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

with Physics as Disciplinary Major

First Revision- 2026

Name of Degree	Name of Specialization	Total intake (Full-time)	Year of Starting	Duration	Eligibility for Admission
B.Sc. B.Ed. (Foundational / Preparatory / Secondary)	Physics and Education	45	2026	4 years (8 semesters)	The ITEP, offered at Foundational, Preparatory and Secondary stages, shall be of four academic years comprising eight semesters including internship (field-based experiences and practice teaching), leading to a dual major degree in Physics (honours) and Education. Candidates with minimum fifty percent marks in Senior Secondary or plus two examinations 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.	Stage Specific Content cum Pedagogy (CP)	4	16
3.	School Experience (SE)	6	20
		Education Credits	**66**
4.	Disciplinary Major (DM)	22	80
		Disciplinary Major (Physics) Credits	**80**
5.	Ability Enhancement and Value added Courses (AE)	11	28
6.	Community Engagement and Service (CE)	1	2
		Other Courses Credits	**30**

Total Credits required 176

PROGRAMME STRUCTURE

Major Disciplinary Subject: PHYSICS

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	ED1051E	Evolution of Indian Education	4	0	0	8	4	FE
2	ED1052E	Language I – English	4	0	0	8	4	AE
3	ED1053E	Understanding India – I (Indian Ethos and Knowledge Systems)	2	0	0	4	2	AE
4	ED1351E	Mechanics	4	0	0	8	4	DM
5	ED1251E	Calculus	3	1	0	8	4	DM
6	ED1151E	Chemistry I	4	0	0	8	4	DM
		Total					22	

Semester 2

Sl. No	Course Code	Title	L	T	P	O	C	Category
1	ED1054E	Mathematical and Quantitative Reasoning	1	1	0	4	2	AE
2	ED1055E	Understanding India – II (Indian Ethos and Knowledge Systems)	2	0	0	4	2	AE
3	ED1056E	Yoga and Understanding Self	2	0	0	4	2	AE
4	ED1057E	Language II - Malayalam	4	0	0	8	4	AE
	ED1058E	Language II - Hindi						
5	ED1352E	Electricity and Magnetism	4	0	0	8	4	DM
6	ED1252E	Matrix Algebra and Differential Equation	3	1	0	8	4	DM
7	ED1152E	Chemistry II	4	0	0	8	4	DM
		Total					22	

Semester 3

Sl. No	Course Code	Title	L	T	P	O	C	Category
1	ED2051E	Teacher and Society	2	0	0	4	2	AE
2	ED2052E	Computer Programming	1	0	2	3	2	AE
3	ED2053E	Child Development and Educational Psychology	4	0	0	8	4	FE
4	ED2054E	Basics of Pedagogy	3	1	0	8	4	CP
5	ED2351E	Heat and Thermodynamics	4	0	0	8	4	DM
6	ED2352E	Electronics	4	0	0	8	4	DM
7	ED2353E	Physics Lab - I	0	0	3	2	2	DM
		Total					22	

Semester 4

Sl. No	Course Code	Title	L	T	P	O	C	Category
1	ED2055E	Philosophical and Sociological Perspectives of Education-I	4	0	0	8	4	FE
2	ED2056E	Content cum Pedagogy of Mathematics - I (Foundational)	3	1	0	8	4	CP
	ED2057E	Content cum Pedagogy of Mathematics - I (Preparatory)	3	1	0	8	4	CP
	ED2058E	Content cum Pedagogy of Mathematics - I (Secondary)	3	1	0	8	4	CP
3	ED2059E	Content cum Pedagogy of Physical Sciences - I (Foundational)	3	1	0	8	4	CP
	ED2060E	Content cum Pedagogy of Physical Sciences - I (Preparatory)	3	1	0	8	4	CP
	ED2061E	Content cum Pedagogy of Physical Sciences - I (Secondary)	3	1	0	8	4	CP
4	ED2354E	Relativity and Quantum Physics	4	0	0	8	4	DM
5	ED2355E	Waves and Optics	4	0	0	8	4	DM
6	ED2356E	Physics Lab - II	0	0	3	2	2	DM
		Total					22	

Semester 5

Sl. No	Course Code	Title	L	T	P	O	C	Category
1	ED3051E	ICT in Education	1	0	2	3	2	AE
2	ED3052E	School Observation	0	0	0	6	2	SE
3	ED3056E	Content cum Pedagogy of Physical Sciences - II (Foundational)	3	1	0	8	4	CP
	ED3057E	Content cum Pedagogy of Physical Sciences - II (Preparatory)	3	1	0	8	4	CP
	ED3058E	Content cum Pedagogy of Physical Sciences - II (Secondary)	3	1	0	8	4	CP
4	ED3351E	Statistical and Solid State Physics	4	0	0	8	4	DM
5	ED3352E	Nuclear and Particle Physics	4	0	0	8	4	DM
6		Physics Elective	4	0	0	8	4	DM
7	ED3353E	Physics Lab - III	0	0	3	2	2	DM
		Total					22	

Semester 6

Sl. No	Course Code	Title	L	T	P	O	C	Category
1	ED3059E	Philosophical and Sociological Perspectives of Education-II	4	0	0	8	4	FE
2	ED3060E	Inclusive Education	2	0	0	4	2	FE
3	ED3061E	Perspectives on School Leadership and Management	2	0	0	4	2	FE
4	ED3062E	Assessment and Evaluation	2	0	0	4	2	FE
5	ED3063E	Art Education- Performing, Visual and Collage Making	1	0	2	3	2	AE
6	ED3064E	Sports, Nutrition and Fitness	1	0	2	3	2	AE
7	ED3065E	Pre-internship Practice	0	0	3	3	2	SE
8	ED3354E	Mathematical Methods for Physics	4	0	0	8	4	DM
9	ED3355E	Physics Lab-IV	0	0	3	2	2	DM
		Total					22	

