M.Sc. PHYSICS

Programme Outcomes of M.Sc.

- Acquire interdisciplinary knowledge and the skill of designing and conducting experiments independently in collaboration and interpreting scientific data.
- Communicate effectively, analyze critically and learn to adapt to the socio technological changes.
- Face competitive examinations that offer challenging and rewarding careers in science and education.
- Identify, formulate and critically analyze various scientific problems and design/develop solutions by applying the knowledge to different domains.

Programme Specific outcome

No	Students will be able to	PSO NO
1	Have well-defined knowledge on theoretical concepts and experimental methods of advanced physics (Classical mechanics, Mathematical physics, Integrated electronics, Astrophysics, Nanophysics, Microprocessor etc.)	PSO-1
2	Acquire skills in performing advanced physics experiments and projects using modern technology and numerical simulations.	PSO-2
3	Develop and communicate analytical skills ranging from nuclear to cosmology to progress in the expanding frontiers of physics	PSO-3
4	Apply and interpret physics principles in various physical observations	PSO-4
5	Become a complete professional with high integrity and ethics.	PSO-5
6	Prepare for deeper research experiences in an area of emphasis.	PSO-6

Semester I
Classical and Statistical Mechanics (Core – I)
Subject code: PP1711

No of hours per week	No of credits	Total no of hours	Marks
6	4	90	100

Course outcomes

CO No	Upon completion of this course, students will be able to	PSOs addressed	CL
CO-1	Define the basic mechanical concepts related to single and system of particles	PSO-2	R

CO-2	Apply various conservation laws in solution of physical problems	PSO-3	Ap
CO-3	Understand the motion of a mechanical system using Lagrange and Hamiltonian Formulation	PSO-6	U
CO-4	Discuss the origin of coriolis and centrifugal terms in the equation of motion in a rotating frame	PSO-1	U
CO-5	Distinguish between stable and unstable equilibrium	PSO-4	An
CO-6	Assess a fundamental knowledge of classical and quantum statistical mechanics and categorize the macroscopic thermodynamics and microscopic statistical mechanics using mathematical methods	PSO-2	E
CO-7	Interpret relationship between equilibrium distributions and kinetic process leading to equilibrium	pso-5	E
CO-8	Explain different statistical ensembles, their distribution functions, ranges of applicability and corresponding thermodynamic potentials	PSO-1	U

Teaching Plan

Total contact hours: 90 (Including lectures, assignment and tests)

Unit	Module	Topics	Lecture Hours	Learning outcomes	Pedagogy	Assessment/ Evaluation
I	Single and many particle Systema and Central Force Problems					
	1	Mechanics Of A Particle, Mechanics of A System Of Particles	**4**	Define the basic mechanical concepts related to single and system of particles	Lecture discussion	Evaluation Class test, oral question Assignment Formative assessment I
	2	Conservation Laws Central Force Problems Reduction To The Equivalent Body Problem	**4**	Apply various conservation laws in solution of physical problems	Derivation and group discussion	
	3	The Equations Of Motion And First Integral - Kepler's Problems	**4**	solution of Kepler's problems using first integral	Derivation and group discussion Seminar	
	4	Inverse Square Law Of Forces Motion In Time In Kepler's Problems	**3**	Apply inverse square law of forces in Kepler's problem	Derivation and group discussion	
II	Hamiltonian Formulation					
	1	Hamiltonian's Canonical Equations Of Motion Deduction of Canonical	**4**	Derive Hamiltonian's Canonical Equations Of Motion	Derivation discussion	Evaluation Class test, oral question Assignment, seminar

		Equations from Variation Principle				Formative assessment I
	2	Principle Of Lest Action	**3**	Define and derive Principle Of Lest Action	Derivation and group discussion Seminar	
	3	Canonical Or Contact Transformations Conditions For A Transformation To Be Canonical Hamilton Jacobi Method	**4**	Phase transformations and Canonical transformations	Derivation and group discussion PPT	
	4	Poisson Bracket Equations of Motion In Poisson Bracket Form Jacobi Poisson Theorem Angular Momentum And Poisson's Bracket	**4**	Poisson Bracket definition and applications	Derivation and group discussion	
III	Rigid Body And Small Oscillations					
	1	Independent Coordinates Of A Rigid Body Euler Angles Infinitesimal Rotation Rate Of Change Of Vector	**4**	Derive Euler Angles Infinitesimal Rotation	Derivation discussion	Evaluation Class test, oral question Assignment, seminar Formative assessment II
	2	Coriolis Forces	**2**	Define and derive Coriolis Forces	Derivation and group discussion	
	3	Small Oscillations: Stable And Unstable Equilibrium Formulation Of The Problem Lagrange's Equations Of Motion For Small Oscillations	**5**	Define and Derive Small Oscillations: Stable And Unstable Equilibrium Formulation	Derivation and group discussion ,PPT	
	4	Normal Co-ordinates And	**4**	Define , derive and apply Parallel Pendulum	Derivation and group	

