MARUDHAR KESARI JAIN COLLEGE FOR WOMEN (AUTONOMOUS)

Vaniyambadi – 635 751

PG & Research Department of Physics

for

Postgraduate Programme

Master of Physics

From the Academic Year 2025-2026

CONTENT

LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK FOR UNDERGRADUATE AND POSTGRADUATE EDUCATION

1. **Preamble**

The curriculum for the P.G. Physics for universities and colleges is revised as per Learning Outcomes- based Curriculum Framework (LOCF). The learner centric courses are designed to enable the students to progressively develop a good understanding of the concepts of various domains in physics. Significant modification is the inclusion of the courses to equip students to face challenges in industries and make them employable. Skill development in different spheres and confidence building are given a special focus.

PROGRAMME OUTCOMES (PO)

Programme	**M.Sc., Physics**
Programme Code	**PS07**
Duration	**2Years[PG]**
Programme Outcomes	**PO1:** Acquire knowledge in Physics to apply the knowledge in their day-to-day life for betterment of self and society. **PO2:** Develop critical, analytical thinking and problem-solving skills **PO3:** Develop research related skills in defining the problem, formulate and test the hypothesis, analyse, interpret, and draw conclusion from data. **PO4:** Address and develop solutions for societal and environmental needs of local regional and national development. **PO5:** Work independently and engage in lifelong learning and enduring proficient progress. **PO6:** Provoke employability and entrepreneurship among students along with ethics andcommunication skills. **PO7:** Understand the importance of ethical behavior in business contexts and be able to recognize and address ethical dilemmas they may encounter in their professional careers. **PO8:** Prepared for lifelong learning and professional development, including the ability to adapt to changes in technology, business practices, and economic conditions throughout their careers.
Programme Specific Outcomes:	**PSO1: Placement**: Acquire the ability to critically analyze complex real life problems using the laws of Physics with appropriate mathematical tools and thereby preparing the students to face various state/national level competitive exams. **PSO2: Entrepreneur:** Acquire employability and entrepreneurial skills through hands-on training in basic as well as advanced areas of Physics and to develop innovative scientific solutions for industrial and societal needs at local, regional, national and global levels. **PSO3: Contribution to the Society:** Create skills required for identifying socially relevant research problems, collection of data, analyze and interpret data leading to knowledge enhancement in addressing the societal challenges.

Eligibility for Admission:

Candidates for admission to the first year of the Master of Physics course shall be required to have passed the Bachelor of Physics by the Government of Tamilnadu or any equivalent.

Methods of Evaluation and Assessment

Methods of Evaluation		
Internal Evaluation		25 Marks
External Evaluation	End Semester Examination	75 Marks
	Total	**100 Marks**
Methods of Assessment		
Recall (K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understand / Comprehend (K2)	MCQ, True/False, Short essays, Concept explanations, short summary or overview	
Application (K3)	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain	
Analyze (K4)	Problem-solving questions, finish a procedure in many steps, Differentiate Between various ideas, Map knowledge	
Evaluate (K5)	Longer essay/Evaluation essay, Critique or justify with pros and cons	
Create (K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations	

Semester - I						
Code	Course Title	Hours Distribution				C
		L	T	P	S	
24PPHC11	CC - Mathematical Physics	5	1	0	0	4
24PPHC12	CC - Classical Mechanics and Relativity	5	1	0	0	4
24PPHC13P	CC – Practical I – Analog and Digital Experiments	0	0	5	0	3
24PPHE11	DSEC - 1 Linear and Digital ICs and Applications	4	0	1	0	3
24PPHE12	EC – 1. Crystal growth and Thin Films/ **2.**Analysis of Crystal Structures	3	0	1	0	3
24PPHA11	AECC - Solar energy utilization	1	1	0	0	3
24PCHR11	VE - 1 Human Rights	1	1	0	0	3
TOTAL					**30**	**21**

Semester -II						
Code	Course Title	Hours Distribution				C
		L	T	P	S	
24PPHC21	CC-Statistical Mechanics	5	0	0	0	4
24PPHC23	CC - Quantum Mechanics – I	5	0	0	0	4
24PPHC24	CC - Electromagnetic Theory	5	0	0	0	4
24PPHC22P	CC - Practical II - General Experiments	0	0	5	0	2
24PPHE21	DSEC I - Advanced Optics	4	0	0	0	3
24PPHE22	DSEC II - Physics of Nanoscience and Technology	4	0	0	0	3
24PPHS21	SEC /NM- Renewable Energy and Energy Harvesting	2	0	0	0	2
TOTAL					**30**	**22**

Semester - III						
24PPHC31	CC - Quantum Mechanics-II	5	1	0	0	5
24PPHC32	CC - Condensed Matter Physics	5	1	0	0	5
24PPHC33P	CC – Practical-III Microprocessor and Programming in C	0	0	5	0	4
24PPHC34	CC - Numerical Methods and Programming in C	3	1	0	0	3
24PPHE31 /24PPHE32	EC – 1. Microprocessor 8085 and Microcontroller 8051 2. Astro Physics	4	0	0	0	3
24PPHS31	SEC - Electrical Circuit Network Skills	1	1	0	0	2
24PPHIN31	Internship	0	0	3	0	2
					30	**24**

Semester - IV						
	CC - Spectroscopy	3	1	2	0	5
	CC - Advanced General Experiments-Practical	0	0	6	0	5
	CC - 14 Project	0	0	6	0	5
	EC - Characterization of Materials	4	1	1	0	4
	PEC - 1	1	1	0	0	2
	SLC - 1	0	0	1	3	2
					30	**23**
	Total Credits	**90+2***				

Students must complete at least one online course (MOOC) from platforms like SWAYAM, NPTEL, or Nanmudalvan within the fifth semester. Additionally, engaging in a specified Self-learning Course is mandatory to qualify for the degree, and successful participation will be acknowledged with an extra credit of 2*.

