

## BSMS-Physics

Semester V						
S. No	Course Code	Course Name	L	T	P	C
1	PH301T	<u>Electrodynamics</u>	2	1	0	6
2	PH302T	<u>Classical Mechanics</u>	2	1	0	6
3	PH303T	<u>Quantum Mechanics - I</u>	2	1	0	6
4	PH420T	<u>Electronics</u>	2	1	0	6
5	PH501T	<u>Mathematical Physics-II</u>	2	1	0	6
6	PH402L	<u>Electronics Laboratory</u>	0	0	3	3
		<b>Total Credits</b>				<b>33</b>

## BSMS-Physics

1	<b>Title of the course (L-T-P-C)</b>	<b>Electrodynamics (2-1-0-6)</b>
2	<b>Pre-requisite courses(s)</b>	Successful completion of PH102
3	<b>Course content</b>	<p>Review of electrostatics and magnetostatics.</p> <p>Electrodynamics: Differential and integral forms of Maxwell's equations, Scalar and vector potentials, gauge transformations, Coulomb and Lorentz Gauge; Maxwell's equations in terms of potentials. Energy and momentum in electrodynamics.</p> <p>Electromagnetic waves: Electromagnetic waves in non-conducting media: Monochromatic plane waves in vacuum, propagation through linear media; Boundary conditions; Reflection and transmission at interfaces. Fresnel's laws; Electromagnetic waves in conductors: Modified wave equation, monochromatic plane waves in conducting media, Dispersion: Dispersion in non-conductors, free electrons in conductors and plasmas. Guided waves.</p> <p>Retarded potentials, Electric dipole radiation, magnetic dipole radiation. Radiation from a point charge: Lienard-Wiechart potentials, fields of a point charge in motion, power radiated by a point charge.</p> <p>Electrodynamics and Relativity: Review of special theory of relativity, Lorentz transformations, Minkowski four vectors, energy-momentum four vector, covariant formulation of mechanics; Transformation of electric and magnetic fields under Lorentz transformations, field tensor, invariants of electromagnetic field, Covariant formulation of electrodynamics, Lorentz force on a relativistic charged particle.</p> <p>Waveguides, Resonant Cavities and Optical Fibers, Basics of Antennas.</p>
4	<b>Texts/References</b>	<ol style="list-style-type: none"> <li>(1) D. J. Griffith: Introduction to Electrodynamics, 4th edition, Pearson, 2015.</li> <li>(2) J.D. Jackson: Classical Electrodynamics, Wiley student edition, 3rd edition, 2007.</li> <li>(3) Modern Electrodynamics, Andrew Zangwill, Cambridge University Press, 2012.</li> <li>(4) Foundations of Electromagnetic Theory, J. R. Reitz, F. J. Milford, and R. W. Christy, Addison-Wesley, 4th edition, 2008.</li> <li>(5) W K H Panofsky and M Philips: Classical Electricity and Magnetism Addison Wesley, 2nd edition, 1962.</li> <li>(6) W Greiner: Classical Electrodynamics, Springer, 1998.</li> <li>(7) Hayt, William H., Jr., and John A. Buck, "Engineering Electromagnetics", 7th ed. McGraw-Hill, 2006.</li> <li>(8) M.A. Heald and J.B. Marion, Classical Electromagnetic Radiation, Saunders, 1983.</li> </ol>