		Normal Frequencies Of Vibration System With Few Degrees Of Freedom: Parallel Pendulum Linear Triatomic Molecule		Linear Triatomic Molecule	discussion Seminar	
IV	Statistical Mechanics					
	1	The Postulate Of Classical Statistical Mechanics Postulate Of Equal a Priori Probability Micro Canonical Ensemble Derivation of Thermodynamics Classical Ideal Gas	**4**	Derive Equal a Priori Probability Micro Canonical Ensemble	Derivation discussion	Evaluation Class test, oral question Assignment, seminar Formative assessment II/III
	2	Gibb's Paradox The Ideal Gases The Ideal gases In Micro-Canonical Ensemble Statistical Weight	**4**	Define and derive Micro-Canonical Ensemble Statistical Weight	Derivation and group discussion , PPT	
	3	Entropy Distribution Law Maxwell-Boltzmann Statistics Bose-Einstein Statistics	**3**	Define and Derive different types of statistics	Derivation and group discussion Seminar	
	4	Fermi-Dirac Statistics Thermodynamic Functions For Boltzmann Gas	**4**	Define , derive and apply Fermi-Dirac Statistics	Derivation and group discussion	
V	Ideal Fermi And Bose Gases And applications					
	1	Ideal Bose Gas Bose Einstein Condensation	**4**	Derive Bose Einstein Condensation	Derivation discussion	Evaluation Class test, oral question Assignment, Seminar Formative assessment III
	2	Thermodynamic Behaviour When T<Tc Thermodynamic Behaviour When T>Tc	**4**	Define and derive Thermodynamic Behaviour	Derivation and group discussion , PPT	
	3	Blackbody	**3**	Define and Derive Photon	Derivation	

		Radiation The Photon Gas		Gas	and group discussion Seminar	
	4	Ideal Fermi Gas Weakly Degenerate And Strongly Degenerate Free Electron Theory of Metals	**4**	Define , derive and apply Free Electron Theory	Derivation and group discussion , PPT	

Course Instructor: Dr. R.Krishna Priya **Head of the Department:**Dr.S.Mary Delphine

Semester I

Electromagnetic theory (Core – II)

Subject Code: PP1712

No of hours per week	No of credits	Total no of hours	Marks
6	4	90	100

Objective: 1. To provide knowledge on the propagation of electromagnetic radiation.
2. To gain insight into the physical nature of electric and magnetic phenomena.

Course Outcomes

CO No	Upon completion of this course, students will be able to	PSOs addressed	CL
CO-1	Outline the fundamental laws of electrodynamics based on Maxwell's equations.	PSO-1	U
CO-2	Derive the expressions for the energy of electrostatic and magnetostatic fields.	PSO-2	R
CO-3	Explain Poyntings theorem based on Maxwells equations and interpret the terms in the theorem physically	PSO-5	E
CO-4	Solve potential problems in simple geometries using separation of variables and the method of images for (electrostatics, Magnetostatics and stationary current distributions in linear, isotropic media)	PSO-4	C
CO-5	Determine the electrical properties of materials and solve the solutions of the wave equation as plane waves in source free regions.	PSO-5	E, C
CO-6	Analyze the wave polarization, and reflection/transmission of plane waves in homogenous Media.	PSO-6	An

Teaching Plan

Credits: 4 **Total Hours: 90 (Incl. Seminar & Test)**

Unit	Module	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I	**Electrostatic field**					
	1	Introduction – Electrostatic field , Divergence and curl of electrostatic field, Gauss law and its applications, Electric potential, Poisson's and Laplace equation	4	Understand the concepts of Electrostatic field and basic equations	PPT, Descriptive lecture	Evaluation through: quiz, Problem solving Descriptive answers short questions Formative assessment (I CIA)
	2	Method of Images, Solution of Laplace's equation using separation of variables in Cartesian Coordinates, Electrostatic fields in conductors and dielectrics	3	Solve solution of Laplace's equation using separation of variables in Cartesian Coordinates and understand the electric fields conductors and dielectrics	Illustration, Descriptive lecture	
	3	Induced dipoles and polarizability, Polarization, Bound charges - field inside a dielectric, Susceptibility permittivity and dielectric constant	3	Understand the basic concept of polarization, field inside a dielectric, Susceptibility permittivity and dielectric constant.	Videos ,group discussion	
	4	Susceptibility, permittivity and dielectric constant, Boundary value problems with linear dielectrics, Electro static energy in dielectric media	3	Differentiate Susceptibility, permittivity and dielectric constant . Boundary value problems with linear dielectrics	Seminar, Lecture	
II	**Magnetostatic field**					
	1	Lorentz's force law, Cyclotron motion, Cycloid motion, Continuity equation, Biotsavart's law for a line current,	4	Understand the concept of Cyclotron motion, Cycloid motion, Biotsavart's law for a	PPT Illustration, Descriptive	Evaluation through: quiz,