Semester 7

Sl. No	Course Code	Title	L	T	P	O	C	Category
1	ED4051E	Curriculum Planning and Development	2	0	0	4	2	FE
2	ED4052E	School based Research Project	0	0	0	6	2	SE
3	ED4053E	Internship in Teaching	0	0	0	30	10	SE
4	ED4351E	Classical Mechanics	4	0	0	8	4	DM
5	ED4352E	Quantum Mechanics	4	0	0	8	4	DM
		Total					22	

Semester 8

Sl. No	Course Code	Title	L	T	P	O	C	Category
1	ED4054E	Education Policy Analysis	2	0	0	4	2	FE
2		Education Elective	4	0	0	8	4	FE
3	ED4055E	Citizenship Education, Sustainability and Environment Education	2	0	0	4	2	AE
4	ED4056E	Post-Internship (Review and Analysis)	0	0	3	3	2	SE
5	ED4057E	Teaching Learning Material/Work Experience	0	0	3	3	2	SE
6	ED4058E	Community Engagement and Service	0	0	3	3	2	CE
7	ED4353E	Statistical Mechanics	4	0	0	8	4	DM
8	ED4354E	DM Project	0	0	0	12	4	DM
		Total					22	

Semester-wise distribution of credits:

Semester	1	2	3	4	5	6	7	8	**Total**
Credit	22	22	22	22	22	22	22	22	**176**

List of Physics Electives:

Sl. No	**Course Code**	**Title**	**L**	**T**	**P**	**O**	**C**	**Category**
1	ED3361E	Laser Physics	4	0	0	8	4	DM
2	ED3362E	Astronomy and Astrophysics	4	0	0	8	4	DM
3	ED3363E	Advanced Electronics	4	0	0	8	4	DM
4	ED3364E	Numerical Techniques and Computational Physics	4	0	0	8	4	DM

List of Education Electives:

Sl. No	**Course Code**	**Title**	**L**	**T**	**P**	**O**	**C**	**Category**
1	ED4061E	Emerging Technologies in Education	4	0	0	8	4	FE
2	ED4062E	Guidance and counselling	4	0	0	8	4	FE

Semester-wise Detailed Syllabus
Physics Major

Semester-I

ED1051E Evolution of Indian Education

Pre-requisites: Nil

L	T	P	O	C
4	0	0	8	4

Total Lecture Sessions: 52

Course Outcomes:

CO1: Analyze the evolution of education in India, including its historical, social, and political influences, enabling them to act as effective teachers.
CO2: Identify the key features of the historical development of education in ancient India and compare it with modern educational practices.
CO3: Assess the impact of various philosophies and systems in ancient India in the genesis, vision, and evolution of education in India from ancient times to the contemporary era.
CO4: Recognize and appreciate the contributions of Indian thinkers to the evolution of the Indian education system and its practices.

Ancient Indian Education: Vedic Period Vision, objectives and salient features of Vedic Education System-Teaching and Learning Process- Development of educational institutions: Finances and Management- Famous Educational institutions and Guru-Shishya Education at the time of Epics: Ramayana and Mahabharata.
Ancient Indian Education: Buddhist and Jain Period Vision, objectives and salient features of Buddhist and Jain Education System- Teaching and Learning Process- Finance and Management of Educational Institutions- Educational Institutions: Nalanda, Taxila, Vikramshila, Vallabhi, Nadia- Famous Guru-Shishya.

Post-Gupta Period to Colonial Period Vision, objectives, brief historical development perspective as well as salient features of Education in India- Teaching and Learning Process- Finance and Management of educational institutions.

Modern Indian Education Colonial education in India; Woods Despatch, Macaulay Minutes and Westernization of Indian Education- Shiksha ka Bhartiyakaran (Indigenous Interventions in education); Swadeshi and Nationalist attempts of educational reforms with special reference to general contribution of Indian thinkers to the education systems of India; Savitribai and Jyotiba Phule, Rabindranath Tagore, Swami Vivekananda, Mahatma Gandhi, Sri Aurobindo, Gijubhai Badheka, Pt. Madanmohan Malaviya, Jiddu Krishnamurti and Dr. Bhima Rao Ambedkar.

Education in Independent India; Overview of Constitutional values and educational provisions- Citizenship Education: Qualities of a good citizen, Education for fundamental rights and duties- UEE, RMSA, RTE Act 2009: Overview and impact- NCF 2005, NEP 2020: vision and implementation for a vibrant India. New digital classrooms: National platforms like DIKSHA, SWAYAM, and NPTEL and their impact on Indian education.

References:

1. Mookerji R. K. *Ancient Indian Education: Brahmanical & Buddhist*, Motilal Banarsidass (2016).
2. F. E. Keay, *Indian Education: An Enquiry into its Origin, Development, and Ideals*. Creative Media Partners, LLC (2023).
3. R. V. Vaidyanatha Iyyer. *History of Education Policymaking in India (1947-2016)*, 4th Edition, Oxford University Press, 2017.

ED1052E Language I - English

Pre-requisites: Nil

L	T	P	O	C
4	0	0	8	4

Total Lecture Sessions: 52

Course Outcomes:

CO1: Demonstrates a knowledge of the relationship between Language and society.
CO2: Demonstrates the ability to use the conventions of grammar, vocabulary, and pronunciation to communicate effectively in a variety of contexts.
CO3: Develop and deliver effective presentations and speeches on a variety of topics using technology.
CO4: Demonstrates the ability to read and comprehend a variety of text types and write for different purposes.

