Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Physics
B.Tech. (Engineering Physics)

First Year of Four Years of B.Tech. (Engineering Physics) B.Tech. I, Semester-I WAVES AND MECHANICS EP 101	Scheme	L	T	P	Credit
		3	1	0	4

1.	Course Outcomes (COs): At the end of the semester students will be able to
CO1	Provide a basic understanding of vector algebra and coordinate systems.
CO2	Define the concepts of various laws of motion and moments of inertia.
CO3	Explain Euler's concepts related to rigid body motion.
CO4	Interpret the elastic properties of materials and rephrase the concept of hydrodynamics.
CO5	Develop an understanding of simple harmonic motions via various applications.
CO6	Classify waves and oscillations.

2.	Syllabus	
	FUNDAMENTALS OF VECTOR ALGEBRA AND DIFFERENT COORDINATE SYSTEMS	**(07 Hours)**
	Unit vectors, Vector operations, Scalar and vector triple products, Vector algebra in terms of the components, Differential calculus, Cartesian coordinate system, Cylindrical coordinate system, Spherical coordinate system.	
	NEWTON'S LAWS OF MOTION, CONSERVATION LAWS, AND MOMENTS OF INERTIA	**(08 Hours)**
	Mechanics of single and many particles, Equation of motion, Various conservation laws, Moments of inertia, Motion in the central force field	
	RIGID BODY MOTION	**(08 Hours)**
	Euler's theorem, Angular momentum and kinetic energy, Euler's equation of motion, Euler's angles.	
	ELASTICITY AND HYDRODYNAMICS	**(08 Hours)**
	Stress and strain, Young's modulus, Shear modulus and Bulk modulus, Buoyancy, Types of fluid flow, Bernoulli's equation, Viscosity, Terminal velocity.	
	WAVES	**(07 Hours)**
	Wave Motion, Interference and the principle of superposition, Reflection and transmission of waves,Standing waves, Vibration, Transverse and longitudinal waves; Propagation of sound wave, its properties, Beats, Diffraction, Doppler effect.	
	OSCILLATIONS	**(07Hours)**
	Simple Harmonic Oscillations, Damped Oscillations, Coupled Oscillations, and Resonance.	
	Tutorials will be based on the coverage of the above topics separately (15 Hours)	
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

3.	**Tutorials**
1.	Proof of various relations formed using the different kind of vectors.
2.	Cover the various mechanical and electrical problems based on vector analysis.
3.	Though the numerical exercise one will learn the role of coordinate systems to solve the problems.
4.	Problems based on the motion of a single and many particles under the influence of different kindof forces.
5.	Projectile motion of particle, Motion of a charged particle in electromagnetic fields, Variousproblems related to moment of inertia.
6.	Numerical questions based on the aspects covered in the section of rigid body motion.
7.	Various types of questions for the calculation of stress, strain, young's modulus, shear modulus and bulk modulus;
8.	Numerical problems based on Bernoulli principles and terminal velocity.
9.	Basic numerical questions to understand the concept of waves on string and sound waves both andobtain various physical parameters used to quantify the waves.
10.	Problems based on simple harmonic motion, damped and coupled oscillations etc.

4.	**BOOKS RECOMMENDED**
1.	Mathur D. S., Mechanics, S. Chand & Company, 2022.
2.	Takwale R. G. & Puranik P. S., Introduction to Classical Mechanics, Tata McGraw-Hill Book Co., 2018.
3.	Feynman R. P., Lighton R. B. and Sands M., The Feynman Lectures in Physics Vol. 1, NarosaPublishers, 2021.
4.	Verma H. C., Concepts of Physics, Vol. 1 & 2, Bharati Bhavan, 2020.
5.	Landau L. D. & Lifshitz E M, Course on Theoretical Physics, Vol. 1: Mechanics, Addison- Wesley, 2012.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
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B.Tech. (Engineering Physics)

First Year of Four Years of B.Tech. (Engineering Physics) B.Tech. I, Semester-I BASICS OF ELECTRONICS EP 103	Scheme	L	T	P	Credit
		3	0	2	4

1.	Course Outcomes (COs): At the end of the semester students will be able to
CO1	Understand the basis concept of circuit analysis theorem
CO2	Demonstrate familiarity with basic electronic components and use them to design simple electronic circuits
CO3	Describe the application of transistors for Current and voltage amplification. Also, to describe the characteristics of different configurations of the transistor
CO4	Discuss the ideal of operational amplifier and their electrical parameters
CO5	Analyze and design the different types of Oscillators, and their applications

2.	Syllabus	
	BASIC CIRCUIT ANALYSIS	**(06 Hours)**
	Kirchhoff's current and voltage law, Network analysis, Superposition theorems.	
	SEMICONDUCTOR JUNCTION DIODES & APPLICATIONS	**(08 Hours)**
	The open circuit p-n junction, Energy bands in junction diode, I-V characteristics of p-n junction,diode as rectifier, Half-wave, full-wave, and bridge rectifier. Various applications of diode	
	SEMICONDUCTOR TRANSISTOR & APPLICATIONS	**(08 Hours)**
	Junction transistor, transistor construction, CB, CE and CC configurations, cut-off and saturation regions, transistor load-line, Quiescent point, Transistor as an amplifier, Current gain and voltagegain.	
	FREQUENCY RESPONSE OF AMPLIFIERS	**(07 Hours)**
	The gain-bandwidth product, frequency response of CB, CE and CC amplifier, Classification of amplifiers, Feed-back in amplifiers and its classification, Study of different properties with feed- back Amplifier applications.	
	OPERATIONAL AMPLIFIERS	**(08 Hours)**
	The differential amplifier, The basic operational amplifier, The emitter-coupled differential amplifier, Transfer characteristics of a differential amplifier, Offset error voltage and currents, Parameters, Frequency response.	
	OSCILLATORS	**(08 Hours)**
	Criteria for oscillation, tank circuit, L-C oscillator, Hertley Oscillator, Colpitts oscillator, The phaseshift oscillator, the Wien bridge oscillator, Crystal oscillator.	
	Tutorials will be based on the coverage of the above topics separately (15 Hours)	
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

