B.Sc (Physics, Mathematics & Computer Science)

First Semester

1. Name of the Department: Mathematics						
2. Course Name	**Algebra and Trigonometry**			**L**	**T**	**P**
3. Course Code	**MT121**			3	1	0
4. Type of Course (use tick mark)		**Core (✓)**	**DSE ()**	**AEC ()**	**SEC ()**	**OE ()**
5. Pre-requisite (if any)	10+2 with PCM	**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 purpose of this undergraduate course is to impart basic and key knowledge of Algebra and Trigonometry. By using the principal of applied 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	Describe and interpret Symmetric, Skew-symmetric, Hermitian and skew-Hermitian matrices, Elementary operations, Rank of Matrix, Linear independence of row and columns matrices, consistency and inconsistency of linear equations, eigen values and eigen vectors, Cayley Hamilton theorem and its applications.
CO2	Evaluate and Interpret Relation between roots and coefficient of general polynomial equation in one variable, transformation of equations, Descarte rule of sign, solution of cubic(Cardon Method), biquardratic equations.
CO3	Expalin and interpret Binary operations, algebraic structures, Definition of a group with examples and simple properties, subgroups, cyclic groups, Permutation groups
CO4	Describe Lagrange's theorem and its consequences. Homomorphism and isomorphism, Normal subgroups, Introduction to ring
CO5	Find and interpret Complex functions and separation into real and imaginary parts, Exponential, direct and inverse trigonometric and hyperbolic functions, logarithmic function, Gregory's series, Summation of series.

10. Unit wise detailed content

Unit-1	**Number of lectures = 08**	**Title of the unit:**
Matrix: Symmetric, Skew-symmetric, Hermitian and skew-Hermitian, Elementary operations, Rank of Matrix, Linear independence of row and columns matrices, consistency and inconsistency of linear equations, characterstic equations, eigen values and eigen vectors, Cayley Hamilton theorem and applications.		
Unit-2	**Number of lectures =08**	**Title of the unit:**
Relation between roots and coefficient of general polynomial equation in one variable, transformation of equations, Descarte rule of sign, solution of cubic (Cardon Method), biquardratic equations.		
Unit-3	**Number of lectures = 08**	**Title of the unit:**
Binary operations, algebraic structures,Definition of a group with examples and simple properties,subgroups,cyclic groups,Permutation groups		
Unit-4	**Number of lectures = 08**	Binary operations
Lagrange's theorem and its consequences. Homomorphism and isomorphism, Normal subgroups, Introduction to ring.		

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

Complex functions and separation into real and imaginary parts, Exponential, direct and inverse trigonometric and hyperbolic functions, logarithmic function, Gregory's series, Summation of series.

11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	Describe and interpret Symmetric, Skew-symmetric, Hermitian and skew-Hermitian matrices, Elementary operations, Rank of Matrix, Linear independence of row and columns matrices, consistency and inconsistency of linear equations, eigen values and eigen vectors, Cayley Hamilton theorem and applications.	3	1	1	1	2	3	2
CO2	Evaluate and Interpret Relation between roots and coefficient of general polynomial equation in one variable, transformation of equations, Descarte rule of sign, solution of cubic(Cardon Method), biquardratic equations.	3	2	1	1	2	1	2
CO3	Expalin and interpret Binary operations, algebraic structures, Definition of a group with examples and simple properties, subgroups, cyclic groups,	2	2	1	1	2	1	1
CO4	Describe Lagrange's theorem and its consequences. Homomorphism and isomorphism, Normal subgroups, Introduction to ring	3	2	2	1	1	1	1
CO5	Find and interpret Complex functions and separation into real and imaginary parts, Exponential, direct and inverse trigonometric and hyperbolic functions, logarithmic function, Gregory's series, Summation of series.	3	2	1	1	2	1	2

3 Strong contribution, 2 Average contribution , 1 Low contribution

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

1. http://nasc.ac.in/nasc/images/StudyMaterials/Physics/UGCGATEmatrix.pdf
2. https://nptel.ac.in/courses/111106113/
3. https://www.youtube.com/watch?v=WaNdQh0w6Xc

13. Books recommended:

1. Topics in Algebra; I.N. Hernstein, Wiley Eastern Ltd., New Delhi.
2. Matrix & Linear Algebra; K.B.Datta, Prentice Hall of India Pvt. Ltd. New Delhi.
3. Basic Abstract Algebra; P.B.Bhattacharya, S.K. Jain & S .R Nagpaul, Cambridge University Press, Indian Edition.
4. Higher Algebra; H.S. Hall, S.R. Knight, H.M. Publications.
5. Text Book on Algebra & theory of equations; Chandrika Prasad, Pothishala Private Ltd., Allahabad.
6. Plane Trigonometry Part II: S.L.Loney, Macmillan & company, London.

