CURRICULUM FOR INTEGRATED TEACHER EDUCATION PROGRAMME LEADING TO B. Sc. B.Ed. DEGREE

Name of Degree	Name of Specialization	Total Intake (Full-time)	Year of Starting	Duration	Eligibility for Admission
B.Sc. B.Ed. (Secondary)	Science and Education	50	2023	4 years (8 semesters)	The ITEP shall be of four academic years comprising eight semesters including internship (field-based experiences and practice teaching). Candidates with minimum fifty percent marks in Senior Secondary or plus two examination or its equivalent (under 5+3+3+4 pattern) from a recognized board are eligible for admission through the National Common Entrance Test (NCET), conducted by the National Testing Agency (NTA)

COURSE CATEGORIES AND CREDIT REQUIREMENTS:
The structure of B.Sc. B.Ed. Programmes shall have the following Course Categories:

Sl. No	Course Category	No. of Courses	No. of credits
1.	Foundations of Education (FE)	10	30
2.	Disciplinary Major and Minor (MM)	16	80
3.	Stage Specific Content cum Pedagogy (CP)	4	16
4.	Ability Enhancement and Value added Courses (AE)	12	28
5.	School Experience (SE)	6	20
6.	Community Engagement and Service (CE)	1	2

Total Credits required: 176

PROGRAMME STRUCTURE

Major Disciplinary Subject: PHYSICS

Minor: One discipline to be chosen from amongst Chemistry, Mathematics, Botany, Zoology and Economics.

The effort to be put in by the student is indicated in the tables below as follows:

L: Lecture (One unit is of 50-minute duration)

T: Tutorial (One unit is of 50-minute duration)

P: Practical (One unit is of one-hour duration)

O: Outside the class effort / self-study (One unit is of one-hour duration)

Semester 1

Sl. No	Course Code	Title	L	T	P	O	C	Category
1	ED1001E	Evolution of Indian Education	4	0	0	8	4	FE
2	ED1002E	Language I – English	4	0	0	8	4	AE
3	ED1003E	Art Education-Collage Making	1	0	2	3	2	AE
4	ED1004E	Understanding India -I	2	0	0	4	2	AE
5	ED1301E	Mechanics and Properties of Matter	3	1	0	8	4	MM
6	ED1103E	Chemistry Minor-I Basics of Theoretical Chemistry and Spectroscopy	3	1	0	8	4	MM
	ED1202E	Mathematics Minor-I Calculus	3	1	0	8	4	MM
	ED1401E	Botany Minor-I Cell Biology and Biochemistry	3	1	0	8	4	MM
	ED1501E	Zoology Minor-I Cell Biology	3	1	0	8	4	MM
	ED1601E	Economics Minor-I Basic Economics	3	1	0	8	4	MM
7	ED1302E	Physics Lab-I	0	0	2	1	1	MM
		Total					21	

Semester 2

Sl. No	Course Code	Title	L	T	P	O	C	Category
1	ED1011E	Language II- Malayalam	4	0	0	8	4	AE
	ED1014E	Language II- Hindi	4	0	0	8	4	AE
2	ED1012E	Understanding India – II	2	0	0	4	2	AE
3	ED1013E	Teacher and Society	2	0	0	4	2	AE
4	ED1311E	Heat and Thermodynamics	3	1	0	8	4	MM
5	ED1312E	Electricity and Magnetism	3	1	0	8	4	MM
6	ED1114E	Chemistry Minor-II Physical Chemistry	3	1	0	8	4	MM
	ED1213E	Mathematics Minor-II Algebra & Differential Equations	3	1	0	8	4	MM
	ED1411E	Botany Minor-II Biotechnology, Molecular Biology and Bioinformatics	3	1	0	8	4	MM
	ED1511E	Zoology Minor-II Animal Biotechnology	3	1	0	8	4	MM
	ED1611E	Economics Minor-II Microeconomics	3	1	0	8	4	MM
7	ED1313E	Physics Lab-II	0	0	2	1	1	MM
		Total					21	

Semester 3

Sl. No	Course Code	Title	L	T	P	O	C	Category
1	ED2001E	Child Development and Educational Psychology	4	0	0	8	4	FE
2	ED2002E	General Pedagogy	3	1	0	8	4	CP
3	ED2301E	Waves and Optics	3	1	0	8	4	MM
4	ED2302E	Electronics	3	1	0	8	4	MM
5	ED2104E	Chemistry Minor-III Inorganic Chemistry	3	1	0	8	4	MM
	ED2203E	Mathematics Minor-III Probability and Statitics	3	1	0	8	4	MM
	ED2401E	Botany Minor-III Ecology and Environmental Science	3	1	0	8	4	MM
	ED2501E	Zoology Minor-III Environmental Conservation and Sustainable Development	3	1	0	8	4	MM
	ED2601E	Economics Minor III Indian Economy: Trends and Policies	3	1	0	8	4	MM
6	ED2303E	Physics Lab-III	0	0	2	1	1	MM
		Total					21	

