PSGR
Krishnammal College for Women

DEPARTMENT OF PHYSICS

MASTER OF PHYSICS

2025-2027 Batch

PSGR Krishnammal College for Women

MASTER OF SCIENCE IN PHYSICS
CHOICE BASED CREDIT SYSTEM (CBCS) & LEARNING OUTCOME BASED CURRICULUM FRAMEWORK (LOCF)
SCHEME AND SYLLABUS OF 2025-2027 BATCH
SEMESTER - I
Examination System

Semester	Course code	Title of the Course	Course Type	Instructions Hours/Week	Total Contact Hours	Tutorials	Duration of Exam in Hours	Maximum Marks			Credits
								CA	ESE	Total	
I	MPS2301	Mathematical Physics –I	CC	6	88	2	3	25	75	100	4
	MPS2302	Classical Mechanics	CC	6	88	2	3	25	75	100	4
	MPS2303	Thermodynamics and Statistical Mechanics	CC	6	88	2	3	25	75	100	4
	MPS2304	Electronics	CC	6	88	2	3	25	75	100	4
	MPS23P1	General Physics - Practical	CC	3	45	-	-	-	-	-	-
	MPS23P2	Electronics - Practical	CC	3	45	-	-	-	-	-	-
I - III	17MONL1	Online Course	ACC	-	-	-	-	-	-	-	-

CC – Core Courses
ESE – End Semester Examination
ACC– Additional Credit Course
CA – Continuous Assessment

Pattern:

Semester system will be followed. A semester consists of a minimum of 90 working days excluding the days of conduct of ESE. There will be Continuous Internal Assessment (CA) to evaluate the performance of students in each course and the End Semester Examination will be held at the end of every semester.

Weightage assigned to various components of Continuous Internal Assessment

Theory

CIA Test : 5 marks **(conducted for 45 marks after 50 days)**
Model Exam : 7 marks **(conducted for 75 marks after 85 days)**
Seminar/Assignment/Quiz : 5 marks
Class Participation : 5 marks
Attendance : 3 marks
Total : 25 Marks

Practical

Lab Performance : 7 marks
Regularity : 5 marks
Model Exam : 10 marks
Attendance : 3 marks
Total : 25 marks

CA Question Paper Pattern and distribution of marks - (First 3 Units)

CA Question from each unit comprising of

One question with a weightage of 2 Marks :2 x 3 = 6
One question with a weightage of 5 Marks (Internal Choice at the same CLO level) :5 x 3 =15
One question with a weightage of 8 Marks (Internal Choice at the same CLO level) :8 x 3 =24
Total :45 Marks

End Semester Examination – Question Paper Pattern and Distribution of Marks

Core and Elective Courses

ESE Question Paper Pattern: 5 x 15 = 75 Marks

Question from each unit comprising of
One question with a weightage of 2 Marks : 2 x 5=10 marks
One question with a weightage of 5 Marks (Internal Choice at the same CLO level): 5 x 5 =25
One question with a weightage of 8 Marks (Internal Choice at the same CLO level): 8 x 5 =40

Criteria for Attendance:

3 Marks (Attendance 75% - 80% - 1 Mark, 81% - 90% - 2 Marks, 91% - 100% - 3 Marks)

Course Code	Course Title	Category	L	T	P	Credit
MPS2301	**MATHEMATICAL PHYSICS - I**	Theory	88	2	-	4

Preamble

The aim of this course is to provide the mathematical foundation in vectors, matrices, Complex numbers and special functions required for the description of the physical phenomena.

Prerequisite

Basic idea on vectors, matrices, complex numbers, Partial Differential Equations, Special Function

Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO 1	Understand the basic principles of mathematical physics and its applications	K2
CLO 2	Analyse the nature of the problems in physics	K3
CLO 3	To improve their logical, mathematical and analytical skills in problem solving	K4
CLO 4	Formulate, interpret and draw inferences from mathematical solutions	K5
CLO 5	Develop expertise in mathematical techniques required in physics	K6

Mapping with Programme Learning Outcomes

COs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO 7
CLO 1	S	S	S	S	M	S	M
CLO 2	S	S	S	S	S	M	S
CLO 3	S	S	S	S	S	M	M
CLO 4	S	S	S	M	S	M	M
CLO 5	S	S	S	S	S	S	S

S- Strong; M-Medium; L-Low

Syllabus

Unit I – Vectors **17 Hrs**

Gauss divergence theorem[1]& its physical interpretation - Gauss's Theorem – Stokes's theorem-Poisson's equations – curvilinear coordinates – orthogonal curvilinear coordinates – condition for orthogonality – **cylindrical coordinates[2]** – spherical polar coordinates. linear vector space, linear independence of vectors and dimensions, basis and expansion theorem, inner product and unitary spaces, Orthonormal sets, Schmidt's orthogonalisation method.

Unit II – Matrices **17 Hrs**

Review of algebraic operations of matrices, sub matrices[3], partitioning of matrices, **special types of matrices and their properties**, **vectors as matrices[4]** and vector spaces, linear transformations, orthogonal and unitary transformation, eigen values, eigen vectors, Cayley Hamilton theorem, **Stochastic matrices, diagonalisation of matrices**, **power of a matrix**, **exponential of a matrix[5]**. Matrices in physics: rotation matrix, Pauli's spins matrices, Dirac matrices.

Unit III – Complex Variables **18 Hrs**

Introduction, **regular functions, elementary functions and mapping,** contour integration, Cauchy's theorem, Cauchy's integral formula, Results based on contour formula, **Taylor's expansion[7]**, Laurent's expansion, Residue and contour integration, Cauchy's residue theorem, integration round the unit circle, evaluation of definite integrals - sin□ and cos□.

Unit IV – Partial Differential Equations **18 Hrs**

Laplace equation, Poisson's equation, Heat flow equation, Wave equation, Helmholtz equation, Solution of Laplace equation in Cartesian co-ordinates, in two dimensional cylindrical co-ordinates, in two dimensional spherical polar co-ordinates, Solution of Poisson equation, **Diffusion equation or equation of heat flow. Solution of heat flow equation in one dimension[8,9].**

Unit V – Special Functions **18 Hrs**

Series solution,**solution of Linear differential equation of first order[10]**, solution of second order linear differential equation with constant coefficients, power series solution-Frobenius' method, Legendre's equation, Legendre's function of I and II kind, Generating function of Legendre polynomial, Recurrence formula for $P_n(x)$, Bessel's function of I kind, recurrence function for $J_n(x)$, generating function for $J_n(x)$, Hermite differential equation, **Hermite polynomial, recurrence for Hermite polynomial[11].**

Text Book

S. No	Authors	Title of the Book	Publishers	Year & Edition
1	Sathya Prakash	Mathematical Physics with Classical mechanics	Sultan Chand & Sons	2014, 6th Edn

