B.Sc (Physics, Mathematics & Computer Science)

Third Semester

1. Name of the Department: Mathematics						
2. Course Name	**NUMERICAL COMPUTING**			**L**	**T**	**P**
3. Course Code	**MT211**			3	1	0
4. Type of Course (use tick mark)				**Core (√)**	**DE ( )**	**FC ( )**
5. Pre-requisite (ifany)		**6. Frequency (use tick marks)**	Even ()	Odd (√)	Either Sem ( )	Every Sem ( )

7. Total Number of Lectures, Tutorials, Practicals

Lectures = 30	**Tutorials = 10**	**Practical = Nil**

8. COURSE OBJECTIVES: The course is aimed to develop the skills in mathematics especially in Numerical Computing which is necessary for grooming them into successful science graduate. The topics introduced will serve as basic tools for specialized studies in science field.

9. COURSE OUTCOMES (CO):

After the successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)	**ATTRIBUTES**
CO1	Apply numerical methods to find the solution of algebraic and transcendental equations using different methods under different conditions, and numerical solution of system of algebraic equations
CO2	Apply different interpolation methods and finite difference concepts
CO3	Apply central interpolation methods and interpolation techniques for unequal intervals
CO4	: Work out numerical differentiation and integration whenever and wherever routine methods are not applicable.
CO5	Work numerically on the ordinary differential equations using different method through the theory of finite differences.

10. Unit wise detailed content

Unit-1	**Number of lectures**	**08**

Solution of Algebraic and Transcendental Equations: Bisection Method, Method of False Position, Iteration Method, Secant Method, Newton-Raphson's Method and their convergence. **Linear System of Equations:** LU decomposition Method, Gauss- Seidel Method.

Unit-2	**Number of lectures**	**08**

Finite Differences: Forward and Backward Difference Operators, Difference Table, Shift and Averaging operators, Relation between Operators, Factorial polynomials.

Interpolation: Polynomial interpolation, Newton-Gregory forward and backward interpolation formulae.

Unit-3	**Number of lectures**	**08**

Central Interpolation: Gauss forward and backward formula, Stirling's, Bessel's and Laplace-Everett's formulae.

Interpolation for Unequal Intervals: Lagrange's interpolation formula, divided differences and Newton's divided difference interpolation formula.

Unit-4	**Number of lectures**	**08**

Numerical Differentiation and Integration: Numerical differentiation and errors in Numerical differentiation, Newton-Cotes formula, Trapezoidal rule, Simpson's rule, Boole's, Weddle's and Euler Maclaurin's formulae.

Unit-5	**Number of lectures**	**08**

Numerical Solutions of Ordinary Differential Equations: Picard's and Taylor's Series, Euler's Method, Runge-Kutta fourth order

Method, Solution of Boundary value problem by finite difference Method .

11. CO-PO mapping

COs	Attributes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7
CO1	Apply numerical methods to find the solution of algebraic and transcendental equations using different methods under different conditions, and numerical solution of system of algebraic equations.	3	2	2	1	3	3	3
CO2	Apply different interpolation methods and finite difference concepts	3	2	2	1	2	2	2
CO3	Apply central interpolation methods and interpolation techniques for unequal intervals	3	2	3	1	3	2	3
CO4	Work out numerical differentiation and integration whenever and wherever routine methods are not applicable.	3	2	3	1	3	3	2
CO5	Work numerically on the ordinary differential equations using different method through the theory of finite differences.	3	2	1	1	3	2	1

3 Strong contribution, 2 Average contribution , 1 Low contribution

12. Brief description of self-learning / E-learning component

1. https://www.youtube.com/watch?v=_f_Pu7t9eP8
2. https://www.youtube.com/watch?v=3B3lGO7wERE
3. https://www.youtube.com/watch?v=1g0G_kjA560&list=PLq-Gm0yRYwTguDcfylj1ZicXxzdZCAr5S&index=4
4. https://www.youtube.com/watch?v=K193avJMCd4&list=PLq-Gm0yRYwTguDcfylj1ZicXxzdZCAr5S&index=5

13. Books recommended:

1. Qazi Shoeb Ahmad, Zubair Khan and Shadab Ahmad Khan, Numerical and Statistical Techniques, Ane Books India, 2015.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, Numerical Methods for Scientific and Engineering Computation, 7th Ed., New Age International Publishers, 2007.
3. Numerical Methods by P. Kandasamy, S. Chand Publication, New Delhi.
4. Introduction to Numerical Analysis, by S.S. Sastry, Prentice Hall of India.