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3.	**Practicals**
1.	Study and verification of Norton's Theorem.
2.	Study and verification of Thevenin's Theorem.
3.	Study and verification of Reciprocity Theorem.
4.	Study and verification of Superposition Theorem.
5.	Study and verification of Maximum Power Theorem.
6.	Study of Half Wave Rectifier.
7.	Study of Full Wave Rectifier.
8.	Study of Full Wave Bridge Rectifier.

4.	**Books Recommended**
1.	Ryder, J.D., Electronics fundamentals and applications: Integrated and Discrete Systems, Prentice – Hall of India, 2012.
2.	Sze, S.M., Physics of Semiconductor Devices, John Wiley & sons, 2018.
3.	Floyd, T.L., Electronic Devices (5th ed). Pearson education Asia, 2018.
4.	Malvino, A.P. Electronic Principles, Tata McGraw Hill, 2014.
5.	Mottershed, A., Electronic Devices and circuits, Prentice Hall India, 2017.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Physics
B.Tech. (Engineering Physics)

First Year of Four Years of B. Tech. (Engineering Physics) B. Tech. - I, Semester - I THERMODYNAMICS EP105	Scheme	L	T	P	Credit
		3	1	0	4

1.	**Course Outcomes (COs):** **At the end of the course, the students will be able to**
CO1	Explain the fundamental concepts of thermodynamics laws and thermodynamic processes
CO2	Acquire the knowledge of Maxwell's thermodynamics relations and thermodynamic potentials.
CO3	Learn the concepts of black body radiation from thermodynamics point of view.
CO4	Develop the fundamental concept of kinetic theory of gases.
CO5	Learn the properties of ideal gas and real Van der wall's gas state.

2.	**Syllabus**	
	FUNDAMENTALS OF THERMODYNAMICS	**(10 Hours)**
	Zeroth law of Thermodynamics, First and Second laws of Thermodynamics, Work done in different Thermodynamic process, Heat capacity and Specific heat capacity, Internal energy and entropy, Heat engine, Carnot Cycle and Theorem, Calculations of change of internal energy and entropy in various thermodynamic processes.	
	THERMODYNAMICS POTENTIALS & MAXWELL'S RELATIONS	**(08 Hours)**
	Internal Energy, Gibbs and Helmholtz energy, Gibb's paradox and its resolution, Enthalpy, Maxwell's thermodynamic relations, Application of Maxwell's thermodynamic relations.	
	THERMODYNAMICS OF BLACK BODY	**(06 Hours)**
	Black body and characteristics, Radiation principles like Rayleigh Jeans, Wein's and Planck's law of black body radiation	
	KINETIC THEORY OF GASES	**(07 Hours)**
	Maxwell Boltzmann equation, Postulates of kinetic theory of gases, velocity of gas molecules, Molecular energy, Kinetic-molecular model of an ideal-gas, kinetic interpretation of temperature, Degree of freedom of gas molecules, Maxwell's law of equipartition of energy.	
	TRANSPORT PROPERTIES	**(07 Hours)**
	Viscosity of a gas, Thermal conductivity of gases, Van der wall's equation of state, Brownian motion.	
	BASICS OF STATISTICAL PHYSICS	**(07 Hours)**
	Concept of microstate and macro-state, Phase space, Principle of equal a priori probabilities, Thermodynamic probability, Fermi Dirac, Maxwell Boltzmann and Bose Einstein distributions.	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**
		(Total Contact Time: 45 Hours + 15 Hours= 60 Hours)

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3.	**Tutorials**
1	Cover a variety of numerical problems to understand the concepts of thermodynamics.
2	Problems based on refrigerator, heat engine and Carnot engine to understand its working principle.
3	Calculation of various equilibrium quantities such as heat capacity, internal energy, pressure, volume, temperature etc. using the thermodynamics potential and Maxwell's relations.
4	Numerical exercise on Maxwell Boltzmann equation and distribution function to understand its concepts used in Kinetic Theory of gases.
5	Problems to obtain the various equilibrium quantities derived in the section of kinetic theory of gases.
6	Problems based on transport properties of gases mainly focused on the calculation of viscosity and thermal conductivity.
7	Problems based on radiation principles, Wein's and Planck's law related to the thermodynamics of black body radiation.
8	Basic problems to get idea about the various terminology used in statistical physics for example, microstate, macro state, configuration space, phase space, probabilities.
9	Problems based on Fermi Dirac, Maxwell Boltzman and Bose Einstein distributions.