		surface current and volume current,		line current	lecture	
	2	Divergence and curl of B, Ampere's law, Applications of Ampere's law, Comparison of magneto statics and electrostatics	3	To understand the the Divergence and curl of B, Applications of Ampere's law	Lecture ,Videos	short questions Descriptive answers Problem solving Formative assessment (I&II CIA)
	3	Magnetic vector potential, Torques and forces on magnetic dipoles, Effect of magnetic field on atomic orbits,	3	To acquire knowledge on magnetic vector potential, Torques and forces on magnetic dipoles	Descriptive lecture	
	4	Magnetic susceptibility and permeability in linear media, Non-linear media, Problems	3	Differentiate magnetic susceptibility and permeability in linear media, non-linear media.	Group Discussion, Lecture, seminar	
III	**Electrodynamics**					
	1	Ohm's law, Electromagnetic induction, Faraday's law, Inductance – energy in magnetic fields.	4	Understand the principle of Ohm's law, Electromagnetic induction	Illustration, Descriptive lecture	Evaluation through: quiz, short questions Descriptive answers Formative assessment (II CIA)
	2	Maxwell's equations, Maxwell's equation free space and linear isotropic media, Boundary conditions on the field at interfaces.	5	Solve the Maxwell's equations and boundary conditions on the field	Descriptive lecture	
	3	Integral and differential forms, Boundary conditions, Continuity equation, Poynting theorem, Poynting vector, Conservation of momentum.	4	Differentiate Integral and differential form. Solve the Poynting theorem	Group Discussion, Lecture, seminar	
IV	**Propagation of Electromagnetic waves**					
	1	Wave equation for E and B monochromatic plane waves, Energy and momentum in electromagnetic waves, Electromagnetic waves in matter	4	Understand the Wave equation, energy for E and B. Explain the electromagnetic waves in matter	PPT Illustration, Descriptive lecture.	Evaluation through quiz, Descriptive

	2	Propagation in linear media, Reflection and transmission at normal incidence and oblique incidence, Fresnel's equations	4	Explain in brief the reflection and transmission at normal incidence and oblique incidence,	Lecture Group discussion	answers short questions Assignment Formative assessment(II &III)
	3	Electromagnetic waves in conductor ,Skin depth, Reflection at a conducting surface	3	Solve equations for reflection at a conducting surface ,skin depth	Lecture, seminar	
	4	Wave guides TE waves in rectangular wave guide, Co-axial transmission lines	3	Explain the rectangular wave guide and co-axial transmission lines	PPT, Lecture	
V	**Relativistic Electrodynamics**					
	1	Einstein's two postulates, Covariant and contra variant vector, Concept of four vectors, Minkowski force.	5	Understand the concept of four vectors, Minkowski force	PPT Illustration, Descriptive lecture	Evaluation through: quiz, short questions Descriptive answers Problem solving Formative assessment (III CIA)
	2	Maxwell's equations in four vector, Four vector form of Lorentz equations.	4	To acquire knowledge on the Maxwell's equations in four vector form .	Descriptive lecture	
	3	Relativistic Lagrangian and Hamiltonian force equations for a relativistic charged particle in external electromagnetic field	4	To acquire knowledge on the Lagrangian and Hamiltonian force equations	Descriptive lecture, Seminar, Assignment	

Course Instructor : Dr. S.Mary Delphine **Head of the Department:** Dr.S.Mary Delphine

Semester I

Numerical and Computational Methods (Core – III)

Subject Code: PP1713

No of hours per week	No of credits	Total no of hours	Marks
6	4	90	100

Objective: 1. To introduce the numerical methods for solving algebraic, differential and matrix equations and its applications in Physics.

2. To make students able to understand and analyse various mechanical problems that require the use of numerical / computational methods.

Course outcomes

CO No	Upon completion of this course, students will be able to	PSOs addressed	CL
CO-1	Understand the theoretical and practical aspects of the use of numerical methods	PSO-3	U
CO-2	Explain theory, algorithms, implementations and analysis of output for numerical methods	PSO-5	E
CO-3	Choose appropriate numerical methods to apply for various problems in science	PSO-2	Ap
CO-4	Infer numerical method for various mathematical operations and tasks (interpolation, differentiation, integration, the solution of linear and non-linear equations and differnetial equations)	PSO-1	U
CO-5	Interpret a function using the appropriate numerical method	PSO-4	E
CO-6	Make use of numerical packages such as MATLAB	PSO-6	Ap

Teaching Plan

Total contact hours: 90 (Including lectures, assignment and tests)

Unit	Module	Topics	Lecture Hours	Learning outcomes	Pedagogy	Assessment/ Evaluation
I	Interpolation and Extrapolation					
	1	Finite Differences - Forward Difference Backward Differences Central Differences	**4**	formulate Forward Difference Backward Differences Central Differences	Problem solving	Evaluation Class test, formula test , oral question Assignment, self work Formative assessment I
	2	Newton's Formula for Interpolation Central Difference Interpolation Formulae Gauss Central Difference Formula and Stirling's Formula	**4**	formulate different Formula for Interpolation and application	Problem solving Derivation and group discussion	
	3	Lagrange's Interpolation Formula Hermite Interpolation Formula	**4**	formulate agrange's Interpolation Formula, Hermite Interpolation Formula	Problem solving Derivation and group discussion	
	4	Divided Differences and their Properties Newton Divided difference Formula Interpolation by Iteration	**3**	Apply Newton Divided difference	Problem solving Derivation and group discussion Seminar	
II	Solution Of Algebraic And Trancedental Equations					

