

Engineering Physics

SEMESTER - IV						
Sl. No.	Course Code	Course Name	L	T	P	C
1	PH305T	<u>Statistical Physics</u>	2	1	0	6
2	EE103T	<u>Digital Systems</u>	2	1	0	6
3	CS302T	<u>Computer Architecture</u>	2	1	0	6
4	EE105T	<u>Electronic Devices (Post mid-sem)</u>	3	0	0	3
5	ME201T	<u>Engineering Mechanics</u>	2	1	0	6
6	PH301L	<u>General Physics Laboratory</u>	0	0	3	3
7	EE101L	<u>Digital Circuits Laboratory</u>	0	0	3	3
8	CS301L	<u>Computer Architecture Laboratory</u>	0	0	3	3
	Fourth Semester Total Credits					36
	Total Cumulative Credits after 2nd Year					149

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1	Title of the course (L-T-P-C)	Statistical Physics (2-1-0-6)
2	Pre-requisite courses(s)	None
3	Course content	<p>Thermodynamics: Thermal equilibrium, the laws of thermodynamics; temperature, energy, entropy, and other functions of state.</p> <p>Probability Theory: Probability densities, cumulants and correlations; central limit theorem; laws of large numbers.</p> <p>Kinetic Theory: Phase space densities; Liouville's theorem, the Boltzmann equation; transport phenomena.</p> <p>Classical Statistical Mechanics: Postulates; microcanonical, canonical and grand canonical ensembles; Gibb's paradox, non-interacting examples. Maxwell Boltzmann distribution, ideal gas.</p> <p>Quantum Statistical Mechanics: Indistinguishability, Bose-Einstein and Fermi- Dirac distributions and Applications</p> <p>Interacting Systems: Virial and cluster expansions; van der Waals theory; liquid- vapor condensation.</p> <p>Quantization effects in molecular gases; phonons, photons; density matrix formulation.</p> <p>Identical Particles: Degenerate quantum gases; Fermi liquids; Bose condensation; superfluidity.</p>
4	Texts/References	<ol style="list-style-type: none"> 1. Huang, Kerson. Statistical Mechanics. 2nd ed. Wiley, 1987. 2. Baierlein, Thermal Physics (Cambridge University Press, 1999). 3. Pathria, R. K. Statistical Mechanics. Pergamon Press, 1972. 4. Ma, Shang-keng. Statistical Mechanics. Translated by M. K. Fung. World Scientific Publishing Company, 1985. 5. J. K. Bhattacharjee, Statistical Physics: Equilibrium and Non-Equilibrium Aspects, Allied Publishes, 2000 6. F. Reif, Fundamentals of Statistical and Thermal Physics Statistical Physics: Amit and Verbin, Word Scientific, 1999

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1	Title of the course (L-T-P-C)	Electronic Devices (3-0-0-3)
2	Pre-requisite courses(s)	EE 102
3	Course content	<ul style="list-style-type: none"> ● Introduction of Semiconductor Equations: Fermi-Dirac Distribution, Boltzmann's approximation ● Semiconductor Diodes: Barrier formation in metal- semiconductor junctions, PN homo- and hetero- junctions; CV characteristics and dopant profiling; IV characteristics; Small signal models of diodes; Some Applications of diodes. ● Field Effect Devices: JFET/HFET, MIS structures and MOSFET operation; JFET characteristics and small signal models; MOS capacitor CV and concept of accumulation, depletion, and inversion; MOSFET characteristics and small signal models. Bipolar transistors: IV characteristics and Ebers-Moll model; small signal models; Charge storage and transient response
4	Texts/References	<ol style="list-style-type: none"> 1. D. A. Neamen, Semiconductor Physics and Devices, 4e Edition, McgrawHill, 13th reprint, 2016. 2. E.S. Yang, Microelectronic Devices, McGraw Hill, Singapore, 1988. 3. B.G. Streetman, Solid State Electronic Devices, 7th Edition, Pearson, 2016. 4. J. Millman and A. Grabel, Microelectronics, II edition 34th reprint McGraw Hill, International, 2017. 5. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, 1991. 6. R.T. Howe and C.G. Sodini, Microelectronics: An integrated Approach, Prentice Hall International, 1997.

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1	Title of the course (L-T-P-C)	Digital Systems (2-1-0-6)
2	Pre-requisite courses(s)	None
3	Course content	<ul style="list-style-type: none"> • 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
4	Texts/References	<ol style="list-style-type: none"> 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 Charles H Roth; Digital Systems Design using VHDL, Thomson Learning, 1998.

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1	Title of the course (L-T-P-C)	Computer Architecture (3-0-0-6)
2	Pre-requisite courses(s)	--
3	Course content	<p>The Language of Bits, Assembly Language, Logic Gates, Registers, and Memories, Processor Design, Principles of Pipelining, The Memory System, Multiprocessor Systems, I/O and Storage Devices.</p> <p>Each concept will be first taught on the basis of the fundamental driving principles. Following this, real world examples (e.g., ARM processors) will be used to emphasize the content.</p>
4	Texts/References	<ol style="list-style-type: none">1. Computer Organization and Architecture, by Smruti Ranjan Sarangi, McGraw Higher Ed, 2017.2. Computer Architecture A Quantitative Approach, Sixth edition, by David Patterson and John L. Hennesy, Morgan Kaufmann, 2017.

