COLLEGE: MBP GOVT. P.G. COLLEGE, ASHIANA, LUCKNOW

ACADEMIC CALENDAR : SESSION- (2023-2024)

NAME OF TEACHER: PROF. (DR.) M . TARIQ
DEPARTMENT: DEPARTMENT OF **PHYSICS**
CLASS: BSC (NEP)-I YEAR (**I SEMESTER**) (APPLICABLE FROM JULY 2023)(CREDITS:04)

S.NO.	CLASS (YEAR, SEMESTER)	PAPER	UNIT	TOPIC NAME	MONTHLY / WEEKLY PLAN	TEACHING PEDAGOGY	LEARNING OUTCOMES	ANY OTHER DETAIL
01	02	03	04	05	06	07	08	09
1	BSC (NEP) – I YEAR, I SEMESTER CREDITS-4 T:04	P-1 (MAJOR & MINOR) PHY-101- MECHANICS AND WAVE MOTION	**Course Outcomes:** 1. The students would clearly understand the conflict between Newtonian mechanics and Special Relativity and thus would know how the progress of the revolutionary scientific ideas is made through logical evidences and observations. 2. They would be able to understand the differences between inertial and noninertial frames and see how pseudo-forces arise in non-inertial frames. 3. They would have a clear understanding of the dynamics of conservative and non-conservative forces in real life such as in gravitational fields or mechanical systems having friction etc. 4. They would feel the thrill to know that the same set of laws that work for planetary and galactic motions also work in our daily life. Further, they would be able to do mathematical calculations with application of these laws to various objects and artificial satellites. 5. They would be able to understand and calculate various macroscopic elastic properties as the response of the widely used materials through the application of simple classical laws. 6. The students would be able to understand and apply the properties of oscillations (natural, damped and forced), and waves and appreciate their omnipresence in various phenomena around us.				
			UNIT-I	Galilean transformations of space and time and their relation to Newton's laws of motion. Strong and weak form of the Newton's third law of motion. Difference between Inertial and non-inertial frames. Action-at-a-distance and Mach's principle. Conclusions of	MIN. 14 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

				Michelson-Morley experiment. Chief arguments against Galilean relativity. Postulates of Special Relativity. Simple ideas of length contraction and time dilation. Energy and momentum in relativistic mechanics and modification of Newton's laws of motion. Concepts of gradient, divergence and curl of physical quantities. Simple application of Gauss's divergence and Stoke's curl theorems. Conservative and non-conservative forces, Conservation laws for energy and linear momentum and their relation to symmetries. Pseudo-forces in rotating frame. Coriolis force.				
			UNIT-II	Elastic and inelastic collisions and one and two dimensions. Centre of mass frame as the zero-momentum frame. Angular momentum, Torque, Conservation of angular momentum and its relation to isotropy of space. Rotational energy and inertia tensor. Moment of inertia for simple bodies (ring, disk, rod, solid and hollow sphere, solid and hollow cylinder, rectangular lamina). The combined translational and rotational motion of a rigid body on horizontal and inclined planes. 4 Elasticity,	MIN 14 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

				Relations between elastic constants. Twisting of hollow and solid cylinders. Torsional rigidity. Bending moment and Flexural rigidity in bending of beam. Geometrical moment of inertia. Depression for cantilever and supported beams.				
			UNIT-III	Reduction of a two-body central force problem in to one-body problem. Reduced mass for a pair of bodies. Relative and centre of mass motion with reduced mass. Motion of Planets, satellites and our solar system. Kepler's laws of planetary motion and their implications. Role of the inverse-square form of Newton's law of gravitation in determination of orbit. Motion of geo-synchronous and geo-stationary satellites. Elementary concepts of Global Positioning System (GPS) based on relativistic mechanics. Structure and motion of our Galaxy due to self gravity.	MIN 12 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
			UNIT-IV	Differential equation of simple harmonic motion and its solution. Damped and Forced harmonic oscillations, Sharpness of Resonance. Quality factor. Plane progressive waves in fluid media and pressure and energy distribution along the waves. Transport of energy along strings.	MIN 12 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

				Reflection of waves from free and fixed boundaries and phase change at the boundaries. Principle of superposition of waves. Standing waves and resonance. Phase and group velocity.				
			References: **Text Books:** 1. Daniel Kleppner and Robert Kolenkow, "An Introduction to Mechanics", (Mc Graw Hill), 2017. 2e. 2. Charles Kittel, Walter D. Knight, Malvin A. Ruderman, Carl A. Helmholz, Burton J. Moyer, "Mechanics (In SI Units): Berkeley Physics Course Vol 1", McGraw Hill, 2017, 2e. 3. Richard P. Feynman, Robert B. Leighton, Matthew Sands, "The Feynman Lectures on Physics - Vol. 1", Pearson Education Limited, 2012. 4. Halliday, Resnick and Walker, "Principles of Physics", (Wiley) 2018, 10e. 5. Frank S. Crawford, Jr, "Waves": Berkeley Physics Course Vol 3", McGraw Hill, 2017. 6. D.S. Mathur, "Mechanics", S. Chand Publishing, 1981, 3e. 7. R.K. Shukla and Anchal Srivastava, "Mechanics" Published by: New Age International (P) Limited Publishers. **Web References:** 1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8				**FINAL EVALUATION THROUGH INTERNAL ASSESMENT UPLODED ON LU EXAM PORTAL**
2	**BSC (NEP) – I YEAR, I SEMESTER CREDITS-4**	**P-2 (MAJOR)**	**Course Outcomes:** 1. The student will get an introduction to the discipline of optics and its role in daily life. 2. The optics course will give the student a basic knowledge of interference, diffraction and polarization. 3. The student will be able to analyze and calculate interference between light waves and application of the theory to various interferometers along with their practical applications. 4. The student would know the conditions for near and far-field diffraction and be able to calculate the far-field diffraction from gratings and simple aperture functions. 5. The student would understand how the polarization of light changes at reflection and transmission at interfaces.					

	T:04	**PHY-102-OPTICS**	**UNIT-1**	Electromagnetic nature of light; Superposition of light waves; Coherence, Spatial and temporal coherence; Interference, Division of Wavefront – Young's double slit experiment, Fresnel's Biprism, Lloyd's Mirror; Division of amplitude – Thin films (parallel and wedge shaped films), Newton's rings. Interferometers: Michelson's Interferometer, (i) Idea about form of fringes, (ii) Determination of wavelength, (iii) wavelength difference, (iv) refractive index and visibility of fringes; Fabry-Perot interferometer; Etalon	MIN 13 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
			UNIT-II	Diffraction; Fresnel Diffraction - Half period zones, Zone plate, diffraction at a straight edge and narrow wire; Fraunhoffer Diffraction – Diffraction at circular aperture, diffraction at single and double slits with derivation of equation for intensity and visibility; Diffraction grating, principal maxima and missing orders.	MIN 13 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
			UNIT-III	Resolving power; Rayleigh's criterion of resolution, Resolving power of grating and telescope. Polarization: polarization by reflection, polarizing angle, Brewster's law, Law of Malus; Polarization by dichroic crystals,	MIN 13 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

				birefringence, anisotropic crystals; Nicol prism, Retardation plates, Babinet compensator; Analysis of polarized light.				
			UNIT-IV	Optical activity and Fresnel's explanation; Specific rotation, Half shade and Biquartz polarimeters. Jones matrix, matrix representation of plane polarized waves, matrices for polarizers, retardation plates and rotators.	MIN 13 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
			References: **Text Books:** 1. F.A. Jenkins and H.E. White, Fundamentals of Optics, Tata McGraw Hill. 2. Brij Lal and N. Subrahmaniyam, Optics, S. Chand. 3. E.Hecht, Optics, Pearson. 4. A.K.Ghatak, Optics, Tata Mc Graw Hill. **Web References:** 1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8				**FINAL EVALUATION THROUGH INTERNAL ASSESMENT UPLODED ON LU EXAM PORTAL**

COLLEGE: MBP GOVT. P.G. COLLEGE, ASHIANA, LUCKNOW

ACADEMIC CALENDAR : SESSION- (2023-2024)

NAME OF TEACHER: PROF. (DR.) M . TARIQ
DEPARTMENT: DEPARTMENT OF **PHYSICS**
CLASS: BSC (NEP)-I YEAR (**II SEMESTER**) (APPLICABLE FROM JANUARY 2024)