Language, Society, and learning: Language acquisition and Language learning—Notion of first language, second language and others—Language variation and social variation— Languages, dialects and varieties— Bilingualism, Multilingualism and its advantages—Cultural transmission of language: language and gender; language and identity; language and power—Constitutional provisions and National Education Policy 2020

Grammar in Communication: Verb and Tenses—Conditionals—Multi word verbs: Phrasal verbs, Collocations—Phrase and clause in practice: Relative clauses, adverb clauses, dangling modifiers—Linking devices, Common errors

Speaking and Pronunciation: Pronunciation and intelligibility: Speech sounds, Tone- Stress, Pitch and Intonation —Tone and pitch in communication—Sense groups and connected speech—Speech and discourse markers—Speaking with confidence—Delivering speeches and presentations—Public speaking—Active listening

Critical reading and writing: Skimming and Scanning—Close Reading - Comprehension – Summarizing and Paraphrasing - Analysis and Interpretation - Literary/Knowledge Texts—Structure of an essay: argumentative, analytical, comparative—Writing as a process: outlining, drafting, revising and proof reading.

References:

1. Mark Hancock, *English Pronunciation in Use.* Cambridge UP. 2003.
2. Martin Hewings, *Advanced Grammar in Use: A Reference and Practice Book for Advanced Learners of English*. 2nd edition, Cambridge University Press, 2005.
3. Sudarshana N. P., Savitha C., English for Technical Communication, Cambridge English, 2016.
4. Valdes J. M., *Culture Bound*, Cambridge University Press. 1986.
5. Kumar S., Lata P., Communication Skills, Oxford University Press, 2015.
6. Grant Taylor, *English Conversation Practice,* McGraw Hill, 2001.

ED1053E Understanding India – I (Indian Ethos and Knowledge Systems)

Pre-requisites: Nil

L	T	P	O	C
2	0	0	4	2

Total Lecture Sessions: 26

Course Outcomes:
CO1: Develop an understanding of ancient Indian knowledge, tradition and culture and explain its potential benefits in modern times.
CO2: Appreciate ancient Indian art, literary, visual and cultural texts and identify its aesthetic and creative elements.
CO3: Familiarize with ancient Indian ideas of kingship, governance and law and appraise its benefits for individuals and society.
CO4: Gain an understanding of ancient Indian economy, its institutions, trade and revenue and identify its relative merits.
CO5: Demonstrate an understanding of traditional environmental practices and health traditions and justify its relevance in the 21st century.

Introduction to the Knowledge of India: Indian Knowledge Systems- scope and significance, need to revisit our ancient knowledge, traditions, and culture.

Culture - Art and Literature: Ancient Indian aesthetics, Rasa theory, Fine arts (Traditional art forms, Arts and spirituality, Arts and identity), Impact of globalization, Performing Arts (Indian dance systems, traditional Indian music, Dramaturgy, visual arts, folk arts, etc.). Literature with special reference to traditional institutions and value systems found in Sanskrit literature, Religious literature, Oral traditions, Folk literature, Sangam literature of South India and Vernacular literature- Bengali, Marathi etc.

Polity, Law and Economy: Kingship-types of government-Local village administration, Ancient Law: Dharma as basis, Criminal Justice, Courts, Police, Jails and punishments; Chanakyaniti-its relevance for modern day, Overview of Indian Economy from the Stone Age to the Guptas; Arthashastra and its relevance; Caste system and relation to professions, guilds, economic institutions; Harappan civilization-economy, agriculture growth of new occupations, Temple economy, Internal / external trade and commerce, trade routes, Indo-roman contacts, and maritime trade of South India. Land ownership - land grants and property rights, land revenue systems.

Environment and Health: Equilibrium between society and environment: Traditional Indian perception of natural resources like forests, land, water, and animals, Sustainable architecture and urban planning; Solving today's environmental challenges (best practices from indigenous knowledge, community-led efforts, etc.), India's Health Tradition: Ayurveda, Siddha, Ashtavaidya, Unani, and other schools of Medicine; Lessons from Sushruta Samhita and Charaka Samhita, Mental health in ancient India: Its time-tested concepts of mental wellness (concept of mind, dhyana, mind-body relationship, Ayurveda, yoga darshan, atman, etc.)

References:
1. Books

1. A.L. Basham (ed.), *A Cultural History of India*, 7th edition, Oxford University Press, 2003.
2. A.L. Basham, *The Wonder That Was India,* Volume 1, Picador, 2019.
3. B.Mahadevan, Vinayak Rajat Bhat, R.N. Nagendra Pavana, *Introduction to Indian Knowledge Systems: Concepts and Applications,* PHI Learning, 2022.
4. B. N. Lunia, *Evolution of Indian Culture –From the earliest times to the present day*, 1992
5. Mohan Raghavan, M.S. Harsha Simha, C.R. Ramaswamy, *Elements of Indic Knowledge Systems and Heritage*, HTSR Institute2023
6. Samskrita Bharati, *Pride of India: A Glimpse in to India's Scientific Heritage*, 2006.

2. Websites

1. Indian Culture. https://www.indianculture.gov.in/
2. Indian Knowledge Systems, Govt. of India. https://iksindia.org/
3. Ministry of Culture, Govt. of India. https://indiaculture.gov.in/
4. Visual arts. CCRT. https://ccrtindia.gov.in/resources/visual-arts/

ED1351E Mechanics

L	T	P	O	C
4	0	0	8	4

Pre-requisites: Nil

Total Lecture Sessions: 52

Course Outcomes:

CO1: Solve problems in mechanics and oscillations using Newton's equations of motion.

CO2: Formulate and solve problems in the dynamics of rigid bodies using angular momentum and torque.

CO3: Analyze oscillatory behavior under different conditions.

CO4: Analyze planetary motion and Kepler's laws in terms of central force dynamics.

Vectors and kinematics: motion in a plane, circular motion, polar coordinates, velocity and acceleration in polar coordinates. Review of Newtonian mechanics: Force, Newton's II law and equations of motion, momentum, energy and work, conservative systems, systems of particles, center of mass, conservation of linear momentum.

Angular momentum, moment of inertia, torque, rotational dynamics. Conservation of angular momentum. Motion in non-inertial frames, Coriolis and centrifugal forces, Foucault pendulum, central forces, gravitational force and motion, Kepler's laws.