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PPHC31	**QUANTUM MECHANICS-II**	Core	5	1	0	0	5	6	25	75	100

Learning Objectives	
LO1	To familiarize the students with the crucial concepts of scattering theory such as partial wave analysis and Born approximation.
LO2	To understand time-dependent Perturbation theory and its application to study of interaction of an atom with the electromagnetic field
LO3	To comprehend the concepts of relativistic equations in quantum mechanics.
LO4	To give the students a firm grounding in relativistic quantum mechanics, with emphasis on Dirac equation and related concepts
LO5	To introduce the concept of classical field in quantum mechanics.

Unit	Content	Hours
1	**SCATTERING THEORY:** Scattering amplitude – Cross sections – Born approximation and its validity– Yukawa potential – Partial wave analysis – Scattering length and Effective range theory for s wave – Optical theorem – Transformation from centre of mass to laboratory frame.	15
2	**PERTURBATION THEORY:** Time dependent perturbation theory – Constant and harmonic perturbations – Fermi Golden rule – Transition probability Einstein's A and B Coefficients – Adiabatic approximation – Sudden approximation – Semi – classical treatment of an atom with electromagnetic radiation – Selection rules for dipole radiation	15
3	**RELATIVISTIC QUANTUM MECHANICS:** Klein – Gordon Equation – Charge and Current Densities – Dirac Matrices –Plane Wave Solutions – Interpretation of Negative Energy States – Antiparticles – Spin of Electron – Magnetic Moment of An Electron Due to Spin	15
4	**DIRAC EQUATION:** Dirac Equation – Covariant form of Dirac Equation – Properties of the gamma matrices – Traces – Relativistic invariance of Dirac equation – Probability Density – Current four vector – Bilinear covariant – Feynman's theory of positron (Elementary ideas only without propagation formalism)	15
5	**CLASSICAL FIELDS & SECOND QUANTIZATION:** Classical fields – Euler Lagrange equation – Hamiltonian formulation – Noether's theorem – Quantization of real and complex scalar fields – Creation, Annihilation and Number operators– Second Quantization of K-G field.	15

CO	Course Outcomes The student will be able to
CO1	Describe the concept of scattering theory such as partial wave analysis and Born approximation
CO2	Explain the relativistic quantum mechanics, with emphasis on perturbation theory.
CO3	Discuss the relativistic quantum mechanical equations namely, Klein-Gordon and Dirac matrices its phenomena accounted by them like electron spin and magnetic moment
CO4	Examine the concept of covariance and the use of Feynman graphs for depicting different interactions
CO5	Analyse the classical fields and second quantization
Textbooks:	
1	P. M. Mathews and K. Venkatesan, A Text book of Quantum Mechanics,2nd Edition, Tata McGraw-Hill, New Delhi, 2010.
2	G. Aruldhas, Quantum Mechanics, 2nd edition, Prentice Hall of India, New Delhi, 2009.
3	L. I. Schiff, Quantum Mechanics, 3rd Edition, International Student Edition, McGraw-Hill Kogakusha, Tokyo, 1968
4	V. Devanathan, Quantum Mechanics, 1st Edition, Narosa Publishing House, New Delhi, 2005.
5	Noureddine Zettili, Quantum mechanics concepts and applications, 2nd Edition, Wiley, 2017
Reference Books:	
1	P. A. M. Dirac, The Principles of Quantum Mechanics, 4th Edition, Oxford University Press, London, 1973.
2	B.K. Agarwal & HariPrakash, Quantum Mechanics, 7th reprint, PHI Learning Pvt. Ltd., New Delhi, 2009.
3	Deep Chandra Joshi, Quantum Electrodynamics and Particle Physics,1 stedition,I.K. International Publishing house Pvt. Ltd., 2006
4	Ghatak and S. Loganathan, Quantum Mechanics: Theory and Applications, 4th Edition, Macmillan India, New Delhi.
5	E. Merzbacher, Quantum Mechanics, 2nd edition, John Wiley and Sons, New York, 1970
Web resources:	
1	http://www.thphys.nuim.ie/Notes/MP463/MP463_Ch1.pdf
2	http://hep.itp.tuwien.ac.at/~kreuzer/qt08.pdf
3	https://www.cmi.ac.in/~govind/teaching/rel-qm-rc13/rel-qm-notes-gk.pdf
4	https://web.mit.edu/dikaiser/www/FdsAmSci.pdf
5	https://ocw.mit.edu/courses/physics/8-05-quantum-physics-ii-fall-2013/lecture notes/MIT8_05F13_Chap_09.pdf