Reference Books

S. No	Authors	Title of the Book	Publishers	Year & Edition

1	ChattopadhayP.K	Mathematical physics	New Age International-New Delhi	2004, 1st Edn
2	Dass.H.K,	Mathematical Physics	S. Chand and Company Pvt. Ltd,	2014, 7th Edn
3	Erwin Kreyzig	Advanced Engineering Mathematics	Wiley India Private Limited,	2011,10th Edn
4	Joshi A.W	Matrices and Tensors in Physics	Wiley Eastern Ltd,	2005, 4th Edn
5	Pipes & Harvill	Applied Mathematics for Engineers and Physicists	McGraw Hill international Book company	2014, 3rd Edn
6	Hans. J Weber and George. B.Arfken	Mathematical methods for Physicists	Academic Press	2011,7th Edn

E-Content link

1. https://www.youtube.com/watch?v=vZGvgru4TwE
2. https://www.youtube.com/watch?v=CrafR-XZubw
3. https://www.youtube.com/watch?v=MqmYlQ9zxvw
4. https://study.com/academy/lesson/types-of-matrices-definition-differences.html
5. https://www.youtube.com/watch?v=LTb9V84hG9w
6. https://www.youtube.com/watch?v=NtM7qFcML
7. https://www.youtube.com/watch?v=3d6DsjIBzJ4
8. https://www.youtube.com/watch?v=1X2MJH_MUgU
9. https://www.youtube.com/watch?v=ky4J7btqfXI
10. https://www.youtube.com/watch?v=2G0nihWWG8Y
11. https://www.youtube.com/watch?v=5UEWlnZbbLQ

Pedagogy

Chalk and Talk lectures, Group Discussion, Seminar, Interaction, power point presentation, E-content link

Course Designers:

1.Mrs.S.Subanya
2. Mrs.D.Niveditha

Course Code	Course Title	Category	L	T	P	Credit
MPS2302	CLASSICAL MECHANICS	Theory	88	2	-	4

Preamble

The aim of this course is to provide an in-depth knowledge of the principles of classical mechanics and the study of specific problems, viz. the two body central force problem and small oscillations.

Prerequisite

- Basic knowledge on differential calculus and Newtonian Mechanics
- Knowledge on rotational dynamics

Course Learning Outcomes

CLO Number	CLO Statement	Knowledge Level
CLO1	Study the applications of Newtonian mechanics in daily life	K2
CLO2	Understand the motion of bodies, including the special case in which bodies remain at rest in accordance with the Newtonian principles	K3
CLO3	Analyze the movement of macroscopic objects, like projectiles, and astronomical objects, such as spacecraft, planets, stars, and galaxies.	K4
CLO4	Develop knowledge of the behaviour of bodies under the influence of forces	K5
CLO5	Develop familiarity with the physical concepts and facilitate with the mathematical methods of classical mechanics	K6

On the successful completion of the course, students will be able to

Mapping with Programme Learning Outcomes

CLOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CLO1	S	S	M	M	M	L	L
CLO2	S	M	S	M	M	L	L
CLO3	S	M	M	L	M	L	L
CLO4	S	M	M	M	M	S	L
CLO5	S	M	M	S	M	M	L

S- Strong; M-Medium; L-Low

Syllabus

Unit I: Fundamental principles of Lagrangian Formulation 18 hrs

Mechanics of a particle- Mechanics of a system of particles- constraints- D'Alembert's principle and Lagrange's equations- Velocity – dependent potentials and the dissipation function- **simple application of the Lagrangian formulation[1]**-Single particle in space-**Atwood's machine[2,3]-bead sliding on a rotating wire[3,4]**, linear harmonic oscillator- **simple pendulum[5]**.

Unit II: Variational principles andLagrange's equations: **17 hrs**

Hamilton's principle- some techniques of the calculus of variations- derivation of Lagrange's equations from Hamilton's Principle- Extension of Hamilton's principle to non holonomic systems- **Advantages of a variational principle formulation[6]** - conservation theorems and symmetry properties-Energy function and the conservation of energy.

Unit III: Two body central force problem 18 hrs

Reduction to the equivalent one-body problem- the equations of motion and first integrals-the equivalent one- dimensional problem and classification of orbits- law potentials- conditions for closed orbits (Bertrand's theorem) - **the Kepler problem: inverse square law of force[7]-the motion in time in the Kepler problem[7]**- The Laplace-Runge-Lenz vector-Scattering in a central force field- **transformation of the scattering problem to laboratory coordinates[8].**

Unit IV: Small oscillations 17 hrs

Formulation of the problem - Eigen value equation and the principle axis transformation-frequencies of free vibrations- normal coordinates- **Free vibrations of a linear tri atomic molecule[9] - Forced vibration and the effect of dissipative forces[10].**

Unit V: Hamilton's Formulation 18 hrs

Legendre transformations and the Hamilton canonical equations of motion –**Cyclic coordinates[11,12]** - Routh's procedure- Hamiltonian formulation of relativistic mechanics-**Derivation of Hamilton's equations from a variational principle[13]**- The principle of least action.

Poisson Brackets-definition-**invariance of Poisson- brackets with respect to canonical transformation[14]** –Equations of motion in Poisson bracket form-**Jacobi's identity[14]**-infinitesimal contact transformations-interpretation in terms of Poisson brackets-The angular momentum and Poisson brackets.

Text Book

S.No	**Authors**	**Title of the Book**	**Publishers**	**Year & Edition**
1.	Herbert Goldstein	Classical Mechanics	Narosa Publishing House	2001, 2nd Edn
2.	Gupta, Kumar & Sharma	Classical Mechanics	PragatiPrakashan	2012, 26th Edn
3.	. R G Takwale& P S Puranik	Classical Mechanics	Tata McGraw Hill Education Pvt. Ltd,	2010, 2nd Edn

Reference Books

S.No	Authors	Title of the Book	Publishers	Year & Edition
1.	Rana&Joag	Classical Mechanics	TMH	2010, 6th Edn
2.	Douglas Gregory	Classical Mechanics	Cambridge Unversity press	2008 1st Edn

References For E-Content:

1. https://youtu.be/3iyDyoKZnrc
2. https://youtu.be/VwOrZ-jDqHY
3. https://youtu.be/OLJrY0v0yPI
4. https://youtu.be/PNnT9e7aTqc
5. https://youtu.be/vJ2pyd_Ag3k
6. https://youtu.be/tN_dNwQmLqU
7. https://slideplayer.com/slide/6379146/
8. https://youtu.be/0C1cbjA0HmU
9. https://youtu.be/CLKhkxaMURQ
10. https://youtu.be/nuZo8KYiWoo
11. https://youtu.be/m7XD44oG1b4
12. https://youtu.be/mQSWuwuwPxI

Predagogy

Chalk and Talk lectures, Group Discussion, Seminar, Interaction, power point presentation

Course Designers:

Dr.B.Punithaveni

Course Code	Course Title	Category	L	T	P	Credit
MPS2303	**THERMODYNAMICS AND STATISTICAL MECHANICS**	Theory	88	2	-	4

Preamble

To acquire a sound understanding of the basic principles of statistical mechanics and its application to realistic problems

