: its components & rate of reading levels of reading comprehension, Reading comprehension strategies
Tests of reading comprehension.

Unit III **7 Hours**

Test of rates of reading - Time limit methods & amount limit method.
Analysis of advertisement on the basis of language.

Unit IV **7 Hours**

Building the reading habits
Analysis of 2 passages from Science, Social Sciences & Mathematics text books of classes VI to X.

Transactional Mode

Panel Discussions, Cooperative Teaching, Dialogue, Group Discussion, Brain Storming, seminars

Suggested Readings

- *Alan Robinson H. (Ed.) (1964). Meeting Individual Difference in Reading, The University of Chicago Press Chicago,*
- *Blanton, W.E. Faee (Ed) (1976). Measuring reading performance International Reading Association, New York,*
- *Dechant, E.V. (1964). Improving the Teaching of Reading, Prentice Hall Englewood Cliff's, Inc. 1964.*
- *EK Wall E.E., (1971).Diagnosis and Remediation of the disabled Readers, Allyn and Bacon, Boston.*

- *Gupta. P.K, Gandhi, A.K, Bhatnagar, S.S. (2015) Text reading and Reflection. R. Lall publishers*
- *Pandey, R. (2016) Reading and Reflective on Text. Rakhi Prakshan*
- *Srivastva, D.S (2016). Reading and Reflecting on Text. Shri Vinod Pustak Mandri Agra*
- *Sandhu, T.S, Brar,A.S, Watts, A., Kaur, P.Garg, B. Kaur, A, Kaur, M (2017). Reading and Reflective on Text. Rigi Publication, Khana, Pb.*

Course Title: Art in Education

Course Code: BAD811

L	T	P	Credits
3	0	0	3

Total Hours: 45

Course Outcomes

On the completion of the course the students will be able to

1. develop the understanding of meaning, concept and relevance of art in education
2. develop personal and professional skills as an art teacher
3. understand the applications of visual, Performing and literary art
4. teach learners effectively and creatively through artistic skills

Course Content

Unit I **10 Hours**

Meaning and Concept of 'Art and Arts in Education.

Understanding aesthetics and its Educational Relevance

Arts as pedagogy of learning, development and understanding of Arts (visual and performing arts) and their importance in different subjects.

Unit II **10 Hours**

Knowledge of Indian Craft, Traditions and its relevance in education

Knowledge of Indian Contemporary Art and Artists

Visual Arts, Indian festivals and their artistic significance

Indian Rasa Theories (Bharat Muni'sNatyaShastra).

Unit III **10 Hours**

Music and Drama in Teaching and Learning-need, importance,
Various forms of Music: Gayan, Vadan andNartan.
The impact of Music on Humanbehavior.

Meaning and types of gestures, Postures and Facial Expression.

Unit IV **15 Hours**

Theatre: Introduction, Importance and role of Drama in general and ineducation
Forms and Styles: Comedy andTragedy.
Components of Theatre: Role play, Space, Time, Audience andPerformance.
Identification of different performing arts forms and artist – dance music andmusical instrument, theatre, puppetryetc

Transactional Mode

Panel Discussions, Mentee Meter, Collaborative Teaching, Cooperative Teaching, Group Discussion, Role Play, Demonstration, Project Based Learning, E-Monitoring, Flipped Teaching, Quiz.

Suggested Readings

- *Gupta S.P., (2002). Elements of Indian Art. Inderaprastha Museum of art and Archaeology, New Delhi.*
- *Ray Niharranjan, (1984). An Approach to Indian Art. Publication Bureau.*
- *Roy C. Craven, (1995). Indian Art A Concise History. Thames and Hudson Ltd, London.*
- *Sharma L. C., (2002). A Brief history of Indian Painting. Goel Publishing House, Meerut.*

- *NCERT (2006). Position paper: National focus group on Arts, Music, Dance and theatre. new delhi: NCERT*
- *Awasthi, S.S. (1964). A Critique of Hindustan Music and Music Education. Jallandhar*
- *Bhatkhande, V. M.(1987). KRAMIK, Pustak Mahika, Laxmi Narayan Garg, Hathras.*
- *Bhatnagar, S. (1988). Teaching of Music. Monika Parkashan, Shimla.*

Course Title :Understanding Discipline and Subjects

Course Code : BAD805

L	T	P	Credits
3	0	0	3

Total Hours: 45

Course Outcomes

On the completion of the course the students will be able to

1. develop understanding on various disciplines and courses
2. elucidate the nature and changes in disciplines and Courses in terms of social, Political and intellectual Context
3. understand the process of developing theories and content
4. differentiate between curriculum and syllabus

Course Content

Unit I **15 Hours**

Disciplines and school subjects: Meaning, Types, Importance and relationship withCourses
Core ideas of Developing Discipline: Meaning andorganization
Philosophical views in different discipline by various Philosophers (JohnDewey, Krishna, and Murthy) in moderncontext.