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2	3	2	3	3	3
CO2	3	3	3	3	3	2	3	2	3	3	3
CO3	2	3	3	2	3	2	3	2	3	3	3
CO4	3	3	3	3	3	2	3	3	3	3	3
CO5	3	3	3	2	3	2	3	3	3	3	3
Total	14	15	15	13	15	10	15	12	15	15	15
Average	**2.8**	**3**	**3**	**2.6**	**3**	**2**	**3**	**2.4**	**3**	**3**	**3**

3 – Strong, 2- Medium, 1- Low

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PPHC32	CONDENSED MATTER PHYSICS	Core	5	1	0	0	5	6	25	75	100

Learning Objectives

LO1	To understand the basics of crystal and describe various crystal structures, symmetry and to analyze allowed rotation , crystal binding differentiate different types of bonding
LO2	To understand reciprocal space, understand the lattice dynamics, evaluate phase and group velocities and apply it to concept of specific heat.
LO3	To critically assess various theories of electrons in solids and their impact in distinguishing solids.
LO4	To outline different types of magnetic materials and explain the underlying phenomena.
LO5	To elucidate concepts of superconductivity, and the underlying theories to relate to current areas of research.

Unit	Content	Hours
1	**CRYSTAL PHYSICS:** Introduction about crystal,lattice and their Types of lattices - Miller indices – Symmetry elements and allowed rotations - Simple crystal structures – Atomic Packing Factor- Crystal diffraction - Diffraction Conditions -Bragg's law – Laue equations- Scattered Wave Amplitude - Atomic form factor- Structure factor- Reciprocal Lattice (sc, bcc, fcc), Brillouin zone. Structure and properties of liquid crystals. Inert gas crystals - Cohesive energy of ionic crystals - Madelung constant - Types of crystal binding (general ideas).	15
2	**LATTICE DYNAMICS:** Lattice with two atoms per primitive cell - First Brillouin zone - Group and phase velocities - Quantization of lattice vibrations - Phonon momentum - Inelastic scattering by phonons – specific heat capacity, Einstein and Debye's theory of lattice heat capacity - Umklapp processes.	15
3	**FREE ELECTRON THEORY OF METALS AND SEMICONDUCTORS:** Drude – Lorentz theory of electrical conduction-Electrical conductivity- Thermal conductivity - Wiedemann-Franz law - Free electron gas in three dimensions - Band theory of metals and semiconductors - Bloch theorem - Kronig-Penney model - Semiconductors - Intrinsic carrier concentration - Mobility - Impurity conductivity – Impurity states - Hall effect – Fermi surfaces and construction - Experimental methods in Fermi surface studies - de Hassvan Alphen effect .	15
4	**MAGNETISM:** Magnetic materials and their types - Diamagnetism - Quantum theory of paramagnetism - Rare earth ion Hund's rule - Quenching of orbital angular momentum - Adiabatic demagnetization - Quantum theory of ferromagnetism - Domain theory of ferromagnetic theory - Heisenberg's interpretation of Weiss field Ferromagnetic domains - Bloch wall - Spin waves - Quantization Magnons - Thermal excitation of magnons - Curie temperature and	15

	susceptibility of ferrimagnets - Theory of anti-ferromagnetism - Neel temperature	
5	**SUPERCONDUCTIVITY:** Experimental facts: Occurrence - Effect of magnetic fields - Meissner effect – Critical field – Critical current – Thermodynamic properties of Entropy and heat capacity - Energy gap - Microwave and infrared properties - Type I and II Superconductors. Theoretical Explanation: Thermodynamics of super conducting transition - London equation - Coherence length – Isotope effect - Cooper pairs – Bardeen Cooper Schrieffer (BCS) Theory – BCS to Bose–Einstein Condensation (BEC) regime - Josephson tunneling - DC and AC Josephson effects - High temperature Superconductors – SQUIDS.	15

CO	**Course Outcomes** Student will be able to
CO1	Describe the types and explain the crystal systems, symmetries allowed in a system and also the diffraction techniques to find the crystal structure
CO2	Visualize the idea of reciprocal spaces, Brillouin Zone and their extension to band theory of solids.
CO3	Examine the process of heat conduction in solids and semiconductors
CO4	Analyse, compare and contrast the different types of magnetic materials.
CO5	Conceptualize the idea of superconductivity and their applications
Textbooks:	
1	C. Kittel, 1996, Introduction to Solid state Physics, 7th Edition, Wiley, New York.
2	Rita John, Solid State Physics, Tata Mc-Graw Hill Publication
3	A. J. Dekker, Solid State Physics, Macmillan India, New Delhi.
4	M. Ali Omar, 1974, Elementary Solid State Physics – Principles and Applications, Addison – Wesley
5	H.P. Myers, 1998, Introductory Solid State Physics, 2nd Edition, Viva Book, New Delhi.
6	Solid State Physics , R L Singhal, Kedarnath Ram Nath& Co., Meerut (2003)
Reference Books:	
1	J. S. Blakemore, 1974, Solid state Physics, 2nd Edition, W.B. Saunder, Philadelphia
2	H. M. Rosenburg, 1993, The SolidState, 3rd Edition, Oxford University Press, Oxford.
3	J. M. Ziman, 1971, Principles of the Theory of Solids, CambridgeUniversity Press, London
4	C. Ross-Innes and E. H. Rhoderick, 1976, Introduction to Superconductivity, Pergamon, Oxford
5	J. P. Srivastava, 2001, Elements of Solid State Physics, Prentice-Hall of India, New Delhi.