4.	**Books Recommended**
1	Sears F. W. & Salingar, Thermodynamics, Kinetic theory and Statical Thermodynamics, 3rdEdition. Addison-Wesley/Pearson, 2023.
2	Young & Freedman, Sears and Zemanski's University Physics, Pearson Education, Singapore, 2022.
3	Feynman R. P., Leighton R. B. and Sands M., The Feynman Lectures in Physics, Vol.1 Narosa Publishers, 2018.
4	Zemanski M. W., Heat and Thermodynamics, McGraw Hill, 2022.

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B.Tech. (Engineering Physics)

First Year of Four Years of B. Tech. (Engineering Physics) B. Tech. - I, Semester - I NUMERICAL METHODS AND COMPUTER PROGRAMMING EP107	Scheme	L	T	P	Credit
		3	0	2	4

1.	Course Outcomes (COs): At the end of the semester students will be able to
CO 1	Students will be able to understand basics about error and numerical solution method for solving Algebraic and Transcendental Equations
CO 2	Analyze about interpolation and curve fitting method for solve real world problems
CO 3	Understand about method for Numerical integration and Ordinary Differential Equations
CO 4	Understand of basics of computers and programming language
CO 5	students will be able to simulate that physical science problems by knowing some compiler languages

2.	Syllabus	
	BASICS OF COMPUTER PROGRAMMING	**(10 Hours)**
	Operating systems, higher level compiler languages, algorithm; flow charting, C Language: Introduction to C language, identifiers and keywords, data types, constants and variables, arithmeticexpressions; input and output statements, conditional statements: while-loop, for-loop, do while– loop; arrays; logical operators and expressions, structures: switch, break and continue statements.	
	C PROGRAMMING	**(06 Hours)**
	C Language: functions; structures; pointer data type; random and sequential files, file handling in C.	
	NUMERICAL METHOD FOR FINDING ROOTS OF EQUATION	**(06 Hours)**
	Error in Numerical Calculation, Errors and their computations, Absolute, relative and percentageerrors, general error formula Solutions of Algebraic and Transcendental Equations, Bi-Section Method, Graphical Method, Regular False, Newton Raphson Method.	
	NUMERICAL INTERPOLATION AND POLYNOMIAL CURVE FITTING	**(07 Hours)**
	Interpolation, Finite Difference, Forward difference, backward difference, Central Difference, Newton interpolation formula, Lagrange interpolation formula, Least Square Fitting Method & Curve Fitting by polynomials.	
	NUMERICAL METHOD FOR INTEGRATION AND ORDINARY DIFFERENTIAL EQUATIONS	**(08 Hours)**
	Numerical Integration, Newton-Cote's formula, Trapezoidal, Simpson 1/3rd and 3/8th rule and Weddle rules.	

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	Numerical Solutions of Ordinary Differential Equations: Euler, Picard and Taylor series methods,Runge–Kutta 2nd order and 4th order method.	
	C PROGRAMMING PRACTICE	**(08 Hours)**
	C Programs: Program writing in C for interpolation, integration, roots of equations, matrixdiagonalization, solution of differential equations. Good programming practices.	
	Practical will be based on the coverage of the above topics separately	**(30 Hours)**
	(Total Contact Time: 45 Hours + 30 Hours = 75 Hours)	

3.	**Practicals**
1	Error in numerical computation, error in construction of a model, approximations, Truncationerror and their estimation
2	Solutions of Algebraic and Transcendental Equations using Newton Raphson method.
3	Interpolation using Lagrange's formula.
4	Linear square fitting and Curve fitting by polynomials method.
5	Numerical Integration using Simpson 1/3rd method.
6	Numerical Solutions of Ordinary Differential Equations using Runge–Kutta Method.
7	Writing and testing C program for Error calculation.
8	Writing and testing C program for Newton Raphson method.
9	Writing and testing C program for Lagrange's formula.
10	Writing and testing C program for Curve fitting.
11	Writing and testing C program for Simpson 1/3rd method.
12	Writing and testing C program for Runge–Kutta Method.

4.	**Books Recommended**
1	Chapra S. C. and Canale R. P., Numerical Methods for Engineers. 7th Edition, TataMcGraw Hill, 2021.
2	Sastry S. S., Introductory Methods of Numerical Analysis, 2nd Edition, PHI, 2022.
3	Hoffman J. D., Numerical Methods for Engineers and Scientist, 2nd Edition, CRC Press, 2018.
4	Xavier C., C Language and Numerical Methods, 2nd Edition, New Age publishers, 2024.
5	Herbert Scheldt, C: The Complete Reference, 4th Edition, McGraw Hill Education, 2018.

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Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Physics
B.Tech. (Engineering Physics)

First Year of Four Years of B. Tech. (Engineering Physics) B. Tech. - I, Semester - I MATHEMATICS FOR PHYSICAL SCIENCES-I MA123	Scheme	L	T	P	Credit
		3	1	0	4

1.	Course Outcomes (COs): At the end of the semester students will be able to
CO1	Explain the basic concept of ordinary differential equation with its different forms and methods.
CO2	Discuss the related Applications in Mathematical Modelling and with knowledge of Ordinarydifferential equations, can resolved here.
CO3	Narrate about the series solution and Frobenius series solution with different point.
CO4	Illustrate the PDE with linear and Non-linear equations and its solution.
CO5	Discuss the Vector calculus and System of Linear Algebraic equations.