1. Name of the Department: Physics						
2. Course Name	**Circuit Fundamentals and Basic Electronics**			**L**	**T**	**P**
3. Course Code	**PY201**			3	1	0
4. Type of Course (use tick mark)		**Core (√)**	**Foundation Course ()**		**Departmental Elective**	
5. Pre-requisite (if any)	10+2 with Physics	**6. Frequency (use tick**	Even ()	Odd (√)	Either Sem ()	Every Sem ()

7. Total Number of Lectures, Tutorials, Practicals

Lectures = 30	Tutorials = 10	Practical = Nil

8. COURSE OBJECTIVES:

- To understand the basic concepts of Growth and decay of currents through inductive resistances, RC and RLC and explain principle of operation for various AC bridges.
- To understand the basic concepts of various semi-conductor material .
- To learn the concept of BJT and feedback amplifier .
- To understand the basic concepts of oscillators and op-amp .
- To understand the basic concepts of modulation and learn the working of electronic instruments.

9. COURSE OUTCOMES (CO):

After the successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)	ATTRIBUTES
CO1	Student will be able to solve complex circuit using theorems. Student will be able to measure the passive component through bridges.
CO2	Student will be able to design power supply. Student will be able to differentiate the semiconductor.
CO3	Learn the signal amplification through BJT and how to increase the gain.

CO4	Design the different oscillator circuits for various frequencies Student will be able to design the mathematical operation using op-amp.
CO5	Student will be able to 1. Use of different modulation and demodulation techniques used in analog communication 2. Identify and solve basic communication problems 3. Measure the voltage, phase and frequency using CRO

10. Unit wise detailed content

Unit-1	**Number of lectures = 08**	**Title of the unit: Circuit Fundamentals**

Growth and decay of currents through inductive resistances, charging and discharging in R.C. and R.L.C. circuits, Time constant, measurement of high resistance, A.C. Bridges, Maxwell's and Scherings Bridges, Wien Bridge, THEVENIN, NORTON and superposition theorems and their applications

Unit-2	**Number of lectures = 08**	**Title of the unit: Theory of Semiconductor**

Semiconductors, intrinsic and extrinsic semiconductors, n-type and p-type semiconductors, unbiased diode forward bias and reverse bias diodes, diode as a rectifier, diode characteristics, zener diode, avalanche and zener breakdown, power supplies, rectifier, bridge rectifier, capacitor input filter, voltage regulation, zener regulator.

Unit-3	**Number of lectures = 08**	**Title of the unit: Transistor Basics**

Bipolar transistors, three doped regions, forward and reverse bias, DC alpha, DC beta transistor curves. Transistor biasing circuits: base bias, emitter bias and voltage divider bias, DC load line, Basic AC equivalent circuits, low frequency model, small signal amplifiers, common collector amplifiers, and common base amplifiers, current and voltage gain, R.C. coupled amplifier, gain, frequency response, equivalent circuit at low, medium and high frequencies, feedback principles.

Unit-4	**Number of lectures = 08**	**Title of the unit: Oscillators and OPAMP**

Input and output impedance, transistor as an oscillator, general discussion and theory of Hartley oscillator only. Operational amplifier (black box approach) and its ideal characteristics, virtual ground, inverting and non-inverting amplifiers, adder, integrator and differentiator.

Unit-5	**Number of lectures = 08**	**Title of the unit: Modulation and Instrumentation**

Elements of transmission and reception, basic principles of amplitude and frequency modulation and demodulation. Principle and design of linear multimeters and their application, cathode ray oscillograph and its simple applications.