	S. O. Pillai - Solid State Physics, Narosa publication
	Raghavan - Materials science and Engineering, PHI
Web resources:	
1	https://archive.nptel.ac.in/courses/115/105/115105099/
2	http://www.digimat.in/nptel/courses/video/115105099/L75.html
3	https://archive.nptel.ac.in/content/storage2/courses/downloads_new/115105099/noc19_ph14_assignment_Week_1.pdf
4	http://www.digimat.in/nptel/courses/video/115102026/L01.html
5	https://nptel.ac.in/downloads/115105099/

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	3	2	3	2	3	3
CO2	3	3	3	3	3	3	2	3	2	2	3
CO3	3	3	3	3	3	2	2	3	3	3	3
CO4	3	3	3	3	2	2	2	3	3	3	3
CO5	3	3	2	3	2	3	2	3	3	2	2
Total	15	15	14	15	13	13	10	15	13	13	14
Average	**3**	**3**	**2.8**	**3**	**2.6**	**2.6**	**2**	**3**	**2.6**	**2.6**	**2.8**

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PPHC34	NUMERICAL METHODS AND PROGRAMMING IN C	Core	3	1	0	0	3	4	25	75	100

Learning Objectives	
LO1	To understand the methods of finding the root of algebraic equations.
LO2	To study the multiple methods of solving simultaneous equations.
LO3	To understand the interpolation and curve fittings
LO4	To study the numerical solutions of integration and solutions of differential equations.
LO5	To understand the basics of programming with C

Unit	Content	Hours
1	**UNIT I: SOLUTIONS OF EQUATIONS** Roots of equation- Linear, Non-linear algebraic equation. Roots of polynomials, nonlinear algebraic equations and transcendental equations - Newton Raphson method. Convergence of solutions in Newton-Raphson methods – Limitations of Newton-Raphson methods.	15
2	**UNIT II: LINEAR SYSTEM OF EQUATIONS** Simultaneous linear equations and their matrix representation– Inverse of a Matrix – Gaussian elimination method – Gauss Jordan method –Eigen values and eigenvectors of matrices – Direct method – Power Method.	15
3	**UNIT III: INTERPOLATION AND CURVE FITTING** **Interpolation:** Interpolation with equally spaced points - Newton forward and backward interpolation - Interpolation with unevenly spaced points - Lagrange interpolation **Curve Fitting:** Method of least squares – Fitting a Straight Line and exponential curves.	15
4	**UNIT IV: DIFFERENTIATION, INTEGRATION & SOLUTION OF DIFFERENTIAL EQUATIONS** Numerical differentiation – Numerical integration – Trapezoidal rule – Simpson's rule – Error estimates – Gauss-Legendre, Gauss-Laguerre, Gauss-Hermite and Gauss-Chebyshev quadrature–solution of ordinary differential equations – Euler and Runga Kutta methods.	15
5	**UNIT V: PROGRAMMING WITH C** Flow-charts – Integer and floating point arithmetic expressions – Built in functions – Executable and non-executable statements – Subroutines and functions – Programs for the following computational methods: (a) Zeros of polynomials/non-linear equations by the Newton-Raphson method, (b) Newton's forward and backward interpolation, Lagrange Interpolation,(c) Trapezoidal and Simpson's Rules, (d) Solution of first order differential equations by Euler's method.	15

CO	Course Outcomes Student will be able to
CO1	Recall the transcendental equations and analyze the different root finding methods. Explain the basic concept involved in root finding procedure such as Newton Raphson methods.
CO2	Relate Simultaneous linear equations and their matrix representation and distinguish between various methods of solving simultaneous linear equations.
CO3	Apply the use of, interpolation will be used in various realms of physics and Apply to some simple problems with respect to newton forward and backward interpolation
CO4	Recollect and apply methods in numerical differentiation and integration. Assess the trapezoidal and Simson's method of numerical integration
CO5	Demonstrate the basics of C-programming and conditional statements.
Textbooks:	
1	V.Rajaraman, 1993, *Computer oriented Numerical Methods*, 3rd Edition. PHI, New Delhi
2	M.K. Jain, S.R. Iyengar and R. K. Jain, 1995, *Numerical Methods for Scientific and Engineering Computation*, 3rd Edition, New Age Intl, New Delhi
3	S.S. Sastry, *Introductory Methods of Numerical analysis*, PHI, New Delhi
4	F.Scheid,1998, *Numerical Analysis*, 2nd Edition, Schaum's series, McGraw Hill, New York
5	E. Balagurusamy, *Problem solving and Python Programming*, McGraw Hill Education (India) Pvt Ltd.,
Reference Books:	
1	S. D. Conte and C. de Boor, 1981, *Elementary Numerical analysis-an algorithmic approach*, 3rd Edition, McGraw Hill
2	B.F. Gerald, and P. O. Wheatley, 1994, *Applied Numerical analysis*, 5th Edition, Addison-Wesley, MA.
3	B.Carnagan, H.A.Luther & J.O.Wilkes, 1969, *Applied Numerical Methods*, Wiley, New York.
4	S. S. Kuo, 1996, *Numerical Methods and Computers*, Addison-Wesley.
5	V. Rajaraman, *Programming in Programming in C*, PHI, New Delhi
Web resources:	
1	https://www.scribd.com/doc/202122350/Computer-Oriented-Numerical-Methods-by-VRajaRaman
2	https://www.scirp.org/(S(lz5mqp453edsnp55rrgjct55))/reference/referencespapers.aspx?referenceid=1682874
3	https://nptel.ac.in/course/122106033/
4	https://nptel.ac.in/course/103106074/
5	https://onlinecourses.nptel.ac.in/noc20_ma33/preview