Oscillations, simple harmonic oscillations, forced oscillations, damping, resonance, coupled oscillators, normal modes – waves, wave equation, solution of wave equation, sound waves, elastic waves, superposition of waves.

References:

1. D. Kleppner and R. J. Kolenkow, An Introduction to Mechanics,1st Edition, McGraw Hill, 2017.
2. D. J. Morin, Introduction to Classical Mechanics: With Problems and Solutions, Cambridge University Press, 2008.
3. K. R. Symon, Mechanics,3rd Edition, Pearson, 2016.
4. D. Halliday, R. Resnick and J. Walker, Fundamentals of Physics 10th Edition, John Wiley and Sons.

ED1251E Calculus

Pre-requisites: Nil

L	T	P	O	C
3	1	0	8	4

Total Lecture Sessions: 39

Course Outcomes:

CO1: Evaluate limits, continuity and differentiability of single and multivariable functions.
CO2: Find the maxima and minima of real valued functions of two variables.
CO3: Apply single and multiple integrals, including transformations, to compute arc length, area, volume, and surface area.
CO4: Formulate and compute line and surface integrals and apply Green's, Gauss, and Stokes' theorems.

Functions of one variable: limit, continuity - differentiability - local maxima and local minima - mean value theorems- Taylor's theorem - L'hôpital's rule - integration - fundamental theorem of calculus - arc length, volume and surface of solid of revolution. Improper Integral, Gamma and Beta functions and their properties, applications of definite integrals

Functions of Several Variables, Definitions of Limit, Continuity and Partial Differentiation, Gradient and Directional derivative, chain rule, Total differential, Differentiability, Taylor's series for functions of two variables, Maxima and Minima of Functions of two Variables, Lagrange's method of multipliers.

Double and Triple integrals, change of order of integration, Jacobians and Change of variables with applications to polar, cylindrical and spherical coordinates.

Vector fields, divergence and curl, Parameterization of curves and surfaces, Line integrals, Scalar Potential, surface integral, Green's, Gauss and Stokes' theorems and related applications.

References:

1. H. Anton, I. Bivens and S. Davis, Calculus, 10th edition, John Wiley & Sons, 2015.
2. G. B. Thomas, M. D. Weir and J. Hass, Thomas' Calculus, 12th edition, Pearson Education, India, 2015.
3. E. Kreyszig, Advanced Engineering Mathematics, 10th edition, John Wiley & Sons, 2015
4. T. M. Apostol, Calculus , 1st edition, Wiley, 2014.

ED1151E Chemistry I

Pre-requisites: NIL

L	T	P	O	C
4	0	0	8	4

Total Lecture Sessions: 52

Course Outcomes:

CO1: Develop comprehensive knowledge and understanding of the fundamental principles of inorganic and organic chemistry.
CO2: Rationalize the structure–property relationships of inorganic compounds using established chemical principles.
CO3: Analyze and interpret the key concepts, terminology, and reaction mechanisms in organic chemistry.

Building blocks of chemistry: Chemistry at the fundamental level is about molecules, their constituent particles. Thomson's and Rutherford's models of atoms, spectral emissions from atoms, and Bohr's model of the atom.

Chemical bonding: the concept of bond order, bond length, and bond strength, and the concepts of hybrid and molecular orbitals. Bonding in homo- and heteronuclear diatomic molecules.

Brønsted and Lewis acid/base concepts, relative acid and base strengths, the concept of pKa, and pH. Non-aqueous solvents, HSAB principle, and superacids.

Oxidation and reduction reaction: electrochemical series; redox reactions; balancing of redox equations.

Coordination Compounds: Nomenclature, geometries, and isomerism of coordination compounds; applications of coordination compounds in biology and industry.

Nomenclature, hybridization and geometry of organic compounds, electronic effects: inductive, resonance and hyperconjugation, reaction intermediates: carbocations, carbanions and radicals, nucleophiles and electrophiles, acidity and basicity in organic molecules, mechanistic approach and energy profile diagrams.

Stereochemistry: optical activity, projection formula, CIP rules and conformational analysis, geometrical isomerism (*E*/*Z*).

Substitution, addition, and elimination reactions, mechanistic aspects and stereochemical considerations, electrophilic and nucleophilic aromatic substitution: nitration, halogenation, Friedel-Crafts reaction, sulfonation, reactivity of substituted benzene derivatives.

References:

1. P. Atkins, T. Overton, J. Rourke, F. Armstrong, and M. Hagerman, Shriver and Atkins' Inorganic Chemistry, 5ed, W. H. Freeman and Company New York, 2009.
2. G. L. Miessler and D. A. Tarr, Inorganic Chemistry, 3ed, Pearson, 2008.
3. J. E. House, Inorganic Chemistry, 3ed, Academic Press, 2019.
4. J. E. Huheey, E. A. Keiter, and R. L. Keiter, Inorganic Chemistry – Principles of Structure and Reactivity, 4 ed, Pearson Education, 2006.
5. J. Clayden, N. Greeves, S. Warren and P. Wothers, Organic Chemistry, 2 ed., Oxford University Press, 2012.
6. J. McMurry, Organic Chemistry, 9 ed., Cengage Learning, 2015.

Semester-II

ED1054E Mathematical and Quantitative Reasoning

Pre-requisites: Nil

L	T	P	O	C
1	1	0	4	2

Total Lecture Sessions:13

Course Outcomes:

CO1: Adapt mathematical reasoning to solve problems in the real world and explain the fundamental ideas and tenets in this field.
CO2: Interpret & deduce the right conclusions from numerical representations like formulas, graphs, or tables.
CO3: Demonstrate critical thinking and problem-solving skills using mathematical and quantitative reasoning methods.
CO4: Analyze mathematical, quantitative and reasoning problems and evaluate the solutions.