2.	Syllabus	
	ORDINARY DIFFERENTIAL EQUATION	**(10Hours)**
	Reorientation of differential equation first order first degree, exact differential equation and Integrating factors, first order higher degree odes, solvable for p, y and x, Solution of homogenous equations higher order, complementary functions, Particular Integrals, Linear differential equation with variable coefficient, Cauchy's Euler and Legendre's equation with variable coefficient, Method of variation of parameters.	
	APPLICATION OF DIFFERENTIAL EQUATION (MATHEMATICAL MODELLING)	**(07 Hours)**
	Modeling of Real world problems particularly Engineering System, Electrical network models (LCR),spread of epidemic (SI, SIS, SIR), Newton's Law of cooling. Single compartment modelling, Bending of beam models.	
	SERIES SOLUTION AND SPECIAL FUNCTIONS	**(07 Hours)**
	Regular point, Singular point, series solution of ODE of 2nd order with variable coefficient with special emphasis to differential equation of Legendre's and Bessel's for different cases of roots of indicial equations.	
	INRODUCTION TO PARTIAL DIFFERENTIAL EQUATION	**(08 Hours)**
	Introduction to Partial differential equation, Formation of partial differential Equation, Partial differential Equation of first order, Linear partial differential equation of first order (Pp+Qq-R) and method of obtaining its general solution, Non-linear partial differential equation of first order f(p, q)=0, f(z.,p.,q)=0, f(x, p)=g(y,q), z=px + qy +f(p,q).	
	VECTOR CALCULUS	**(07 Hours)**
	Scalar and vector point function, differential operator, gradient, directional derivative, divergence, curl and Laplacian operator with their properties, Line integral, Surface Integral, Volume integral, Green's, Gauss and Stokes theorem (Only statement) & application.	

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	SYSTEM OF LINEAR ALGEBRIC EQUATION	**(06 Hours)**
	Linear systems, Elementary row and column transformation, rank of matrix, consistency of linear system of equations, Linear Independence and Dependence of vectors, Gauss Elimination method, Gauss-Jorden Method, Gauss-Jacobi Iteration Method	
	Tutorials will be based on the coverage of the above topics separately.	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1	Tutorial one will be related to Ordinary differential equations.
2	Tutorial two, also will be on ordinary differential equations with variable co-efficient.
3	Tutorial three will be on different examples of ordinary differential equations.
4	Tutorial four will be on Mathematical modelling.
5	Tutorial five will be on Series solution and other special cases of it.
6	Tutorial six will cover partial differential equations.
7	Tutorial seven will be on examples of partial differential equations.
8	Tutorial eight will be on Vector Calculus.
9	Tutorial nine will be on applications of Area, Volume.
10	Tutorial ten will be on system of linear algebraic equations

4.	**Books Recommended**
1	Kreyszing E., Advanced Engineering Mathematics, John Wiley & Sons, Singapore, Int Student Ed. 2015.
2	James Steward De, Calculus, Thomson Asia, Singapore, 2003.
3	O'Neel Peter., Advanced Engg. Mathematics, Thompson, Singapore, Ind. Ed. 2002.
4	Hilderband, F. B., Methods of Applied mathematics, PHI, New Delhi, 1968
5	Wiley C. R., Advanced Engineering Mathematics, McGraw Hill Inc., New York Ed. 1993,
	Reference Books
1	Ramana D. V., Higher Engg. Mathematics, The MaGraw-Hill Inc., New Delhi, 2007.
2	Hay George E., Vector and Tensor Analysis. Dover Publications, 2012.
3	Srimanta Pal, Subodh C. Bhunia, Engineering Mathematics, Oxford University Press, New Delhi, 2015.
4	Boas.Mary L., Mathematical Methods in the Physical Sciences, John Wiley & Sons,Ed.2005.
5	Kapur. J. N., Mathematical Models in Biology and Medicine. East west Press, New Delhi 1985.

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Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Physics
B.Tech. (Engineering Physics)

First Year of Four Years of B. Tech. (Engineering Physics) B.Tech. I /M.Sc. I: Semester I/ II INDIAN VALUE SYSTEM AND SOCIAL CONSCIOUSNESS HS120	Scheme	L	T	P	Credit
		2	0	0	2

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	interpret the important values that need to be cultivated
CO2	analyse the cultures depicted in Ramayana, Mahabharata, Jainism and Buddhism
CO3	review the structure of Indian knowledge system
CO4	discuss the significance of constitution of India
CO5	demonstrate social responsibility

2.	Syllabus	
	HUMAN VALUES AND CONSCIOUSNESS	**(08 Hours)**
	Human Values Definition and Classification of Values; The Problem of Hierarchy of Values andtheir Choice; Self-Exploration; 'Basic Human Aspirations; Right understanding, Relationship and Physical Facility; fulfilment of aspirations; Understanding Happiness and Prosperity, Harmony at various levels. What Is Consciousness? ; Can We Build A Conscious Machine?; Levels Of Consciousness; Mind,Matter And Beyond; Holistic Lifestyle; Dealing With Anxiety; Connecting Mind To Brain; Minds, Brains, And Programs.	
	INDIAN CULTURE AND HERITAGE	**(07 Hours)**
	Culture and its salient features: The Vedic – Upanishadic Culture and society, Human aspirations in those societies; Culture in Ramayana and Mahabharata: The Ideal Man and Woman, Concepts Maitri, Karuna, Seela, Vinaya, Kshama, Santi, Anuraga – as exemplified in the stories and anecdotes of the Epics; The Culture of Jainism: Jaina conception of Soul, Karmaand liberation, Buddhism as a Humanistic culture; The four Noble truths of Buddhism; Vedanta and Indian Culture;	
	INDIAN KNOWLEDGE SYSTEM	**(08 Hours)**
	Indian knowledge as a unique system, Place of Indian knowledge in mankind's evolution, Relevance of Indian knowledge to present day and future of mankind, Nature of Indian Knowledge; Structure of Indian Knowledge: Types of knowledge (para, apara), The scientific and the unscientific, Instruments for gaining and verifying knowledge, Knowledge traditions: Lineages, Instruments - debate, epistemology and pedagogy, The inverted tree – axiomatic, deductive, empirical knowledge, and evolution of knowledge; Disciplines of Study: A brief outline of	