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	3	2	2	2	3	2	3	2	2
CO2	3	2	3	2	2	2	3	2	3	2	2
CO3	3	2	3	2	2	2	3	2	2	3	2
CO4	3	2	3	2	2	2	3	2	2	3	2
CO5	3	2	3	2	2	2	3	2	2	2	2
Total	15	10	15	10	10	10	15	10	12	12	10
Average	**3**	**2**	**3**	**2**	**2**	**2**	**3**	**2**	**2.4**	**2.4**	**2**

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PPHE31	MICROPROCESSOR 8085 AND MICROCONTROLLER 8051	Ele- I	4	0	0	0	3	4	25	75	100

Learning Objectives

LO1	To understand the architecture and programming of the 8085 microprocessor and learn to write assembly language programs for the 8085 microprocessor.
LO2	To study the concepts of interfacing various devices with the 8085 microprocessor and learn to design and develop interfacing circuits for various applications.
LO3	To learn about the various components of the 8051 microcontroller, including the CPU, memory, and I/O ports and to Understand the different types of memory used in the 8051 microcontroller, including internal RAM, external RAM, and ROM.
LO4	To comprehend the 8051 instruction set architecture and the different types of instructions and learn to write assembly language programs for the 8051 microcontroller.
LO5	To explain the concept of interrupts and interrupt programming in microcontrollers and also understand the concept of interrupt priority and interrupt nesting.

Unit	Content	Hours
1	**8085 PROGRAMMING, PERIPHERAL DEVICES AND THEIR INTERFACING:** Instruction set - Addressing modes - Memory and I/O interfacing - Data transfer schemes - Interrupts of 8085 - Programmable peripheral interface 8255 (PPI) - Programmable interrupt controller (PIC) 8259 - Programmable communication interface 8251 - Programmable counter /interval timer 8253.	12
2	**8085 INTERFACING APPLICATIONS:** Seven segment display interface -Interfacing of Digital to Analog converter and Analog to Digital converter - Stepper motor interface - Measurement of electrical quantities (Voltage and current) Measurement of physical quantities (Temperature and strain).	12
3	**8051 MICROCONTROLLER HARDWARE:** Introduction – Features of 8051 – 8051 Microcontroller Hardware: Pin-out 8051, Central Processing Unit (CPU), internal RAM, Internal ROM, Register set of 8051 – Memory organization of 8051 – Input/Output pins, Ports and Circuits – External data memory and program memory: External program memory, External data memory.	12
4	**8051 INSTRUCTION SET AND ASSEMBLY LANGUAGE PROGRAMMING:** Addressing modes – Data moving (Data transfer) instructions: Instructions to Access external data memory, external ROM / program memory, PUSH and POP instructions, Data exchange instructions – Logical instructions: byte and bit level logical operations, Rotate and swap operations – Arithmetic instructions: Flags, Incrementing and decrementing, Addition, Subtraction, Multiplication and division, Decimal arithmetic – Jump and CALL instructions: Jump and Call program range, Jump, Call and subroutines	12
5	**INTERRUPT PROGRAMMING AND INTERFACING TO EXTERNAL WORLD:** 8051 Interrupts – Interrupt vector table – Enabling and disabling an interrupt – Timer interrupts and programming – Programming external hardware interrupts – Serial communication interrupts and programming – Interrupt priority in the 8051: Nested interrupts, Software triggering of interrupt, Hex key interface.	12