Prerequisite

- An idea on thermodynamical variables, quantum and classical statistics

Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowldge Level
CLO1	Learn relationship between equilibrium distributions and kinetic processes leading to equilibrium	K2
CLO2	Apply classical and quantum distributions in circumstances varying from standard examples to real statistical problems	K3
CLO3	Become aware of the richness and complexity of statistical behaviour exhibited by interacting systems and various approaches (phenomenological and microscopic) developed to comprehend such systems	K4
CLO4	Examine appropriate limiting behaviours in various statistical systems and to develop statistical description of system	K5
CLO5	Construct a partition function for a system in thermal equilibrium and use it to obtain thermodynamic quantities of interest.	K6

Mapping with Programme Learning Outcomes

CLOs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CLO1	S	S	S	S	S	M	S
CLO2	S	S	S	M	S	S	S
CLO3	S	S	S	L	S	S	L
CLO4	S	S	M	S	S	S	L
CLO5	S	S	S	S	S	L	S

S- Strong; M-Medium; L-Low

Syllabus

Unit – I: Thermodynamics **18 hrs**

Thermodynamic variables[1]- extensive and intensive variables- **Zeroth law of thermodynamics**[2] - equivalence of heat and work - **first law of thermodynamics**[3,4] - Significance of the first law of thermodynamics - thermodynamic processes - reversible process – irreversible process - state variables and process variables - **definition of entropy**[5] **- second law of thermodynamics**[6,7] - entropy changes in irreversible processes - Maxwell's Thermodynamical relations - thermodynamic potentials – **Enthalpy**[8]**,** Helmholtz and the Gibbs functions- Phase transitions – Clausius - Clapeyron equation – van der waals equation of state.

Unit- II: Classical Statistics - I **18 hrs**

Macroscopic and microscopic states[9] **-** phase space - Volume in phase space - postulate of equal a priori probability - density distribution in phase space - Liouville's theorem, Maxwell-Boltzmann distribution law - **micro-canonical ensemble**[10, 11] **- canonical ensemble**[10, 11]- calculation of mean values and fluctuations in a canonical ensemble - fluctuation dissipation relation - energy fluctuations and heat capacity - Grand-canonical ensemble - fluctuations in number of particles.

Unit – III: Classical Statistics - II **17 hrs**

Classical partition functions and their properties - Calculations of thermodynamic quantities - Chemical potential - Ideal mono atomic gas - entropy of mixing - Gibbs paradox – Equipartition theorem and its simple applications.i) Mean kinetic energy of a molecule in a gas ii) **Brownian motion**[12] iii) **Harmonic Oscillator**[13] iv) Specific heat of solid. Maxwell velocity distribution, Doppler Broadening of Spectral lines**.**

Unit – IV: Quantum Statistical Mechanics – I **17 hrs**

Ideal Bose systems

Symmetric and antisymmetric wavefunctions – The density matrix - **Quantum harmonic oscillator**[14] - Einstein's theory of heat capacity - Debye's theory of heat capacity - Bose – Einstein statistics - **black body radiation**[15]- photon gas - Planck's law - Bose-Einstein Condensation - lambda transition – Liquid helium – **Super fluidity**[16,17]

Unit-V: Quantum Statistical Mechanics - II **18 hrs**

Fermi-Dirac statistics[18] **- Fermi distribution**[18] **- Fermi energy**[18] - Mean energy of Fermions at absolute zero - Fermi energy as a function of temperature - electrons in metals - Electronic specific heat - **White Dwarfs**[19]- Compressibility of Fermi gas - Pauli's para magnetism - A relativistic degenerate electron gas.

Text Books

S. No	Authors	Title of the Book	Publishers	Year & Edition
1	Gupta Kumar	Elementary Statistical Mechanics	Pragati Prakashan	2011, 24th Edn
2	Kerson Huang	Introduction to Statistical Physics	Taylor & Francis	2001, 1st Edn
3	B.B. Laud	Fundamentals of Statistical Mechanics	New age International Publishers	2011,1st Edn

Reference Books

S. No	Authors	Title of the Book	Publishers	Year & Edition
1	K. Huang	Statistical Mechanics	John Wiley & Sons	2009, 2nd Edn
2	L. D. Landau and E. M. Lifshitz	Statistical Physics	Pergamon Press	2011,3rd Edn
3	R.K.Pathria& Paul D. Beale	Statistical Mechanics	Elsevier-Butterworth Heinemann	2011,3rd Edn
4	F.Reif	Statistical Physics	Tata McGraw	2008,Special Indian Edn
5	Satya Prakash	Statistical Mechanics	Kedar Nath Ram Nath Publications	2011,Special Edn

E-Content

1. https://youtu.be/fTQslkc7f4g
2. https://youtu.be/-42JmVBdlM4
3. https://youtu.be/1OFlW8OXN64
4. https://youtu.be/dHdlH3l8FkM
5. https://youtu.be/870y6GUKbwc
6. https://youtu.be/y6pGjfi8FZw
7. https://youtu.be/mGDJO2M7RBg
8. https://youtu.be/x_pbr5RFhVc
9. https://youtu.be/F_NmS-Wy2lE
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11. https://youtu.be/8ttrMYZWNXc
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13. https://youtu.be/py3EWLKQaMs
14. https://youtu.be/yG_Ot9rsNaw
15. https://youtu.be/Na-mFjyP8eU
16. https://youtu.be/2Z6UJbwxBZI
17. https://youtu.be/dLcwmMGCfU8
18. https://youtu.be/Ww9wcs3yNWI
19. https://youtu.be/ITD8s-bLXSk

Pedagogy

Chalk and Talk, ppt, group discussion, seminar, Interaction, problem solving

Course Designers:

1. Dr.N.Priyadharsini

Course Code	Course Title	Category	L	T	P	Credit
MPS2304	ELECTRONICS	Theory	88	2	-	4

Preamble

This course deals with semiconductor device characteristics, Op-Amp characteristics and their applications& digital principles

Prerequisite

- Basic idea on semiconductor devices
- Concepts of amplifiers and oscillators

Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the concepts of semiconductor devices.	K2
CLO2	Design counters and to explain power devices and their application in various fields	K3
CLO3	apply the concepts of operational amplifier to solve differential and simultaneous equations.	K4
CLO4	Solve problem related to semiconductor devices and oscillator circuit Familiarize the conversion of data from Analog to Digital and Digital to Analog	K5
CLO5	Take projects in electronics relevant to industrial and R &D needs	K6

Mapping with Programme Learning Outcomes

CLOs	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7
CLO 1	S	S	S	L	L	M	L
CLO 2	S	S	M	S	M	M	M
CLO 3	S	S	S	M	L	M	M
CLO 4	S	S	S	M	L	M	M
CLO 5	S	S	S	M	S	S	M

S- Strong; M-Medium; L-Low

Syllabus

Unit I : Electronic Circuits and Devices I: 18 hrs

Tunnel Diode- Structure-Characteristics- **applications[1]** - IMPATT- PNPN diodes characteristics &**applications[2]** – Gunn diode- device operation-negative differential resistance, SCR-characteristics &**applications[3]**, Silicon Controlled Switch(SCS) – UJT structure & characteristics - UJT Oscillator - **Applications of UJT[4]**.

