Course curriculum for Engineering Physics for 2021 Batch

Semester IV (2021 Batch)				
Serial no.	**Course code**	**Course name**	**Credits**	**Instructor**
1	PH 202	Classical Mechanics	6	Prof. Koushik Saha
2	PH 203	Quantum Mechanics - I	6	Prof. R Prabhu
3	PH 212	General Physics Laboratory	3	All Physics Faculty (Week-wise)
4	EE 224	Digital systems	6	Prof. Nagaveni S
5	EE 214	Digital Circuits Lab	3	Prof. Nagaveni S
6	EE 212	Devices and Circuits Lab	3	Prof. Ruma Ghosh
Total credits			**27**	

SYLLABUS

Academic Unit: Department of Physics		**Level** (underline any one): ● UG ● PG
1	**Title of the course**	PHxxx: Classical Mechanics
2	**Credit Structure*** (L-T-P-C)	L: 2 T: 1 P: 0 C: 6 Semester(Full/Half)^: Full
3	**Pre-requisite courses(s)** ** specify course code(s) %	Nil
4	**Recommended$ prior exposure** specify course code(s) or background / knowledge / skills %	None
5	**Course content**	Review of Newtonian Mechanics - Newton's Laws of Motion and Conservation Laws. 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. Central Force: Equations of motion Virial Theorem, Kepler's Laws, Scattering in a Central Force Field. Rigid Body: Euler angles, Coriolis Effect, Euler equations, moment of inertia tensor, motion of asymmetric top. Small Oscillations: Eigen value problem, frequencies of free vibrations and normal modes, forced vibration, dissipation. 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. Hamiltonian Equation, Gauge transformation, canonical transformation, Infinitesimal transformation, Poisson brackets, Hamilton-Jacobi equations, Separation of variables. Lagrangian and Hamiltonian formulation of continuous systems.

6	**Texts/References** (Minimum 2/3)	1. Classical Mechanics: H. Goldstein, C. P. Poole, and J. Safko, Pearson 2011. 2. Classical Mechanics: N. C. Rana and P. S. Joag, Tata McGraw Hill, 2017. 3. Introduction to Classical Mechanics: David Morin, Cambridge University Press, 2008. 4. Mechanics: L.D. Landau and E. M. Lifshitz, Butterworth-Heinemann, 3rd edition, 1982. 5. Mechanics: From Newton's Laws to Deterministic Chaos, F. Scheck, Springer, 5th edition, 2010. 6. Introduction to Classical Mechanics, R G Takwale and P S Puranik, Tata McGraw Hill, 2008.
7	**Need for introducing the course**	Classical Mechanics is a mature field in Science describing the motion of macroscopic objects. Consequently, content of this course will be useful for all kinds of Engineers.
8	**Name (s) of other departments / Academic Units to whom the course is relevant** %	Physics and All Engineering
9	**Is there any course(s) in the same/ other academic unit(s) which is similar to this course? If so, please give details.**%	No
10	**DUGC or DPGC Approval Date** (DD/MM/YYYY)	19/10/2021

Academic Unit: Department of Physics **Level** (underline any one): ● UG ● PG

1	**Title of the course**	PHxxx: Quantum Mechanics
2	**Credit Structure*** (L-T-P-C)	L: 2 T: 1 P: 0 C: 6 Semester(Full/Half)^: Full
3	**Pre-requisite courses(s)** ** specify course code(s) %	PH101 MA101
4	**Recommended$ prior exposure** specify course code(s) or background / knowledge / skills %	None
5	**Course content**	Review of Wave mechanics, Schrodinger equation, Uncertainty principle, wave packets, group velocity and phase velocity. Postulates of quantum mechanics, probability and probability current density, operators, eigenvalues and eigenfunctions. Bound states, delta-function potential, and harmonic oscillator. Formalism: Hilbert space, Observables, Eigenfunctions of Hermitian operator, Dirac's notation, matrix representations of vectors and operators, parity operation, matrix theory of harmonic oscillator. Theory of Angular Momentum: Spherical harmonics, eigenvalues of L^2 and Lz, addition of angular momentum, commutation relations, degeneracies. Hydrogen atom, quantum numbers, two particle systems.
6	**Texts/References** (Minimum 2/3)	1. Introduction to Quantum Mechanics, D. J. Griffiths and D. F. Schroeter, Cambridge University Press, 3rd edition, 2019. 2. Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press, 2017. 3. Principles of Quantum Mechanics, R. Shankar, Springer, 2014. 4. Quantum Physics, S. Gasiorowicz, John Wiley, 2000. 5. Quantum Mechanics, L. D. Landau and E.M. Lifshitz, Pergamon press, 1965