S.NO.	CLASS (YEAR, SEMESTER)	PAPER	UNIT	TOPIC NAME	MONTHLY/WEEKLY PLAN	TEACHING PEDAGOGY	LEARNING OUTCOMES	ANY OTHER DETAIL
01	02	03	04	05	06	07	08	09
1	**BSC (NEP) – I YEAR, I I SEMESTER CREDITS-4 T:04**	**P-3 (MAJOR & MINOR) PHY-201- ELECTRICITY AND MAGNETISM**	**Course Outcomes:** After successful completion of this course, students will: 1. Understand the basic mathematical concepts related to Electromagnetic fields, and use the understanding of calculus along with basic principles to solve problems encountered in science. 2. Comprehend and apply the understanding of fundamental laws and concepts in electricity and magnetism, primarily with regard to Maxwell's laws, to explain natural physical processes and related technological advancements. 3. Learn about the origin and basic properties of static as well as dynamic Electric and Magnetic fields, and the kinds of physical phenomena they generate - Electromagnetic waves and their properties. 4. Account for the importance of electricity and magnetism in society, especially with regard to technological applications. 5. Visualize and design experiments based on the basic concepts of electricity and magnetism, and obtain information in order to explore physical principles.					
			UNIT-I	Electrostatics: Electric charge & types of electric charge densities, Coulomb's Law. General expression for Electric field E. Electric flux, Gauss's law (applications included). Divergence & Curl of Electrostatic field. Line integral of Electric field, Electric potential (V), Electric field as negative of gradient of electric potential (E = - ∇V), conservative nature of Electrostatic field. Electric	MIN 12 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

				potential and Electric field due to a Dipole, and Quadrupole. Force and torque on a Dipole in uniform as well as non-uniform Electric field. Electrostatic Energy of a configuration of charges, and uniformly charged sphere. Electric fields in Matter: Polarization, Polarization vector (P), Bound charges, Electric displacement vector (D), Electric Susceptibility and Dielectric constant. Relation between E, P and D. Lorentz local field, Clausius-Mossotti equation, Debye equation.				
			UNIT-II	Magnetostatics: Magnetic effect of currents, Magnetic field (B), Biot-Savart's Law (applications included). Ampere's Circuital law and its applications. Divergence and Curl of magnetic field. Scalar and Vector magnetic potential. Forces on a moving charge. Magnetic Force on a current carrying wire and its loop. Torque on a current loop in a uniform Magnetic Field. Current loop as a magnetic dipole and its dipole moment. Magnetic Properties of Matter: Magnetization vector (M), Magnetic Intensity(H), Magnetic Susceptibility and permeability. Relation between B, M and H.	MIN 12 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

				Types of Magnetic materials. B-H curve and Hysteresis.				
			UNIT-III	Time Varying Electromagnetic Fields: Faraday's laws of Electromagnetic Induction and Lenz's law. Induced Electric field, non- conservative nature of Induced electric field. Self and Mutual Induction (applications included). Selfinductance of a solenoid and toroid, Mutual inductance of two Coils. Energy stored in Magnetic Field. Skin effect. Motion of Electron in a changing Magnetic field – Betatron equation. Theory and working of the moving coil Ballistic galvanometer (applications included).	MIN 12 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
			UNIT-IV	Electromagnetic Waves: Equation of continuity of current, Displacement current, derivation of Maxwell's equations and physical significance of Maxwell Correction term. Electromagnetic waves in vacuum and isotropic Dielectric medium, Transverse nature of Electromagnetic waves, Energy density in Electromagnetic wave - Poynting vector.	MIN 14 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
			References:					**FINAL EVALUATION**

<table>
<tr>
<td></td>
<td></td>
<td></td>
<td colspan="5">

E.M. Purcell, “Electricity and Magnetism (In SI Units): Berkeley Physics Course Vol 2”, McGraw Hill, (2017), 2e.
Richard P. Feynman, Robert B. Leighton, Matthew Sands, “The Feynman Lectures on Physics - Vol. 2”, Pearson Education Limited, (2012).
David J. Griffiths, “Introduction to Electrodynamics” 4th Edition, (Cambridge Univ. Press 2020)
W.K.H Panofsky and M. Philips, “Classical Electricity and Magnetism” (Dover Books on Physics, 2012)
Arthur F. Kip, “Fundamentals of Electricity and Magnetism”, (McGrawHill, 1968)
J.H. Fewkes& John Yarwood, “Electricity and Magnetism”, Vol. I (Oxford Univ. Press, 1991).
B B Laud, “Electromagnetics”, New Age International (P) Limited.
D.C. Tayal, “Electricity and Magnetism”, Himalaya Publishing House Pvt. Ltd., 2019, 4e
N. Wadhwani, “Electricity and magnetism”, PHI Learning, ISBN: 9788120339651, 9788120339651
R.K. Shukla, “Introduction to Electricity & Magnetism”, HP Hamilton Limited.

<u>WEB REFERENCES:</u>
1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
</td>
<td>THROUGH INTERNAL ASSESMENT UPLODED ON LU EXAM PORTAL</td>
</tr>
<tr>
<td>2</td>
<td>BSC (NEP) – I YEAR,

I I SEMESTER

CREDITS-4

T:04</td>
<td>P-4

(MAJOR)

PHY 202-MECHANICS,

ELECTRICITY & MAGNETISM

AND OPTICS LAB</td>
<td colspan="5">
<u>Course Outcomes:</u>
Experimental physics has the most striking impact on the industry wherever the instruments are used to determine the thermal and electronic properties. The following outcomes are expected by this laboratory course:
1. Students will achieve measurement precision.
2. Students will verify the conceptual learning through experiments in these areas.
3. Students will better appreciate the theoretical concepts in mechanics, electricity and magnetism, and optics through experiments.
4. Online Virtual Lab Experiments are expected to give insight in the simulation techniques, and provide basis for modeling.
Lab Experiment List :
Students have to do total of 06 experiments from the following list taking any two experiments from each group. Students have to do three virtual experiments taking one each from the groups.
</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>(A)

Mechanics:</td>
<td>1. Determination of Young Modulus of the material of a beam by flexure
2. Determination of modulus of</td>
<td>MIN 10 LECTURES</td>
<td>DISCUSSIONS & OFFLINE TEACHING METHOD</td>
<td>STUDENTS WILLGET THE UNDERSTANDING OF THE TOPIC DISCUSSED.</td>
<td>EVALUATION THROUGH PRACTICALS AND DISCUSSIONS</td>
</tr>
</table>

				rigidity of a wire by statical method 3. Determination of 'g' by compound pendulum. 4. Determination of Surface Tension of water by capillary rise method. 5. Determination Coefficient of Viscosity of water. 6. Determination of the frequency of A.C. Mains				
			(B) **Optics**	1. Measurement of Dispersive power of a given prism 2. Determination of the wavelength of light by Newton's ring. 3. Measurement of height of tower by a Sextant 4. Verification of Brewster's Law 5. Determination of specific rotation of an optically active substance by polarimeter 6. Diffraction at a wire	MIN 10 LECTURES	DISCUSSIONS & OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH PRACTICALS AND DISCUSSIONS
			(C) **Electricity and Magnetism**	1. Determination of High resistance by leakage method. 2. Determination of Mutual Induction by Ballistic galvanometer. 3. Determination of Horizontal component of earth's magnetic field by earth inductor. 4. Determination of Magnetic field of a electro magnet by Ballistic galvanometer. 5. Determination of Time	MIN 10 LECTURES	DISCUSSIONS & OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH PRACTICALS AND DISCUSSIONS

				constant striking & extension Potential of neon bulb in CR circuit. 6. Magnetic field by Helmholtz coil.				
			Online Virtual Lab Experiment List/Link MECHANICS MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu / Virtual Labs at Amrita Vishwa Vidyapeetham https://vlab.amrita.edu/?sub=1&brch=74 1. Torque and angular acceleration of a fly wheel 2. Torsional oscillations in different liquids 3. Moment of inertia of flywheel 4. Newton's second law of motion 5. Ballistic pendulum 6. Collision balls 7. Projectile motion 8. Elastic and inelastic collision **Online Virtual Lab Experiment List / Link OPTICS** Virtual Labs at Amrita Vishwa Vidyapeetham https://vlab.amrita.edu/?sub=1&brch=189 1. Newton's Rings: Wavelength of light 2. Newton's Rings: Refractive index of liquid 3. Brewster's angle determination 4. Laser beam divergence and spot size Virtual Labs at Amrita Vishwa Vidyapeetham https://vlab.amrita.edu/index.php?sub=1&brch=281 5. Spectrometer: Refractive index of the material of a prism 6. Spectrometer: Dispersive power of a prism **Online Virtual Lab Experiment List / Link** ELECTRICITY AND MAGNETISM Virtual Labs at Amrita Vishwa Vidyapeetham https://vlab.amrita.edu/?sub=1&brch=192 1. Tangent galvanometer 2. Magnetic field along the axis of a circular coil carrying current 3. Deflection magnetometer 4. Van de Graaff generator 5. Barkhausen effect 6. Temperature coefficient of resistance 7. Anderson's bridge 8. Quincke's method				

			REFERENCES: 1. B.L. Worsnop, H.T. Flint, “Advanced Practical Physics for Students”, Methuen & Co., Ltd., London, 1962, 9e 2. S. Panigrahi, B. Mallick, “Engineering Practical Physics”, Cengage Learning India Pvt. Ltd., 2015, 1e 3. Anchal Srivastava and R.K. Shukla,“Practical Physics (Electricity, Magnetism and Electronics)”, Published by: New Age International (P) Limited Publishers 4. R.L. Boylestad, L. Nashelsky, “Electronic Devices and Circuit Theory”, Prentice-Hall of India Pvt. Ltd., 2015, 11e 5. A. Sudhakar, S.S. Palli, “Circuits and Networks: Analysis and Synthesis”, McGraw Hill, 2015, 5e **WEB REFERENCES:** Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=194 Virtual Labs an initiative of MHRD Govt. of India, http://vlabs.iitkgp.ac.in/be/# Digital Platforms/Web Links of other virtual labs may be suggested /added to this lists by individual Universities	**FINAL EVALUATION THROUGH INTERNAL PRACTICAL EXAMS UPLODED ON LU EXAM PORTAL**