11. CO-PO mapping

COs	**Attributes**	**PO1**	**PO2**	**PO 3**	**PO 4**	**P O**	**P O**	**PO7**
CO1	Student will be able to solve complex circuit using theorems. Student will be able to measure the passive component through bridges.	**3**	**1**	**1**				**1**
CO2	Student will be able to design power supply. Student will be able to differentiate the semiconductor.	**3**	**1**	**1**				**1**
CO3	Learn the signal amplification through BJT and how to increase the gain.	**3**	**1**	**1**				**1**
CO4	Design the different oscillator circuits for various frequencies Student will be able to design the mathematical operation using op-amp.	**3**	**1**	**1**				**1**
CO5	Student will be able to 1. Use of different modulation and demodulation techniques used in analog communication 2. Identify and solve basic communication problems 3. Measure the voltage, phase and frequency using CRO	**3**	**1**	**1**				**1**

3: Strong contribution, 2: Average contribution , 1: Low contribution

12. Brief description of self learning / E-learning component

1. **https://nptel.ac.in**
2. **www.youtube.com**

13. Books recommended:

1. B. G. Streetman; "Solid State Electronic Devices", IInd Edition (Prentice Hall of India, New Delhi, 1986).
2. W.D. Stanley: "Electronic Devices, Circuits and Applications" (Prentice-Hall).
3. J.D. Ryder, "Electronics Fundamentals and Applications" 2nd Edition (Prentice-Hall of India, New Delhi, 1986).
4. Millman and A. Grabel, "Microelectronics", International Edition (McGraw Hill Book Company, New York, 1988).
5. Bollested, R. and Nashelksky, L. "Electronic Devices and Circuit Theory" (Prentice Hall).

1. Name of the Department: Physics						
2. Course Name	**Kinetic Theory and Thermodynamics**			**L**	**T**	**P**
3. Course Code	**PY202**			3	1	0
4. Type of Course (use tick mark)		**Core (√)**	**Foundation Course ()**		**Departmental Elective**	
5. Pre-requisite (if any)	10+2 with Physics	**6. Frequency (use tick**	Even ()	Odd (√)	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practicals						
Lectures = 30		**Tutorials = 10**		**Practical = Nil**		

8. COURSE OBJECTIVES: To provide the basic knowledge of ideal and real gases, thermodynamics of a system, basic principles and their applications. Thermodynamic potentials, heat engine and theory of radiation and to give the students a thorough understanding of the theory kinetic theory gases.

9. COURSE OUTCOMES (CO):

After the successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)	ATTRIBUTES
CO1	Students will gain an understanding of the basic properties of ideal and real gases like equation of state related to these gases.
CO2	Students will be able to develop a deep understanding of various transport phenomena in ideal and real gases and temperature dependence properties.
CO3	Students will be able to understand basic laws of thermodynamics methods and their effects,
CO4	Students will be able to develop a deep understanding of various thermodynamic potentials, effect and heat equations of various thermodynamic systems.
CO5	Students will be able to gain knowledge of theory of Radiation and basic laws of radiation.

10. Unit wise detailed content

Unit-1	**Number of lectures = 08**	**Title of the unit: Ideal and Real Gases**

Ideal Gas: Kinetic model, deduction of Boyle's law, interpretation of temperature, estimation of r.m.s. speeds of molecules, Brownian motion, estimate of the Avogadro number, equipartition of energy, specific heat of monatomic gas, extension to di- and triatomic gases, adiabatic expansion of an ideal gas.

Real Gas: Vander Waals gas, equation of state, nature of Van der Waals forces, comparison with experimental P-V curves, Joule expansion of ideal gas and of a Vander Waals gas, Joule coefficient.

Unit-2	**Number of lectures = 08**	**Title of the unit: Liquefaction of Gases and Transport phenomenon**

Liquefaction of gases: Boyle temperature and inversion temperature, principle of regenerative cooling and of cascade cooling, liquefaction of hydrogen and helium gas, Refrigeration cycles, meaning of efficiency.

Transport phenomena in gases: Molecular collisions mean free path and collision cross sections. Transport of mass, momentum and energy and interrelationship.