Optoelectronics: Photo Resistor-Photo Diode - Photo Transistor, LEDs- Device structure and **Working principle[5].**

Unit II: Electronic Circuits and Devices II: 18 hrs

The junction field effect transistor- **the pinch off voltage[6]** (Vp)-the JFET volt-ampere characteristics- Biasing the FET- FET as a Voltage Variable Resistor - the FET small signal model- the common source Amplifier at low & High Frequencies - common Drain amplifier at low & High Frequencies - MOS structure and principle of operation – **current voltage characteristics[7]**. Logic gates using MOSFETs – Complementary MOSFETs.

Unit III : Operational Amplifier: 17 hrs

The operational amplifier - parameters of op amps, Frequency Response of an amplifier**, the comparator[8]**, Basic Operational Amplifier applications-Differential DC amplifier- integrator and differentiator-Electronic analog Computation solving Simultaneous and Differential equations- **log and Exponential amplifiers[9].**

Unit IV : Oscillators and Data Converters 17hrs

Wave Form Generators and Wave Shaping Circuits using Op amps – Phase Shift-Oscillator-Wien Bridge Oscillator-Crystal Oscillator- Multivibrators- Schmitt Trigger-Triangular Wave Generators – Pulse Generators - the weighted resistor D/A convertor- The R-2R ladder D/A converter – **Switches for D/A converters[10]- Inverted ladder D/A converter[11]-** A/D converters- A counter type- successive Approximation converters. IC 555 Timer and its **Applications[12].**

Unit V : Registers and Counters 18 hrs

The shift register, Serial in –Serial out, Serial in – Parallel out, **Parallel in – Serial out[13]**, Parallel in – Parallel out – Counters, methods to improve counter speed,- Mod-3 counters, Mod 5, Mod 7, Mod 9 and **decade counters[14]**, Ripple counter, the up-down ripple counter, the up-down synchronous counter, ring counters, **sequence generator[15]**.

Text Books

S.No.	Author	Title of the book	Publisher	Year & Edition
1	Jacob Millman & Arvin Grabel	Microelectronics	Tata McGraw Hill Publishing Company Ltd-New Delhi	1999, 2nd Edn
2	Jacob Millman & Christos C Halkias	Integrated Electronics	Tata McGraw Hill Publishing Company Ltd-New Delhi	2005, 41st Edn

3	Malvino Leach	Digital Principles and Applications	Tata McGraw Hill Publishing Company Ltd-New Delhi	1995, 5th Edn
4	Ramakant A.Gayakwad	Opamps and Linear Integrated Circuits	PHI Learning Pvt.Ltd,New Delhi	2000, 4th Edn.
5	Sze .S.M,	Semiconductor devices Physics and Technology	Wiley Student Edition	2012, 2nd Edn
6	V Vijayendran	Introduction to Integrated Electronics (Digital and Analog)	Viswanathan (Printers and Publishers) Pvt. Ltd,	2011, Reprint

Reference books

S.No.	Author	Title of the book	Publisher	Year & Edition
1	MehtaV.K & Rohit Mehta	Principles of Electronics,	Tata McGraw Hill Publishing Company Limited New Delhi	2014, 11th Edn
2	Gupta & Kumar,	Hand Book of Electronics,	Pragati Prakashan	2010, 32nd Edn
3	Chatterji B.N	Digital Computer technology	Khanna Publishers Delhi	1986, 2nd Edn

E-Content

1. https://youtu.be/PuG8CCUbg58
2. https://youtu.be/Miu22EkyXyQ
3. https://youtu.be/8OgHY4-gcQw
4. https://youtu.be/ZOOUofPeSYY
5. https://youtu.be/NUR9tebFDRc
6. https://youtu.be/paK2Tjxuog0
7. https://youtu.be/-o39YVNMYVs
8. https://youtu.be/66Jl4YmpAMY
9. https://youtu.be/-qs3qJz6dTU
10. https://youtu.be/gsF6GVz9wV0
11. https://youtu.be/gcRBw--n9yw
12. https://youtu.be/7LmBcGiiYwk
13. https://youtu.be/TqHme0lvvCU
14. https://youtu.be/fKVZpupyP_o
15. https://youtu.be/XNAK-L7NlO

Pedagogy

Chalk and Talk, Group Discussion, Demonstration, Problem solving, Seminar, Designing circuits, PPT and Assignment

Course Designers:

1. Dr.G.Vanitha
2. Mrs.T.Poongodi

Course Code	Course Title	Category	L	T	P	Credit
MPS23P1	**GENERAL PHYSICS - PRACTICAL**	Practical	-	-	4	4

Preamble

The aim of this course is to make the students gain a practical knowledge in the basics of Physics.

Prerequisite

- Basic experience in handling devices/instruments (UG level)

Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CO Statement	Knowledge Level
CLO1	Understand the basics of experimental physics	K2
CLO2	Explore the concepts involved in the thermodynamics, heat and modern optics	K3
CLO3	Acquire strong laboratory skills	K4
CLO4	Enhance the skill to meet the present day requirements in industries, research fields	K5
CLO5	Create the knowledge of theories involved in physics using practical experiments	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
CLO1	S	M	M	S	M	M	M
CLO2	S	M	S	M	M	S	S
CLO3	S	S	M	M	S	M	M
CLO4	S	M	M	M	M	M	M
CLO5	S	M	M	M	M	S	S

S- Strong; M-Medium; L-Low

Syllabus

GENERAL PHYSICS - PRACTICAL
(Examination at the end of Second Semester)
Any Twelve Experiments

1. Young's Modulus-Elliptical Fringes
2. Young's Modulus-Hyperbolic Fringes
3. Viscosity of a Liquid-Mayer's Oscillating Disc
4. Determination of
   (i) Refractive Index of transparent solids and liquids using Laser source
   (ii) Particle size (iii) Diffraction at a circular aperture (pin hole)
5. Study of characteristics of Laser
   (i) Determination of Gaussian nature of laser source and evaluation of beam spot size.
   (ii) Measurement of Laser beam divergence (iii) Absorption of light on various filters
6. Electronic Specific Charge - 'e/m' by Thomson's Method
7. Thermistor -Temperature Coefficient and Band Gap Energy
8. Magnetic Hysteresis loop tracing
9. Study of characteristics of optical fibre –

(i) Numerical aperture (ii) bending losses (iii) splice losses (iv) attenuation by fibre cut –Back method

10. Determination of Curie Temperature of Ferro electric solid
11. Characteristic study of Photo Transistor, photodiode and photovoltaic cell (solar cell)
12. Determination of critical potential by Frank Hertz experimental method.
13. Thickness of Wire by Air Wedge Diffraction
14. Determination of dipole moment of a liquid
15. Identification of prominent lines – Copper arc
16. Characteristic study of LED, LDR and Opto coupler.

Course Designers:

1.Dr. G.Praveena

Course Code	Course Title	Category	L	T	P	Credit
MPS23P2	**ELECTRONICS - PRACTICAL**	Practical	-	-	4	4

Preammble

The aim of this course is to make the students to practically learn the characteristics of different electronic circuits.