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	the subjects, the major contributions and theories along with timelines where relevant: Mathematics; Astronomy; Physical Sciences; Cosmogony; Language studies;Astrology; Moral studies/righteousness; Statecraft and political philosophy	
	INDIAN CONSTITUTION	**(04 hours)**
	History of Making of the Indian Constitution; Philosophy of the Indian Constitution: Preamble; Salient Features; Contours of Constitutional Rights & Duties; Organs of Governance: Parliament; Composition; Qualifications and Disqualifications; Powers and Functions	
	SOCIAL RESPONSIBILITY	**(03 Hours)**
	Social Responsibility: Meaning and Importance, Different Approaches of Social Responsibility. Social Responsibility of Business towards different Stakeholders. Evolution and Legislation ofCSR in India.	
		(Total Contact Time: 30 Hours)

3.	**Books Recommended**
1	D. K. Chaturvedi, Professional Ethics Values and Consciousness, Ane Books Pvt. Ltd., 2023.
2	R.R. Gaur, R Sangal, G. P. Bagaria, Human Values and Professional Ethics, Excel Books, New Delhi, 2010.
3	A.N. Tripathi, Human Values, New Age Intl. Publishers, New Delhi, 2004.
4	P R Rao, Indian Heritage and Culture, Sterling Publishers Pvt. Ltd, 1988.
5	D. Singh, Indian Heritage and Culture, APH Publishing Corporation, 1998.
6	Sri Prashant Pole, Treasure Trove of Indian knowledge, Prabhat Prakashan, 2021.
7	Sri Suresh Soni, Sources of our cultural heritage, Prabhat Prakashan, 2018.
8	D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Physics
B.Tech. (Engineering Physics)

First Year of Four Years of B. Tech. (Engineering Physics) B. Tech. - I, Semester - II BASICS OF ELECTROMAGNETICS EP102	Scheme	L	T	P	Credit
		3	1	0	4

1.	Course Outcomes: At the end of the semester students will be able to
CO1	Outline briefly the basics of vector algebra, various coordinate systems and differential calculus.
CO2	Explain the Coulomb's law and Gauss's law and their applications in electrostatics.
CO3	Classify the electric fields in conductors and dielectrics and extend it to understand the polarization effects and apply to boundary value problems.
CO4	Explain the Ampere's law and related aspects, and their applications in magnetostatics.
CO5	Explain the magnetic fields in matter and examine magnetization in linear and nonlinear media.

2.	Syllabus	
	VECTOR CALCULUS	**(06 Hours)**
	Vector Algebra, Coordinate Systems and Transformations, Differential Length, Differential Area and Differential Volume; Line, Surface and Volume Integrals, Gradient, Divergence, Curl and Laplacian (Cartesian & Polar Coordinates)	
	ELECTROSTATICS	**(06 Hours)**
	Coulomb's Law, Intensity of Electric field, Gauss's Law and its Application, Divergence and curl of Electric Field, Electric Potential, Work and Energy in Electrostatics.	
	SPECIAL TECHNIQUES	**(08 Hours)**
	Laplace's equation, The method of images, Separation of variables, Multipole expansion	
	ELECTRIC FIELDS IN MATTER	**(08 Hours)**
	Polarization, The Field of a Polarized Object, The electric Displacement, Linear Dielectrics	
	MAGNETOSTATICS	**(08 Hours)**
	The Lorentz Force Law, The Biot-Savart Law, The Divergence and Curl of B, Applications of Ampere's Law, Magnetic Vector Potential	
	MAGNETIC FIELDS IN MATTER	**(08 Hours)**
	Magnetization – Diamagnets, Paramagnets, Ferromagnets, The field of a Magnetized Object, The	

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	Auxiliary Field H, Linear and Nonlinear media,	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1.	Numerical problems based on vector algebra, various coordinate systems and differential calculus.
2.	Problems related to the calculation of electric fields and potentials using coulomb' law and Gauss's law.
3.	Numerical problems based on Laplace's equation, The method of images.
4.	Numerical Problems related to Separation of variables, Multipole expansion.
5.	Problems for the calculation of polarization and fields due to a polarized objects.
6.	Problems related to electric displacement and the calculation of energy and forces in dielectric systems.
7.	Problems based on the Lorentz force law, the Biot-Savart Law and Ampere's law.
8.	Problems based on magnetic vector potentials.
9.	Problems for the calculation of magnetization and the field due to a magnetized object.
10.	Numerical exercise for the calculation of the Auxiliary field H and other problems based on linear and nonlinear media.