Unit-3	**Number of lectures = 08**	**Title of the unit: The Laws of Thermodynamics**

The zeroth law, various indicator diagrams, work done by and on the system, first law of thermodynamics, internal energy as a state function and other applications, Reversible and irreversible changes, Carnot cycle and its efficiency, Carnot theorem and the second law of thermodynamics, different versions of the second law, Entropy, principle of increase of entropy, third law of thermodynamics, impossibility of attaining the absolute zero, Seebeck, Peltier and Thomson effect.

Unit-4	**Number of lectures = 08**	**Title of the unit: Thermodynamic Potentials**

Thermodynamic variables: Extensive and intensive, Enthalpy, Gibbs, Helmholtz and internal energy functions. Maxwell's thermo dynamical relations & applications - Joule-Thompson Effect, Clausius- Clapeyron heat Equation, Expression for ($C_P - C_V$), C_P/C_V, TdS equations.

Unit-5	**Number of lectures = 08**	**Title of the unit: Theory of Radiation**

Blackbody radiation, pure temperature dependence, Stefan-Boltzmann law, pressure of radiation, spectral distribution of Black body radiation. Wien's displacement law, Rayleigh-Jean's law, Planck's law the ultraviolet catastrophy.

11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO 4	PO5	PO6	P O
CO1	Students will gain an understanding of the basic properties of ideal and real gases like equation of state related to these gases.	**3**	**2**	**1**			**3**	**2**
CO2	Students will be able to develop a deep understanding of various transport phenomena in ideal and real gases and temperature dependence properties	**3**	**2**	**1**			**3**	**2**
CO3	Students will be able to understand basic laws of thermodynamics methods and their effects, working of ideal and real engine.	**3**	**1**	**1**			**3**	**2**
CO4	Students will be able to develop a deep understanding of various thermodynamic potentials, effect and heat equations of various thermodynamic systems	**3**	**1**				**3**	**2**
CO5	Students will be able to gain knowledge of theory of Radiation and basic laws of radiation.	**3**	**1**	**1**			**3**	**2**

3: Strong contribution, 2: Average contribution , 1: Low contribution

12. Brief description of self learning / E-learning component

1. https://www.youtube.com/watch?v=AKyJwI5jkjs
2. https://www.youtube.com/watch?v=ju7akwzEmAw
3. https://www.youtube.com/watch?v=4G_dLx4M76A

13. Books recommended:

1. G. G. Agarwal and H.P. Sinha "Thermal Physics".
2. S. K. Agarwal and B.K. Agarwal "Thermal Physics".
3. M.W. Zemansky, "Heat and thermodynamics (6^{th} Edition Mcgraw Hill).

Fourth Semester

1. Name of the Department: Mathematics						
2. Course Name	**Tensor Analysis**			**L**	**T**	**P**
3. Course Code	**MT213**			3	1	0
4. Type of Course (use tick mark)		**Core (□)**	**DSE ()**	**AEC ()**	**SEC ()**	**OE ()**
5. Pre-requisite (if any)	10+2 with Mathematics	**6. Frequency (use tick marks)**	Even ()	Odd (□)	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials, Practicals						
Lectures = 30		**Tutorials = 10**		**Practical = Nil**		

8. COURSE OBJECTIVES: The purpose of this undergraduate course is to impart basic and key knowledge of tensors and their types & properties. Students will also be able to apply addition, subtraction, multiplication on tensors. After successful completion of course, the student will be able to explore subject into their respective dimensions.

9. COURSE OUTCOMES (CO):
successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)	ATTRIBUTES
CO1	Students will be able to understand Vector Spaces, dual spaces, tensor product of vector spaces, and also about transformation formulae for tensors.
CO2	Students will gain an understand of Tensors and their types: Contravariant and covariant vectors and tensors, mixed tensors, Symmetric and skewsymmetric tensors, Associated tensors, Reciprocal tensors.
CO3	Students will be able to learn and implement Algebra of tensors, Contraction and inner product. They will also study about Quotient law & Riemannian metric tensor
CO4	Students will create the own understanding of Christoffel Symbols. They will learn covariant differentiation of tensors and also study about Gradient, divergence and curl in tensor notation.
CO5	Students will gain an understanding of The fundamental theorem of local Riemannian geometry, Differential operators, curvature tensor, Geodesics, geodesics coordinate system, geometrical interpretation of the curvature tensor.