CO	Course Outcomes Students will be able to
CO1	Apply knowledge of 8085 microprocessor programming and interfacing to solve real-world problems in areas such as embedded systems, robotics, and automation.
CO2	Design and develop interfacing circuits for various devices such as keyboards, displays, printers, and sensors using the 8085 microprocessor and also write programs to interface devices with the 8085 microprocessor using assembly language.
CO3	Design and implement simple digital systems using the 8051 microcontroller and also write programs to interface the 8051 microcontroller with external devices, such as LEDs, switches, and LCD displays.
CO4	Explain the 8051 instruction set architecture and the different types of instructions and also write assembly language programs for the 8051 microcontroller to perform simple tasks.
CO5	Explain the concept of interrupts and interrupt programming in microcontrollers and implement interrupt priority and interrupt nesting in microcontroller-based systems.
Textbooks:	
1	V.Vijayendran,2005, "*Fundamentals of Microprocessor-8085"*, 3rd Edition S.Visvanathan Pvt. Ltd.
2	Ramesh Gaonkar, *Microprocessor Architecture, Programming and Applications with8085*, Penram International Publishing (2013).
3	A. Nagoor Kani, *Microprocessors & Microcontrollers*, RBA Publications (2009).
4	A. P. Godse and D. A. Godse, *Microprocessors*, Technical Publications, Pune (2009).
5	B.Ram, *Fundamentals of Microprocessors & Microcontrollers*, Dhanpat Rai publications New Delhi (2016).
Reference Books:	
1	Douglas V. Hall, *Microprocessors and Interfacing programming and Hardware*, Tata Mc Graw Hill Publications (2008)
2	Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. Mckinlay, The 8051 Microcontroller and Embedded Systems, Pearson Education (2008).
Web resources:	
1	https://www.tutorialspoint.com/microprocessor/microprocessor_8085_architecture.html
2	http://www.electronicsengineering.nbcafe.in/peripheral-mapped-io-interfacing/
3	https://www.geeksforgeeks.org/programmable-peripheral-interface-8255/
4	http://www.circuitstoday.com/8051-microcontroller
5	https://www.elprocus.com/8051-assembly-language-programming/

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	3	2	3	3	3
CO2	2	2	2	2	2	2	3	2	3	3	3
CO3	2	2	3	2	2	3	3	2	3	3	3
CO4	2	3	2	3	2	2	3	2	3	3	3
CO5	3	3	2	2	2	3	3	2	3	3	3
Total	12	13	12	11	10	12	15	10	15	15	15
Average	**2.4**	**2.6**	**2.4**	**2.2**	**2**	**2.4**	**3**	**2**	**3**	**3**	**3**

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PPHE32	**ASTRO PHYSICS**	Elective	3	1	0	0	3	4	25	75	100

Learning Objectives

LO1	To gain knowledge on the physical universe and its evolution.
LO2	To study the constituents and dynamics of galaxies.
LO3	To study electromagnetic radiation from stars, atomic spectra and classification of stars.
LO4	To learn the properties and the evolution of stars.
LO5	To understand fundamental principles and techniques of astronomy and astrophysics.

Unit	Content	Hours
1	**COSMOLOGY:** Galaxies and the expanding Universe; Hubble's Law; the age of the Universe; the Big Bang; cosmic microwave background; big bang nucleosynthesis (cosmic abundances, binding energies, matter & radiation); introductory cosmology cosmological models; dark energy and the accelerating Universe.	12
2	**GALAXIES:** Constituents of galaxies; stellar populations; the interstellar medium; HII regions; 21cm line; spirals and ellipticals; galactic dynamics; galaxy rotation curves and dark matter; active galaxies and quasars.	12
3	**PROPERTIES OF STARS:** Brightness (luminosities, fluxes and magnitudes); colours (black body radiation, the Planck, Stefan-Boltzmann and Wien's laws, effective temperature, interstellar reddening); spectral types; spectral lines (Bohr model, Lyman & Balmer series); Hertzprung-Russell diagram; the main sequence (stellar masses, binary systems, Kepler's laws, mass-luminosity relations); distances to stars (parallax, standard candles, P-L relationships, ms-fitting etc.).	12
4	**THE LIFE AND DEATH OF STARS:** Energy source (nuclear fusion, p-p chain, triple-alpha, CNO cycle, lifetime of the Sun); solar neutrinos; basic stellar structure hydro static equilibrium, equation of state; evolution beyond the main sequence; formation of the heavy elements; supernovae; stellar remnants (white dwarfs, neutron stars, black holes, degeneracy pressure, Swarszchild radius, escape velocities).	12
5	**OBSERVATIONAL ASTRONOMY:** The electromagnetic spectrum; geometrical optics (ray diagrams, focal length, magnification etc.); diffraction (resolving power, Airy disc, diffraction limit etc.); telescopes (reflecting, refracting, multi wavelength)	12

CO	Course Outcomes
CO1	Recall and understand the electromagnetic radiation from celestial objects. Analyze the wave nature of light in the form of ray diagram.
CO2	Correlate luminosity, flux and magnitude, related to the brightness of a star. Analyze the evolution of stars using HR diagram.
CO3	Define nuclear fusion, which is the fundamental energy source of stars. Analyze how neutrinos are born during the process of nuclear fusion in the sun.
CO4	Remember and illustrate the structure of our Milky way galaxy. Classify the types of galaxies.
CO5	Explain cosmology, a branch of astronomy that involves the origin and evolution of the universe, from the Big Bang to today and on into the future.
Textbooks:	
1	Zeilik& Gregory, Introductory Astronomy & Astrophysics,4thedition (Saunders College Publishing)
2	Morison,I.,IntroductiontoAstronomyand Cosmology, (Wiley)
3	Kutner,M.L., Astronomy: A Physical Perspective (Cambridge University Press)
4	Green,S.F.& Jones,M.H.,An Introduction to the Sun and Stars (Cambridge University Press)
Reference Books:	
1	Jones, M.H.& Lambourne, R.J.A., An Introduction to Galaxies & Cosmology (Cambridge University Press)
2	Carroll, B.W. &Ostlie, D.A., An Introduction to Modern Astrophysics (Pearson)
3	Shu, F.H.,The Physical Universe, An Introduction to Astronomy, (University Science Books)
4	Motz, L.&Duveen,A.,The, A.,The Essentials of Astronomy, (Colombia University Press)
Web resources:	
1	https://r.search.yahoo.com/_ylt=Awrx_5JxP6RnKQIAuIy7HAx.;_ylu=Y29sbwNzZzMEcG9zAzUEdnRpZAMEc2VjA3Ny/RV=2/RE=1740026994/RO=10/RU=https%3a%2f%2fwww.physics.utoronto.ca%2f~phy224_324%2fLabManuals%2fBlackbodyRadiation.pdf/RK=2/RS=fYcBR3Ni7GtwWIO4M7ZiN0Ojx2Q-
2	https://web.astro.princeton.edu/academic/undergraduate-program/introduction-astrophysics