Prerequisites

- Basic experience in constructing and handling electronic circuits (UG level)

Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CO Statement	Knowledge Level
CLO1	Understand the basic concepts in IC's, digital devices and C programming.	K2
CLO2	Apply circuit systems to construct electronic devices	K3
CLO3	Evaluate the functioning of circuits	K4
CLO4	Enhance the skill to meet the present day requirements in industries, research fields.,	K5
CLO5	Become proficient to be directly employed or start his/her own work as Electronic circuit Designer	K6

Mapping with Programme Learning Outcomes

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CLO1	S	M	M	S	M	M	M
CLO2	S	M	S	M	S	M	S
CLO3	S	S	M	M	M	M	S
CLO4	S	M	M	M	M	M	M
CLO5	S	M	M	M	M	M	S

S- Strong; M-Medium; L-Low

Syllabus

ELECTRONICS - PRACTICAL
(Examination at the end of second Semester)
Any Twelve Experiments

1. Design of Regulated and Dual Power Supply and Construction using fixed voltage regulator and 723.
2. Characteristics of UJT
3. UJT Relaxation Oscillator
4. FET –common source amplifier
5. FET –common drain amplifier
6. Op-Amp parameters
7. Wave Form Generators- using Op-Amp and Timer 555.
8. (i) Phase-Shift Oscillator (ii) Wien's Bridge Oscillator using Op-Amp
9. Op-Amp – log and antilog amplifier
10. Sign Changer, Scale Changer, Summer and Subtractor- Op-Amp
11. Analog Computer Setup-Solving Simultaneous Equations
12. Schmitt Trigger using discrete components and OP-AMP/ Timer 555

By Simulation and using ICs

13. Flip-Flops (RS, JK , D)
14. Counters- Digital ICs
15. Shift register- Digital ICs
16. (i) Write a C program to calculate the De Broglie's wave length $\left(\lambda = \frac{h}{p}\right)$

    (ii) Write a C program to prove Heisenberg's Uncertainty Principle
17. Write a C program to find the solution for the ground state of hydrogen atom
18. Write a C program to integrate a given function using Simpsons Rule.
19. Write a C program to study the Motion of a particle under the force f(x) = -x
20. Write a C program to calculate the bond length of NaCl

Course Designers:

1. Dr. N.Priyadharsini

PSGR
Krishnammal College for Women

Affiliated to Bharathiar University \ Autonomous \ College of Excellence \ Accredited with A++ Grade \ Ranked 9th in NIRF

DEPARTMENT OF PHYSICS

CHOICE BASED CREDIT SYSTEM (CBCS) &
LEARNING OUTCOMES - BASED CURRICULUM FRAMEWORK (LOCF)

MASTER OF SCIENCE - PHYSICS
2025-27 BATCH
SEMESTER – II

MASTER OF SCIENCE IN PHYSICS
CHOICE BASED CREDIT SYSTEM (CBCS) &
LEARNING OUTCOMES - BASED CURRICULUM FRAMEWORK (LOCF)
SCHEME & SYLLABUS OF EXAMINATION
2025-2027 BATCH
SEMESTER – II

Semester	Course Code	Title of the Course	Course Type	Instructions Hours/week	Contact Hours	Tutorial	Duration of exam	Examination marks			Credits
								CA	ESE	Total	
II	MPS2305	Mathematical Physics –II	CC	5	73	2	3	25	75	100	5
	MPS2306	Quantum Mechanics -I	CC	5	73	2	3	25	75	100	5
	MPS2307	Electromagnetic Theory	CC	5	73	2	3	25	75	100	5
II/III	MPS23CE	Python for data science and Artificial Intelligence	CC	4	60	-	-	100	-	100	3
II	MPS17A1/ MTH23A4	Inter Disciplinary Course Biophysics/ Tensors and Numerical Methods	GC	3	45	-	3	-	100	100	3
	MPS23P1	General Physics Practical	CC	4	60	-	4	25	75	100	4
	MPS23P2	Electronics Practical	CC	4	60	-	4	25	75	100	4
I-III	17MONL1	Online Course	ACC	-	-	-	-	-	-	-	-

CC – Core Courses

ACC– Additional Credit Course

DSE – Discipline Specific Elective

GC-General Course

ESE – End Semester Examination

CA – Continuous Assessment

Examination System

Pattern:

Semester system will be followed. A semester consists of a minimum of 90 working days excluding the days of conduct of ESE. There will be Continuous Internal Assessment (CA) to evaluate the performance of students in each course and the End Semester Examination will be held at the end of every semester.

Weightage assigned to various components of Continuous Internal Assessment

Theory

CIA Test : 5 marks **(conducted for 45 marks after 50 days)**
Model Exam : 7 marks **(conducted for 75 marks after 85 days)**
Seminar/Assignment/Quiz : 5 marks
Class Participation : 5 marks
Attendance : 3 marks
Total : 25 Marks

Practical

Lab Performance : 7 marks
Regularity : 5 marks
Model Exam : 10 marks
Attendance : 3 marks
Total : 25 marks

CA Question Paper Pattern and distribution of marks - (First 3 Units)

CA Question from each unit comprising of

One question with a weightage of 2 Marks :2 x 3 = 6
One question with a weightage of 5 Marks (Internal Choice at the same CLO level) :5 x 3 =15
One question with a weightage of 8 Marks (Internal Choice at the same CLO level) :8 x 3 =24
Total :45 Marks

End Semester Examination – Question Paper Pattern and Distribution of Marks

Core and Elective Courses

ESE Question Paper Pattern: 5 x 15 = 75 Marks

Question from each unit comprising of
One question with a weightage of 2 Marks : 2 x 5=10 marks
One question with a weightage of 5 Marks (Internal Choice at the same CLO level): 5 x 5 =25
One question with a weightage of 8 Marks (Internal Choice at the same CLO level): 8 x 5 =40

Criteria for Attendance:

3 Marks (Attendance 75% - 80% - 1 Mark, 81% - 90% - 2 Marks, 91% - 100% - 3 Marks)

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDITS
MPS2305	MATHEMATICAL PHYSICS-II	THEORY	73	2	-	5

Preamble

This course aims at the introduction of advanced mathematical tools such as transforms, probability distribution and group theory.

Prerequisite

- Basic Idea on Series and transforms, probability

Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Understand the basic theories and formulas in solving the physical problems.	K2
CLO2	Applications include boundary value problems in electrodynamics and diffusion, eigen value problems in quantum mechanics, and Green's function methods for scattering.	K3
CLO3	Analyse the nature of the problem	K4
CLO4	Capable of evaluating problem at higher order levels using advanced mathematical tools	K5
CLO5	Enhances the mathematical implementation in physics.	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
CLO1	S	S	S	M	M	S	M
CLO2	S	M	S	L	S	M	M
CLO3	S	M	S	M	S	M	L
CLO4	S	M	M	S	M	M	M
CLO5	S	M	M	S	S	M	S

S- Strong; M-Medium; L-Low

Syllabus

Unit I – Fourier Series And Transform **15 Hrs**

Evaluation of the coefficients of Fourier series[1,2], Dirichlet's theorem, Dirichlet's condition, Half range series, change of interval, Fourier series in the interval (0 to T) and uses of Fourier series. Applications Half and full wave rectifier. **Properties of Fourier series[3]**, Gib b's phenomenon, Parseval's identity of Fourier series, Fourier sine and cosine transforms of derivatives.