COLLEGE: MBP GOVT. P.G. COLLEGE, ASHIANA, LUCKNOW

ACADEMIC CALENDAR : SESSION- (2023-2024)

NAME OF TEACHER: PROF. (DR.) M . TARIQ
DEPARTMENT: DEPARTMENT OF **PHYSICS**
CLASS: BSC (NEP)-II YEAR (**III SEMESTER**) (APPLICABLE FROM SEPTEMBER 2023)(CREDITS:04)

S.NO.	CLASS (YEAR, SEMESTER)	PAPER	UNIT	TOPIC NAME	MONTHLY / WEEKLY PLAN	TEACHING PEDAGOGY	LEARNING OUTCOMES	ANY OTHER DETAIL
01	02	03	04	05	06	07	08	09
1	**BSC (NEP) – II YEAR, III SEMESTER CREDITS-4 T:04**	**P-5 (MAJOR & MINOR)** PHY301- Heat and Thermodynamics	**Course Outcomes:** The students will understand the fundamental principles of thermodynamics, including the first and second laws. 2. They would learn the idea of entropy and associated theorems, and the thermodynamic potentials and their physical meanings. 3. Students will have an understanding of Maxwell's thermodynamic relations. 4. They will acquire the knowledge about the fundamentals of gas kinetic theory and transport phenomenon.					
			UNIT-I	Thermodynamics: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between Cp & Cv, Work Done during Isothermal and Adiabatic Processes, Compressibility & Expansion Coefficient, Reversible & irreversible processes, Second law & Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes. Clausius Inequality, entropy and unavailable energy, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.Thermodynamic Potentials: Enthalpy, Gibbs,	MIN. 14 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

				Helmholtz and Internal Energy functions, Maxwell's relations & applications (1) Clausius-Clapeyron Equation, (2)Expression for (CP– CV), (3)CP/CV (4) TdS equations.				
			UNIT-II	Real Gases: Deviations from the Ideal Gas Equation, Behaviour of Real Gases, The Virial Equation. Andrew's Experiments on CO2 Gas. Critical Constants. Boyle Temperature. Van der Waal's Equation of State for Real Gases. Values of Critical Constants. Law of Corresponding States. Joule's Experiment. Free Adiabatic Expansion of a Perfect Gas. Joule-Thomson Porous Plug Experiment. Joule-Thomson Effect for Real and Van der Waal Gases.Temperature of Inversion. JouleThomson Cooling.	MIN 14 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
			UNIT-III	Kinetic Theory of Gases: RMS speed, Kinetic Interpretation of temperature, Degree of Freedom, Law of equipartition of energy (no derivation) and its15 applications to specific heat of gases; mono-atomic and diatomic Gases. Mean free path, Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Derivation of Maxwell's law of distribution of velocities and its experimental verification.	MIN 12 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
			UNIT-IV	Theory of Radiation: Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution	MIN 12 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

				law, Rayleigh-Jeans Law, Stefan-Boltzmann Law and Wien's displacement law from Planck's law. Solar Constant.		TEACHING METHOD)		
			References: 1.S. Garg, R. Bansal and C. Ghosh,"Thermal Physics" McGraw Hill Education 1993. 2. Meghnad Saha, and B.N. Srivastava, "A Treatise on Heat"Indian Press 1969. 3. Enrico Fermi , "Thermodynamics" Dover Publications, 2013. 4. M.W. Zemansky and R. Dittman, "Heat and Thermodynamics" McGraw- Hill College 1996. 5. F.W. Sears & G.L. Salinger, "Thermodynamics, Kinetic theory & Statistical thermodynamics" Pearson 1975. **Web References:** 1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8				**FINAL EVALUATION THROUGH INTERNAL ASSESMENT UPLODED ON LU EXAM PORTAL**
2	**BSC (NEP) – II YEAR, III SEMESTER CREDITS-4 T:04**	**P-6 (MAJOR)** PHY302-Perspectives of Quantum Physics	**Course Outcomes:** Study of the syllabus in Perspectives of Quantum Physics will have the following outcomes: 1. It will help students understand the basics concepts of Quantum Physics. 2. It will make students understand the development of quantum mechanics as a continuity of classical concepts and also as a leap jumpfrom classical to quantum world of Physics. 3. A student will be able to understand as to how the inadequacies of classical Physics were overcome by various concepts and theoretical developments of modern Physics i.e. Understand how major concepts developed and changed over time. 4. A study of the Heisenberg's Uncertainty principle and its applications will make students understand the most modern concept of wave particle duality as to how a wave could behave like a particle and how a particle could behave like a wave. 5. An appreciation of the Schrödinger Wave Equation and its application to various problems in quantum mechanics will make students more analytical. This will give them the needed tool to solve problems across science subjects as Schrödinger equation appears in multidisciplinary subjects. 6. It will make students capable of analyzing and solving problems using reasoning skills based on the concepts of modern physics.					
			UNIT-1	Inadequacy of Classical Physics, The Black Body Radiation, Spectral Distribution of Black Body Radiation, Rayleigh Jeans Law,Wien's Displacement Law,	MIN 13 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

				Planck's Radiation Law, Photoelectric Effect, The Quantum Theory of Light, Continuous and characteristic X-ray, X-ray generation and uses, Compton effect, Gravitational Red Shift, de Broglie waves, de Broglie Wave Function and its Properties, Interpretation of wave function, de Broglie Wave Velocity, Complementary principle, Principle of Superposition, Wave and Group Velocity, Motion of Wave Packets, Davisson and Germer Experiment-Diffraction of Electrons, Wave-particle duality Experiment.		TEACHING METHOD)		
			UNIT-II	Heisenberg's Uncertainty principle and its applications, Estimating minimum energy of a confined particle using uncertainty principle, Estimate of Hydrogen Ground State Energy; Wave Equation, Wave Equivalent of an unrestricted Particle, Time Dependent Schrödinger wave equation: Eigenvalues and Eigen Functions, Probability Current; Expectation Value, Expectation Values of Energy and Momentum Operators, Ehrenfest theorem.	MIN 13 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
			UNIT-III	Continuity of wave Function, Boundary Condition and Discrete Energy Levels,Steady State Schrödinger Equation, Application of Schrödinger Wave Equation for Particle in an infinitely Rigid Box: Energy and Momentum Quantization, Normalization, Quantum Dot as an example; One Dimensional Step Potential,Rectangular Barrier, Square	MIN 13 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

				Well Potential				
			UNIT-IV	Bohr atomic model, de Broglie Waves and Stationary Orbits, Hydrogen Atom Spectrum, Atomic Excitation-Franck Hertz Experiment, Correspondence Principle, Sommerfeld Elliptic Orbits. Electron Angular Momentum, Space Quantization, Electron Spin and Spin Angular Momentum, Spin Magnetic Moment, Stern – Gerlach Experiment, Pauli's Exclusion Principle and PeriodicTable. Fine structure, Spin Orbit Coupling, Spectral Notation for Atomic States, Total Angular Momentum, Vector Model, Coupling schemes (LS and jj) for two electron systems. Zeeman Effect for one Electron System.	MIN 13 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
				References: 1.Arthur Beiser, "Concepts of Modern Physics", McGraw-Hill, 2009. 2. John R. Taylor, Chris D. Zafiratos, Michael A.Dubson, "Modern Physics",PHI Learning2009. 3. Thomas A. Moore, "Six Ideas that Shaped Physics: Particles Behave like Waves" McGraw Hill, 2009. 4. R.A. Serway, C.J. Moses, and C.A. Moyer "Modern Physics" Third Edition, 2005, Cengage Learning. 5. P.M. Mathews & K. Venkatesan, "A Text book of Quantum Mechanics",2nd Ed., 2010, McGraw Hill. 6. AjoyGhatak, S. Lokanathan, "Quantum Mechanics: Theory and Applications", Macmillan Publishers IndiaLimited. 7. R.M. Eisberg, "Fundamentals of Modern Physics" Wiley, New York. 8. H.E. White, "Introduction to Atomic Spectra" ,McGraw-Hill, New York **Web References:** 1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx SwayamPrabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8				**FINAL EVALUATION THROUGH INTERNAL ASSESMENT UPLODED ON LU EXAM PORTAL**

COLLEGE: MBP GOVT. P.G. COLLEGE, ASHIANA, LUCKNOW

ACADEMIC CALENDAR : SESSION- (2023-2024)

NAME OF TEACHER: PROF. (DR.) M . TARIQ
DEPARTMENT: DEPARTMENT OF **PHYSICS**
CLASS: BSC (NEP)-II YEAR (**IV SEMESTER**) (APPLICABLE FROM JANUARY 2024)(CREDITS:04)