	1	Solution Of Algebraic And Trancedental Equations, Zeros of Linear and Non-linear Algebraic Equations: The Bisection Method Newton Raphson Method	**4**	Solve Algebraic And Trancedental Equations	Problem solving Derivation and group discussion	Evaluation Class test, oral question Assignment, seminar Formative assessment I
	2	Ramanujan's Method Birge-Vieta Method Solution Of Simultaneous Equations: Direct Method-Gauss Elimination	**3**	Solve Solution Of Simultaneous Equations	Problem solving Derivation and group discussion	
	3	Gausss Jordon Methods Modification Of Gauss Method To Compute the Inverse Solution Of Linear Systems- Iterative methods	**4**	Solve Inverse Solution Of Linear Systems	Problem solving Derivation and group discussion Seminar	
	4	Gauss Siedal and Gauss Jacobi Method	**4**	Gauss Siedal and Gauss Jacobi Method	Problem solving Derivation and group discussion	
III	Numerical Differentiation and Integration					
	1	Methods Based on Interpolation: Finite Difference and Undetermined Coefficients Differentiation Using Newtons Forward and Backward Difference Formulae	**4**	Derive Finite Difference and Undetermined Coefficients Differentiation	Problem solving Derivation and group discussion	Evaluation Class test, oral question Assignment, seminar Formative assessment II
	2	Numerical Differentiation Errors in Numerical Differentiation	**2**	Define and derive Numerical Differentiation	Problem solving Derivation and group discussion	
	3	Numerical Integration Trapezoidal Rule Simpson's 1/3 Rule - Errors Simpson's 3/8 Rules	**5**	Define and Derive Numerical Integration	Problem solving Derivation and group discussion Seminar	
	4	Monte Carlo Integration Evaluation of Simple Integrals	**4**	Define , derive and apply Monte Carlo Integration	Problem solving Derivation	

					and group discussion	
IV	Numerical Solutions Of Ordinary Differential Equations					
	1	The Postulate Of Solution OfTalyor's Series Picard's Method of Successive Approximations	**4**	Derive Solution Of Talyor's Series	Derivation discussion Problem solving and group discussion	Evaluation Class test, oral question Assignment, seminar Formative assessment II/III
	2	Euler's Method Runge-Kutta Methods – Second order Runge-Kutta Methods – fourth order	**4**	Define and derive Euler's Method Runge-Kutta Methods	Derivation discussion Problem solving and group discussion	
	3	Predictor-Corrector Methods: Adam's -Moulton Method Milne's Method	**3**	Define and Derive different types of Ordinary Differential Equations	Derivation discussion Problem solving and group discussion Seminar	
	4	Boundary Value Problems-Finite Difference Method	**4**	Define , derive and apply Boundary Value Problems	Derivation discussion Problem solving and group discussion	
V	Introduction To MATLAB Programming					
	1	Basics Of MATLAB MATLAB Windows On-line Help Input- Output	**4**	Define and derive Basics Of MATLAB	Discussion and program writing	Evaluation Class test, oral question and program writing Assignment, Seminar Formative assessment III
	2	File Types Platform Dependence General Commands Input Indexing And Matrix Manipulation Creating vectors - Matrices and Vectors	**4**	Define and derive General Commands Input Indexing And Matrix Manipulation	Derivation and group discussion, PPT and program writing	
	3	Matrix and Array Operations-Arithmetic Operations Relational Operators and Logical Operators Elementary Math Function	**3**	Define and Derive Relational Operators and Logical Operators	Derivation and group discussion PPT and program writing	

	4	Solving a Linear System - Gaussian Elimination Finding Eigen values and Eigen Vectors Matrix Factorizations	**4**	Define , derive and apply Linear System using MATLAB	Derivation and group discussion, PPT and program writing Seminar	

Course Instructor: Dr. Therasiamma Chacko **Head of the Department:** Dr.S.Mary Delphine

Semeter I
a. Experimental Techniques (Elective – I)
Subject Code: PP1714

No of hours per week	No of credits	Total no of hours	Marks
6	5	90	100

Objective:

1. To provide knowledge on the measurements including error, signal and thermal analysis, nuclear radiation measurement using counters and detectors.
2. To gain insight in different experimental and analytical techniques involving mass spectroscopy, surface and laser spectroscopy, vacuum techniques, diffusion pumps, measuring gauges and sensors.

Course Outcomes

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO- 1	Understand the different types of error and curve fitting techniques involved in physical measurement .	PSO-4	U
CO- 2	Relate signal to noise ratio and analyse signal to noise enhancement	PSO-4	Ap
CO- 3	Analyse the functioning of various types of nuclear radiation measurement and thermal analysis techniques.	PSO-1	An
CO- 4	Assess the method of measurement of mass and pressure using mass spectrometers , and guages and vacum production techniques	PSO-1	E
CO -5	Understand the spectroscopic behaviour of molecules and working/application of different types of lasers	PSO-6	U
CO- 6	Analyse the behaviour of sensors and transducers	PSO-2	An

Teaching Plan
Total Hours:90 (Incl. Seminar & Test)

Unit	Module	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I	**Mathematical techniques and signal analysis**					
		Error – Types of Error, Error in a series approximation, General Error formula,Truncation error	4	To be able to evaluate errors using different formulations	Problem solving using different formulas	Evaluation through: quiz, Problem solving