Unit II – Laplace Transform **14 Hrs**

Properties of Laplace transforms[4,5], Laplace transform of the derivative of a function,Laplace transform of integral, Laplace transform of periodic fun ctions, Inverse Laplace transform , properties, Faltung theorem, Evaluation of inverse Laplace transform by convolution theorem, applications of Laplace transform.

Unit III – Dirac Delta Function and Green's Function **15 Hrs**

Dirac delta function, properties, Fourier transform of delta function, Laplace transform ofdelta function, derivative of delta function, completeness condition in terms of Dirac delta function, three dimensional Dirac delta function.

Green's function for one dimensional case, general proof of symmetry property of Green's function, Eigen function, Green's function for Poisson's equation and solution of Poisson's equation.

Unit IV – Probability **14 Hrs**

Mathematical definition of priori probability[6], sample space[7], mutually exclusive events [8], theorem of total probability[8], compound events and theorems of compound probability, binomial and multinomial theorem of probability, Laplace-de-Moivre limit theorem, Measures of central tendency, measures of dispersion, Karl Pearson's coefficient of correlation, standard deviation. Theoretical distribution- Binomial, Poisson and Normal distribution.

Unit V – Group Theory **15 Hrs**

Concept of a group, abelian group, generation of finite group, cyclic group, group mul tiplication table [9,10], rearrangement theorem, subgroups, cosets, conjugate elements and classes, product ofclasses, complexes, Isomorphism, homomorphism, permutation groups, C ayley's theorem, representation of groups square and triangle only, reducible and irreducible representations, orthogonality theorem

Books for Study:

S.No	Authors	Title of the Book	Publishers	Year & Edition
1.	Sathya Prakash	Mathematical Physics with Classical mechanics	Sultan Chand & Sons	2023 and 7th Edn
2.	B S Rajput	Mathematical physics	Pragati Prakashan	2020 and 21stEdn

Reference Books:

S.No	Authors	Title of the Book	Publishers	Year & Edition

1.	Dass.H.K	Mathematical Physics	S.Chand and Company Pvt. Ltd	2015 and 6th Edn
2.	Erwin Kreyzig	Advanced Engineering Mathematics	Wiley India Private Limited	2008 and 8th Edn
3.	Eugene Butkov	Mathematical Physics	Addison Wesley London 1973	2000 and 1stEdn
4.	GuptaMathematical Physics	Vikas Publishing House Pvt. Ltd	2006	2005 and 3rd Edn
5.	Joshi A.W	Elements of Group Theory for Physicists	John Wiley & Sons (Asia) Pvt. Ltd3rd Edition	2015 and 8th Edn
6.	Weber and George. B.Arfken	Mathematical methods for Physicists	Hans. J, Academic Press	2001 and 6th Edn

E-content Reference for E-content

1. https://www.youtube.com/watch?v=52r-fBTWcww
2. https://www.youtube.com/watch?v=x04dnqg-iPw
3. https://www.youtube.com/watch?v=FQdhWQ9Z6mk
4. https://www.youtube.com/watch?v=zModDQ-ST30
5. https://www.youtube.com/watch?v=M-dy4MJAnN0
6. https://www.youtube.com/watch?v=CDwDliZsFS4
7. https://www.youtube.com/watch?v=leVm6xuKdlU
8. https://www.youtube.com/watch?v=sMh8tsW_b_I
9. https://youtu.be/S2Bsw0aix6g
10. https://www.youtube.com/watch?v=yF5t2BwMiwU

Pedagogy

Chalk and talk, PPT, Seminar, Group discussion, e-contents

Course Designers:

1. Mrs.S.Subanya
2. Mrs.D.Niveditha

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDITS
MPS2306	QUANTUM MECHANICS-I	THEORY	73	2	-	5

Preamble

The aim of this course is to build a strong base on the basic facts of quantum mechanics and to make students understand the methods that are required for the accurate description of various microscopic systems.

Prerequisite

- Fundamental knowledge on classical mechanics
- Basic idea on operators and wave equations

Course Learning Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	KnowledgeLevel
CLO1	Understand the central concepts and basic formalisms of quantum mechanics; and the set of mathematical tools needed to formulate problems in quantum mechanics.	K2
CLO2	Solve problems in one, two and three dimensions, such as barrier potentials, harmonic oscillator, rigid molecule, hydrogen atom etc., and on systems of identical particles, e.g. determine the symmetry properties of the wave function, and the total spin.	K3
CLO3	Establishing the relations and validating various results. Inspecting on the quantum effects on various spectra. Comparing the properties of various quantities, methods and so on. Give concise physical interpretations, and arguments for the validity of the methods.	K4
CLO4	Integrate several components of the course like quantum states, symmetries, angular momentum etc in the context of finding solution to the problems in atomic and molecular physics	K5
CLO5	Present the tools, methodologies, language and conventions of quantum mechanics from this course to prove and test ideas and explanations on various problems involving many body systems.	K6

Mapping with Programme Learning Outcomes

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7
CLO1	S	S	S	M	L	L	L
CLO2	S	S	S	S	S	M	M
CLO3	S	S	S	S	S	M	M
CLO4	S	S	S	S	S	S	M
CLO5	S	S	S	S	S	S	S

S- Strong; M-Medium; L-Low

Syllabus

Unit I **15 hrs**

General formalism of quantum mechanics: Linear Vector Space[1]- Linear Operator- **Eigen Functions and Eigen Values[2]-** Hermitian Operator- Postulates of Quantum Mechanics- Simultaneous Measurability of Observables- General Uncertainty Relation- Dirac's Notation- **Equations of Motion; Schrodinger[3]**, Heisenberg and Dirac representation- momentum representation.

Unit II **14 hrs**

Energy Eigen value problems Particle in a box – **Linear Harmonic oscillator[4]-** Tunnelling through a barrier- particle moving in a spherically symmetric potential- System of two interacting particles-**Rigid rotator**[5]**- Hydrogen atom[6]**

Unit III **15 hrs**

Angular Momentum Orbital Angular Momentum-Spin Angular Momentum-**Total Angular Momentum Operators**[7]**-Commutation Relations of Total Angular Momentum with Components**[8]- Ladder operators-Commutation Relation of Jz with J+ and J- - Eigen values of J^2, Jz- Matrix representation of J2, Jz, J+ and J- - Addition of angular momenta- Clebsch Gordon Coefficients – Properties.

Unit IV **15 hrs**

Approximate Methods: Time Independent Perturbation Theory in Non-Degenerate Case- Ground State of Helium Atom-Degenerate Case-**First order perturbation theory for Degenerate level[9]-Stark Effect in Hydrogen**[10] – **Spin-orbit interaction**[11]-Variation Method & its Application to Hydrogen Molecule- WKB Approximation.