S.NO.	CLASS (YEAR, SEMESTER)	PAPER	UNIT	TOPIC NAME	MONTHLY / WEEKLY PLAN	TEACHING PEDAGOGY	LEARNING OUTCOMES	ANY OTHER DETAIL
01	02	03	04	05	06	07	08	09
1	**BSC (NEP) – II YEAR, IV SEMESTER CREDITS-4 T:04**	**P-7 (MAJOR & MINOR)** PHY401 - Electronics	**Course Outcomes:** The learning of this paper on electronics will enhance the understanding of the 1. Utility of resonant circuits and AC bridges. 2. The basic electronic devices and their applications. 3. Transistor biasing. 4. Concept of frequency response, bandwidth and audio amplifiers. 5. Feedback circuits 6. The importance of amplitude modulation and demodulation 7. Applications of various electronic instruments.					
			UNIT-I	Circuit fundamentals : Time varying currents, Growth and decay of currents in LR circuit., Charging and discharging of capacitor in RC and LCR circuits. Measurements of High resistance by leakage method , A C circuits : Alternating currents in LCR circuit, Method of imaginaries, Complex impedances, Q factor, Series and parallel resonant circuit, Coupled circuits,	MIN. 14 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

				Impedance matching, Maximum power transfer theorem, AC Bridges : measurement of inductance (Maxwell's bridge), and measurement of capacitance (Schering's and Wein's bridge).				
			UNIT-II	Diodes: Qualitative idea of Fermi level. Formation of depletion layer in PN junction diode, field and potential at the depletion layer. Barrier width , Qualitative idea of current flow mechanism in forward and reverse biased diode, current conduction in PN junction diode and its characteristics, Application of PN junction diodes : Transistor as a switch , Half wave rand Full wave (centre tap and bridge) rectifiers, calculation of ripple factor and rectification efficiency, Clippers and Clampers Zener Diode : Characteristics and applications of Zener diode, Avalanche and Zener breakdown, Filter circuits: choke input, capacitor input, L type and pi type filters, voltage regulated power supply.	MIN 14 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
			UNIT-III	Bipolar transistors: PNP and NPN transistors. Study of CB, CE and CC configurations w.r.t. characteristics; active, cutoff and saturation regions, current gains and relations between them, applications of	MIN 12 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

				transistors Transistor Biasing: Faithful amplification and need for biasing. Fixed Bias (Base Resistor Method), Collector to Base Bias (Base Bias with Collector Feedback) Emitter Bias (Fixed Bias with Emitter Resistor) and Voltage Divider Bias, DC Load Line and Q-point stabilization, thermal runaway, StabilityFactors, Amplifiers : single stage and multistage transistor amplifier, Theory and working of RC coupled voltage amplifier (Uses of various resistors & capacitors) , frequency response of RC coupled amplifier and its analysis.				
			UNIT-IV	Feedback Circuits: Effects of positive and negative feedback. Feed back factor, loop gain. advantages of negative feedback amplifiers , Input Impedance and Output Impedance, Oscillator Circuits: Use of positive feedback for oscillator operation. Barkhausen criterion for self sustained oscillations, types of oscillator ,introduction to sinusoidal and square wave oscillators, tank circuit , qualitative analysis of Hartley oscillator Basic principle of transmission and reception : principles of amplitude modulation, modulation index, demodulation Electronic Instruments : Multimeter: linear and digital multimeters, measurement of dc voltage, dccurrent, ac voltage, ac current and resistance.	MIN 12 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

				Cathode Ray Oscilloscope: Block diagram of basic CRO. Construction of CRT, applications of CRO Electronic components: colour codes of resistors and capacitors, identification ans testing of active and passive components.				
			References: 1. B.G. Streetman, S.K. Banerjee, "Solid State Electronic Devices", Pearson Education India, 2015, 7e 2. W.D. Stanley, "Electronic Devices: Circuits and Applications", Longman Higher Education, 1989 3. J.D. Ryder, "Electronic Fundamentals and Applications", Prentice-Hall of India Private Limited, 1975, 5e 20 4. R.L. Boylestad, L. Nashelsky, "Electronic Devices and Circuit Theory",Prentice-Hall of India Pvt. Ltd., 2015, 11e 5. J. Millman, C.C. Halkias, Satyabrata Jit, "Electronic Devices and Circuits",McGraw Hill, 2015, 4e 6. A. Sudhakar, S.S. Palli, "Circuits and Networks: Analysis and Synthesis",McGraw Hill, 2015, 5e 7. B. L. Theraja, " Basic Electronics ", S. Chand, Lucknow 8. S.L. Gupta, V. Kumar, "Handbook of Electronics", Pragati Prakashan,Meerut, 2016, 43e **WEB REFERENCES:** 1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8 Suggested Equivalent Online Courses 1. Coursera, https://www.coursera.org/browse/physical-science-andengineering/ physics-and-astronomy 2. edX, https://www.edx.org/course/subject/physics 3. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/ 4. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html				**FINAL EVALUATION THROUGH INTERNAL ASSESMENT UPLODED ON LU EXAM PORTAL**
	BSC (NEP)		**Course Outcomes:**					

2	**– II YEAR, IV SEMESTER CREDITS-4 T:04**	**P-8 (MAJOR) PHY402-Heat and Electronics LAB**	1. Experimental physics has the most striking impact on the industry wherever the instruments are used to determine the thermal and electronic properties. 2. Measurement precision and perfection is achieved through Lab Experiments. 3. Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling. Lab Experiment List Students have to do three experiments from Group A and three experiments from Group B Students have to do one experiment each from virtual labs of Heat and Thermodynamics, and Electronics					
			Group A Heat and Thermodynamics	1. Mechanical Equivalent of Heat by Callender and Barne's method 2. Coefficient of thermal conductivity of copper by Searle's apparatus 3. Value of Stefan's constant 4. Variation of thermo-emf across two junctions of a thermocouple with temperature 5. Temperature coefficient of resistance by Platinum resistance Thermometer.	MIN 10 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
			Group B Electronics	1. PN Junction/ Zener diode characteristics 2. Half wave & full wave rectifiers and Filter circuits 3. Characteristics of a transistor (PNP / NPN) in CE, CB and CC configurations 4. Unregulated and Regulated power supply 5. Diode as clipper and Clamper 6. Frequency response of RC coupled amplifier 7. Diode as clipper and Clamper 8. Various measurements with Cathode Ray Oscilloscope (CRO) 9. Charging and discharging in RC circuits 10. A.C. Bridges: experiments based on measurement of L and C 11. Resonance in series and parallel RCL circuit	MIN 10 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

			HEAT:	Virtual Labs at Amrita Vishwa Vidyapeetham https://vlab.amrita.edu/?sub=1&brch=194 1. Heat transfer by radiation 2. Heat transfer by conduction 3. Heat transfer by natural convection 4. The study of phase change 5. Blackbody radiation: Determination of Stefan's constant 6. Newton's law of cooling 7. Lee's disc apparatus 8. Thermo-couple: Seebeck effect	MIN 10 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
			ELECTRONICS:	Virtual Labs an initiative of MHRD Govt. of India http://vlabs.iitkgp.ernet.in/be/index.html# 1. Familiarisation with resistor 2. Familiarisation with capacitor 3. Familiarisation with inductor 4. Ohm's Law 5. VI characteristics of a diode 6. Half & Full wave rectification 7. Capacitative rectification 8. Zener Diode voltage regulator 9. BJT common emitter characteristics 10. BJT common base characteristics 11. Studies on BJT CE amplifier 12. RC frequency response http://vlabs.iitkgp.ac.in/psac/# 13. Diode as Clippers 14. Diode as Clampers 15. BJT as switch and Load Lines http://vlabs.iitkgp.ac.in/be/# 16. RC frequency response Virtual Labs at Amrita Vishwa Vidyapeetham https://vlab.amrita.edu/index.php?sub	MIN 10 LECTURES	OFFLINE TEACHING METHOD (NOTES IN FORM OF PDF,AUDIO/ VIDEO,CLASS ROOM TEACHING METHOD)	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

				=1&brch=201 17. Hartley oscillator 18. Colpitt oscillator				
			REFERENCES: 1. B.L. Worsnop, H.T. Flint, “Advanced Practical Physics for Students”,Methuen & Co., Ltd., London, 1962, 9e 2. S. Panigrahi, B. Mallick, “Engineering Practical Physics”, Cengage Learning India Pvt. Ltd., 2015, 1e 3. Anchal Srivastava and R.K. Shukla,“Practical Physics (Electricity, Magnetism and Electronics)”, Published by: New Age International (P) Limited Publishers 4. R.L. Boylestad, L. Nashelsky, “Electronic Devices and Circuit Theory”,Prentice-Hall of India Pvt. Ltd., 2015, 11e 5. A. Sudhakar, S.S. Palli, “Circuits and Networks: Analysis and Synthesis”,McGraw Hill, 2015, 5e **WEB REFERENCES:** Virtual Labs at Amrita Vishwa Vidyapeetham,https://vlab.amrita.edu/?sub=1&brch=194 Virtual Labs an initiative of MHRD Govt. of India,http://vlabs.iitkgp.ac.in/be/# Digital Platforms/Web Links of other virtual labs may be suggested /added to this lists by individual Universities				**FINAL EVALUATION THROUGH INTERNAL ASSESMENT UPLODED ON LU EXAM PORTAL**