4.	**Books Recommended**
1.	Griffiths D. J., Introduction to Electrodynamics, 3rd Edition, Pearson Education, 2022.
2.	Jackson J. D., Classical Electrodynamics, 3rd Edition, Wiley, 2018.
3.	Sadiku M.N.O., Elements of Electromagnetics, 6th Edition, Oxford university press, 2022.
4.	Landau L. D., Lifshitz E. M., The Classical Theory of Fields, Course of Theoretical Physics: Vol. 2, 3rd Edition, Pergamon Press, 2021.
5.	Edminister J. A., Schaum's Outline series, Theory and Problems of Electromagnetics, McGraw Hill, 2023.

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Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Physics
B.Tech. (Engineering Physics)

First Year of Four Years of B.Tech. (Engineering Physics) B.Tech. - I, Semester - II INTRODUCTION TO PYTHON PROGRAMMING EP104	Scheme	L	T	P	Credit
		3	0	2	4

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	Learn the basics of programming and create your first program in Python IDLE.
CO2	Implement Conditional Statement concepts in your programming.
CO3	Use different Python Libraries and Create an application with the support of graphics in Python.
CO4	Write code using functions, files, and exception handling.
CO5	Implement Python to Physics and Machine Learning problems.

2.	Syllabus	
	INTRODUCTION	**(08 Hours)**
	Introduction: The Programming Language, History, features, Debugging: Syntax Errors, Runtime Errors, Semantic Errors, Experimental Debugging, Formal and Natural Languages Features of Python, Python installation and setup, Python IDLE and basic operations, Writing and executing Python programs, Variables and data types, Basic operations, Input/output operations	
	CONDITIONAL STATEMENTS	**(08 Hours)**
	Conditional Statements: if, if-else, nested if–else Looping: for, while, nested loops Control statements: Terminating loops, skipping specific conditions	
	INTRODUCTION TO POPULAR PYTHON LIBRARIES	**(07 Hours)**
	Introduction to popular Python libraries (e.g., NumPy, Pandas, Matplotlib), Introduction to data analysis and visualization in Python, working with data using Python libraries (e.g., Pandas, Matplotlib). GUI Programming With Tkinter, import the module – Tkinter, create the main window (container), add any number of widgets to the main window, and apply the event trigger on the widgets.	
	OVERVIEW OF LISTS, TUPLES AND DICTIONARIES	**(10 Hours)**
	Lists: Values and Accessing Elements, Lists are mutable, traversing a List, Deleting elements from List, Built-in List Operators, Concatenation, Repetition, In Operator, Built-in List functions and methods Tuples and Dictionaries: Tuples, accessing values in Tuples, Tuple Assignment, Tuples as return values, Variable-length argument tuples, Basic tuples operations, Concatenation, Repetition, in Operator, Iteration, Built-in Tuple Functions Creating a Dictionary, Accessing Values in a dictionary, Updating Dictionary, Deleting Elements from Dictionary, Properties of Dictionary keys, Operations in Dictionary, Built-In Dictionary Functions, Built-in Dictionary Methods.	

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

	FILE HANDLING and INTRODUCTION TO ML & AL	**(12 Hours)**
	Files: Text Files, The File Object Attributes, Directories Exceptions: Built-in Exceptions, Handling Exceptions, Exception with Arguments, User-defined Exceptions. Introduction to machine learning and its applications, Introduction to popular Python libraries for machine learning (e.g., scikit-learn, TensorFlow).	
	Practical will be based on the coverage of the above topics separately.	**(30 Hours)**

(Total Contact Time: 45 Hours + 30 Hours= 75 Hours)

3.	**Practical**
1	Program to calculate the sum and average of a list of numbers using functions.
2	Write a program that prints a giant letter A like the one below. Allow the user to specify how large the letter should be.
3	Program to read data from a CSV file using the Pandas library and perform data analysis.
4	Program to plot & save graph of sine wave and cosine wave using Matplotlib.
5	Program to create a class representing a student and calculate their grades based on specific criteria.
6	Program to calculate the mean, median, and mode of a list of numbers using NumPy and statistics.
7	Program to implement linear regression using the scikit-learn library for a given dataset.
8	Program to calculate the roots of a quadratic equation using the math library.
9	Program to compute the derivative of a given function using symbolic mathematics with SymPy.
10	Program to calculate the eigenvalues and eigenvectors of a matrix using NumPy.

4.	**Books Recommended:**
1	Zhang Y., An Introduction to Python and Computer Programming, Springer Verlag, Singapore, 2021.
2	Langtangen H.P., A Primer on Scientific Programming with Python, Springer, 2022.
3	Ham, D. A., Object-oriented Programming in Python for Mathematicians Paperback, 2023.
4	Johansson R., Numerical Python: Scientific Computing and Data Science Applications with NumPy, SciPy, and Matplotlib, Apress,2019.
5	Fuhrer C., Solem, J.E. and Verdier O., Scientific Computing with Python: High-performance scientific computing with NumPy, SciPy, and Pandas, Packt Publishing Limited, 2021.

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Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Physics
B.Tech. (Engineering Physics)

First Year of Four Years of B.Tech. (Engineering Physics) B.Tech. - I, Semester - II QUANTUM PHYSICS AND APPLICATIONS EP106	Scheme	L	T	P	Credit
		3	1	0	4

1.	Course Outcomes: At the end of the semester students will be able to
CO1	Remembering the origin of quantum theory and interpret the wave function properties
CO2	Explain the central potential and utilize it to describe the energy spectrum of hydrogen atom
CO3	Identify symmetries in quantum mechanics and interpret the angular momentum and spin in general
CO4	Apply the Schrödinger's time-independent equation in solving various quantum models, and many-body problems.
CO5	Interpret various technological applications of quantum mechanics.