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	3	3	3	3	3	3
CO2	3	3	3	2	3	3	3	3	3	3	3
CO3	3	3	3	2	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3
Total	15	15	15	12	15	15	15	15	15	15	15
Average	**3**	**3**	**3**	**2.4**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PPHS31	ELECTRICAL CIRCUIT NETWORK SKILLS	SEC	2	0	0	0	2	2	25	75	100

Learning Objectives	
LO1	To introduce the basic principle of electrical circuits.
LO2	To learn electrical drawing symbols, colour coding and circuit designing.
LO3	To understand the functions of electric motors & solid state devices
LO4	To introduce the concepts of electrical protection
LO5	To learn about proper electrical wiring

Unit	Content	Hours
1	**UNIT I: Basic Electricity Principles & Electrical Circuits** **Basic Electricity Principles**: Voltage, Current, Resistance, and Power. Ohm's law. AC Electricity and DC Electricity. Familiarization with millimeter, voltmeter and ammeter **Electrical Circuits**: Main electric circuit elements and their combination. Rules to analyze DC sourced and AC sourced electrical circuits. Current and voltage drop across the DC circuit elements. Single – phase and three – phase alternating current sources. Power factor. Saving energy and money	6
2	**UNIT II: Electrical Drawing and Symbols & Generators and Transformers** **Electrical Drawing and Symbols**: Drawing symbols. Reading Schematics. Ladder diagrams. Electrical Schematics. Power circuits. Control circuits. Tracking the connections of elements and identify current flow and voltage drop **Generators and Transformers**: DC Power sources. AC/DC generators. Inductance, capacitance and impedance. Operation of transformers	6
3	**UNIT III: Electric Motors & Solid-State Devices** **Electric Motors**: Single-phase, three-phase & DC motors. Basic design. Interfacing DC or AC sources to control heaters & motors. Speed & power of ac motor. **Solid-State Devices**: Resistors, inductors and capacitors. Diode and rectifiers. Components in Series or in shunt. Response of inductors and capacitors with DC or AC sources	6
4	**UNIT IV: Electrical Protection** **Electrical Protection**: Relays. Fuses and disconnect switches. Circuit breakers. Overload devices. Ground-fault protection. Grounding and isolating. Phase reversal. Surge protection. Interfacing DC or AC sources to control elements (relay protection device)	6
5	**UNIT V: Electrical Wiring** **Electrical Wiring**: Different types of conductors and cables. Basics of wiring- Star and delta connection. Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Splices: wire nuts, crimps, terminal blocks, split bolts, and solder. Preparation of extension board	6

CO	Course Outcomes Students will be able to
CO1	Explain the components of basic electrical circuits
CO2	Illustrate various types of electrical drawings and symbols
CO3	Demonstrate the principal and working of electrical motors
CO4	Evaluate the various types of electrical protection elements
CO5	To analyse and apply different types of electrical wiring and splices elements
Textbooks:	
1	A text book in Electrical Technology – B L Theraja – S Chand &Co.
2	A text book of Electrical Technology – A K Theraja
Reference Books:	
1	Dr D M Marathe, Dr K G Kolhe, Dr M S Kale, Dr R B Waghulde, Dr S D Chavhan, Dr S R Gosavi, Dr S V Borse, Prof Dr R S Khadayate" Electrical Circuits and Network Skills" ISBN:9789389501407
2	Performance and design of AC machines-M G Say ELBS Edn
Web resources:	
1	https://www.coursera.org/courses?query=circuit%20analysis
2	https://onlinecourses.nptel.ac.in/noc23_ee81/preview
3	https://www.udemy.com/topic/electrical-circuits/?srsltid=AfmBOoqH8g8PJOyRf6KfOpfBkdQz578bFZOUGWbSRXmCJcKhHQzAe8nT
4	https://www.engineeringdevotion.com/electric-circuit-lectures.html
5	https://www.classcentral.com/subject/electric-circuits