COLLEGE: MBP GOVT. P.G. COLLEGE, ASHIANA, LUCKNOW

ACADEMIC CALENDAR : SESSION- (2023-2024)

NAME OF TEACHER: PROF. (DR.) M . TARIQ
DEPARTMENT: DEPARTMENT OF **PHYSICS**
CLASS: BSC (NEP)-III YEAR (**V SEMESTER**) (APPLICABLE FROM SEPTEMBER 2023)(CREDITS:04)

XS.NO.	CLASS (YEAR, SEMESTER)	PAPER	UNIT	TOPIC NAME	MONTHLY/WEEKLY PLAN	TEACHING PEDAGOGY	LEARNING OUTCOMES	ANY OTHER DETAIL
01	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**
I	**BSC(NEP) - III YEAR, V SEM** **CREDITS-4** **T:04**	**PAPER –9** P09 PHY501-Solid State Physics	**Course Outcomes:** This syllabus aims to introduce the theoretical and experimental topics in solid state physics. On successful completion of the units students would get an understanding of 1. The crystal geometry with respect to symmetry operations 2. The power of X-ray diffraction and the concept of reciprocal lattice 3. The various properties based on crystal bindings 4. Lattice dynamics and its influence on the properties of materials, 5. Physics of electrons in solids and 6. Magnetic, dielectric and superconducting properties of solids along with recent published results by various researchers. 7. Such study would provide a foundation for research in condensed matter physics, material science and nanotechnology.					
			UNIT-I	Crystal Structure: Lattice, Basis & Crystal structure. Lattice translation vectors, Primitive & non-primitive cells. Symmetry operations, Point group & Space group. 2D & 3D Bravais lattice. Parameters of cubic	MIN 12 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

				lattices. Lattice planes and Miller indices. Simple crystal structures – bcc, fcc & hcp, Diamond, Cubic Zinc Sulphide, Sodium Chloride, Caesium Chloride and Glasses. Crystal Diffraction: X-ray diffraction and Bragg's law. Experimental diffraction methods - Laue, Rotating crystal and Powder methods (including XRD patterns of new materials),. Derivation of scattered wave amplitude. Reciprocal lattice, Reciprocal lattice vectors and relation between Direct & Reciprocal lattice. Diffraction conditions, Ewald's method and Brillouin zones. Reciprocal lattice to sc, bcc and fcc lattices. Atomic Form factor and Crystal Structure factor.				
			UNIT-II	Crystal Bindings: Classification of Crystals on the Basis of Bonding - Ionic, Covalent, Metallic, van der Waals (Molecular) and Hydrogen bonded. Crystals of inert gases, Attractive interaction (van der Waals-London) & Repulsive interaction, Equilibrium lattice constant, Cohesive energy and Compressibility	MIN 12 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

				& Bulk modulus. Ionic crystals, Cohesive energy, Madelung energy and evaluation of Madelung constant. Lattice Vibrations: Lattice Vibrations: Lattice vibrations for linear mono & di atomic chains, Dispersion relations and Acoustical & Optical branches (qualitative treatment). Qualitative description of Phonons in solids. Lattice heat capacity, Dulong-Petit law and Einstein's and Debye theories of specific heat of solids. T3 law				
			UNIT-III	Free Electron Theory: Drude Model, Wiedemann-Franz law, Fermi energy, Density of states, Heat capacity of conduction electrons, Paramagnetic susceptibility of conduction electrons and Hall effect in metals & semiconductors. Band Theory: Origin of band theory, Bloch theorem (Proof and analysis), , Kronig-Penny model (proof and analysis of results), Effective mass of an electron , Concept of Hole, Surface states, Classification of solids on the basis of band theory. Qualitative idea of Simulation of Band structure	MIN 12 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

				of solids				
			UNIT-IV	Magnetic Properties of Matter: Origin of magnetism Dia-, Para-, Ferri- , Ferro- and anti-ferromagnetic Materials. Classical Langevin Theory of dia– and Paramagnetic Domains. Curie's law, Weiss‟s Theory of Ferromagnetism and ferromagnetic domains, Qualitative discussion of B-H Curve. Hysteresis, soft and hard material and Energy Loss. Dielectric Properties of Materials: Polarization, Depolarization Field , Electric Susceptibility. Polarizability. Intoduction to Superconductivity: Qualitative idea and Recent published results in research journals. Defects in solids: Point defects, vacancies, concentration of defects -Schottky, Frenkel (including recent published results in research journals)	MIN 12 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
			REFERENCES : 1. Charles Kittel, "Introduction to Solid State Physics", Wiley India Private Limited, 2012, 8e 2. A.J. Dekker, "Solid State Physics", Macmillan India Limited, 1993 3. S.O. Pillai, "Solid State Physics", New Age International Publishers 4. S.O. Pillai, "Modern Physics and Solid State Physics (Problems and Solutions)", New Age International Publishers 5. J. P. Shrivastava, " Elements of Solid State Physics" PHI					**FINAL EVALUATION THROUGH INTERNAL ASSESMENT UPLODED ON LU EXAM PORTAL**

			6. R. L. Singhal, " Solid State Physics" Kedar Nath Ram Nath &Co. Publishers 7. H.C. Gupta, "Solid State Physics" Vikas Publishing/S.Chand Publishers8. Ashcroft and Mermin, "Solid State Physics", Cengage Learning, Incorporated. WEB REFERENCES: 1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx 4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8				
II	**BSC(NEP) - III YEAR, V SEM** **CREDITS-4**	**PAPER-10** P10 PHY502-Nuclear Physics	**Course outcomes:** After successful completion of the course on Nuclear Physics, students will: 1. Grasp the knowledge about basic nuclear properties and nuclear models for a better understanding of nuclear reaction dynamics. 2. Analyze quantum mechanical phenomena in nuclear physics and develop an understanding of quantum mechanics also. 3. Comprehend the general understanding of phenomena like nuclear fusion and fission and develop the skills required for solving basic problems in nuclear physics at different nuclear energy ranges. 4. Develop the basic understanding of accelerator physics and particle detectors. 5. Acquire and apply basic nuclear physics knowledge in subjects such as medicinal, archaeology, geology, and other multidisciplinary fields of Physics and Chemistry.				
			UNIT-1	Quantitative facts about mass, radii, charge density, matter density, binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, nuclear fission and fusion, valley of stability N/Z plot. Angular momentum, parity, magnetic dipole, and electric quadrupole moments (qualitative aspects	MIN 12 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

				only). System with two nucleons (deuteron), P-P, N-P, N-N interactions.				
			UNIT-II	Theory of α-emission, α-decay spectroscopy. □-decay: Energetics in □-decay, β spectrum, neutrino hypothesis, parity violation in beta decay, Gamma decay: Gamma rays emission from the excited state of the nucleus & kinematics, internal conversion, nuclear isomerism.Compound nucleus formation, reaction cross-section. Interactions of radiation with matter; Gas detectors: GM counter and Proportional counter, Scintillation Detectors and photo-multiplier tube; Semiconductor detectors (Si and Ge); (basic properties, basic working method, resolution and efficiency of detectors), Accelerators: DC and AC; Vande Graaff generator (Tandem accelerator) and Linear accelerator (Linac). Cyclotron, synchrocyclotron and Collider.	MIN 12 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
			UNIT-III	Liquid Drop Model and semi-empirical mass formula, fission explanation,	MIN 12 LECTURE	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE	EVALUATION THROUGH ASSIGNMENTS

				Single particle Shell model (odd-A ground state and excited state spin and parity, ground state spin and parity of odd-odd nuclei; Collective model: vibrational and rotational model, theirspectra and energy level schemes.	S		UNDERSTANDING OF THE TOPIC DISCUSSED.	AND DISCUSSIONS
			UNIT-IV	Particle interactions; basic features, types of particles and its families. Symmetries and conservation laws(energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness), concept of quark model, color quantum number and gluons, basic idea about Standard model.	MIN 12 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
			REFERENCES : 1. Krane, K.S.,"Introductory Nuclear Physics", Wiley India Pvt. Ltd., (2008). 2. Roy, R.R. and Nigam, B.P., "Nuclear Physics", New Age International Ltd., (2001). 3. Kaplan Irving, "Nuclear Physics", Narosa Publishing House, (2000). 4. Bernard L. Cohen, "Concepts of Nuclear Physics", McGraw Hill, (1974). 5. C. M. H. Smith. Pergamon, "A Textbook of Nuclear Physics", New York, (1965). 6. John Lilley, "Nuclear Physics: Principles and Applications" Willey Publication (2006). 7. Glen F. Knoll, "Radiation detection and measurement" 4th Edition, Wiley (2010), ISBN: 978-0-470-13148-0. 8. Wiedemann, Helmut, "Particle accelerator Physics", Springer 9. David Griffiths, "Introduction to Elementary Particles" Wily (1987) **WEB REFERENCES:** 1.MIT Open Learning - Massachusetts Institute of Technology,				**FINAL EVALUATION THROUGH INTERNAL ASSESMENT UPLODED ON LU EXAM PORTAL**

			https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx				
III	**BSC(NEP) - III YEAR, V SEM** **CREDITS-4**	**PAPER-11** P11x PHY503-Lasers and Optoelectronics I	**Course Outcomes:** 1. Opting for this course will give the students an opportunity to know and understand applications of fiber optics and laser technology. 2. Students will be able to appreciate the importance of lasers, fiber optical methods and sensors in all spheres of life i.e. various communication requirements, medical, travel etc. 3. Students will learn about optical fibers in detail and will be able to appreciate the current communication system existing globally. 4. They will also gain the knowledge of basic concepts of optical communication and of different types of optical fibers thereby getting enabled to appreciate the huge advantage of such systems. 5. Students will be able to know about various types of fiber optic sensors and their use in the areas of security, safety, medical and space ventures. 6. Finally, students may emerge with an idea for new sensor or a new application of the existing ones.				
			UNIT-I	Laser theory, Light Amplification, threshold condition, Laser Rate Equationstwo, three and four level systems, Laser power around threshold, optimum output coupling, Line Broadening Mechanisms– Natural, Collision and Doppler, Optical Resonators – Modes of a rectangular cavity and open planar resonator, Modes of a confocal resonator system, General Spherical resonator, Higher order modes.	MIN 12 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