Semester 4

Sl. No	Course Code	Title	L	T	P	O	C	Category
1	ED2011E	Philosophical and Sociological Perspectives of Education-I	4	0	0	8	4	FE
2	ED2012E	Minor Pedagogy (Physical Science)	3	1	0	8	4	CP
	ED2013E	Minor Pedagogy (Mathematics)	3	1	0	8	4	CP
	ED2014E	Minor Pedagogy (Biological Science)	3	1	0	8	4	CP
	ED2015E	Minor Pedagogy (Social Science)	3	1	0	8	4	CP
3	ED2311E	Classical and Relativistic Mechanics	3	1	0	8	4	MM
4	ED2312E	Quantum and Statistical Mechanics	3	1	0	8	4	MM
5	ED2114E	Chemistry Minor-IV Organic Chemistry	3	1	0	8	4	MM
	ED2213E	Mathematics Minor-IV Mathematical Analysis	3	1	0	8	4	MM
	ED2411E	Botany Minor-IV Structural Biology	3	1	0	8	4	MM
	ED2511E	Zoology Minor-IV Bioinformatics	3	1	0	8	4	MM
	ED2611E	Economics Minor IV- Money and Personal Finance	3	1	0	8	4	MM
6	ED2313E	Physics Lab-IV	0	0	2	1	1	MM
		Total					21	

Semester 5

Sl. No	Course Code	Title	L	T	P	O	C	Category
1	ED3001E	ICT in Education	1	0	2	3	2	AE
2	ED3002E	Major Pedagogy-I (Physical Sciences)	3	1	0	8	4	CP
3	ED3003E	Pre-internship Practice	0	0	3	3	2	SE
4	ED3301E	Atomic and Molecular Physics	3	1	0	8	4	MM
5	ED3302E	Nuclear and Solid State Physics	3	1	0	8	4	MM
6	ED3303E	Major Project	0	0	0	12	4	MM
		Total					20	

Semester 6

Sl. No	Course Code	Title	L	T	P	O	C	Category
1	ED3011E	Assessment and Evaluation	2	0	0	4	2	FE
2	ED3012E	Major Pedagogy-II (Physical Sciences)	3	1	0	8	4	CP
3	ED3013E	Inclusive Education	2	0	0	4	2	FE
4	ED3014E	Mathematical and Quantitative Reasoning	1	1	0	4	2	AE
5	ED3015E	School Observation	0	0	0	6	2	SE
6 & 7	ED3311E	Elementary Particle Physics	3	1	0	8	4	MM
	ED3312E	Numerical Techniques And Computational Physics	3	1	0	8	4	MM
	ED3313E	Advanced Electronics	3	1	0	8	4	MM
	ED3314E	Laser Theory	3	1	0	8	4	MM
	ED3315E	Astronomy And Astrophysics	3	1	0	8	4	MM
		Total					20	

Semester 7

Sl. No	Course Code	Title	L	T	P	O	C	Category
1	ED4001E	Perspectives on School Leadership and Management	2	0	0	4	2	FE
2	ED4002E	Curriculum Planning and Development	2	0	0	4	2	FE
3	ED4003E	Art Education- Performing and Visual	1	0	2	3	2	AE
4	ED4004E	Sports, Nutrition and Fitness	1	0	2	3	2	AE
5	ED4005E	School based Research Project	0	0	0	6	2	SE
6	ED4006E	Internship in Teaching	0	0	0	30	10	SE
7	ED4301E	Mathematical Physics	3	1	0	8	4	MM
8	ED4302E	Classical Mechanics	3	1	0	8	4	MM
		Total					28	

Semester 8

Sl. No	Course Code	Title	L	T	P	O	C	Category
1	ED4011E	Philosophical and Sociological Perspectives of Education-II	4	0	0	8	4	FE
2	ED4012E	Education Policy Analysis	2	0	0	4	2	FE
3	ED4019E	Emerging Technologies in Education	4	0	0	8	4	FE
	ED4020E	Guidance and counselling	4	0	0	8	4	FE
4	ED4014E	Yoga and Understanding Self	2	0	0	4	2	AE
5	ED4015E	Citizenship Education, Sustainability and Environment Education	2	0	0	4	2	AE
6	ED4016E	Post-Internship (Review and Analysis)	0	0	3	3	2	SE
7	ED4017E	Teaching Learning Material/Work Experience	0	0	3	3	2	SE
8	ED4018E	Community Engagement and Service	0	0	3	3	2	CE
9	ED4303E	Quantum Mechanics	3	1	0	8	4	MM
10	ED4304E	Statistical Mechanics	3	1	0	8	4	MM
		Total					28	