		Straight line fitting by LSF method-problem solving	2	to understand the mathematical method of straight line and parabolic fit for physical problems	Analysis and Problem solving	short questions Descriptive answers Formative assessment(I)
		Linear curve fitting law of the type $y=ax^{b,}$ $y=a\ e^{bx}$ - problem solving	4	To be able to apply straight line and parabolic fit to physical problems	Analysis and Problem solving	
		source of noice in instrumental analysis–hard ware techniques, software methods	4	To assess signal to noise enhancement using hard ware and software methods	comparative analysis and group discussion	
II	**Nuclear radiation measurements**					
	1	Methods of detection of free charge carrier, Ionization chamber, G.M. counter	4	To analyse the working of charge carrier detectors	PPT Illustration, lecture, comparative study	Evaluation through: quiz, short questions Descriptive answers Formative assessment (I&II)
	2	Semi-conductor detectors	2	To apply semiconductors as charge sensing device	PPT Illustration, Descriptive lecture	
	3	Methods based on light sensing- Scintillation detector, Wilson cloud chamber	4	To identify the principle and working of detectors based on light sensing	PPT Illustration, Descriptive lecture, comparative study	
	4	Nuclear emulsion techniques, Solid state nuclear track detector	2	To understand the working of detectors based on the tracks produced	PPT Illustration, Descriptive lecture	
III	**Mass spectroscopy and Vacuum techniques**					
	1	Ion production (Volatile, involatile) Field desorption - SIMS, FAB, Californium plasma desorption	4	To understand the different ion production techniques	PPT Illustration, Descriptive lecture	Evaluation through: quiz, short questions Descriptive answers Assignment on applications Formative assessment (II)
	2	Components of mass spectrometers principle , production , Ion analysis	4	To understand the principle and working of the mass spectrometer.	Illustration, Descriptive lecture	
	3	Exhaust pumps, Rotary pumps, Diffusion pumps	4	To identify the principles and working of various vacum production techniques	PPT Illustration, Descriptive lecture	
	4	Pirani and ionization gauges	2	To understand the principle and working of guages used to detect ionisation	PPT Illustration, Descriptive lecture	

IV	**Solid state, surface and Laser spectroscopy**					
	1	Vibration studies of surfaces	2	To analyse the phenomena of spectroscopic behaviour of molecules	Descriptive lecture	Evaluation through: quiz, short questions Descriptive answers Assignment on applications. Formative assessment (II&III)
	2	Electron energy loss spectroscopy (EELS), Electronic spectroscopy of surfaces	3	To understand the concept of concept and features of EELS and electronic spectroscopy	Descriptive lecture	
	3	Photoelectron spectroscopy (PES), Ultraviolet PES (UPES), Auger electron spectroscopy (AES), X-Ray fluorescence (XRF)	4	To differentiate between the different concepts and features of PES, UPES, AES,and XRF	Descriptive lecture	
	4	Helium – neon laser, Semiconductor lasers, Lasers in medicine	4	To understand the working and application of different lasers	PPT Illustration, Descriptive lecture	
V	**Thermal analysis,sensors and transducers**					
	1	Thermal analysis, Types of measurement, Main Techniques , Thermal events	2	To relate the thermal events ,the techniques and methods of thermal analysis	PPT Illustration, Descriptive lecture	Evaluation through: quiz, short questions Descriptive answers Formative assessment (III)
	2	Thermo gravimetry-instrumentation	2	To understand the concept and instrumentation of TG	PPT Illustration, Descriptive lecture	
	3	DTA and DSC , Interpretation and applications of DTA and DSC	4	To differentiate between the DTA , DSC and their applications	Descriptive lecture	
	4	Sensors/transducer specification / Classification, Displacement and position tensor , Potentiometer, Strain gauges	3	To understand the principle and working of various sensors and their applications	Illustration, group discussion, Descriptive lecture	
	5	Capacitive sensor, LVDT, Piezoelectric , temperature sensor, Resistance temperature detector, Thermistor , photodiode	4	To analyse the principle and working of various detectors and transducers	Illustration, Descriptive lecture	

Course Instructor: Dr. Fernando Lorretta **Head of the Department:**Dr. S. Mary Delphine

Semester III
Core VII: Integrated Electronics
Subject Code: PP1731

Number of hours per week	No of credits	Total number of hours	Marks
6	4	90	100

Objectives: 1. To provide knowledge in the basic structure and working concepts of electronic devices.
2.To acquire application skills involving digital integrated circuit.

Course Outcomes

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO- 1	Understand the basic operation ,features and parameters related to diodes,transistor, switching devices and interpret their applications (FET,JFET,D-MOSFET,EMOSFET,SCR,DIAC,TRIAC)	PSO-1	U
CO- 2	Explain about the internal circuitry and logic behind any digital system (AND,OR,NOT,NAND,NOR,RTL,TTL,I^2L).	PSO-2	U
CO- 3	Assess the working of combinational circuits.(flipflops , counters)	PSO-3	E
CO -4	Design various synchronous and asynchronous sequential circuits.	PSO-6	C
CO- 5	Understand the characteristics of op-amps and the applications of op-amps	PSO-2	U
CO -6	Analyse the behaviourof active filters and IC555	PSO-4	C