7	**Need for introducing the course**	This course concentrates on developing the postulates that governs the quantum physics, some necessary tools to understand the behavior of quantum systems, introduces the Dirac's formalism to quantum mechanics, and addresses the understanding of some physical systems at quantum level. In the first course of quantum physics, through PH101, the students are introduced to various basic aspects of quantum systems. Which was more generic in nature, however, this course tries to make the learning of quantum mechanics streamlined and deal with exact physics systems.
8	**Name (s) of other departments / Academic Units to whom the course is relevant** %	Physics and All Engineering
9	**Is there any course(s) in the same/ other academic unit(s) which is similar to this course? If so, please give details.**%	No
10	**DUGC or DPGC Approval Date** (DD/MM/YYYY)	19/10/2021

1	**Title of the course**	General Physics Lab
2	**Credit Structure (L-T-P-C)** (e.g. L:2, T:1, P:0, C:6)	L: 0 T: 0 P: 3 C: 3
3	**Whether full or half semester course** Tick mark (or underline) appropriate option	Y <u>Full Semester</u> ☐ Half Semester
4	**Course content**	**Experiments:** 1. Measurement of centrifugal force *To determine the centrifugal force as a function of (a) mass, (b) angular velocity and (c) distance from the axis of rotation to the centre of gravity of a car.* 2. Pohl's Pendulum *Measurement and analysis of forced harmonic rotary oscillations.* 3. Hall effect *To determine the Hall coefficient and the carrier concentration of n-type and p-type Germanium.* 4. Hysteresis loop of a ferromagnetic material *To obtain the hysteresis loop (B-H curve) of a ferromagnetic material and to measure its retentivity, coercivity and saturation magnetization.* 5. Specific heat capacity of solids *To determine the specific heat of solids (Copper, lead and glass).* 6. Franck-Hertz experiment *(i) To measure the excitation potential of Argon using the Franck-Hertz method.* *(ii) To verify that atomic systems have discrete energy levels by bombarding electrons and observing the difference in energy levels.* 7. Photoelectric effect *(i). To determine the stopping potential for different light frequencies and intensities and plot it over light frequency.* *(ii). To calculate Planck's constant from the dependence of stopping potential on the light frequency.* 8. Newton's Rings

		To measure the wavelength of a monochromatic light.
5	**Texts/References**	1. R. A. Dunlop, Experimental Physics, Oxford University Press, 1988. 2. A. C. Melissinos, Experiments in Modern Physics, Academic Press, 1996. 3. A. Beiser, Concepts of Modern Physics, McGraw-Hill Education (2015). 4. Charles Kittel, Introduction to Solid State Physics, 8th edition (2004). 5. Fundamentals of Optics, Fourth Edition by Francis A. Jenkins and Harvey E. White (2001).
6	**Name (s) of other departments / Academic Units to whom the course is relevant**	NA
7	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
8	**Mandatory Pre-requisite(s) - specify course number(s)**	NA
9	**Recommended Pre-requisite(s) - specify course number(s)**	NA
10	**Justification/ Need for introducing the course**	The experiments will provide the students a practical understanding of various fundamental physical phenomena in the core subjects of Physics. The experience attained will be further helpful for them in carrying out more advanced experiments in the field of their interest in Physics.

Name of Academic Unit: Electrical Engineering
Level: UG
Programme: B.Tech.

i	**Title of the course**	EE 204 Digital Systems
ii	**Credit Structure (L-T-P-C)**	(2-1-0-6)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Spring
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) specify course number(s)**	None
vii	**Course Content**	• **Introduction to Digital Systems** • **Number systems and Logic:** Number Systems, Different Codes, Boolean logic, basic gates, truth tables • **Introduction to Logic families:** TTL, CMOS etc. • **Boolean Algebra:** Laws of Boolean Algebra, logic minimization using K maps • **Combinational Logic Circuits:** Adders, Subtractors, Multipliers, MSI components like Comparators, Decoders, Encoders, MUXs, DEMUXs • **Sequential circuits:** Latches, Flipflops, Analysis of clocked sequential circuits, Registers and Counters (Synchronous and Asynchronous), State Machines • **Introduction to Hardware Description Languages** • **Array based logic elements:** Memory, PLA, PLD, FPGA • **Special Topics:** Asynchronous State machines, Testing and Verification of Digital Systems
viii	**Texts/References**	1. J. F. Wakerly: Digital Design, Principles and Practices,4th Edition,Pearson Education, 2005 2. M. Moris Mano; Digital Design, 4th Edition, Pearson,2009 3. Ronald J. Tocci; Digital System, Principles and Applications, 10th Edition, Pearson, 2009 4. H.Taub and D. Schilling; Digital Integrated Electronics, McGraw Hill, 1977 5. Charles H Roth; Digital Systems Design using VHDL, Thomson Learning, 1998
ix	**Name(s) of Instructor(s)**	RG
x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	Computer Science Engineering
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which**	No