Semester-wise distribution of credits:

Semester	1	2	3	4	5	6	7	8
Credit	21	21	21	21	20	16	28	28

Total Credits: 176

Syllabi of courses added to seventh and eight semesters

ED4301E MATHEMATICAL PHYSICS

Pre-requisites: Nil
Total Lecture Sessions: 39

L	T	P	O	C
3	1	0	8	4

Course Outcomes:

CO1: Use techniques in vector differential calculus to solve problems.
CO2: Test for linear independence of vectors, perform orthogonalization of basis vectors and represent operators as matrices.
CO3: Apply the ideas of vector spaces to describe space of functions.
CO4: Examine the properties of ODEs and PDEs and apply them to some physical examples.

Vector Analysis - Gradient, Divergence and Curl - Gauss theorem, Stokes theorem, Green's theorem - Curvilinear coordinate systems - Coordinate transformations.

Linear Algebra: Sets, Compositions, Groups, Rings, Fields - Vector spaces - Span - Linear Independence - Bases - Linear Transformations - Operators - Matrix Representations - Dual vector spaces - Tensor product spaces - Bilinear forms - Gram-Schmidt orthogonalization - Eigenvalue problem, Diagonalization.

Infinite dimensional vector spaces, function space, $L2$-spaces - Expansion in orthogonal functions, classical orthogonal polynomials, generating functions - Fourier series - Fourier transform – Dirac delta function.

Differential Equations - Second Order Differential Equations, Frobenius method, series solutions - Special functions, examples - Partial Differential equations - Separation of variables - Laplace equation - Heat Equation.

References:

1. Phillippe Dennery and Andre Krzywicki, *Mathematics for Physicists*, Dover publications, 1995.

2. K. F. Riley, M. P. Hobson and S. J. Bence, *Mathematical Methods for Physics and Engineering*, Cambridge University Press, 2006.

3. G. F. Simmons, *Differential Equations with Applications and Historical Notes*, McGraw Hill, 2017.

4. R. Bronson and G. B. Costa, *Differential Equations*, (Schaum's Series) McGraw-Hill, 2006.

5. M. R. Spiegel, *Vector Analysis*, (Schaum's Series) McGraw-Hill, 1959.

ED4302E CLASSICAL MECHANICS

Pre-requisites: Nil
Total Lecture Sessions: 39

L	T	P	O	C
3	1	0	8	4

Course Outcomes:

CO1: Use ideas of Calculus of Variations and Lagrangian for problems in Classical Mechanics.
CO2: Utilize the concepts of Hamiltonian, Symmetry properties, Canonical Transformations and Poisson Brackets to simplify the description of different systems.
CO3: Apply and extend ideas of Classical Mechanics to two body central force problems, small oscillations and rigid body dynamics to solve equations of motion
CO4: Examine the symmetries of phase space using the concepts of symplectic geometry.

Constraints - Generalized Coordinates -Virtual Displacements - D'Alembert's Principle - Calculus of Variations, examples - Lagrangian, Euler - Lagrange Equations, examples - Central force motion.

Legendre transformations - Hamilton's equations and examples - Cyclic coordinates - Symmetry - Conservation principles and Noether's theorem - Canonical transformations - Poisson bracket formulation

System of oscillators - eigenvalue problem and normal modes - damping - forced oscillations and resonance - the inertia tensor - Euler angles and equations of motion - Symmetric top.

Dynamical systems - stability analysis - phase space dynamics - Generating Functions – Hamilton- Jacobi equation - Action angle variables.

References:

1. Herbert Goldstein, Classical Mechanics (II Ed.), Narosa Publishers, 2001.

2. Landau and Lifshitz, Mechanics (III Ed.), Pergamon press, 2009.

3. D. Kleppner and R. J. Kolenkow, An Introduction to Mechanics, Cambridge University Press, 2010.

4. Spiegl M. R., Theoretical mechanics, (Schaum Series), McGraw Hill, 1982.

5. D. A. Wells, Theory and Problems of Lagrangian Dynamics, (Schaum Series) McGraw-Hill, 1967.

ED4303E QUANTUM MECHANICS

Pre-requisites: Nil
Total Lecture Sessions: 39

L	T	P	O	C
3	1	0	8	4

Course Outcomes:

CO1: Compute probability distribution for observables of a system in a given quantum state.
CO2: Solve Schrodinger equation for simple one-dimensional problems.
CO3: Analyze three dimensional central field problems and compute eigenvalues and eigenstates.
CO4: Investigate symmetries of a quantum system.