			UNIT-II	Essential criterion to observe non linear optical effects, First experimental demonstration of non-linear phenomena, Classical theory of non-linear response in one dimension, Generalization to three dimensions, General properties of the polarizability tensor – Reality condition, Intrinsic symmetry, general form and frequency dependence, overall symmetry, Second harmonic generation and phase matching techniques, Basic idea of self-focusing.	MIN 12 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
			UNIT-III	Fiber as a guiding medium, Total Internal reflection, Acceptance angle, Numerical aperture, Types of fiber, Refractive index profiles, Concept of modes, Electromagnetic analysis of guided modes in symmetric step indexplanar wave guide and step index fiber, Concept of Normalized Frequency, V Parameter, Pulse dispersion in step index fibers, Concept of Dispersion shifted and Dispersion flattened Fibers, Fiber attenuation, Misalignment losses, Fiber material, Fiber fabrication, Splices and Connectors.	MIN 12 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

			UNIT-IV	Luminescence, Direct and indirect band gaps materials, Principle of electroluminescence, LED source materials and emission wavelengths (01 Lectures), Surface emitting and Edge emitting LED structures, Double hetrojunction (DH) LED structure, Emission properties and efficiency of LED, Semiconductor Lasers, Laser Modes, Condition for lasing action, Principle of the operation of photo-detector, Materials for Photo-detectors, Types of photodetectors.	MIN 12 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
			REFERENCE BOOK: 1. David J. Griffiths, "Introduction to Electrodynamics", Prentice-Hall of India, New Delhi. 2. John David Jackson, "Classical Electrodynamics",Wiley India. 3. Theory and Problems of Electromagnetics: Joseph A. Edminster, Tata McGraw Hill. 4. E.M. Purcell, "Electricity and Magnetism", Berkeley Physics Course , Vol II, McGrawHill. 5. J. R. Reitz, F. J. Milford and R. W. Christy, "Foundations of Electromagnetic Theory" Pearson. 6. J. V. Narlikar, "An Introduction to Relativity", Cambridge Univ. Press. 7. Ray D'Inverno, "Introducing Einstein's Relativity"Clarendon Press, Oxford. 8. G. Lehner, "Electromagnetic Field Theory for Engineers and Physicists"Springer. 9. A. Zangwill, "Modern Electrodynamics",Cambridge University Press. **Additional Readings:** 1. Fiber Optics and Optoelectronics, R. P. Khare, OXFORD University Press. 2. Fiber-Optic Communication Systems, Govind P. Agrawal, Wiley India (P) Ltd.				**FINAL EVALUATION THROUGH INTERNAL ASSESMENT UPLODED ON LU EXAM PORTAL**

<table>
<tr><td></td><td></td><td></td><td colspan="6">3. Optical Fiber Communications, John M. Senior, Pearson Education Limited.
4. Fiber-Optic Communication Systems, R. K. Singh, Wiley India Pvt. Ltd.
5. Fiber-Optic Communication Systems and Components, Vivekanand Mishra and Sunita P. Ugale, Wiley India Pvt. Ltd.
6. Optical fiber Communication Systems, R.K. Shukla, MKSES Publication. 7. Textbook on Optical Fiber Communication and its Applications, S. C. Gupta, PHI Learning Private Limited.
8. Photonics An Introduction, P. R. Sasi Kumar, PHI Learning Private Limited</td><td></td></tr>
<tr><td rowspan="4">III</td><td rowspan="4">BSC(NEP) - III YEAR, V SEM

CREDITS-4</td><td rowspan="4">PAPER-11

P11y PHY504-The Second Quantum Revolution</td><td colspan="6">Course Outcomes:
In the 1970s and 1980s instead of looking at quantum systems purely as phenomena to be explained scientists began looking at these systems that could be designed to accommodate computer science and information theory. An enormous amount of progress has taken place in the field of quantum information science in the last twenty years. The most remarkable progress has been in the actual implementation of these quantum systems via superconducting circuits or nuclear spins or single photon systems or trapped ions.
It becomes imperative that we develop at least a basic understanding of things to come.
Quantum Computation is the future.
The main outcomes this course aims to achieve are as follows:
1. To understand the main ideas of quantum computation.
2. To develop an understanding of the fundamental concepts of the field.
3. To equip the student with enough technical expertise to may be take up a career in this new, exciting and rich field of research.
4. To introduce some experimental developments pertaining to quantum computers.</td></tr>
<tr><td>UNIT-I</td><td>INTRODUCTION AND OVERVIEW
History of Quantum Computation and Quantum Information, Linear Algebra
and quantum mechanics, Frequentlyused quantum gates and circuit symbols,
Qubits, multiple qubits, single qubit gates, quantum circuits.</td><td>MIN 12 LECTURES</td><td>OFFLINE TEACHING METHOD</td><td>STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.</td><td>EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS</td></tr>
<tr><td>UNIT-II</td><td>QUBIT COPYING CIRCUITS
Bell states,hidden variables, quantum teleportation, classical computation on a
quantum computer.</td><td>MIN 12 LECTURES</td><td>OFFLINE TEACHING METHOD</td><td>STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.</td><td>EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS</td></tr>
<tr><td colspan="6"></td></tr>
</table>

			UNIT-III	ACTUALIZING QUANTUM COMPUTATION Quantum jumps, quantum measurement in continuous time, entanglement, negativity of quasi-probabilities, contextuality, decoherence, no-cloning, quantum trajectories.	MIN 12 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
			UNIT-IV	A NEW FRAMEWORK 33 Laser cooling and trapping, nonclassical light sources such as squeezed light and entangled photons , and cavity QED, circuit QED .	MIN 12 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
			REFERENCES: 1. Michael A. Nielsen and Isaac L. Chuang, "Quantum computation and quantum information" Cambridge University Press, reprint 2020. 2. J.J. Sakurai, "Modern quantum mechanics" Pearson Education, 2001. 3. William H. Gotthman, "Digital electronics: An Introduction to Theory and Practice", Prentice-Hall series in Electronic Technology, 2002. 4. Ivan H. Deutsch, "Harnessing the Power of the Second Quantum Revolution" PRX QUANTUM 1, 020101, 2020. **ADDITIONAL READINGS**: 1. R. P. FEYNMAN Simulating physics with computers, Int. J. Theor. Phys., 21:467, 1982. 2. QUANTUM EFFECTS IN THE BRAIN: A REVIEW, Bettony Adams and Francesco Petruccione, arXiv:1910.08423[q-bio-NC]				**FINAL EVALUATION THROUGH INTERNAL ASSESMENT UPLODED ON LU EXAM PORTAL**

❖ **NOTE:** THERE WILL BE **INTERNSHIP / TERM PAPER** **IN V SEMESTER (NEP).**

COLLEGE: MBP GOVT. P.G. COLLEGE, ASHIANA, LUCKNOW

ACADEMIC CALENDAR : SESSION- (2023-2024)

NAME OF TEACHER: PROF. (DR.) M . TARIQ
DEPARTMENT: DEPARTMENT OF **PHYSICS**
CLASS: BSC (NEP)-III YEAR (**VI SEMESTER**) (APPLICABLE FROM JANUARY 2024)(CREDITS:04)

XS.NO.	CLASS (YEAR, SEMESTER)	PAPER	UNIT	TOPIC NAME	MONTHLY/WEEKLY PLAN	TEACHING PEDAGOGY	LEARNING OUTCOMES	ANY OTHER DETAIL
01	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**
I	**BSC(NEP) - III YEAR, VI SEM** **CREDITS-4**	**PAPER –12** P12 PHY601-Advanced LAB	**Course Outcomes:** 1. Measurement precision and perfection is achieved through Lab Experiments. 2. The experiments in advance laboratory will enable students to be industry ready in the field of electronics. 3. The exposure to this laboratory will enable students to do research in applied optics and optoelectronics. 4. The students will be able to appreciate the concept of electronic communication. 5. Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling.					
			Lab Experiment List	Students will do any six experiments out of the following list and any three virtual experiments:	MIN 30 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTAN	EVALUATION THROUGH AND