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1	Title of the course (L-T-P-C)	Computer Architecture Laboratory (0-0-3-3)
2	Pre-requisite courses(s)	--
3	Course content	The lab will closely follow the theory course. The idea is to have the students develop a software model of a simple processor, capturing both functionality and timing aspects. They will implement modules as the concepts are taught in class.
4	Texts/References	Nil

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1	Title of the course (L-T-P-C)	Engineering Mechanics (2-1-0-6)
2	Pre-requisite courses(s)	--
3	Course content	<p>Module 1: Introduction to Engineering Mechanics covering, Force Systems Basic concepts, Particle equilibrium in 2-D & 3-D; Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy</p> <p>Module 2: Friction covering, Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack;</p> <p>Module 3: Basic Structural Analysis covering, Equilibrium in three dimensions; Method of Sections; Method of Joints; How to determine if a member is in tension or compression; Simple Trusses; Zero force members; Beams & types of beams; Frames & Machines;</p> <p>Module 4: Centroid and Centre of Gravity covering, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook;</p> <p>Module 5: Virtual Work and Energy Method- Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, degrees of freedom. Active force diagram, systems with friction, mechanical efficiency. Conservative forces and potential energy (elastic and gravitational), energy equation for equilibrium. Applications of energy method for equilibrium. Stability of equilibrium.</p> <p>Module 6: Particles dynamics- Kinematics of Particles: Rectilinear motion, Plane curvilinear motion - rectangular coordinates, normal and tangential coordinates, polar coordinates, Space curvilinear - cylindrical, spherical (coordinates), Relative and Constrained motion. Kinetics of Particles: Force, mass and acceleration – rectilinear and curvilinear motion, work and energy, impulse and momentum – linear and angular; Impact – Direct and Oblique. Kinetics of System of Particles: Generalized Newton's Second Law, Work-Energy, Impulse-Momentum, Conservation of Energy and Momentum</p> <p>Module 7: Introduction to Rigid body dynamics Kinematics of Planar Rigid Bodies: Equations for rotation of a rigid body about a fixed axis, General plane motion, Instantaneous Center of Rotation in Plane Motion Plane Motion of a Particle Relative to a Rotating Frame. Coriolis Acceleration Kinetics of Planar Rigid Bodies: Equations of Motion for a Rigid Body, Angular Momentum of a Rigid Body in Plane Motion, Plane Motion of a Rigid Body and D'Alembert's Principle, Systems of Rigid Bodies, Constrained Plane Motion; Energy and Work of Forces Acting on a Rigid Body, Kinetic Energy of a Rigid Body in Plane Motion, Systems of Rigid Bodies, Conservation of Energy, Plane Motion of a Rigid Body - Impulse and Momentum, Systems of Rigid Bodies, Conservation of Angular Momentum.</p>

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		<p>Module 8: Mechanical Vibrations covering, Basic terminology, free and forced vibrations, resonance and its effects; Degree of freedom; Derivation for frequency and amplitude of free vibrations without damping and single degree of freedom system, simple problems, types of pendulum, use of simple, compound and torsion pendulums</p>
4	Texts/References	<p>Textbooks:</p> <ol style="list-style-type: none"> 1. J. L. Meriam and L. G. Kraige, Engineering Mechanics, Vol I – Statics, Vol II – Dynamics, 6th Ed, John Wiley, 2008. 2. F. P. Beer and E. R. Johnston, Vector Mechanics for Engineers, Vol I - Statics, Vol II – Dynamics, 9th Ed, Tata McGraw Hill, 2011. 3. R. C. Hibbler, Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press, 2006. <p>References:</p> <ol style="list-style-type: none"> 1. S. P. Timoshenko and D. H. Young, Engineering Mechanics. Fourth Edition. McGraw-Hill, New York, 1956. 2. I. H. Shames, Engineering Mechanics: Statics and dynamics, 4th Ed, PHI, 2002. 3. Robert W. Soutas-Little; Daniel J. Inman; Daniel Balint, Engineering Mechanics: Dynamics – Computational Edition, 1st Ed., Cengage Learning, 2007 4. Robert W. Soutas-Little; Daniel J. Inman; Daniel Balint, Engineering Mechanics: Statics-Computational Edition, 1st Ed., ,Cengage Learning, 2007

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1	Title of the course (L-T-P-C)	Digital Circuits Laboratory (0-0-3-3)
2	Pre-requisite courses(s)	Digital Systems Theory (EE224)
3	Course content	<p>This purpose of this lab is to complement the Digital Systems Theory Course. The following is the tentative list of experiments for this lab:</p> <p>Experiments with discrete ICs</p> <ol style="list-style-type: none">1. Introduction of digital ICs2. Realizing Boolean expressions3. Adder/Subtractor4. Shift registers5. Synchronous Counters6. Asynchronous Counters +7. segment display8. Finite State Machines (2 weeks) Experiments with CPLDs9. Arithmetic and Logic Unit10. LCD, Buzzer Interfacing Pipelining
4	Texts/References	<ol style="list-style-type: none">1. M. Moris Mano; Digital Design, 5th Edition, Pearson, 20092. J.F.Wakerly: Digital Design, Principles and Practices, 4th Edition, Pearson Education, 20053. Ronald J. Tocci; Digital System, Principles and Applications, 10th Edition, Pearson, 2009