1. Name of the Department: Mathematics						
2. Course Name	**CALCULUS**			**L**	**T**	**P**
3. Course Code	**MT122**			3	1	0
4. Type of Course (use tick mark)		**Core (✓)**	**DSE ()**	**AEC ()**	**SEC ()**	**OE ()**
5. Pre-requisite (if any)	10+2 with PCM	**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 course is aimed to develop the skills in mathematics specially in calculus 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	Take limits of algebraic and trigonometric expressions of the form 0/0 (that simplify), non-zero number over 0, including limits that go to (positive or negative) infinity, limits that don't exist and limits that are finite.
CO2	Use and understand the limit definitions of derivative for polynomial, rational and some trigonometric functions; understand definition of continuity and consequences.
CO3	Differentiate all polynomial, rational, radical, and trigonometric functions and compositions of those functions; perform implicit differentiation and compute higher order derivatives.
CO4	Compute indefinite integrals and find anti-derivatives, including finding constants of integration given initial conditions.
CO5	Apply the definite integral to compute area between two curves, volumes of solids of revolutions, arc length, surface area for surfaces of revolution and work problems.

10. Unit wise detailed content

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

ε−δ definition of the limit of a function, Continuous functions and classification of discontinuities, Differentiability, Chain rule of differentiability, Rolle's theorem, First and second mean value theorems, Taylor's theorems with Lagrange's and Cauchy's forms of remainder, Successive differentiation and Leibnitz's theorem.Hamilton theorem and applications.

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

Expansion of functions (in Taylor's and Maclaurin's series), Indeterminate forms, Partial differentiation and Euler's theorem, Jacobians.

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

Maxima and Minima (for functions of two variables), Tangents and normals (polar form only), Curvature, Envelopes and evolutes.

Unit-4	**Number of lectures = 08**	Binary operations

Asymptotes, Tests for concavity and convexity, Points of inflexion, Multiple points, Tracing of curves in Cartesian and polar co-ordinates. Integral Calculus Reduction formulae, Beta and Gamma functions.

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

Qudrature, Rectification, Volumes and surfaces of solids of revolution, Pappus theorem, Double and triple integrals, Change of order of integration, Dirichlet's and Liouville's integral formulae.

11. CO-PO mapping

COs	**Attributes**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	Take limits of algebraic and trigonometric expressions of the form 0/0 (that simplify), non-zero number over 0, including limits that go to (positive or negative) infinity, limits that don't exist and limits that are finite.	**3**	**2**	**2**	**1**	**3**	**3**	**3**
CO2	Use and understand the limit definitions of derivative for polynomial, rational and some trigonometric functions; understand definition of continuity and consequences.	**3**	**2**	**2**	**1**	**2**	**2**	**2**
CO3	Differentiate all polynomial, rational, radical, and trigonometric functions and compositions of those functions; perform implicit differentiation and compute higher order derivatives.	**3**	**2**	**3**	**1**	**3**	**2**	**3**
CO4	Compute indefinite integrals and find anti-derivatives, including finding constants of integration given initial conditions.	**3**	**2**	**3**	**1**	**3**	**3**	**2**
CO5	Apply the definite integral to compute area between two curves, volumes of solids of revolutions, arc length, surface area for surfaces of revolution and work problems.	**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://nptel.ac.in/content/storage2/courses/111101109/W3A1.pdf
2. http://www.cdeep.iitb.ac.in/webpage_data/nptel/Core%20Science/Mathematics%20I/Course_home_27.2.html
3. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/111105121/lec19.pdf
4. https://nptel.ac.in/content/storage2/nptel_data3/html/mhrd/ict/text/111101109/lec35.pdf

https://www.youtube.com/watch?v=t4T0ru5LWa0

13. Books recommended:

1. Gabriel Kiambauer, Mathematical Analysis, Marcel Dekkar, Inc. New York,
2. Murray R. Spiegel, Theory & Problem of Advanced Calculus, Schaum's outline series, Schaum's Publishing Co., New York
3. N.Piskunov, Differential & Integral Calculus, Peace publishers, Moscow.
4. P.K.Jain & S.K. Kaushik, An Introduction to Real Analysis, S.Chand & Co. New Delhi
5. Differential Calculus by Gorakh Prasad, Seventeenth Edition, Reprint 2007,

Integral Calculus by Gorakh Prasad, Fourteenth Edition, Reprint 2007, Pothishala Private Limited, Allahabad.