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	2	2	1	2	2	2
CO2	2	2	2	3	2	2	2	2	2	2	2
CO3	2	2	2	3	2	2	2	2	1	3	2
CO4	3	2	2	2	3	2	2	2	2	2	3
CO5	3	2	2	2	3	2	2	2	2	2	3
Total	13	10	10	12	12	10	10	9	9	11	12
Average	**2.6**	**2**	**2**	**2.4**	**2.4**	**2**	**2**	**1.8**	**1.8**	**2.2**	**2.4**

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PPHC33P	**Practical-III Microprocessor and Programming in C**	Practical	0	0	5	0	4	5	25	75	100

Learning Objectives

LO	To understand the theory and working of optical interferometry experiments, Microprocessor, Microcontroller and their applications

	Content **(Minimum 10 Experiments from the list)**	Hours
	1. Lagrange interpolation with Algorithm, Flow chart and output. 2. Newton forward interpolation with Algorithm, Flow chart and output. 3. Newton backward interpolation with Algorithm, Flow chart and output. 4. Curve-fitting: Least squares fitting with Algorithm, Flow chart and output. 5. Numerical integration by the trapezoidal rule with Algorithm, Flow chart and output. 6. Numerical integration by Simpson's rule with Algorithm, Flow chart and output. 7. Numerical solution of ordinary first-order differential equations by the Runge- Kutta method with Algorithm, Flow chart and output. 8. Finding Roots of a Polynomial - Newton Raphson Method – 9. Solution of Simultaneous Linear Equation by Gauss elimination method. 10. Solution of Ordinary Differential Equation by Euler **Microprocessor Experiments** 1) (a) Clock program- 12/24 hours- six digits - Decimal Counters using microprocessor 8085. (b) Interfacing of seven segment display using microprocessor 8085 2) (a) Sum of a set of N data (8-bit number) and search of an element in an array using 8085. (b) Interfacing of DC stepper motor – clockwise, anti-clockwise, required angle and wiper action using microprocessor 8085. 3) (a) Code conversion-8-bit number: (a) Binary to BCD (b) BCD to Binary using microprocessor 8085 (b) Interfacing using DAC with IC 0800 – Wave form generation – Square, Triangular and Saw tooth wave using microprocessor 8085 4) (a) 8 bit Addition, subtraction, multiplication and division using Microcontroller – 8051 (b) Ascending/ descending order - Linear sort using microcontroller 8051. 5) (a) Block transfer using 8051 microcontroller. (b) Interfacing of HEX keyboard using microcontroller 8051.	60

2nd YEAR: THIRD SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
24PPHIN31	Internship	SEC	0	0	2	0	2	3	**25**	**75**	**100**

Learning Objectives	
LO1	Introduce the Working Ambience, Attitude, Adaptability, Problem Solving Ability, Ability to work with Supervisor, Ability to take Directions, etc..
LO2	Expose on the different phases of Developing a Computer Solution with Team Spirit.
LO3	Learn about Problem Solving Skills, Soft Skills and other related Skills required for the industry.
LO4	To develop skill competencies specific to an occupation or profession..
LO5	To acquire additional interpersonal communication and interaction skills

S.No	REGULATIONS	Hour
I	1. The students have to undergo 30 hours/15 days of Internship/ Industrial Training in the Industry during the holidays of the Second Semester. 2. The Candidates need to get a Project, Analyze, learn the various stages of Developing a solution, Test, Validate and carryout the other related requirements. 3. During the Third Semester, candidates are required to refine the work completed during their industry internship by incorporating constructive feedback received from the industry and/or the institution during reviews, and by further developing the project to meet industry standards. 4. The Candidates have to prepare and submit the manuscript of the Internship experience as a Report as per the requirements of the Department for Evaluation. 5. The submission of the Internship Report will be done at the end of the Third Semester for Presentation and Viva-Voce during the Practical Examinations of the Semester. 6. The Passing Minimum for Internship is 50%. 7. If the Candidate fails to score 50% in the Internship, the Candidate has to improve it during the next attempt. 8. A Faculty Member from the Department will act as a Guide to Supervise/Monitor the progress of the Candidates. 9. The Faculty Member will act as the Internal Examiner during the course of Internship as well as at the time of conducting the Viva-Voce Examination. 10. The Internal Marks for the Internship will be awarded by the concerned Guide /Internal Examiner. 11. The Internal and External Examiners shall both evaluate the Internship Report, Presentation and conduct the Viva-Voce Examination.	30

CO	Course Outcomes Students will able to
CO1	Find the specific areas of interest, refine their skills and abilities.
CO2	Show a greater sense of self-awareness and appreciation for others.
CO3	Develop work habits and attitudes that are essential to succeed in the workplace.
CO4	Discover the importance of communication, interpersonal and other critical skills.
CO5	Discover the importance of communication, interpersonal and other critical skills

INTERNAL MARKS AWARDED FOR THE INTERNSHIP -25 Marks
✓ Internship Review 1 (During the beginning of the Semester) - 5 Marks ✓ Internship Review 2 (During the end of the Semester)- 5 Marks ✓ Progress of the Internship by the Candidate's active Participation- 15 Marks
EXTERNAL MARKS AWARDED FOR THE INTERNSHIP -75 Marks
✓ Evaluation of the Internship Report - 50 Marks ✓ Presentation & Viva-Voce Examination- 25 Marks

HOD **PRINCIPAL**