Foundations of Quantitative Reasoning
Concepts: Meaning, nature, and scope of quantitative reasoning.
Mathematization: Moving from concrete problems to abstract mathematical models.
Applications: Importance of logic and numeracy in social sciences and daily decision-making.

Data Sources in the Indian Education System
Data requirement, Understanding Literacy Rates, Key Indicators: School enrolment, Gross Enrolment Ratio (GER), Net Enrolment Ratio (NER), and Dropout Rates.
Different sources of data: Census of India: History and the nature of data collected.
National Surveys: NFHS (National Family Health Survey) and NSSO.
Institutional Data: UDISE (Unified District Information System for Education) and its role in school education.

Data Analysis, Interpretation & Analytics
Descriptive Statistics: Measures of Central Tendency (Mean, Median, Mode) and Variability (Range, Standard Deviation).
Data Visualization: Construction and interpretation of Bar Diagrams, Histograms, and Pie Charts.
Learning Analytics: Introduction to how data is used to track student progress and improve learning outcomes.
Practical Interpretation: Reading tables and graphs specifically related to educational reports.

References:

1. V.G. Kulkarni, Quantitative Methods in Social Sciences, Oxford University Press.
2. S.P. Gupta, Statistical Methods, Sultan Chand & Sons, 46th Ed. 2021.
3. John W. Creswell, Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research, Pearson Education, 2015.
4. Darrell Huff, How to Lie with Statistics W. W. Norton & Company, 1993.
5. Jeffrey O. Bennett and William L. Briggs, Using and Understanding Mathematics: A Quantitative Reasoning Approach, 6th Edition, Pearson Education, 2015.
6. Government of India Reports, UDISE+ Flash Statistics & Census of India Handbooks: https://dashboard.udiseplus.gov.in/report-new-v.6-demo2025/static/media/UDISE+2022_23_Booklet_existing.d209e7c7516d77939da9.pdf

ED1055E Understanding India – II (Indian Ethos and Knowledge Systems)

Pre-requisites: Nil

L	T	P	O	C
2	0	0	4	2

Total Lecture Sessions: 26

Course Outcomes:

CO1: Demonstrate an understanding of ancient Indian knowledge, tradition and culture and evaluate its relevance in present times.

CO 2: Analyze key Indian philosophical ideas, ethics and values and explain its position.

CO 3: Demonstrate an understanding of ancient Indian linguistic traditions and explain its significance.

CO 4: Show an awareness of traditional Indian dress, food and health practices and appraise its potential benefits.

CO 5: Appreciate the contribution of Indian science and technology and identify the efficacy of ancient scientific concepts in day-to-day life.

Introduction of Knowledge of India: Recap of the previous semester's definitions and knowledge.

Philosophy, Ethics & Values: Schools of Philosophy: Vaishesika, Nyaya, Samkhya, Yoga, Purva Mimansa and Vedanta or Uttara Mimansa (theory and the major thinkers) – Jain, Buddhist, and Charvak traditions; Vedanta: philosophical systems (Advaita, Vishishtadvaita, Dvaita); Ethics, morality, and social dilemma (including self-leadership) and their relevance in today's time; How do Indians value spirituality? Spirituality and Social Responsibility; Importance of Spirituality in current times; Using ethics in a technologically volatile world: leading an ethical and modern life; Practical Vedanta for well-being (mindfulness, inter-connectedness, society-self relationship, etc.).

Culture-Lifestyle:

Language as culture and identity, Ancient Indian Linguistics and oral traditions, Evolution of different Indian languages-Ancient grammarians and their contributions, Food (regional cuisines, ayurvedic diet, food and festival, food and hospitality, impact of globalization), Clothes (traditional Indian clothing, Textile arts- handmade- texture-embroidery, clothing status- for occasions-significance of colour-varieties for gender, impact of globalization), The lifestyle of Yoga; adapting ancient lifestyle – A path towards longevity, Indian spirituality- Importance of spirituality in current times, Sports (traditional Indian sports, martial arts, sports and gender, impact of globalization).

Science & Technology:

Arithmetic and Logic, Natural sciences: Mathematics, Physics, Chemistry, Metallurgy, Astronomy: India's contributions to the world, Indian notions of time and space, Technology in the economy: agriculture, transportation, etc.

References:

1. Books

7. A.L. Basham (ed.), *A Cultural History of India*, 7th edition, Oxford University Press, 2003.
8. A.L. Basham, *The Wonder That Was India,* Volume 1, Picador, 2019.
9. B.Mahadevan, Vinayak Rajat Bhat, R.N. Nagendra Pavana, *Introduction to Indian Knowledge Systems: Concepts and Applications,* PHI Learning, 2022.
10. B. N. Lunia, *Evolution of Indian Culture –From the earliest times to the present day*, 1992
11. Mohan Raghavan, M.S. Harsha Simha, C.R. Ramaswamy, *Elements of Indic Knowledge Systems and Heritage*, HTSR Institute2023
12. Samskrita Bharati, *Pride of India: A Glimpse in to India's Scientific Heritage*, 2006.

2. Websites

5. Indian Culture. https://www.indianculture.gov.in/
6. Indian Knowledge Systems, Govt. of India. https://iksindia.org/
7. Ministry of Culture, Govt. of India. https://indiaculture.gov.in/
8. Visual arts. CCRT. https://ccrtindia.gov.in/resources/visual-arts/

ED1056E Yoga and Understanding Self

Pre-requisites: Nil

L	T	P	O	C
2	0	0	4	2

Total Lecture Sessions: 26

Course Outcomes:

CO1: Explain the historical development and philosophical foundations of Yoga.
CO2: Describe the importance of practicing Yoga Asana.
CO3: Apply the ethical principles of Yoga (Yamas and Niyamas) in daily life.
CO4: Demonstrate practical knowledge of Pranayama and meditation for mental well-being.
CO5: Practice basic Yoga Asanas/ Kriyas.