## BSMS-Physics

1	<b>Title of the course (L-T-P-C)</b>	<b>Classical Mechanics (2-1-0-6)</b>
2	<b>Pre-requisite courses(s)</b>	Nil
3	<b>Course content</b>	<p>Review of Newtonian Mechanics - Newton's Laws of Motion and Conservation Laws.</p> <p>Principles of Canonical Mechanics - Constraints and generalized coordinates, Alembert's principle, Lagrange's equation, Hamilton's variational principle, canonical systems, symmetries and conservation laws, Noether's theorem, Liouville's Theorem.</p> <p>Central Force: Equations of motion Virial Theorem, Kepler's Laws, Scattering in a Central Force Field.</p> <p>Rigid Body: Euler angles, Coriolis Effect, Euler equations, moment of inertia tensor, motion of asymmetric top.</p> <p>Small Oscillations: Eigen value problem, frequencies of free vibrations and normal modes, forced vibration, dissipation.</p> <p>Special Theory of Relativity: Newtonian relativity, Michelson-Morley experiment, Special theory of relativity, Lorentz transformations and its consequences, addition of velocities, variation of mass with velocity, mass-energy relation, Minkowski four-dimensional continuum, four vectors.</p> <p>Hamiltonian Equation, Gauge transformation, canonical transformation, Infinitesimal transformation, Poisson brackets, Hamilton-Jacobi equations, Separation of variables.</p> <p>Lagrangian and Hamiltonian formulation of continuous systems.</p>
4	<b>Texts/References</b>	<ol style="list-style-type: none"> <li>1. Classical Mechanics: H. Goldstein, C. P. Poole, and J. Safko, Pearson 2011.</li> <li>2. Classical Mechanics: N. C. Rana and P. S. Joag, Tata McGraw Hill, 2017.</li> <li>3. Introduction to Classical Mechanics: David Morin, Cambridge University Press, 2008.</li> <li>4. Mechanics: L.D. Landau and E. M. Lifshitz, Butterworth-Heinemann, 3rd edition, 1982.</li> <li>5. Mechanics: From Newton's Laws to Deterministic Chaos, F. Scheck, Springer, 5th edition, 2010.</li> <li>6. Introduction to Classical Mechanics, R G Takwale and P S Puranik, Tata McGraw Hill, 2008.</li> </ol>

## BSMS-Physics

1	<b>Title of the course</b> (L-T-P-C)	<b>Quantum Mechanics - I</b> <b>(3-1-0-8)</b>
2	<b>Pre-requisite courses(s)</b>	PH101 MA101
3	<b>Course content</b>	<p>Review of Wave mechanics, Schrodinger equation, Uncertainty principle, wave packets, group velocity and phase velocity.</p> <p>Postulates of quantum mechanics, probability and probability current density, operators, eigenvalues and eigenfunctions. Bound states, delta-function potential, and harmonic oscillator.</p> <p>Formalism: Hilbert space, Observables, Eigenfunctions of Hermitian operator, Dirac's notation, matrix representations of vectors and operators, parity operation, matrix theory of harmonic oscillator.</p> <p>Theory of Angular Momentum: Spherical harmonics, eigenvalues of <math>L^2</math> and <math>L_z</math>, addition of angular momentum, commutation relations, degeneracies.</p> <p>Hydrogen atom, quantum numbers, two particle systems.</p>
4	<b>Texts/References</b>	<ol style="list-style-type: none"><li>1. Introduction to Quantum Mechanics, D. J. Griffiths and D. F. Schroeter, Cambridge University Press, 3<sup>rd</sup> edition, 2019.</li><li>2. Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press, 2017.</li><li>3. Principles of Quantum Mechanics, R. Shankar, Springer, 2014.</li><li>4. Quantum Physics, S. Gasiorowicz, John Wiley, 2000.</li><li>5. Quantum Mechanics, L. D. Landau and E.M. Lifshitz, Pergamon press, 1965</li></ol>

## BSMS-Physics

1	<b>Title of the course (L-T-P-C)</b>	<b>Electronics 2-1-0-6</b>
2	<b>Pre-requisite courses(s)</b>	--
3	<b>Course content</b>	Network theorems; application to simple circuits. Semiconductor basics, diodes, p-n junction devices, transistors; biasing schemes; small signal amplifiers; feed-back theory; oscillators; power supply; wave shaping circuits. Bipolar junction transistor: configurations, small signal amplifier, oscillators; JFET and MOSFET: characteristics, small signal amplifier. OP-AMP: Differential amplifiers; Op-Amp (741) circuits (amplifiers; scalar; adder; subtractors; comparator; logarithmic amplifiers; etc.) Digital electronics : Logic gates, Boolean algebra, Karnaugh maps, flip flops, shift registers, adders, counters, ADC and DAC.
4	<b>Texts/References</b>	<ul style="list-style-type: none"><li>• J. Millman, C. C. Halkias, C. D. Parikh, Integrated Electronics, 2nd edition, McGraw Hill Education (2017).</li><li>• A. P. Malvino, Electronic Principles, 7th edition, McGraw Hill Education (2017).</li><li>• R. L. Boylestad and L. Nashelsky, Electronic Devices and Circuit Theory, 11th edition, Prentice Hall (2013).</li><li>• D. P. Leach, A. P. Malvino and G. Saha, Digital Principles and Applications, 8th edition, McGraw Hill Education (2014).</li><li>• R. Gaekwad, Op-Amps and Linear Integrated Circuits, 4th edition, Prentice Hall of India (2015).</li></ul>