Unit II **10 Hours**

Nature, importance and historical perspective of various schoolCourses
Changes in school Courses in terms of social, political and intellectualcontext
Curriculum: Concept, Principles of curriculum construction for differentCourses.

Unit III **10 Hours**

Meaning ofcorrelation/relationship.
Correlation between academic disciplines and school Courses, effects on curriculum framework.

Unit IV **10 Hours**

Meaning of inter disciplinary approach to education and its effects on schoolCourses.
Theory of content for selection of school Course incurriculum.

Transactional Mode

Video based Teaching, Mentee Meter, Cooperative Teaching, Case Analysis, Dialogue, Group Discussion, Brain Storming, Role Play, Demonstration, Project Based Learning, Quiz, Simulation, Lecture method, lecture-cum-demonstration, seminars

Suggested Readings

- *Butchvarov, P.(1970). The Concept of Knowledge. Evanston, IIlinois: Western University Press.*
- *Debra H. Martin,H. Pam C.and Lingard,B. (2007). Teachers and Schooling: makinga difference. Australia: Allen andUnwin.*
- *Gardner, H.(2007). Creating Minds. New York: BasicBooks.*
- *Noddings, N.(2007). Critical Lessons: What our schools should teach. Cambridge UniversityPress.*
- *Prnstein, Allen C., Edward F.P. & Stacey B.O.(2006). Contemporary issues in curriculum. Allyn &Bacon.*
- *Bruner, J.S. ((2006). In Search of Pedagogy, Vol-I &II,(he selected works), Lonson: Routledge.*
- *Kneller, G.F.,(1963). Foundations of Education. London and New York: John Wiley &Sons, Inc.*
- *NCERT (2005). National Curriculum Framework. NewDelhi.*

Course Title : Guidance and Counselling

Course Code : BAD807

L	T	P	Credits
3	0	0	3

Total Hours: 45

Course Outcomes

On the completion of the course, the students will be able to

1. understand the meaning, aims, objectives, and principles of guidance and counselling
2. use the upcoming trends of guidance and counselling to help learners in different aspects
3. learn the importance of guidance andcounselling cell andorganize guidance andCounselling cell in the institute
4. acquire the skills to provide guidance and counselling in school

Course Content

Unit I **11 Hours**

Meaning, need, principles, aims and objectives and scope ofGuidance.
Dimensions of Guidance: Educational, Vocational and personal Guidance, stepsand techniques.
News trends and demands in the field of Guidance.

Unit II **10 Hours**

Counselling – Meaning and purposes, directive, non-directive and eclectic approachesto Counselling, CounsellingInterview.
Minimum programmes and organization of Guidance and Counselling servicesat secondary level, and Principles oforganization.

Unit III **10 Hours**

Role of Counsellor, Guidance worker and teachers inguidance.
Difference between Guidance&Counselling.
Major areas and Barriers in understanding process, common problems of studentsat secondarylevel.

Unit IV **14 Hours**

Techniques of understanding anindividual
Quantitativetechniques: (Intelligence, Interest, Aptitude and Achievement tests)
Qualitative techniques: (Cumulative Record Cards / Rating Scales/Stoichiometry), Job Analysis- Meaning, functions andmethods.

Transactional Modes

E–TeamTeaching, PanelDiscussions, Mentee Meter, Collaborative Teaching, Dialogue, Group Discussion, Demonstration, Project Based Learning, Flipped Teaching, Simulation, Lecture method, seminars

Suggested Readings

- *Bhatia, K.K. (2002). Principles of Guidance and counseling. Ludhiana: Kalyani Publishers.*
- *Bhatnagar, A. and Gupta, N. (1999). Guidance and counseling, Vol-1&2: A practical approach, New Delhi: Vikas Publishers.*
- *Gibson, R.L. and Mitchell, M.H. (2003).Introduction to Counseling and Guidance. New Delhi: Pearson Education.*
- *Jones, R.N. (2000). Introduction to Counseling skills: Text and Activities. New Delhi, Sage Publications.*
- *Rathus, S. A. and Nevied, J. S. (1980).Adjustment and Growth: The challenges of life. New York: Rinehart and Winston.*
- *Robinson (2005). Principles and Procedures in Student Counselling. New York: Harper Row. Safaya, B.N. (2002). GuidanceCounseling. Chandigarh: Abhishek Publications.*
- *Sharma, R.A. (2008). Fundamentals of Guidance and Counseling. Meerut: R. Lall Book Depot.*
- *Sharma, Tara Chand (2002). Modern Methods of Guidance and Counseling. New Delhi: Sarup and Sons.*
- *Shertzer, Bruce and Stone, Shelly C. (1974). Fundamentals of Counseling. London: Houghton Missli.*

Course Title : Distance and Open Learning

Course Code : BAD808

L	T	P	Credits
3	0	0	3

Total Hours: 45

Course Outcomes

On the completion of the course the students will be able to

1. differentiate face-to-face education and open and distance education
2. identify different types of Distance Education Institutions
3. use of technological applications in Open and Distance Learning
4. evaluation and assessment process in Distance Learning

Course Content

Unit I **12 Hours**

Distance and Open learning: Concept, History, Need, Scope and Barriers.
Theories of distance education
Modes and Models of Distance Education
Recommendations regarding Distance Education in Indian perspective: NEP 1986 and NPE, 2020.