Unit V **14 hrs**

Many Electron Atoms Indistinguishable particles – Pauli principle- Inclusion of spin – spin functions for two-electrons- **The Helium Atom[13]** – Central Field Approximation - **Thomas-Fermi model of the Atom**[14] - Hartree Equation - Hartree-Fock equation.

Books for Study & Reference:

S.No	Authors	Title of the Book	Publishers	Year & Edition
1.	P.M. Mathews & K. Venkatesan	A Text Book of Quantum Mechanics	Tata McGraw Hill	2010 and 2nd, Edn
2.	G. Aruldhas	Quantum Mechanics	Prentice Hall of India	2008 and 2nd, Edn
3.	David J. J.Griffiths	Introduction to Quantum Mechanics	Pearson Prentice Hall	2005 and 3rd Edn
4.	L.I Schiff	Quantum Mechanics	McGraw Hill	1968 and 3rd Edn

5.	A. Devanathan	Quantum Mechanics	Narosa Publishing New Delhi	2011 and 2nd,Edn
6.	R.Shankar,	Principles of Quantum Mechanics	Springer	2005 and 2nd,Edn

Reference for E-content

1. https://www.youtube.com/watch?v=y3ARLfm-52w
2. https://www.youtube.com/watch?v=cUUFIk0ISuY
3. https://www.youtube.com/watch?v=lMFgfqRZYoc
4. https://www.youtube.com/watch?v=4FjX_TTzHYw
5. https://www.youtube.com/watch?v=iNqnrJ5JjZg
6. https://www.youtube.com/watch?v=ACY-Wbudg0o
7. https://www.youtube.com/watch?v=xoCHe0mtxu0
8. https://www.youtube.com/watch?v=0ROXdIoJZZQ
9. https://www.youtube.com/watch?v=GWCXKzDY-Y0
10. https://www.coursera.org/lecture/approximation-methods/stark-effect-Khbgm
11. https://www.youtube.com/watch?v=UI_xLwq_W2U
12. https://www.youtube.com/watch?v=DpNZ70Uam0M
13. https://www.youtube.com/watch?v=Mc7i0OeFr1Q

Pedagogy

Chalk and Talk lectures, Group Discussion, Seminar, Interaction, Power Point Presentation

Course Designers

1. Dr.G.Praveena

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDITS
MPS2307	ELECTROMAGNETIC THEORY	THEORY	73	2	-	5

Preamble

Students will develop a physical understanding of electromagnetic fields and waves to unify their understanding of electricity and magnetism

Prerequisite

- Undergraduate-level course in electricity and magnetism
- Mathematical methods

Course Learnin g Outcomes

On the successful completion of the course, students will be able to

CLO Number	CLO Statement	Knowledge Level
CLO1	Summarize the fundamentals of Electrostatics and Magnetostatics	K2
CLO2	Analyse the concept of Electrodynamic fields	K3
CLO3	Apply the concept of electromagnetic theory in electromagnetic waves	K4
CLO4	Understand the transverse behaviour of electromagnetic waves in different geometrics of wave guides	K5
CLO5	Formulate electromagnetic wave equations for different propagating media and to determine the flow of energy and wave velocity	K6

Mapping with Programme Learning Outcomes

CLOs	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7
CLO1	S	S	S	S	S	L	L
CLO2	S	S	S	L	S	L	L
CLO3	S	S	M	S	S	L	M
CLO4	S	M	L	S	S	L	L
CLO5	S	S	S	L	S	L	L

S- Strong; M-Medium; L-Low

Syllabus

Unit I: Electrostatics and Magnetostatics (14 Hrs)

Coulomb's Law[1],Gauss's Law and applications[2],potential function,field due to a continuous distribution of charge, equi-potential surfaces, **Poison's equation[3], Laplace's equation[4],**methodof electrical images- spherical conductor when earthed, insulated conducting sphere near a point charge capacitance, electro-static energy, boundary value problems with dielectrics, the electro-static uniqueness theorem for field of a charge distribution

Unit II: Magnetostatics (14 Hrs)

Lorentz force, electric Current-**Ampere's law and applications[5]**-Long straight wire, Circular coil, Solenoid, Ampere's law for a current element -Ampere's law in differential vector form - **Biot-Savart law**[6], Magnetic scalar potential– Importance – Applications – magnetic dipole, Circular coil and Vector potential – Importance - Applications- Magnetic dipole, Long current carrying wire, equation of continuity-magnetization

Unit III: Applied Electromagnetic Waves (15 Hrs)

Equation of continuity for time varying fields–inconsistency of ampere'slaw- **Maxwell's equations – derivations[7]** – electromagnetic waves in free space – uniform plane wave propagation and its characteristics –wave equations for conducting medium–**Maxwell's equation in phasor form[8]** – wave propagation in lossless, conducting and dielectric media – depth of penetration

Unit IV: Electromagnetic Waves in Bounded Media & Power Flow (15 Hrs)

Poynting's theorem - statement and proof[9] – Interpretation of Poynting's vector – Power flow for a plane wave – power flow in a concentric cable and conductor having resistance – Instantaneous, average and complex Poynting vector – power loss in a plane conductor and a resonator -Boundary conditions – proof – reflection of plane waves by a perfect conductor for normal and oblique incidence – reflection of plane waves by a perfect dielectric for normal and oblique incidence– **Brewster's angle[10]**.

Unit V: Guided Waves and Wave Guides (15 Hrs)

Waves between parallel planes–Transverse electric waves-Transverse magnetic waves characteristics of TE and TM waves–Transverse electromagnetic waves–Attenuation in parallel plane guides – **attenuation for TE waves, TM waves and TEM waves[11]** – Rectangular guides – Transverse magnetic waves and Transverse electric waves in rectangular guides – Field configurations for dominant TM and TE modes - **Impossibility of TEM wave in wave guides[12]** –Transmission line analogy for waveguides- Q factor of wave guides.

Text Books

S.No	Authors	Title of the Book	Publishers	Year & Edition
1.	Chopra Agarwal	Electromagnetic Theory	K.Nathand Co	2010 and 5nd,Edn

2.	Edward C, Jordan & Keith G Balmain	Electromagnetic Waves and Radiating Systems,	Prentice Hall of India, New Delhi	1997 and 2nd Edn
3.	Gupta, Kumar, Singh	Electrodynamics	Pragati Prakashan, Meerut	2021 and 25th Edn

Reference Books

S.No	Authors	Title of the Book	Publishers	Year & Edition
1.	D.Griffiths	Introductionto Electrodynamics	Prentice Hall of India,New Delhi	1999 and 3rd Edn
2.	J.D.Jackson,	Classical electrodynamics,	Wiley-Eastern Ltd-NewDelhi	1997 and 3rd Edn.