10. Unit wise detailed content

Unit-1	**Number of lectures = 08**	**Title of the unit:**
Vector Spaces, dual spaces, tensor product of vector spaces, transformation formulae.		
Unit-2	**Number of lectures =08**	**Title of the unit:**
Tensor, Contravariant and covariant vectors and tensors, mixed tensors, Symmetric and skewsymmetric tensors, Associated tensors		
Unit-3	**Number of lectures = 08**	**Title of the unit:**
Algebra of tensors, Contraction and inner product, Quotient law, Reciprocal tensors, Riemannian metric tensor		
Unit-4	**Number of lectures = 08**	**Title of the unit:**
Christoffel Symbols, covariant differentiation, Gradient, divergence and curl in tensor notation.		
Unit-5	**Number of lectures = 08**	**Title of the unit:**
The fundamental theorem of local Riemannian geometry, Differential operators, curvature tensor, Geodesics, geodesics coordinate system, geometrical interpretation of the curvature tensor.		

11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	Students will be able to understand Vector Spaces, dual spaces, tensor product of vector spaces, and also about transformation formulae for tensors.	**3**	**2**	**2**	**1**	**1**	**1**	**2**
CO2	Students will gain an understand of Tensors and their types: Contravariant and covariant vectors and tensors, mixed tensors, Symmetric and skewsymmetric tensors, Associated tensors, Reciprocal tensors.	**3**	**1**	**2**	**1**	**1**	**1**	**2**
CO3	Students will be able to learn and implement Algebra of tensors, Contraction and inner product. They will also study about Quotient law & Riemannian metric tensor.	**3**	**1**	**2**	**1**	**1**	**1**	**2**
CO4	Students will create the own understanding of Christoffel Symbols. They will learn covariant differentiation of tensors and also study about Gradient, divergence and curl in tensor notation.	**3**	**1**	**2**	**1**	**1**	**1**	**2**
CO5	Students will gain an understanding of The fundamental theorem of local Riemannian geometry, Differential operators, curvature tensor, Geodesics, geodesics coordinate system, geometrical interpretation of the curvature tensor.	**3**	**1**	**2**	**1**	**1**	**1**	**2**

3 Strong contribution, 2 Average contribution , 1 Low contribution

12. Brief description of self learning / E-learning component

1. https://cosmolearning.org/video-lectures
2. https://content.kopykitab.com/ebooks/2016/02/5649/sample/sample_5649.pdf
3. https://www.win.tue.nl/casa/education/AntWiskDict/_3/e.%20Algebra,%20Meetkunde%20en%20Discrete%20Wiskunde/TENSOR--Dictaat-2004-Partial%20Translation.pdf

13. Books recommended:

1. Tensor Calculus, Zafar Ahsan, Anamaya Publication, New Delhi.
2. Differential Geometry of manifolds, U.C.De & A.A.Shaikh, Narosa Publishing House Pvt. Ltd, 2007.
3. Schaum's Outlines of Tensor Calculus.
4. Tensor Calculus & Riemannian Geometry, D.C. Agarwal, Krishna Publications

1. Name of the Department: Mathematics						
2. Course Name	**Abstract Algebra**			**L**	**T**	**P**
3. Course Code	**MT214**			3	1	0
4. Type of Course (use tick mark)		**Core (✓)**	**DSE ()**	**AEC ()**	**SEC ()**	**OE ()**
5. Pre-requisite (if any)	10+2 with Mathematics as	**6. Frequency (use tick**	Even (✓)	Odd ()	Either Sem ()	Every Sem ()
7. Total Number of Lectures, Tutorials						
Lectures = 30		**Tutorials = 10**		**Practical = Nil**		

8. COURSE OBJECTIVES: The objective is to introduce the basic concept to the subject of algebra. The course deals with the some algebraic structures namely groups, rings, fields and some related structures. Abstract algebra enables students to build mathematical thinking and skill.