Philosophical and Historical Perspective of Yoga

Concept and Meaning of Yoga, Philosophy of Yoga, Objective of Yoga Historical Evolution: Overview of Ancient (Vedic), Classical (Patanjali's Yoga Sutras), and Modern Yoga.
Relevance: Importance of Yoga for health, stress management, and a balanced lifestyle in the modern era.

Schools of Yoga and Ethical Principles

Major Streams: Introduction to Gnana (Knowledge), Bhakthi (Devotion), and Karma (Action) Yoga, Construction of Yoga Practice for all round development, Principles of Yoga: - Ahimsa, Satya, Asteya, Brachmacharya, Aparigraha, Shoucha, Santhosha, Tapas, swadyaya and Isvara Paridhana.

Modern Principles of Yoga and Meditation

Modern Principles: Human Body as a holistic entity, Pranayama: Concept of life force, importance of breath control, and techniques (Nadi Shodhana, Bhramari). Meditation: The process of Dharana (Concentration) and Dhyana (Meditation); techniques for mental clarity.
Yoga as a Way of Life: Cultivating peace, harmony, and love; using Yoga to understand the 'Self' as described in Indian philosophy. Teacher's Perspective: The role of reflective practice in personal and professional growth.

References:

1. Swami Vivekananda, Raja Yoga (Fundamentals of Yoga philosophy).
2. B.K.S. Iyengar, Light on Yoga (Basic principles and postures).
3. NCERT, Yoga: A Healthy Way of Living (Specifically designed for UG/College students).
4. Peter Connolly*, A Student's Guide to the History and Philosophy of Yoga,* Equinox Publishing Limited, 2014.
5. L. D. Allman, *Yogic Wisdom*, Page Publishing, 2020.
6. M. A. Keneipp, *Meditation, An Ancient Practice for Modern Time,* Robertson Publishing. 2018.
7. N. K. Fard*, Principles of Teaching Yoga to Kids*, Balboa Press, 2020.
8. Dr. K.S. Joshi, Yoga in Daily Life (Practical instructions).
9. Ravindra Kumar, Yoga for Beginners (Comprehensive guide).

ED1057E Language II- Malayalam

Pre-requisites: Nil

L	T	P	O	C
4	0	0	8	4

Total Lecture Sessions: 52

Course Outcomes:

CO1: മലയാള ഭാഷയിലുള്ള വായന, എഴുത്ത്, സംസാരം, ശ്രവണം എന്നിവയിൽ പ്രാവീണ്യം നേടുക.
CO2: വ്യാകരണ പിശകുകളില്ലാതെ ആശയങ്ങൾ വ്യക്തമായി പ്രകടിപ്പിക്കാൻ ശീലിക്കുക.
CO3: സാഹിത്യകൃതികളെ വിമർശനാത്മകമായി വിശകലനം ചെയ്യാനും സർഗ്ഗാത്മകമായി പ്രതികരിക്കാനും പ്രാപ്തരാവുക.

ആശയവിനിമയത്തിന്റെ അടിസ്ഥാനങ്ങൾ
ഭാഷയും വിനിമയവും: ഭാഷയുടെ നിർവ്വചനങ്ങൾ, മനുഷ്യഭാഷയുടെ സവിശേഷതകൾ.
വിനിമയ പ്രക്രിയ: വാമൊഴി, ശരീരഭാഷ (Body Language), എഴുത്ത്, നിരീക്ഷണം.
വിനിമയ മാതൃകകൾ: സങ്കേതനം (Encoding), വിസങ്കേതനം (Decoding), ഓർഗനോൺ മാതൃക (ചുരുക്കത്തിൽ).
ഭാഷയും സമൂഹവും: ഭാഷാഭേദങ്ങൾ, മാനകഭാഷ (Standard Language), ഇന്ത്യൻ ഭാഷാസാഹചര്യം.

വ്യാകരണവും ഭാഷാവിശകലനവും
അടിസ്ഥാന ഘടകങ്ങൾ: വർണം, അക്ഷരം, ലിപി, അക്ഷരമാല (സ്വരം, വ്യഞ്ജനം, ചില്ലുകൾ).
ശരിയായ ഉച്ചാരണം: വർഗ്ഗാക്ഷരങ്ങൾ, സംവൃതോകാരം, കടന്നുവന്ന പദങ്ങൾ (തത്സമം, തത്ഭവം).
സന്ധിയും പദഘടനയും: ലോപം, ആഗമം, ദ്വിത്വം, ആദേശം. സമാസം, വിഭക്തി (അടിസ്ഥാന ധാരണകൾ).
വാക്യരചന: ചിഹ്നനം (Punctuation) - കോമ, ഫുൾസ്റ്റോപ്പ്, ചോദ്യചിഹ്നം തുടങ്ങിയവയുടെ കൃത്യമായ ഉപയോഗം. എഴുത്തിലെ സൂക്ഷ്മതയും ഔചിത്യവും.

വായനയും സാഹിത്യപാഠങ്ങളും
വായനാനൈപുണി: വായനയുടെ രീതികൾ - വിമർശനാത്മക വായന, ആശയരൂപീകരണം.
വിശദപഠനം (കൃതികൾ):
നോവൽ: പ്രേമലേഖനം - വൈക്കം മുഹമ്മദ് ബഷീർ (ഹാസ്യവും സാമൂഹിക വിമർശനവും).
കഥ: നെയ്യായസം - മാധവിക്കുട്ടി (സ്ത്രീപക്ഷ വായന, വികാരം).
കവിത: തിരസ്കാരം - കെ.ജി. ശങ്കരപ്പിള്ള (ആധുനികത, പ്രതിഷേധം).
ലേഖനം: കല ജീവിതത്തെ എങ്ങനെ സ്പർശിക്കുന്നു - കുട്ടിക്കൃഷ്ണമാരാർ (സൗന്ദര്യശാസ്ത്രം).