Postulates of Quantum Mechanics, Dirac formalism – bra-ket notation, states and observables, measurement theory, Born interpretation – Translation operator and momentum, canonical commutation relations – expectation values – uncertainty principle – matrix representation of operators, change of basis, position and momentum representation – time evolution, Hamiltonian operator, Time dependent Schrödinger equation, Time independent Schrodinger equation – Schrödinger, Heisenberg and interaction pictures.

One dimensional time independent potential problems, general properties, bound and scattering solutions – Free particle – potential wells and barriers, tunneling – Simple harmonic oscillator: operator method and algebraic method – periodic potential, Bloch's theorem, band structure – symmetry, conservation laws – parity, time reversal.

Rotations, angular momentum operators, commutation relations, eigenvalues and eigenfunctions - orbital and spin angular momentum – Addition of angular momenta, Clebsch-Gordon coefficients - Composite systems, quantum entanglement – locality principle and Bell's inequalities – three dimensional time independent potential problems: central field problems, hydrogen atom.

References:

1. Richard L. Liboff, *Introductory Quantum Mechanics (4th Ed.)*, Pearson education, 2003.
2. J. J. Sakurai, , *Modern Quantum Mechanics (3rd Ed.)*, Addison Wesley, 1999.
3. R. Shankar, *Principles of Quantum Mechanics (2nd Ed.)*, Springer, 1994.
4. David. J. Griffiths, *Introduction to Quantum Mechanics (2nd Ed.)*, Pearson Education, 2005.
5. Nouredine Zettili, *Quantum Mechanics: Concepts and Applications (2nd Ed.)*, John Wiley, 2009.
6. P. M. Mathews and K. Venkatesan, *A Textbook of Quantum Mechanics (2nd Ed.)*, McGraw Hill, 2017.

ED4304E STATISTICAL PHYSICS

Pre-requisites: Nil

Total Lecture Sessions: 39

L	T	P	O	C
3	1	0	8	4

Course Outcomes:

CO1: Apply the concepts of statistical ensemble theory to connect thermodynamic properties of systems to the statistical distribution of the microstates of the system.

CO2: Analyse properties of thermodynamic systems using microcanonical, canonical, and grand canonical ensembles.

CO3: Apply concepts of quantum statistical physics to various problems such as free electrons, photon gas, specific heat of solids, Bose-Einstein condensate.

CO4: Apply methods of statistical mechanics to characterize first-order and continuous phase transitions in liquid-gas and magnetic systems

Need for statistical physics – review of thermodynamics and basic probability theory – macro states and microstates: phase space, Liouville's theorem – fundamental postulate of equilibrium statistical mechanics – Ensemble Theory: microcanonical ensemble, Gibbs paradox, enumeration of microstates, canonical ensemble, partition function, free energy, calculation of thermodynamic quantities, entropy, fluctuations, grand canonical ensemble.

Classical ideal gas: Maxwell-Boltzmann distribution, equipartition theorem, virial theorem, specific heat of gases – Real gases – Magnetic system: Paramagnetism, Langevin and Brillouin functions, Curie's law – negative temperature concept – system of harmonic oscillators.

Systems of identical, indistinguishable particles: spin, symmetry of wavefunctions, bosons, fermions, Pauli's exclusion principle, Bose-Einstein and Fermi-Dirac distributions, degeneracy – Ideal Fermi gas and ideal Bose gas, Bose-Einstein condensation, Applications: free electron gas, radiation, specific heat of crystalline materials: Einstein and Debye theories, electronic contribution to specific heat of metals.

Introductory ideas on phase transitions – first-order phase transition – theory of Yang and Lee– Weiss theory of ferromagnetism – second-order phase transition – Landau theory – critical point exponents.

References:

1. R. K. Pathria, *Statistical Mechanics (2nd Edition)*, Butterworth-Heinemann, 1996.
2. K. Huang, *Statistical Mechanics (2nd edition)*, John Wiley, 1987.
3. F. Reif, *Fundamentals of Statistical and Thermal Physics*, McGraw Hill, 1985.
4. M. Kardar, *Statistical Physics of Particles*, Cambridge University Press, 2007.
5. H. B. Callen, *Thermodynamics and An Introduction to Thermostatics (2nd edition)*, Wiley, 1985.
6. E. A. Jackson, *Equilibrium Statistical Mechanics*, Prentice-Hall, 1968.