9. COURSE OUTCOMES (CO):

successful course completion, learners will develop following attributes:

COURSE OUTCOME (CO)	ATTRIBUTES

CO1	Students will be able to explain the fundamental concept of Group and its well behaved subsets.
CO2	Students will be able to describe fundamental properties of Ring and its related structures.
CO3	Students will be an understanding of Elementary row operations and their applications to solution of a system of linear equations.
CO4	Students will be able to describe Vector spaces and its properties.
CO5	Students will be able to explain Linear transformation and its properties as well as applications.

10. Unit wise detailed content

Unit-1	**Number of lectures = 08**	**Title of the unit:**
Group, homomorphism, isomorphism, conjugacy relation, normalizer, centre of group.		
Unit-2	**Number of lectures =08**	**Title of the unit:**
Ring, ring homomorphism, ideals, integral domain, introduction to field.		
Unit-3	**Number of lectures = 08**	**Title of the unit:**
Elementary row operations and row-reduced echelon form, inverse of a matrix through elementary row operation, solution of a system of linear equations.		
Unit-4	**Number of lectures = 08**	**Title of the unit:**
Vector spaces, Subspaces, Span of a set, Linear dependence and independence, Dimension and basis.		
Unit-5	**Number of lectures = 08**	**Title of the unit:**
Linear transformation and their matrix representation, rank nullity theorem.		

11. CO-PO mapping

COs	**Attributes**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	Students will be able to explain the fundamental concept of Group and its well behaved subsets.	**3**	**2**	**1**	**2**	**3**	**1**	**3**
CO2	Students will be able to describe fundamental properties of Ring and its related structures.	**3**	**2**	**2**	**2**	**3**	**1**	**2**
CO3	Students will be an understanding of Elementary row operations and their applications to solution of a system of linear equations.	**3**	**2**	**2**	**2**	**2**	**1**	**2**
CO4	Students will be able to describe Vector spaces and its properties.	**3**	**2**	**2**	**2**	**2**	**1**	**3**
CO5	Can explain Linear transformation and their matrix representation, rank nullity theorem.	**3**	**2**	**1**	**2**	**3**	**1**	**2**

3 Strong contribution, 2 Average contribution , 1 Low contribution

12. Brief description of self learning / E-learning component

1. https://nptel.ac.in/courses/111/105/111105112/
2. https://nptel.ac.in/courses/111/101/111101115/

13. Books recommended:

1. University Algebra by N.S. Gopalakrishnan,New Age International publishing house, New Delhi.
2. Modern Algebra by Surjeet Singh, Vikas Publishing House Pvt. Ltd., New Delhi.
3. An introduction to Linear Algebra by V. Krishnamurthy, V.P. Mainra & J. L. Arora, East West Press Pvt. Ltd., New Delhi.

1. Name of the Department: Physics							
2. Course Name	**Electricity and Magnetism**				**L**	**T**	
3. Course Code	**PY204**				3	1	
4. Type of Course (use tick mark)		**Core (√)**		**Foundation**		**Department**	
5. Pre-requisite (if any)	10+2 with Physics	**6. Frequency (use tick marks)**		Even (√)	Odd ( )	Either Sem ( )	
7. Total Number of Lectures, Tutorials, Practicals							
Lectures = 30		**Tutorials = 10**		**Practical = 00**			

8. COURSE OBJECTIVES: The purpose of this undergraduate course is to impart basic and key knowledge of electricity and magnetism by using the principal of physics and mathematics to obtain quantitative relations which are very important for higher studies. After successfully completion, of course, the student will able explore subject into their respective dimensions.

9. COURSE OUTCOMES (CO): ***After the successful course completion, learners will develop following attributes:***

COURSE OUTCOME (CO)	ATTRIBUTES
CO1	To learn basic mathematical tools with their physical significance as a prerequisite for the course.
CO2	To understand and explain the principles/methods of evaluation of electric field, potential due to charge distribution and apply them to practical systems.
CO3	To learn the principles and methods of evaluation of magnetic field and scalar magnetic potential due to due to current or magnetic dipoles. Thereby apply them to analyse magnetic properties of dia, para
CO4	To describe the principles of electromagnetic induction and study the devices based upon, to investigate their experimental working.
CO5	To formulate Maxwell's equations and apply them to investigate the propagation of electromagnetic waves in free space, dielectric and conducting medium.