2.	Syllabus:	
	ORIGINS OF QUANTUM THEORY & APPLICATIONS	**(12 Hours)**
	The conceptual aspect, The state vectors, Bra-Ket notation, Hilbert space, Operators, Eigenfunctions, Eigenvalues, Commutation relations, Fourier transform, Kronecker and Dirac delta functions, Interpretation of the wave function, The postulates of quantum mechanics.	
	SCHRÖDINGER EQUATION AND RELATED PROBLEMS	**(10 Hours)**
	Equation of motion, Hamiltonian, Time dependent and time-independent Schrödinger equations, Infinite Potential Box, Potential well, Simple Harmonic Oscillator (SHO), etc.	
	CENTRAL POTENTIALS, ANGULAR MOMENTUM AND RADIAL SCHRÖDINGER EQUATION	**(12 Hours)**
	Spherically symmetric potentials, Angular momentum and its components in Spherical coordinate system, Eigenvalues of angular momentum, Spherical harmonics, Atomic orbitals, Reduced Radial Schrödinger Equation, Effective potential.	
	HYDROGEN ATOM PROBLEM	**(05 Hours)**
	The two-body problem, Solution of Hydrogen atom problem, Energy spectrum of Hydrogen atom.	
	TECHNOLOGY APPLICATIONS	**(06 Hours)**
	Tunnel Diode, Scanning Tunnel Microscope (STM), Magnetic Resonance Imaging (MRI), Quantum Computations with Qubits.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

3.	**Tutorials:**
1.	Numerical exercise on various pre-quantum principles and quantum postulates.
2.	Problems related to Bra-Ket algebra, Eigenstates and eigenvalues and Operators.
3.	Problems related to Commutation relations and Fourier transform.
4.	Problems related to Kronecker and Dirac delta functions.
5.	Numerical exercise on the applications of various quantum models.
6.	Problems based on the angular momentum operators.
7.	Problems based on radial Schrödinger equation, effective potential, etc.
8.	Numerical exercise related to Hydrogen atom problem and applications.

4.	**BOOKS RECOMMENDED:**
1.	L. I. Schiff, Quantum Mechanics, McGraw Hill Education, 4th Edition, 2017.
2.	A. K. Ghatak and S. Loknathan, Quantum Mechanics: Theory and Applications, Laxmi Publications, 2022.
3.	Zettili N., Quantum Mechanics: Concepts and Applications; Wiley; 3rd Edition, 2022.
4.	Bransden, B. H. and Joachain, C. J., Quantum Mechanics, Pearson Education; 2nd Edition, 2024.
5.	Mathews, P.M. and Venkateshan, K., A Text book of Quantum Mechanics; McGraw Hill Education, 2nd Edition, 2017.

Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Physics
B.Tech. (Engineering Physics)

First Year of Four Years of B.Tech. (Engineering Physics) B.Tech. - I, Semester – II MATHEMATICS FOR PHYSICAL SCIENCES -II MA118	Scheme	L	T	P	Credit
		3	1	0	4

1.	Course Outcomes (COs): At the end of the semester students will be able to
CO1	Explain about infinite series.
CO2	Discuss the Fourier series and periodic functions and with different period.
CO3	Narrate the Fourier transform and theorems.
CO4	Explain Complex Variables.
CO5	Illustrate basic of statistics and sampling theory and estimation.

2.	Syllabus	
	INFINITE SERIES	**(05 Hours)**
	Introduction, Positive term series, Comparison test, Cauchy's root test, D'Alembert's test, Raabe'stest, Logarithmic test, Integral test, Gauss's test.	
	FOURIER SERIES	**(07 Hours)**
	Definition, Fourier series with arbitrary period, in particular periodic function with period 2π. Fourier series of even and odd function, Half range Fourier series.	
	FOURIER TRANSFORM AND FOURIER TRANSFORM OF AN INTEGRAL	**(07 Hours)**
	Fourier transform and its operational properties, Fourier Integral theorem, Fourier Cosine and solution, transform of derivatives, Inversion formula for Fourier transforms.	
	COMPLEX VARIABLES	**(06 Hours)**
	Basic mathematical concept, Analytic function, Cauchy – Riemann equations, Harmonic functions, its applications, Linear transformation of complex domain, bilinear transformations, conformal mapping and its application, complex integration over closed contour.	
	BASIC OF STATISTICS AND PROBABILITY DISTRIBUTION	**(06Hours)**
	Reorientation of random experiments, events, probability and its distributions of Binomial &Poisson‟s, their properties and Normal distribution, jointly distributed random variables, expectedvalues, function of random variable moments, moment generating functions.	
	SAMPLING THEORY AND ESTIMATION	**(07 Hours)**
	Some basics of sampling, statistical inference, Random Samples, Sampling distribution, Sample mean, variance and other statistics, point estimate and interval estimate confidence of interval, maximum likehood estimate.	
	TESTING OF HYPOTHESIS	**(07 Hours)**

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	Sampling and Test of significance, Statistical hypothesis and significance, Type I and Type II errors,Test of significance. Level of Significance, single tail and two tail tests hypothesis Chi-square (2 χ) test, student's t Test of significance of the mean of a random sample, t-test for difference of meansof two small samples, Snedecor‟s variance ratio test or F-test and tis applications.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

3.	**Tutorials**
1.	Tutorial one will be related to infinite series.
2.	Tutorial two will be on different test of infinite series for its convergence.
3.	Tutorial three, will be on Fourier series.
4.	Tutorial four will be on Fourier transform.
5.	Tutorial five will cover examples of Fourier integral theorem.
6.	Tutorial six will be on Complex variables.
7.	Tutorial seven will cover basic of statistics.
8.	Tutorial eight will be based on Probability Distribution.
9.	Tutorial nine will be based on Sampling theory.
10.	Tutorial ten will be on Estimation: different test and its applications.