Teaching Plan

Credit:5 **Total Hours: 90 (Incl. Seminar & Test)**

Unit	Module	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I	**Devices and Applications**					
	1	FET – Types, Principle and working, Salient features and Important Terms / parameters, Practical JFET and FET applications	4	Understand the concepts and salient features of FET and JFET	Illustration, Descriptive lecture	Evaluation through: quiz, Problem solving short questions Descriptive answers Formative assessment (I)
	2	MOSFET – Types and circuit operation, D-MOSFET	3	Distinguish between MOSFET and D-MOSFET and their working	Illustration, Descriptive lecture	
	3	SCR – Working and Equivalent circuit, SCR as a switch and Application of SCR	3	Understand the working of SCR as a switch.	Illustration, Descriptive lecture of Circuit theory	
	4	Triac - Construction / Operation / Characteristics and Applications, Diac and its Applications	3	Differentiate DIAC and TRIAC their working and applications	Discussion on circuit working differences.	
II	**Digital Logic circuits and Flip Flops**					
	1	Digital IC characteristics, Diodes and	4	Identify the use of	PPT	Evaluation

		transistors in logic circuits,		and transistors in logic circuits	Illustration, Descriptive lecture	through: quiz,
	2	DTL type – AND, OR, NAND and NOR, RTL and TTL type NAND, ECL and I^2L circuits	4	Explain about the internal circuitry and working of basic logic circuits	Discussion on circuit working differences.	short questions
	3	Flip flops – NAND Latch, SR, D, JK flip flop	3	Assess the functioning of various flip flops	Descriptive lecture on circuit working differences.	Descriptive answers Assignment
	4	T and JK master – Slave flip flop	2	Understand the working of various flip flops	Discussion on circuit working differences	Formative assessment (I&II)
III	**Registers and Counters**					
	1	Shift register, Ring counter , Shift counter (Johnson's counter)	4	Understand the principle and working of registers and counters	Illustration, Descriptive lecture	Evaluation through: quiz,
	2	Asynchronous counter / Ripple counter, Mod counters, 4-bit binary down counters and 4 Bit up/down counters, BCD counter using decoding gates	5	Identify the different construction and circuit design of asynchronous counters	Discussion on circuit working differences. Practical demonstration	short questions Descriptive answers
	3	Synchronous counters –Design, Mod 3 counter, Random Sequence generator, Synchronous BCD counter	4	Able to design counters with random counting sequence	Lecture discussion on design techniques of Mod counters	Formative assessment (II)
IV	**Op-Amp Circuits**					
	1	Characteristics and parameters, Op-amp comparator, Schmitt Trigger, Inverting and non-inverting amplifier, Voltage follower , summing and difference amplifier, Differentiator and Integrator	4	Understand the basic operations, features and application of OP-amp	PPT Illustration, Descriptive lecture. Practical demonstration	Evaluation through: quiz, Problem solving
	2	Current to voltage converter, Solution of Differential equation and simultaneous equation using op-amp, Instrumentation Amplifier using Transducer Bridge	4	Assess the instrumental Applications of OP-amp	Group design of instrumentation amplifiers	short questions Descriptive answers
	3	Temperature indicator and controller, Light intensity meter , Measurement	3	Apply the OP-amp for different	Discussion on design	Assignment

		of flow and thermal conductivity, Analog weight scale		applications	techniques of Mod counters	Formative assessment (II&III)
	4	Differential input and output amplifier, Voltage to current converter, Very high impedence circuit , sample and hold system	3	Identify the use of OP-amp in various circuits .	Discussion on circuit working differences	
V	**Filter circuits and 555 Timer**					
	1	Active filters , First and second order Low pass Butterworth filter, Filter design, frequency scaling	3	Understand the principle of filter design	PPT Illustration, Descriptive lecture	Evaluation through: quiz, short questions Descriptive answers Formative assessment (III)
	2	First order and Second order High pass Butterworth filter	3	Differentiate between the working of first and second order filter	Descriptive lecture with PPT Illustration,	
	3	Higher order filters, Band pass filter, Wide and Narrow Band Rejection filter,Wide and Narrow Band Rejection filter, All pass Filter	4	Extend the design and application of various types of filters.	Descriptive lecture	
	4	555 Timer - internal structure, Schmitt Trigger, Astable multivibrators, Monostable multivibrators	4	Understand the working and applications of 555 timer	Practical demonstration Descriptive lecture with PPT Illustration,	

Course Instructor : Dr. V.Shally **Head of the Department:**Dr.S.Mary Delphine

Semester III
Core VIII: Microprocessor and Microcontroller
Subject Code: PP1732

No of hours per week	No of credits	Total no of hours	Marks
6	4	90	100

Objectives: **1.** To provide knowledge on the hardware, programming and applications of 8085 microprocessor and 8051 microcontroller.

2. To gain hands on experience in interfacing peripherals to the microprocessor.

Course Outcomes

CO	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	Explain the operation of various components of the microprocessor 8085 and Pheripheral I/O, memory mapped I/O.	PSO-1	A
CO-2	Explain the various addressing modes and the instruction set of 8085 microprocessor	PSO-1	A

CO-3	Develop skill in writing programs for 8085 microprocessor	PSO-2	Ap
CO-4	Understand the various data transfer schemes, interrupts and interfacing circuits of 8085 microprocessor	PSO-1	U
CO-5	Experiment with the common applications of microprocessor (Display of decimal numbers, Generation of waves forms, Microprocessor based traffic control,Measurement of frequency, resistance, temperature, display of speed of a motor)	PSO-4	A
CO-6	Explain the architecture of 8051 microcontroller and some applications	PSO-1	U