				1. Characteristics of Silicon Controlled Rectifier 2. To observe the characteristics of UJT and to calculate the interbase resistance and Intrinsic Stand-Off Ratio . 3. To study IC amplifier 4. Effect of voltage and current feedback on frequency response of RC coupled amplifier 5. To study the process of amplitude modulation and demodulation 6. To study negative feedback amplifier 7. To study characteristics of FET/ MOSFET 8. To study FET as voltage variable attenuator and its application as voltage controlled attenuator 9. To study frequency response of IC amplifier. 10. To determine wavelength of sodium light/ difference between two lines of sodium / refractive index of mica sheet using Michelson Interferometer. 11. To analyse elliptically polarized light with the help of Babinet compensator. 12. To calibrate a spectrometer by the method of Edser and Butler 13. To determine the wavelength			DING OF THE TOPIC DISCUSSED.	DISCUSSIONS

				of mercury spectral lines with the help of diffraction grating 14. To determine the wavelength of mercury spectral lines with the help of reflection grating 15. To determine the wavelength of sodium light with the help ofFresnel biprism. 16. Verification of Fresnel's Formula				
			Online Virtual Lab Experiment List / Link Electronics http://vlabs.iitkgp.ac.in/be/# 7. RC frequency response Virtual Labs at Amrita Vishwa Vidyapeetham https://vlab.amrita.edu/index.php?sub=1&brch=201 8. Hartley oscillator 9. Colpitt oscillator Online Virtual Lab Experiment List / Link Optics Virtual Labs at Amrita Vishwa Vidyapeetham https://vlab.amrita.edu/?sub=1&brch=189 1. Michelson's Interferometer: Refractive index of glass plate 2. Michelson's Interferometer: Wavelength of laser beam 3. Newton's Rings: Wavelength of light 4. Newton's Rings: Refractive index of liquid 5. Brewster's angle determination 6. Laser beam divergence and spot size Virtual Labs at Amrita Vishwa Vidyapeetham https://vlab.amrita.edu/index.php?sub=1&brch=281 7. Spectrometer: Refractive index of the material of a prism 8. Spectrometer: Dispersive power of a prism 9. Spectrometer: Determination of Cauchy's constants				
			REFERENCES : 1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962, 9e 2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015, 1e3. Anchal Srivastava and R.K. Shukla,"Practical Physics (Electricity, Magnetism				**FINAL EVALUATION THROUGH PRACTICALS UPLODED ON LU EXAM**

			and Electronics)", Published by: New Age International (P) Limited Publishers 4. R.L. Boylestad, L. Nashelsky, "Electronic Devices and Circuit Theory", Prentice-Hall of India Pvt. Ltd., 2015, 11e 5. A. Sudhakar, S.S. Palli, "Circuits and Networks: Analysis and Synthesis", McGraw Hill, 2015, 5e **WEB REFERENCES:** 1. Virtual Labs at Amrita Vishwa Vidyapeetham,https://vlab.amrita.edu/?sub=1&brch=194 2. Virtual Labs an initiative of MHRD Govt. of India,http://vlabs.iitkgp.ac.in/be/# 3. Digital Platforms/Web Links of other virtual labs may be suggested/added to this lists by individual Universities					**PORTAL**
II	**BSC(NEP) - III YEAR, VI SEM** **CREDITS-4**	**PAPER-13** P13 PHY602-Atomic and Molecular Spectroscopy	**Course Outcomes:** 1. After completion of the course students will be able to understand the spectra produced by one and two valence electron systems, intensity of spectral lines and effect of magnetic field on one electron systems as well as origin of hyperfine structure. 2. Students will acquire knowledge of rotational, vibrational and electronic spectra of molecules in addition to acquaintance with the principle of electron spin and nuclear magnetic resonance, nuclear quadrupole spectroscopy and their applications. 3. They will also learn the Laser principle, basic Lasers and its applications.					
			UNIT-1	Introduction to Quantum theory, Spin-Orbit interaction energy, Doublet separation, Spectroscopic Description of Atomic Electronic States–Term Symbols, Intensity rules for fine structure doublet, Fine structure of Hydrogen lines. Optical spectra of alkali metals, Non penetrating and penetrating orbits, Rydberg-Schruster law, Runge's Law, The Ritz Combination Principle, Optical spectra of alkaline earth elements, Singlet and triplet terms.	MIN 12 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

			UNIT-II	Coupling scheme for two electron systems– non-equivalent and equivalent electron cases, Hund's rule, Lande's interval rule. Normal and Anomalous Zeeman Effect, Paschen-Back effect of one electron system. Hyperfine structure, Isotope effect in atomic spectra, distinction between isotope effect and hyperfine structure, Normal and inverted terms, Applications of Hyperfine structure, Lamb Rutherford Shift.	MIN 12 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
			UNIT-III	Microwave Spectroscopy – Rotational spectra, Diatomic and polyatomic molecules, Infrared Spectroscopy – Vibrating diatomic molecule, the diatomic vibrating rotator, Rotation- Vibration spectra of diatomic molecules, Raman Spectroscopy- Pure rotational Raman spectra, Vibrational Raman spectra, Structural determination from Raman Spectroscopy, Selection rules, P.Q and R branches, Isotopic shift.	MIN 12 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
			UNIT-IV	Electronic Spectra of Diatomic molecules -Breakdown of Born Oppenheimer Approximation, Intensity of Vibrational -Electronic Spectra-	MIN 12 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

				The Franck Condon Principle, Dissociation energy and Dissociation Products, Rotational Fine Structure of Electronic-Vibration transitions, The Fortrat diagram, Predissociation, Effect of anharmonicity, Coriolis force. Coherence-spatial and temporal, He-Ne gas laser, ruby laser, Raman spectroscopy, uses of lasers in Raman spectroscopy, Principle of Electron Spin Resonance (E.S.R), Nuclear Magnetic Resonance (N.M.R), and Nuclear Quadrupole Resonance (N.Q.R.) spectroscopy and their applications.			TOPIC DISCUSSED.	
			REFERENCE BOOK: 1. H.E. White,"Introduction to Atomic Spectra", McGraw Hill,1934. 2. Gerhard Herzberg,"Atomic Spectra and Atomic Structure", Dover Publications, 2010. 3. C.N. Banwell and E.M. McCash, "Fundamentals of molecular spectroscopy" Tata McGraw Hill 2007. **WEB REFERENCES:** 1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/ 2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd 3. Uttar Pradesh Higher Education Digital Library , http://heecontent.upsdc.gov.in/SearchContent.aspx				**FINAL EVALUATION THROUGH INTERNAL ASSESMENT UPLODED ON LU EXAM PORTAL**

III	**BSC(NEP) - III YEAR, VI SEM** **CREDITS-4**	**PAPER-14** P14x PHY603-History of Science in India	Course Outcomes: 1. Students will realize and sense the excitement how deeply the mysteries of the starry sky and several socio-cultural aspects of human coexistence with nature have puzzled the great minds of all times in India and motivated them into extensive enquiry. 2. Students will learn about the long tradition of the monumental ancient-to-modern wisdom in science contributed by Indian scientists with their sheer dedication and intellect despite the obvious lack of adequate resources and experimental facilities. 3. They would clearly understand how the scientific ideas progress through the application of mathematics built on reason and logical methods and ultimately lead to scientific revolutions. 4. Thus, students will appreciate the role of human observations in verification of the scientific principles and necessity of the technological tools to add to or modify or overturn the already acquired knowledge along the line of history.					
			UNIT-1	Emergence of science in India. Methods of Indian numerals. Ten digits based numerals (dashmic sthanmaan) including zero. Sidddhantic Astronomy. “Aryabhatiya” as the first paurusheya Indian text in astronomy: Revolutionary Principles of the spin motion of the earth at its axis as described in “Dashgitikapaad” and “Golapaad” . Aryabhat’s rebuttal of the Rahu-Ketu (ascending and descending nodes) eclipse beliefs in “Golapaad”. Relative orientation of earth’s equatorial plane and the lunar orbital plane from the ecliptic. Motion of intersecting nodes. Brahmgupta’s criticism of Aryabhat’s sidhhants. Bhaskar II’s (12 century AD) ideas about attractive nature of earth’s	MIN 12 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

				gravitation in his text, “Sidhhant-shiromani”.				
			UNIT-II	Progress of empirical science in India. Calculation tables and observational verification, streams of medicine (Susrut, Charak and Vagbhata I—vridhha trayi), chemical (Nagarjuna) and agricultural sceience. Development of technological tools from ancient - to - medieval civilizations. Compilation of of Zij tables by Raja Jai Singh Sawai. Writing of Monographs e.g., Yantra-Raj (1370 AD) (the first monograph on instrumentation in Sanskrit) . Establishment of observatories at Delhi, Jaipur, Mathura, Ujjain and Varanasi in medieval period. Progress in chemical science: Nagarjuna’s accounts of distillation of ores for extraction of metals (mercury from cinnabar).	MIN 12 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