4.	**Books Recommended**
1.	Kreyszing E., Advanced Engineering Mathematics, John Wiley & Sons, Singapore, Int. Student Ed. 1995.
2.	Wiley C. R., Advanced Engineering Mathematics, McGraw Hill Inc., New York Ed. 1993
3.	O‟Neil Peter., Advanced Engg. Mathematics, Thompson, Singapore, Ind. Ed. 2002.
4.	Greenbar Michael D., Advanced Engg. Mathematics, Pearson, Singapore, Ind. Ed. 2007.
5.	Ramana D. V., Higher Engg. Mathematics, The MaGraw-Hill Inc., New Delhi, 2007.

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Sardar Vallabhbhai National Institute of Technology (SVNIT) Surat
Department of Physics
B.Tech. (Engineering Physics)

First Year of Four Years of B.Tech. (Engineering Physics) B.Tech. - I/ M.Sc. - I, Semester – I/II ENGLISH AND PROFESSIONAL COMMUNICATION HS110	Scheme	L	T	P	Credit
		3	1	0	4

1.	Course Outcomes (COs): At the end of the course, the students will be able to
CO1	show enhanced reception towards the use of English language.
CO2	choose and employ appropriate words for professional communication.
CO3	develop sentences and text in English coherently and formally.
CO4	demonstrate overall improvement in oral communication.
CO5	analyze and infer from written and oral messages.

2.	Syllabus	
	COMMUNICATION	**(05 Hours)**
	Introduction to Communication, Different forms of Communication, Barriers to Communicationand some remedies, Non-Verbal Communication – Types, Non-Verbal Communication in Intercultural Context.	
	VOCABULARY AND USAGE OF WORDS	**(05 Hours)**
	Common Errors, Synonyms, Antonyms, Homophones, and Homonyms; One Word Substitution; Misappropriations; Indianisms; Redundant Words.	
	LANGUAGE THROUGH LITERATURE	**(09 Hours)**
	Selected short stories, essays, and poems to discuss nuances of English language.	
	LISTENING AND READING SKILLS	**(06 Hours)**
	Types of listening, Modes of Listening-Active and Passive, Listening and note taking practice, Practice and activities. Reading Comprehension (unseen passage- literary /scientific/technical) Skimming and scanning, fact vs opinion, Comprehension practice	
	SPEAKING SKILLS	**(10 Hours)**
	Effective Speaking, JAM, Presentation Skills- types, preparation and practice. Interviews- types, preparation and mock interview; Group Discussion- types, preparation and practice.	
	WRITING SKILLS	**(10 Hours)**
	Prerequisites of effective writing, Memo-types, Letter Writing- types, Email etiquette and Netiquette, Résumé-types, Report Writing and its types, Editing.	
	Tutorials will be based on the coverage of the above topics separately	**(15 Hours)**
	(Total Contact Time: 45 Hours + 15 Hours = 60 Hours)	

Subject Code: ##nXX; ##: Department Identity, n: Year, XX: Subject Sequence number XX: last digit 0 (subject offered in both ODD and EVEN semesters, XX: 01 to 30 – last digit ODD and EVEN for ODD and EVEN semesters (Mandatory Core), XX: 31 to 50 (Optional Core), XX: 51 to 99 (Elective), Subjects list for Minor and Honor (M/H#1-4), Subjects list for Specialization track (#1-4) EG: Engineering Subject, SC: Science Subject (offered combinedly by departments) (SVNIT Surat)

3.	**Tutorials**
1	Letter and Resume
2	Group Discussion
3	Presentation Skills (Individual)
4	Role Play on Nonverbal communication
5	Group Presentation
6	Debate
7	Body language and intercultural communication
8	Listening Activities
9	Editing
10	Report Writing
11	Mock interviews
12	JAM

4.	**Books Recommended**
1	Kumar, Sanjay and Pushp, Lata. *Communication Skills*, 2nd Edition, OUP, New Delhi, 2015.
2	Raman, Meenakshi & Sharma Sangeeta. *Technical Communication Principles and Practice*, 3rdEdition, OUP, New Delhi, 2015.
3	Raymond V. Lesikar and Marie E Flatley. *Basic Business Communication skills for Empowering theInternet generation.* Tata McGraw Hill publishing company limited. New Delhi 2005.
4	Courtland L. Bovee, John V. Thill, and Mukesh Chaturvedi. "Business Communication Today." NinthEdition. Pearson, 2009.
5	Mike Markel. "Practical Strategies for Technical Communication," Bedford/ St. Martin's SecondEdition, 2016
6	Laura J. Gurak and John M. Lannon. "Strategies for Technical Communication in the Workplace,"Pearson, 2013.