പ്രായോഗിക ഭാഷാ വിനിയോഗം
എഴുത്ത് നൈപുണി: ഉപന്യാസം, കത്തുകൾ, റിപ്പോർട്ട് തയ്യാറാക്കൽ, നവമാധ്യമ രചന (ബ്ലോഗ്, സോഷ്യൽ മീഡിയ).
പ്രഭാഷണ നൈപുണി: പ്രഭാഷണം, സംവാദം, അവതരണ കല, ശരീരഭാഷയുടെ പ്രാധാന്യം.
ശ്രോതൃനൈപുണി: സജീവമായ കേൾവി (Active Listening), കുറിപ്പെടുക്കൽ (Note-making).
അക്കാദമിക രചന: അക്കാദമിക ആവശ്യങ്ങൾക്കായുള്ള ചിന്താശേഷിയും അപഗ്രഥന നൈപുണികളും.

References:

1. കുട്ടിക്കൃഷ്ണമാരാർ, മലയാളശൈലി.
2. എ.ആർ. രാജരാജവർമ്മ, ശബ്ദശോധിനി.
3. കല്പറ്റ നാരായണൻ, എഴുത്തുകാർക്ക് ഒരു പണിപ്പുര.
4. ഡോ. പി.എം. ഗിരീഷ്, ഭാഷയും അധികാരവും.
5. കെ.എസ്. നാരായണപിള്ള, ആധുനിക മലയാള വ്യാകരണം.

ED1058E Language-II Hindi

Pre-requisites: Nil

Total Lecture Sessions: 52

L	T	P	O	C
4	0	0	8	4

Course Outcomes:

CO1: Enable the students to acquire basic skills in functional language of Hindi
CO2: Develop independent reading skills and appreciate literary works in Hindi
CO3: Internalize grammar rules to facilitate fluency in speech and writing in Hindi
CO4: Develop functional and creative skills in Hindi language

History of Language and Literature

Hindi Bhasha ka Itihas - Aadi kaal, Madhya Kaal aur Aadhunik Kaal, Hindi Grammar Kaal and Kriya, Hindi Sahitya ka Itihas - Aadi kaal, Madhya Kaal, Riethi Kaal aur Aadhunik Kaal

Poetry

kbeer ke Paanch Dohe, Suryakant Tripathi Nirala: Joohi ki Kali, Dhoomil Sudhama Panday: Proud Siksah, Nagarjun: Aakal Aur Uske Bad, Ramdarash Mishra: Chidiya, Kedarnath Singh: Aakal Me Saras (For Extra Reading), Jitendra Sreevastava: Mein Ik Chidiya Hoom Pappa.

Gadya

Harishankar Parsai: Premchandh ke Phate Juthe (Nibandh), Bhagavathi Sharan Varma: Sbse Bada Aadmi (Ekanki), Mohan Rakesh:Uski Roti (Short Story) (For Extra Reading), Bhishm Sahani: Chief ki Dawat (Short Story), Uday Prakash: Aparadh (Short Story), Chitra Mudgal: Domin Kaaki (Lakhu kadha)

References:

1. Ramchandra Shukla, Hindi Sahitya Ka Itihas, Rajkamal Prakashan.
2. Dr Nagendra, Hindi Sahitya Ka Itihas, Mayoor Paperbacks.
3. Maneger Panday, Bhakti Aandolan aur Surdaska Kavya, Vani Prakashan.
2. Dr Ramdars Mishra, Hindi Kahani- Antarang Pahchan, Vani Prakashan.
3. Namvar Singh, Hindi Ka Gadyaparva, Rajkamal Prakashan.
4. Dr Ramvilas Sharma, Bhasha, Yugbodh aur Kavita, Vani Prakashan.
5. Dr P Ravi, Kavita ka Vartmaan, Vani Prakashan.
6. Ramswaroop Chaturvedi, Hindi Kvaya ka Itihas, Lokbharti Prakashan.
7. Kailash Nath Panday, Prayojanmoolak Hindi ki Nayee Bhoomika, Rajkamal Prakashan Samooh.
8. Kamta Prasad Guru, Hindi Vyakaran, Sahitya Sarowar.

ED1352E Electricity and Magnetism

Pre-requisites: Nil

Total Lecture Sessions: 52

L	T	P	O	C
4	0	0	8	4

Course Outcomes:

CO1: Apply concepts of vector calculus to describe electric and magnetic fields.
CO2: Identify simplifying principles like symmetry to compute electric and magnetic fields.
CO3: Formulate and solve problems involving time dependent electromagnetic fields using Maxwell's equations.
CO4: Analyze propagation of electromagnetic waves in vacuum and dielectric media.

Electrostatic force and field: scalar and vector fields, Coulomb's law, flux of the electric field and Gauss's law, divergence of electric field, electric potential, line integral of the field, curl of the electric field, Poisson and Laplace equation, electrostatic work and energy, conductors and electric fields, field and potential of dipoles, electric polarization vector, Gauss's law for a dielectric medium, electrostatic boundary conditions.

Magnetostatics: Electric current, current density, surface and volume currents, continuity equation, magnetic field, Biot-Savart law, divergence and curl of magnetic field, Ampere's law, field due to a magnetic dipole, magnetic dipole in an external magnetic field, magnetostatic energy, magnetized materials, magnetostatic boundary conditions.

Electromotive force: Faraday's law, Lenz's law, electromagnetic induction, mutual and self- inductance, Maxwell's equations, Maxwell's correction to Ampere's law, displacement current, electromagnetic field, energy density, Poynting's theorem.

Maxwell's equations: In free space, wave equation, plane wave solutions, structure of the electro-magnetic waves, propagation in dielectric medium and refractive index.