			UNIT-III	Advances in physical sciences through observations with light. Transit of Mercury (1651 AD) observed at Surat. Discovery of the binary nature of the bright star Alpha Centauri at Pondicherry (1689 AD). Accomplishments with Madras observatory as Meridian for Great Trigonometric Survey of India. Discovery of vaiable star R Reticuli by Chintamani Ragoonathchaari. Historical outline of observatory at Trivendrum and the Lucknow Observatory. Discovery of spectral line due to Helium during Total Solar Eclipse at Guntur. The first helioscope at Simla. Spectroscopic Solar photography in Calcium K and Hydrogen alpha light.	MIN 12 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
			UNIT-IV	Transition of science to modern period. Brief summary of monumental contributions by J. C. Bose, S. N. Bose, Meghnad Saha, Sir C. V. Raman, H. J. Bhabha and N.S. Kapany about the nature of electromagnetic waves and their interaction with matter. Raman Effect and its modern applications. Discovery of Comet (C/1949N1-	MIN 12 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

				Bappu-Bok-Newkirk comet) by M. K. Vainu Bappu. Wilson-Bappu Effect about emission of Ca II K spectral lines. Contributions by N. N. Sen, V. V. Narlikar, P.C. Vaidya, A. K. Raychaudhri, S. Chandrasekhar and C.V. Vishveshwara and E.C.G. Sudarshan, V. A. Sarabhai and Harish-Chandra in modern physics, P. C. Ray in Chemistry, S. Ramanujan in Mathematics, P.C. Mahalnobis in Statistics, P.N. Bose and B. Sahni in geology and palaeobotany.				
				REFERENCES : 1. Indian National Science Academy Publications: (i) "Aryabhatiya": original by Aryabhat and Hindi Translation by Ram Niwas Rai. (INSA, New Delhi) (ii) "Aryabhatiya":Aryabhat's original text with English Translation by Kripa Shankar Shukla and K.V. Sharma (INSA, New Delhi). 2. Indian Journal of History of Science: Vol 18, 2. (on Aryabhat's works). 3. "Brahmasphut-siddhanta", (original with commentary): Pt. Sudhakar Dwivedi (Varanasi, 1902). 4. "Siddhanta-shiromani": original by Bhaskar II: Commentary byBapudev Shastri (Varanasi, 1913). 5. GunakarMuley,"Bhaskaracharya", RajkamalPrakashan, 2011. 6. D. M. Bose, S.N. Sen and B.V. Subbbarayappa,"A Concise History of Science in India": (Universities Press, 2009). 7. J. V. Narlikar," The Scientific Edge"Penguin India, 2003. 8. P. Kutumbiah, "Ancient Indian Medicine"Orient Longmans, 1999, 2nd ed. 9. Patrick Geddes ,"Life and Work of Sir Jagdish C. Bose"Longman Greens, 1920. 10. G. Venkataraman,"Bose and his Statistics" Universities Press, 1992. 11. G. Venkataraman,"Saha and his Formula"Universities Press, 1997. 12. G. Venkataraman,"Raman and his Effect", Universities Press, 1995. 13. G. Venkataraman,"Bhabha and his Magnificent Obsession" Universities Press, 1994. 14. G. Venkataraman,"Chandrasekhar and his Limit", Universities Press, 1992. 15. N. Mukunda,"The Life and Work of E.C. George Sudarshan": Resonance, 24 (2), 129 (2019.				**FINAL EVALUATION THROUGH INTERNAL ASSESMENT UPLODED ON LU EXAM PORTAL**

<table>
<tr><td></td><td></td><td></td><td colspan="6">16. K. P. Singh,“In Memory of Narinder Singh Kapany”: (Nature Photonics, 15, 403, 2021).
17. Robert Kanigel,“The man who knew infinity -- A life of the Genious Ramanujan”, Abacus, 1992. Also an adaptation into a film by Matthew Brown in 2015.
18. D. D. Majumdar ,“Scientific Contributions of Prof. P.C. Mahalnobis”: Current Science 65 (1) , 97-101, 1993.
19. U. R. Rao and K. Kasturirangan,“Vikram Sarabhai: the Scientist”: Resonance 6 (12), 2001.
20. V.S. Varadrajan,“Harish-Chandra and his mathematical Work”: Current Science, 65 (12), 918, 1993.
21. “https://vigyanprasar.gov.in/digital-repository/biographies-ofscientists/ (Vigyan Prasar, Department of Science and Technology, New Delhi).</td><td></td></tr>
<tr><td>III</td><td>BSC(NEP) - III YEAR, VI SEM

CREDITS-4</td><td>P14y PHY604-Plasma Physics and Space Science</td><td colspan="6">Course Outcomes:
1. After completing the course the students will understand the basic concepts of plasma physics and will have very good knowledge of mathematical models for plasma and will be able to distinguish the dynamics of plasmas and neutral fluid media.
2. They will be able to describe the propagation of waves in plasmas and will have good insight into plasma instabilities.
3. Students will be able to know about the atmospheric structures, the Sun-Earth system and space weather.
4. The students will feel a great deal of excitement with our current understanding into the mysteries of the stars and universe, especially with the modern state-of-the-art technology like “Hubble Space Telescope” and “Planck” spacecraft..</td></tr>
<tr><td></td><td></td><td></td><td>UNIT-I</td><td>Elementary Concept of Plasma: Definition of Plasma, Plasma as ionized gas, Saha’s ionization equation, Concept of Plasma temperature, Debye shielding, Quasi-neutrality, Plasma parameters, Plasma approximation, Hydro dynamical description of plasma, fundamental equations. Occurrence of Plasma, Applications of Plasma in brief with special reference to nuclear fusion and particle acceleration. Single-particle motion, Dynamics of charged particles in electro-magnetic fields, particle drifts, EXB</td><td>MIN 12 LECTURES</td><td>OFFLINE TEACHING METHOD</td><td>STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.</td><td>EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS</td></tr>
</table>

				drifts, Grad-B drift, Curvature drift, Polarization drift				
			UNIT-II	Wave phenomena in magnetoplasma: polarization, phase velocity, group velocity, cutoff, resonance for electromagnetic wave propagating parallel, perpendicular to magnetic field, Appleton-Hartree formula. Kinetic theory of Plasma: Vlasov equations, Solution of linearized Vlasov equation, Langmuir waves, Wave-particle interaction and Landau damping. Fluid theory of Plasma - Plasma oscillations, Electron-acoustic waves, Ion-acoustic waves. Applications of plasma physics (only theory in brief) to nuclear fusion and particle acceleration.	MIN 12 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
			UNIT-III	Atmosphere, atmospheric layers, composition. Elements of Ionosphere and Magnetosphere, structure and density profile, ionosphere-magnetosphere coupling. Structure of the Sun: solar interior, solar atmosphere, photosphere,	MIN 12 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS

				chromosphere, corona. Sunspots and their properties, Sun-Earth interactions, basic concept of storm and substorm phenomena. Solar activity cycles, solar wind, solar flares, coronal mass ejections (CMEs), Space weather, causes and consequences, space climate.				
			UNIT-IV	Stellar structure (equilibrium, nuclear reactions, energy transport) and stellar evolution (with example of our Sun). Chandrasekhar limit for white dwarfs. Neutron stars and Blackholes. Exoplanets. Morphology and types of galaxies: Our Milky Way. Concept of dark matter. Cosmic microwave background radiation. HST and Planck observations. Redshifts. Accelerated expansion of the Universe and current explanations with and without dark energy. Evolution of the Universe.	MIN 12 LECTURES	OFFLINE TEACHING METHOD	STUDENTS WILL GET THE UNDERSTANDING OF THE TOPIC DISCUSSED.	EVALUATION THROUGH ASSIGNMENTS AND DISCUSSIONS
			REFERENCES: 1. Bittencourt, J. A., "Fundamentals of Plasma Physics", Springer, New York, 2004). 2. Bellan, P. M., "Fundamentals of Plasma Physics", Cambridge, UK, 2006. 3. Chen, F. F., "Introduction to Plasma Physics and Controlled Fusion", 2nd ed., Plenum, New York, 1984. 4. Piel, A., "Plasma Physics: An Introduction to Laboratory, Space and Fusion Plasmas", Springer, Heidelberg, 2010. 5. Ackerman, S.A. and Knox, J.A.,"Meteorology Understanding the Atmosphere, Thomson Learning".				**FINAL EVALUATION THROUGH INTERNAL ASSESSMENT UPLODED ON LU EXAM PORTAL**

			6. Kevilson, M.G. and Russell, C.T., "Introduction to Space Physics", Cambridge University Press, 1995. 7. Singhal, R.P., "Element of Space Physics", Prentice Hall of India, New Delhi. 8. BasuBaidyanath, "Introduction to Astrophysics", Prentice Hall of India, 2013. 9. Frank Shu, "The Physical Universe", University Science Books. 10. Weinberg, S., "The First Three Minutes", Basic Books, 1993. 11. Hawking, S.W., "A Brief History of Time", Bantam, 1995.	

❖ **NOTE:** THERE WILL BE **MINOR PROJECT** IN VI SEMESTER (NEP).