10. Unit wise detailed content

Unit-1	**Number of lectures = 08**	**Title of the unit: Vector Analysis & Electrostatics I**

Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their physical significance, vector integration, electrostatic field, electric flux, Coulomb's law, electric field and potentials, Field due to a uniform charged sphere, derivations of Poisson and Laplace Equations with applications, Uniqueness theorem.

Unit-2	**Number of lectures = 08**	**Title of the unit: Electrostatics II**

Gauss law and its application: The Field of a conductor, electric dipole, field and potential due to an electric dipole, Dipole approximation for an arbitrary charge distribution, method of electrical images, electric quadruple, field due to a quadruple, electrostatic energy of a charged uniform sphere, energy of a condenser.

Unit-3	**Number of lectures = 08**	**Title of the unit: Magnetostatics and Magnetic Properties of**

Magnetic field and force of a current, Magnetic Induction and Biot-Savart Law, Lorentz Force, Vector and Scalar Magnetic potentials, Magnetic Dipole, Magnetomotive force and Ampere's Circuital theorem and its applications to calculate magnetic field due to wire carrying current and solenoid. Intensity of magnetization and magnetic susceptibility, Properties of Dia, Para and Ferromagnetic materials, Curie temperature, Hysteresis and its experimental determination

Unit-4	**Number of lectures = 08**	**Title of the unit: Electromagnetic Induction**

Faraday's laws of electromagnetic induction, Lenz's law, self inductance (L) of single coil, mutual inductance (M) of two coils, Energy stored in magnetic field. Motion of electron in changing magnetic field, Betatron, Magnetic energy, Induced magnetic field (Time varying electric field), theory and working of moving coil ballistic galvanometer.

Unit-5	**Number of lectures = 08**	**Title of the unit: Maxwell's Equations and Electromagnetic**

Idea of displacement current and Maxwell's modification of Ampere's law, Integral and differential forms of Maxwell's equations and their physical significance, skin effect. The wave: (equation satisfied by E and B, plane electromagnetic waves in vacuum), Poynting vector, reflection at a plane boundary of dielectrics, EM waves in a conducting medium, reflection and refraction by the ionosphere.

11. CO-PO mapping

COs	Attributes	PO	PO	PO	PO	PO	PO	PO
CO1	To learn basic mathematical tools with their physical significance as a	**3**	**2**	**1**		**1**	**1**	**1**
CO2	To understand and explain the principles/methods of evaluation of electric field, potential due to charge distribution and apply them to practical systems.	**3**	**2**	**2**		**3**	**1**	**1**

CO3	To learn the principles and methods of evaluation of magnetic field and scalar magnetic potential due to due to current or magnetic dipoles. Thereby apply them to analyse magnetic properties of dia, para and ferromagnetic materials.	**3**	**2**	**2**		**3**	**1**	**1**
CO4	To describe the principles of electromagnetic induction and study the devices based upon, to investigate their experimental working.	**3**	**2**	**2**		**3**	**1**	**1**
CO5	To formulate Maxwell's equations and apply them to investigate the propagation of electromagnetic waves in free space, dielectric and conducting medium.	**3**	**2**	**1**		**2**	**1**	**1**

3: Strong contribution, 2: Average contribution , 1: Low contribution

12. Brief description of self learning / E-learning component

1. https://nptel.ac.in/courses/115104088/
2. http://library.iul.ac.in/ELibrary.aspx
3. https://www.youtube.com/watch?v=XJYY4jlwZzo

13. Books recommended:

1. Berkeley Physics Course; Electricity and Magnetism, Ed. E.M. Purcell (McGraw Hill).
2. D. J. Griffith; “Introduction to Electrodynamics” (Prentice-Hall of India).
3. Reitz and Milford; “Electricity and Magnetism (Addison-Wesley).
4. S. Mahajan and A. A. Rangwala; “Electricity and Magnetism” (Tata McGraw- Hill).
5. M. Portis; “Electromagnetic Fields”.
6. Pugh and Pugh; “Principles of Electricity and Magnetism” (Addison-Welsley).
7. Panofsky and Phillips; “Classical Electricity and Magnetism” (India Book House),
8. S. S. Atwood; “Electricity and Magnetism” (Dover).