## BSMS-Physics

1	<b>Title of the course</b> (L-T-P-C)	<b>Mathematical Physics-II</b> <b>2-1-0-6</b>
2	<b>Pre-requisite courses(s)</b>	--
3	<b>Course content</b>	<ul style="list-style-type: none"><li>• Tensor analysis, Curvilinear coordinates.</li><li>• Group Theory, Group Representation, Irreducible representation. Lorentz Group SU(2) O(3)....</li><li>• Differential equations- boundary value problems–Sturm- Liouville theory.</li><li>• Fourier Analysis, Fourier Transforms, Convolution, Discrete FT.</li><li>• Dirac Delta Function, Green's function in 1-d, 2-d and 3-d</li><li>• Special functions: Gamma, Beta, Sterling Series, Riemann Zeta function, Hermite, Laguerre, Chebyshev, Elliptical Integrals</li><li>• Asymptotic series,</li><li>• Method of Steepest descent,</li><li>• Integral equations.</li></ul>
4	<b>Texts/References</b>	<ol style="list-style-type: none"><li>1. G. F. Simmons, Differential Equations with Applications and Historical notes, 2nd edition, Mc Graw Hill, 1991.</li><li>2. H. A. Hinchey, Introduction to Applicable Mathematics Part I, Wiley Eastern, 1980.</li><li>3. G. B. Arfken, H. J. Weber, F. E. Harris, Mathematical Methods for Physicists, 7th ed., Academic Press Prism Books, 2017.</li><li>4. P. Morse and H. Feshbach, Methods of Theoretical Physics, Vol.1, McGraw Hill, 1953.</li><li>5. V. Balakrishnan, Mathematical Physics, Ane Books 2017.</li><li>6. K. F. Riley, M. P. Hobson, H. J. Bence, Mathematical Methods for Physics and Engineering, 3rd edition, Cambridge University Press (2006).</li></ol>

## BSMS-Physics

1	<b>Title of the course (L-T-P-C)</b>	<b>Electronics Laboratory 0-0-3-3</b>
2	<b>Pre-requisite courses(s)</b>	--
3	<b>Course content</b>	<p>The following is the proposed list of experiments/topics for this lab:</p> <ul style="list-style-type: none"><li>• Diode properties of transistor junctions</li><li>• Transistor as function generator</li><li>• Characteristics of field-effect transistor</li><li>• Half and full-wave rectifier</li><li>• RC-coupled amplifier</li><li>• Differential amplifier circuits</li><li>• Unregulated and regulated power supply</li><li>• Wein bridge oscillator using OP-Amp</li><li>• Op-Amp as adder/subtractor/integrator/differentiator</li><li>• MOSFET characteristics</li><li>• Universality of NOR/NAND gates</li><li>• Verification of De Morgan's theorem</li><li>• RC/ LR/ LCR circuit</li></ul>
4	<b>Texts/References</b>	<ul style="list-style-type: none"><li>• J. Millman, C. C. Halkias, C. D. Parikh, Integrated Electronics, 2nd edition, McGraw Hill Education (2017).</li><li>• A. P. Malvino, Electronic Principles 7th edition, McGraw Hill Education (2017).</li><li>• R. L. Boylestad and L. Nashelsky, Electronic Devices and Circuit Theory 11th edition, Prentice Hall (2013).</li><li>• D. P. Leach, A. P. Malvino and G. Saha, Digital Principles and Applications 8 th edition, McGraw Hill Education (2014).</li><li>• R. Gaekwad, Op-Amps and Linear Integrated Circuits, 4th edition, Prentice Hall of India (2015).</li></ul>