Teaching Plan

Credit:4 **Total Hours:90 (Incl. Seminar & Test)**

Unit	Module	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I	**Evolution and architecture of microprocessor 8085**					
	1	Evolution of microprocessors – Intel 8085 microprocessor – Architecture – ALU – Timing and control unit	4	To be able to describe the architecture of 8085 microprocessor	PPT Illustration, Descriptive lecture	Evaluation through: quiz, short questions Descriptive answers Formative assessment(I)
	2	Registers (general purpose & special purpose registers) – Flags – Data and address bus – Pin configuration – 8085-based microcomputer	4	To explain the organization of 8085 microprocessor	PPT Illustration, Descriptive lecture, comparative study	
	3	8085 machine cycles and bus timings	4	To understand the working of each instruction and its execution	Descriptive lecture, comparative study	
	4	Memory interfacing – Peripheral I/O – Memory mapped I/O	3	To realize the interfacing of memory & various I/O devices with 8085 microprocessor	Descriptive lecture and group discussion	
II	**Introduction to assembly language programming**					
	1	Intel 8085 instructions – Opcode and operands – Instruction word size	4	To understand the instruction set of 8085 microprocessor	Descriptive lecture, comparative study	Evaluation through: quiz, short questions Descriptive answers Formative assessment(I& II)
	2	Instruction set of Intel 8085 – Instruction and data formats	4	To classify the instruction set of 8085 microprocessor	Descriptive lecture	
	3	Addressing modes – Stack – Subroutines	3	To identify the addressing mode of an instruction	PPT Illustration, Descriptive lecture, comparative study	
	4	Examples of assembly language	4	To distinguish the use	Descriptive	

		programs: addition of two 8-bit numbers – 8-bit subtraction – One's compliment – Two's compliment – Square of a number – Largest number in an array – Ascending or descending order – Smallest number in an array		of different instructions and apply it in assembly language programming.	lecture and comparative study	
III	**(a) Data transfer schemes – Interrupts – Interfacing (b) Microprocessor based data acquisition system**					
	1	Address space partitioning – Memory and I/O interfacing – Data transfer schemes – Programmed data transfer schemes, DMA data transfer scheme	4	To understand the various data transfer schemes of 8085 microprocessor	Descriptive lecture	Evaluation through: quiz, short questions Descriptive answers Formative assessment(II)
	2	– Interrupts of Intel 8085 – Hardware and software interrupts – Interrupt call locations – RST 7.5, 6.5 and 5.5 – Interfacing I/O devices – I/O ports: non programmable I/O port Intel 8212, Programmable Peripheral Interface (PPI) Intel 8255	4	To understand the operation of Programmable Interface devices	Descriptive lecture	
	3	Analog to digital converter – Sample and hold circuit – Analog multiplexer – ADC 0800 – Interfacing of A/D converter ADC 0800	4	To be able to describe the interfacing of A/D converter	PPT Illustration, Descriptive lecture	
	4	Interfacing of ADC 0800 and analog multiplexer AM 3705 – Interfacing of ADC 0800, analog multiplexer and sample and hold circuit	3	To realize the programming & interfacing of various devices with 8085 microprocessor	PPT Illustration, Descriptive lecture	
IV	**Microprocessor applications**					
	1	Delay subroutine – 7 Segment LED display	4	To demonstrate the assembly language programming for delays and subroutines	Descriptive lecture	Evaluation through: quiz, short questions Descriptive answers Assignment on applications. Formative
	2	Display of decimal numbers – Display of alphanumeric characters – Formation of codes for alphanumeric characters	3	To demonstrate the interfacing of display	Descriptive lecture	
	3	Generation of square wave or pulse – 8-bit multiplication – 8-bit division – Measurement of electrical quantities – Frequency	4	To develop programming skills in assembly language	Descriptive lecture	

		measurement – Resistance measurement				assessment(II & III)
	4	Measurement of physical quantities – Temperature measurement and control – Measurement and display of speed of a motor – Microprocessor based traffic control	4	To build up the assembly language programming skills and real time applications of microprocessor	Descriptive lecture	
V	**The 8051 Microcontroller**					
	1	Inside the 8051 – Introduction to 8051 assembly programming – Assembling and running an 8051 program – The program counter and ROM space in the 8051	5	To understand the basic concepts and architecture of 8051	PPT Illustration, Descriptive lecture	Evaluation through: quiz, short questions Descriptive answers Group discussion Formative assessment (III)
	2	Data types and directives – 8051 Flag bits and the PSW register – 8051 register banks and stack – Pin description of 8051 –	4	To explain the register organization of 8081	PPT Illustration, Descriptive lecture	
	3	– I/O programming – Bit Manipulation. Arithmetic Instructions: Addition of unsigned numbers, - Addition of Individual bytes	4	To develop knowledge about assembly language programs of 8051	Descriptive lecture	
	4	Subtraction of unsigned numbers– Unsigned multiplication and division.	2	To build up knowledge about assembly language programs of 8051	Descriptive lecture and comparative study	

Course Instructor :M. Mary Freeda Head of the Department: Dr.S.Mary Delphine

Semester III
Elective III (a): Physics of the Cosmos
Subject Code: PP1733

No of hours per week	No of credits	Total no of hours	Marks
6	5	90	100

Objectives: 1. The course enables the students to understand and realize the historical evolution of Universe and principles involved in Astrophysics
2. The topics included are Solar system, Comets, Galaxy, Cosmology and Astronomical Instruments which play a key role in the future employability and global progress of students.