Reference for E-content

1 https://www.physicsclassroom.com/class/estatics/Lesson-3/Coulomb-s-Law
2 https://collegedunia.com/exams/applications-of-gauss-law-physics-articleid-10
3 https://www.youtube.com/watch?v=lVRIw36CAWs
4 https://www.youtube.com/watch?v=XtHif0xNhjE
5 https://www.youtube.com/watch?v=UUfZR33FblY
6 http://hyperphysics.phy-astr.gsu.edu/hbase/magnetic/Biosav.html
7 http://hyperphysics.phy-astr.gsu.edu/hbase/electric/maxeq.html
8 https://eng.libretexts.org/Bookshelves/Electrical_Engineering/Electro-Optics/Book%3A_Electromagnetics_I_(Ellingson)/09%3A_Plane_Waves_in_Loseless_Media/9.01%3A_Maxwell%E2%80%99s_Equations_in_Differential_Phasor_Form
9 chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://marwaricollege.ac.in/study-material/525532270Poynting%20vector%20and%20poynting%20theorem.pdf
10 https://vlab.amrita.edu/index.php?brch=189&cnt=1&sim=333&sub=1
11 chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://hsic.sjtu.edu.cn/Assets/userfiles/sys_eb538c1c-65ff-4e82-8e6a-a1ef01127fed/files/Lec6%20Transmission%20Lines%20and%20waveguides%EF%BC%88I%EF%BC%89.pdf
12 https://www.youtube.com/watch?v=G8u2WEBF7MY

Pedagogy

Chalk and Talk, PPT, Video lecture, group discussion, seminar, Interaction, problem solving

Course Designers

Dr.N.Priyadharsini

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDITS
MPS23CE	COURSERA - PYTHON FOR DATA SCIENCE AND ARTIFICIAL INTELLIGENCE	THEORY	60	-	-	3

Preamble

The objective of introducing this paper is to give the students a working knowledge of the most popular and widely used programming languages of modern days, namely 'Python' language.

- **Python for Data Science , AI and Development**

  (17hrs)

  Python basics- Python Data Structures- Python Programming Fundamentals- Working with Data in Python- APIs, and Data Collection

- **Introduction to Artificial Intelligence (9 hrs)**

  AI and its Applications- AI concepts, Terminology and application areas- Issues , concerns and Ethical Considerations- The future with Ai and Ai in Action

- **Tools for Data Science**

  (14hrs)

  Overview of Data Science Tools-Languages of Data Science-Packages, APIs, Datasets and Models-Jupyter Notebooks and JupyterLab-RStudio & GitHub-Create and Share your Jupyter Notebook- IBM Watson Studio

- **Python Programming Essentials**

  (10hrs)

  Python as a Calculator-Functions-Logic and Conditionals-Python Modules

- **Python Basics : Selection and Iteration**

  (8hrs)

  Fundamentals-Operators- Conditionals-Loops

COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	CREDITS
MTH23A4	TENSOR & NUMERICAL METHODS	THEORY	45	-	-	3

Preamble

- To present students the elements of tensoranalysis.
- To introduce different methods for solving problemsnumerically.
- To enable the students to find solution to practical and real world problem using numerical methods.

Mapping with Course LearningOutcomes

Upon the successful completion of the course, students will be to

CLO Number	CLO Statement	Knowledge Level
CLO1	Describe the basic concepts of tensor analysis and its application in science and engineering.	K2
CLO2	Demonstrate the theoretical and practical aspects of numerical methods.	K3
CLO3	Implement numerical methods for a variety of multidisciplinary applications.	K4
CLO4	Understand the different numerical methods for interpolation, differentiation, integration and solving set of ordinary differential equations	K5
CLO5	Implement numerical methods in various physical problems.	K6

Mapping with Programme Learning Outcomes

CLOs/ PLOs	PLO1	PLO2	PLO3	PLO4
CLO1.	S	M	M	M
CLO2.	S	S	S	M
CLO3.	S	S	S	M
CLO4.	S	S	S	S
CLO5.	S	S	M	S

S- Strong; M-Medium; L-Low

Syllabus

Unit I **(8Hrs)**

Tensor Analysis Definition of Tensors - Contravariant - covariant and mixed tensors - addition and subtraction of Tensors - Summation convention - Symmetry and Anisymmmetry Tensor - Contraction and direct product - Quotientlaw.

Unit II **(8Hrs)**

Numerical solutions of Algebraic and Transcendental Equation: Method of False position (RegulaFalsi method) -Newton -Raphson Method -Solution of Simultaneous Linear Algebraic Equations: Gauss Elimination Method -Interpolation with equal intervals: Gregory -Newton's forward interpolation formula for Equal Intervals - Gregory -Newton's Backward interpolation formula for Equal Intervals - Interpolation with unequal Intervals: Lagrange's Interpolation Formula for unequal Intervals - Method of Least Squares: Fitting a straight line - Fitting a Second Degree Parabola.

Unit III **(8 Hrs)**

Numerical Differentiation: Values of the derivatives of y - based on Newton's Forward Interpolation formula - Values of the derivatives of y - based on Newton's Backward Interpolation formula.

Unit IV **(8 Hrs)**

Numerical integration: Newton -Cote's Quadrature Formula - Trapezoidal rule - composite trapezoidal rule - Simpson's one - third rule - composites Simpson's one - third rule - Simpson's three - eighths rule - composite Simpson's three eights rule.

Unit V **(8 Hrs)**

Numerical solutions of ordinary differential equations: Euler's method - Runge -Kutta formulas of first and second order - Runge - Kutta formulas of the third and fourth order - RungeKutta formula for the solution of second order differentialequation.

Text Book

S. No	Author	Title of the book	Publishers	Year & Edition
1.	A.W.Joshi	Matrices and Tensors in Physics Unit I Part II – Chapter - 15,16,17	New Age International Publishers, Revised Edition	2010 and 3rd Edn

2.	M.K.Venkataraman	Numerical methods in science and engineering **Unit II,III,IV,V** **Unit:II** Chapter I – Sec:1.6,1.7,1.8 Chapter III – Sec: 4,5,6 ChapterIV – Sec:1,2,3 Chapter VI - Sec: 6.1,6.3,6,4 Chapter VIII – Sec:4 **UNIT:III** Chapter:IX – Sec:1,2,3 UNIT:IV Chapter IX – Sec:7,8,10,11 UNIT:V Chapter XI- Sec: 10,13,14,15,16	National Publisher Company	1999 and 3rd Edn

Reference Books

S. No	Author	Title of the book	Publishers	Year & Edition
1.	V. Rajaraman	Computer Oriented Numerical Methods	Prentice–Hall of India	1993 and 3rd Edn
2.	P.Kandasamy	Numerical methods	S.Chand and company limited, NewDelhi	2003 and 2ndEdn
3.	S.C. Chapra and P.C.Raymond	Numerical methods for Engineers	Tata McGrawHill, NewDelhi	2000 and 7th Edn
4.	Shaheer Khan	Tensor Analysis and Its Applications	Partridge India	2015 and 8th Edn

Course Designers

1. Mrs.S.Aiswarya, Assistant Professor
2. Mrs.C.R.Parvathy, Assistant Professor