References:

1. D. J. Griffiths, *Introduction to Electrodynamics,* 4th Edition, PHI Learning, 2012.
2. E. Purcell and D. Morin, *Electricity and Magnetism,* 3rd Edition, Cambridge University Press, 2013.
3. D. Halliday, R. Resnick and J. Walker, *Fundamentals of Physics, 10th Edition*, John Wiley & Sons, 2013
4. R. P. Feynman, R. Leighton and M. Sands, *Feynman Lectures on Physics Vol.- I,* Millenium Edition, Pearson, 2012.
5. J. Edminister, *Schaum's Outline: Theory and Problems in Electromagnetics,* 2nd Edition, McGraw-Hill, 1979.

ED1252E Matrix Algebra and Differential Equation

Pre-requisites: Nil

L	T	P	O	C
3	1	0	8	4

Total Lecture Sessions: 39

Course Outcomes:

CO1: Apply matrix and algebraic techniques to solve systems of equations and related problems.
CO2: Analyze vector spaces and linear transformations using appropriate mathematical tools.
CO3: Compute and interpret eigenvalues and eigenvectors for matrix analysis and applications.
CO4: Solve and analyze differential equations, including systems, using standard methods.

Basic Matrix Operations, special matrices, elementary row operations, row reduced echelon form, determinant and trace, inverse of a matrix, linear independence and dependence, rank of a matrix, solvability of linear equations, Gauss-Jordan elimination, subspaces of R^n and C^n, span of vectors, basis and dimensions, matrix as a linear transformation, eigen values and eigen vectors, characteristic polynomial, Cayley-Hamilton Theorem, diagonalization.

First order ODEs: Exact equations, Integrating factors , Existence and uniqueness theorem, examples on non-uniqueness. Second and Higher order linear ODEs with constant coefficients, Wronskian, Method of undetermined coefficients, Method of variation of parameters, Cauchy-Euler equation. Solution of system of ODEs using matrix method.

References:

1. Kreyszig E., Advanced Engineering Mathematics, 10th Edition, Wiley, 2011.
2. Singh A., Introduction to Matrix Theory, Springer, 2021.
3. Jain R.K. and Iyanger S.R.K., Advanced Engineering Mathematics, 5th edition, Narosa Publication, 2015
4. Zill D.G. and Wright W.S., Advanced Engineering Mathematics, 4th Edition, Viva, 2011.

ED1152E Chemistry II

Pre-requisites: NIL

L	T	P	O	C
4	0	0	8	4

Total Lecture Sessions: 52

Course Outcomes:

CO1: Develop a fundamental understanding of the principles of thermodynamics, kinetic theory, and equations of state to describe the macroscopic behavior of matter.
CO2: Apply thermodynamic and kinetic concepts to analyze chemical and phase equilibria, electrochemical systems, and reaction rates quantitatively.
CO3: Introduce the microscopic basis of physical chemistry through quantum mechanics and spectroscopy, enabling interpretation of molecular structure and energy levels.

Ideal gas laws and equations of state; real gas behavior and compressibility factor; van der Waals equation and critical constants; kinetic theory of gases and derivation of pressure; molecular interpretation of temperature and kinetic energy; Maxwell–Boltzmann distribution and molecular speeds (mean, RMS, most probable); mean free path and collision frequency; transport properties (diffusion, viscosity, thermal conductivity)

Thermodynamic systems, variables, and state vs path functions; work and heat, reversible and irreversible processes; First Law of thermodynamics and internal energy; enthalpy and heat capacities; thermochemistry (Hess's law); temperature dependence of enthalpy (Kirchhoff's law); adiabatic processes; Joule–Thomson effect and liquefaction of gases; Second Law of thermodynamics and spontaneity; Carnot cycle and efficiency; entropy and its physical significance; entropy changes in ideal gases and phase transitions; Clausius inequality and irreversibility; Gibbs and Helmholtz free energies; criteria for spontaneity and equilibrium; Maxwell relations and thermodynamic identities; Third Law of thermodynamics and absolute entropy

Law of mass action and equilibrium constant; thermodynamic derivation of equilibrium condition (ΔG and K); temperature dependence of equilibrium (van't Hoff equation); Le Chatelier principle (quantitative aspects); phase rule and phase diagrams; Clausius–Clapeyron equation and applications; electrochemical cells and redox processes; origin of electrode potentials and electromotive force; Nernst equation and its applications; relationship between Gibbs free energy, EMF, and equilibrium; conductance, ionic mobility, and Kohlrausch law (introductory)

Rate of reactions and rate laws; order and molecularity; integrated rate equations (zero, first, second order); experimental determination of rate laws; temperature dependence of reaction rates (Arrhenius equation); collision theory and activation energy; reaction mechanisms (elementary steps, steady-state approximation); catalysis (homogeneous, heterogeneous, enzyme kinetics basics)

Failure of classical physics (blackbody radiation, photoelectric effect); de Broglie hypothesis and wave–particle duality; Schrödinger equation; particle in a box and quantization; interaction of radiation with matter; rotational spectroscopy (rigid rotor model); vibrational spectroscopy (harmonic oscillator model); interpretation of molecular spectra

References:

1. B. R. Puri, L. R. Sharma, M. S. Pathania, *Principles of Physical Chemistry*, 47th ed., Vishal Publishing Co., 2016.
2. A. Bahl, B. S. Bahl, G. D. Tuli, *Essentials of Physical Chemistry*, 28th ed., S. Chand Publishing, 2022.
3. P. Atkins, J. de Paula, *Atkins' Physical Chemistry*, 11th ed., Oxford University Press, 2018.
4. R. Chang, J. W. Thoman Jr., *Physical Chemistry for the Chemical Sciences*, University Science Books, 2014.
5. M. Paul. *Physical Chemistry: Understanding Our Chemical World*., John Wiley & Sons, 2008
6. D. A. McQuarrie, J. D. Simon, *Physical Chemistry: A Molecular Approach*, University Science Books, 1997.