Course Outcomes

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO- 1	**Perceive** the historical evolution of solar system and universe	PSO-3	E

CO- 2	**Describe** the principles of physics in the formation of astronomical objects like planets-Satellites - Asteroids and Comets	PSO-1	U
CO- 3	**Examine** the requirements and limitations of instrumentation for modern astrophysical observations (Optical telescopes and Radio telescopes)	PSO-2	An
CO -4	**Explain** the basic issues involved in present day astrophysical investigations (Red shift and the expansion of the universe)	PSO-6	U
CO- 5	**Analyse** the formation of Binary stars, multiple stars, Neutron stars and Black holes	PSO-4	An
CO -6	**Interpret** the observations of Galaxies, dark matter, quasars and pulsars.	PSO-5	E
CO -7	Distinguish between of some important models of the universe and its observational tests.	PSO-5	An

Teaching Plan

Total contact hours: 90 (Including lectures, assignment and tests)

Unit	Module	Topics	Lecture Hours	Learning outcomes	Pedagogy	Assessment/ Evaluation
I	**Solar system**					
	1	Components of the solar system - The Sun - The Planet - Two types of planets- Satellites	**4**	Define the basic Components of the solar system	Lecture discussion	Evaluation Class test, oral question assignment Formative assessment I
	2	Asteroids and Comets - Composition differences between the Inner and Outer planets - Bode's law: The search for order - Density as a measure of a planet's composition –	**4**	Apply various Inner and Outer planets	Discussion and PPT Seminar	
	3	Age of solar system - Origin of solar system - Interstellar cloud - Formation of the solar Nebula	**4**	Study of solar system	Discussion and PPT	
	4	Condensation in solar Nebula - Accretion and Planetesimals - Formation of Planets - Formation of Moons - Final stages of Planet formation - Formation of Atmospheres - Cleaning up the solar system	**3**	Formation of Planets	Derivation and group discussion	
II	**Stars**					
	1	Introduction – Visual Binary – Spectroscopic Binary – Eclipsing Binary – Multiple stars – Origin of Binary stars	**4**	Study on Binary and multiple stars	Derivation discussion	Evaluation Class test, oral question

						Assignment, seminar Formative assessment I
	2	Stellar masses and mass Luminosity Relation – Mass transfer in close Binary systems.	**3**	Define and derive mass Luminosity Relation	Discussion and PPT	
	3	Discovery of pulsars – Rotating Neutron star model of pulsars – Period distribution and loss of rotational energy	**4**	Study on Neutron stars and Black holes	Derivation and group discussion PPT Seminar	
	4	Test of rotating neutron star model of pulsars Gold's model of pulsars, Black holes.	**4**	Neutron star and its models	Discussion and PPT	
III	**Galaxies**					
	1	Discovering Galaxies - early observations of Galaxies - Types of Galaxies - Differences in Stellar and Gas content of Galaxies	**4**	Study on galaxies	Derivation discussion,PPT	Evaluation Class test, oral question Assignment, seminar Formative assessment II
	2	The cause of Galaxy types - Galaxy collisions and Mergers - Measuring properties of Galaxies - Galaxy distances - using Cepheid Variables -	**2**	Define and derive Galaxy types	Derivation and group discussion	
	3	The Red shift and Hubble Law - Measuring the diameter of a Galaxy -Measuring the Mass of a Galaxy - Dark Matter- Quasars as probes of Intergalactic Space	**5**	Define and Derive Red shift and Hubble Law, Dark Matter and Quasars	Derivation and group discussion,PPT	
	4	Gravitational Lenses-Galaxy clusters - The local group-Rich and Poor Galaxy clusters - Super clusters	**4**	Define , derive and apply Gravitational Lenses and Galaxy clusters	Derivation and group discussion,PPT Seminar	
IV	**Cosmology**					
	1	Introduction – Red shift and the expansion of the universe – Matter Density in the universe and Declaration parameter	**4**	Prove Red shift and the expansion of the universe	Derivation, discussion,PPT	Evaluation Class test, oral question Assignment, seminar Formative assessment II/III
	2	Perfect cosmological principle – Fundamental equation of cosmology.	**4**	Define and derive Fundamenta	Derivation and group discussion,	

				l equation of cosmology	PPT	
	3	The current theories – Some important models of the universe	**3**	Define and Derive Some important models of the universe	Derivation and group discussion Seminar	
	4	Observational tests of cosmological models.	**4**	Define , derive and apply cosmologica l models.	Derivation and group discussion	
V	**Astronomical Instruments**					
	1	Light and its properties – Earth atmosphere and the electromagnetic radiation	**4**	Study on light and Earth atmosphere	Discussion, PPT	Evaluation Class test, oral question Assignment, Seminar Formative assessment III
	2	Optical telescopes	**3**	Define, discus and sketch Optical telescopes	discussion, PPT Seminar	
	3	Radio telescopes – Hubble space telescopes – Astronomical spectrographs – Photoelectric photometry	**4**	Define, discus and sketch Radio telescopes	discussion, PPT	
	4	Spectrophotometry – Detectors and Image processing.	**4**	Define, discus and sketch Detectors and Image processing.	discussion, PPT	

Course Instructor: Dr.C .Nirmala Louis

Head of the Department: Dr.S.Mary Delphine