	is/ are equivalent to this course? If so, please give details.	
xii	**Justification/ Need for introducing the course**	This course introduces students to the world of Digital Systems by introducing concept of Boolean Algebra and Logic Functions. This course is a beginning of the spine related to Digital Design, Microprocessor, Embedded Systems etc,

Name of Academic Unit: Electrical Engineering
Level: B. Tech
Programme: B. Tech.

i	**Title of the course**	**EE 214: Digital Circuits Laboratory**
ii	**Credit Structure (L-T-P-C)**	(0 0 3 3)
iii	**Type of Course**	Core course
iv	**Semester in which normally to be offered**	Autumn
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – *specify course number(s)***	Digital Systems Theory (EE224)
Vii	**Course Content***	This purpose of this lab is to complement the Digital Systems Theory Course. The following is the tentative list of experiments for this lab: Experiments with discrete ICs 1. Introduction of digital ICs 2. Realizing Boolean expressions 3. Adder/Subtractor 4. Shift registers 5. Synchronous Counters 6. Asynchronous Counters + 7-segment display 7. Finite State Machines (2 weeks) Experiments with CPLDs 1. Arithmetic and Logic Unit 2. LCD, Buzzer Interfacing 3. Pipelining
Viii	**Texts/References**	1. M. Moris Mano; Digital Design, 5th Edition, Pearson, 2009 2. J.F.Wakerly: Digital Design, Principles and Practices,4th Edition,Pearson Education, 2005 3. Ronald J. Tocci; Digital System, Principles and Applications, 10th Edition, Pearson, 2009
ix	**Name(s) of Instructor(s) *****	RG

x	**Name(s) of other Departments/ Academic Units to whom the course is relevant**	Computer Science
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	The lab deals with fundamental digital circuits which are extensively used in electronic gadgets.

Name of Academic Unit: Electrical Engineering
Level: B. Tech.
Programme: B.Tech.

i	**Title of the course**	Devices and circuits Lab
ii	**Credit Structure (L-T-P-C)**	0-0-3-3
iii	**Type of Course**	Core (Lab)
iv	**Semester in which normally to be offered**	Spring
v	**Whether Full or Half Semester Course**	Full
vi	**Pre-requisite(s), if any (For the students) – specify course number(s)**	Electronic Devices, Analog circuits
vii	**Course Content**	This lab will reinforce concepts thought in Electronic devices and analog circuits. It will have experiments on Device characterization and circuits design and characterization. The following is the tentative list of experiments for this lab: 1. LED and Photodiode characterization 2. BJT biasing and CE amplifier 3. Solar cell characterization 4. Diode Temperature characteristics 5. NMOS characterization and CS amplifier 6. MOS differential amplifier 7. basic opamp circuits 8. Active filters 9. Multivibrators 10. Audio amplifiers
viii	**Texts/References**	1. J.V.Wait, L.P.Huelsman and GA Korn, Introduction to Operational Amplifier theory and applications, 2nd edition, McGraw Hill, New York, 1992. 2. J. Millman and A. Grabel, Microelectronics, 2nd edition, McGraw Hill, 1988. 3. Behzad Razavi, Fundamentals of microelectronics, Wiley Publications 4. A.S.Sedra and K.C. Smith,Microelectronic Circuits, Saunder's College Publishing, Edition IV, 2017. 5. Ramakant Gayakwad, Op-amps and Linear Integrated Circuit, 4th edition, Pearson, 2000.
ix	**Name(s) of Instructor(s)**	NK
x	**Name(s) of other Departments/**	Electrical Engineering

	Academic Units to whom the course is relevant	
xi	**Is/Are there any course(s) in the same/ other academic unit(s) which is/ are equivalent to this course? If so, please give details.**	No
xii	**Justification/ Need for introducing the course**	The lab trains students in design and debug of analog electronic circuits and improves understanding of electronic devices. The lab is required for the reinforcement of the concepts taught in Electronic devices, Analog circuits and network theory courses.