Unit-II **10 Hours**

Role of teacher and students in distance and open leaning
Differences Between Face-To-Face Education and Open Distance Learning
Student Support Services in Distance Education

Unit-III **13 Hours**

Applications of Educational Technology in Open and Distance Learning
Open Education Resources, e- Inclusion and Application of Assistive technology in e- learning
Established Web-based Models for Distance Learning

Unit-IV **10 Hours**

Concept of Evaluation and assessment
Formative and Summative assessment in distance education

Tools of Assessment and Evaluation in distance education: Assignment, Tests, Examination

Transactional Mode

Lecture cum demonstration, blended learning, team teaching, peer learning, problem solving, mobile teaching, collaborative and cooperative learning

Suggested Readings

- *Popenici, S (2015). Deceptive promises: the meaning of MOOCs-hype for higher education. In E McKay and J Lenarcic (Eds.), Macro-level learning through massive open online courses (MOOCs): Strategies and predictions for the future. Hershey, USA: IGI Global*
- *Zhadko, O. &Ko, S. (2020). Best practices in designing courses with open educational resources. New York: Routledge.*
- *Kumar, S. (2010). Open and Distance Education. Straight Forward Publication Pvt. Ltd.*

Course Title : Value Education

Course Code : BAD809

L	T	P	Credits
2	0	0	2

Total Hours: 30

Course Outcomes

On the completion of the course, the students will be able to

1. understand the significance of values
2. understand the relevance of family, society and teacher in value education
3. know the traditions of Indian Value System as well as Indian constitutional values
4. understand the Religious and Cultural practices in the context of value education

Course Content

Unit I **8 Hours**

Value Education: Meaning, need & importance, Classification of values.

Challenges of values adoption.
Methods, approaches and strategies of inculcating values.

Unit II **7 Hours**

Role of family, society and teacher in promoting the value education.
Integration of values in education.
Good habits: concept, meaning and significance in life.

Unit III **8 Hours**

Evolution of Value Education in Indian perspective.

Values inherent in the preamble of Indian Constitution.

Values for Character Development.

Unit IV **7 Hours**

Role of Religious and Cultural practices in Value Education.
Core values- truth, righteous conduct, peace, love and non-violence.

Transactional Mode

Cooperative Teaching, Case Analysis, Dialogue, Group Discussion, Brain Storming, Role Play, Demonstration, Project Based Learning, Ted Talks, E-Monitoring, Flipped Teaching, Quiz, Simulation, Lecture method, seminars

Suggested Readings

- *Chandrasekaran, V. & Rajesh V. R. (2012) Role of Sustaining Values among Children, Towards*
- *Excellence in Education, Almighty Book Company, Chennai-11.*
- *Ugin Rositta, M. (2012) Values dwell when Humanity lives, Towards Excellence in Education, Almighty Book Company, Chennai-11.*
- *Rajapriya G. (2012) Value Education – Need of the Hour Towards Excellence in Education,*
- *Caroline Jeba Sorna P. (2012) Role of Human Engineers in Sustaining Values for Excellence in Education Towards Excellence in Education, Almighty Book Company, Chennai -11*
- *Myrtle Joyce Shobha D'Soua (2015) Value-Based Approach to promote Peace Education, Edutracks, A monthly Scanner of Trends in Education May 2015 Vol .14 No.9*

- *Ajit Kumar Singh, Ritu Nigam (2015) Policy Perspectives in Peace and Value Education in the Indian context. Edutracks, A monthly Scanner of Trends in Education Feb 2018, Vol. 17 No.6*
- Vibha Devpura (2018) Empowering Adolescents with Life Skills Education Edutracks, A monthly Scanner of Trends in Education Mar 2018 Vol .17 No.
- Pandey V.C., Education cultureand human values (2005) The New International Webster's Comprehensive Dictionary of the English Language (Deluxe EncyclopaedicEdition), Trident Press International, Naples, 2001, p.927.
- Powney, J., Cullen, M-A., Schlapp, U., Johnstone, M. & Munn, P. (2127). *Understanding value education in the primary school.* York: Reports Express.