1. Name of the Department: Physics						
2. Course Name	**Mechanics and Wave Motion**			**L**	**T**	
3. Course Code	**PY106**			3	1	
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
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 physical chemistry. 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	Grasped the fundamentals of different types of frames of references and transformation laws Both Galilean and Lorentz and learned conservation laws of energy and linear and angular momentum and apply them to solve problems.
CO2	Students will gain an understanding of rotation motion and get the knowledge about forces help the students in their daily life.
CO3	Students will gain an understanding of gravitational forces and learn the basics of potentials and fields, central forces, and Kepler's laws
CO4	Students will understand the physical characteristics of SHM and obtaining solution of the oscillator using differential equations.
CO5	Students will gain basic knowledge of wave motion and ability to outline the physical properties of wave motion.

10. Unit wise detailed content

Unit-1	**Number of lectures = 08**	**Title of the unit: Conservation Laws**

Inertial reference frame, Newton's laws of motion, dynamics of particle in rectilinear and circular motion, conservative and non -conservative forces, conservation of energy, liner momentum and angular momentum, collision in one and two dimensions, cross section.

Unit-2	**Number of lectures =08**	**Title of the unit: Rotational Motion**

Rotational energy and rotational inertia for simple bodies, the combined translation and rotational and motion of a rigid body on horizontal and inclined planes, simple treatment of the motions of a top, Relations between elastic constants, bending of beams and torsion of cylinder.

Unit-3	Number of lectures = 08	Title of the unit: Gravitation

Law of gravitation, gravitational field and potential, gravitational potential energy, gravitational field intensity, central forces, two particle central force problem, reduced mass, relative and centre of mass motion, law of gravitation, Kepler's laws, motions of planets and satellites, geo-stationary satellites.

Unit-4	Number of lectures = 08	Title of the unit: Oscillations

Simple harmonic motion, differential equation of S. H. M. and its solution, some examples (mass- spring, simple pendulum, and compound pendulum), damped oscillator: Equation of motion and its solution, forced oscillations and resonance: solution of differential equation of a forced oscillator and variation of amplitude with frequency and damping.

Unit-5	Number of lectures = 08	Title of the unit: Wave Motion

Classification of waves, expression for a plane progressive and transverse harmonic wave, particle velocity and acceleration, path difference and phase difference, velocity of transverse waves in a string, differential equation of wave motion, plane progressive waves in fluid media, reflection of waves, phase change on reflection, superposition, stationary waves, pressure and energy distribution, phase and group velocity.

11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	Grasped the fundamentals of different types of frames of references and transformation laws Both Galilean and Lorentz and learned conservation laws of energy and linear and angular momentum and apply them to solve problems.	3	1	1		2	1	1
CO2	Students will gain an understanding of rotation motion and get the knowledge about forces help the students in their daily life.	3	1	2		3	1	1
CO3	Students will gain an understanding of gravitational forces and learn the basics of potentials and fields, central forces, and Kepler's laws	3	1	2		3	1	1
CO4	Students will understand the physical characteristics of SHM and obtaining solution of the oscillator using differential equations	3	1			2	1	
CO5	Students will gain basic knowledge of wave motion and ability to outline the physical properties of wave motion.	3	1			2	1	

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

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

13. Books recommended:

1. E. M. Purcell, Ed: "Berkeley Physics Course, Vol. 1, Mechanics" (McGraw- Hill).
2. R. P. Feymman, R. B. Lighton and M Sands; The Feymman Lectures in Physics, Vol. 1 (BI Publications, Bombay, Delhi, Calcutta, Madras).
3. J. C. Upadhyay: 'Mechanics (Himalaya Publishing House)
4. D.S. Mathur "Mechanics" (S. Chand).
5. P. K. Srivastava: "Mechanics" (New Age International).

Second Semester

1. Name of the Department: Mathematics						
2. Course Name	**VECTOR ANALYSIS AND GEOMETRY**			**L**	**T**	**P**
3. Course Code	**MT123**			3	1	0
4. Type of Course (use tick mark)		**Core (✓)**	**DE ()**	**FC ()**		**OE ()**
5. Pre-requisite (if any)		**6. Frequency (use tick**	Even (✓)	Odd ()		Every Sem ()
7. Total Number of Lectures, Tutorials						
Lectures = 30		**Tutorials = 10**		**Practical = Nil**		

8. COURSE OBJECTIVES: The purpose of this undergraduate course is to impart basic and key knowledge of vector analysis and geometry. By using the principal of applied mathematics to obtain quantitative relations which are very important for higher studies. After successfully completion of course, the student will able to 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	Find and interpret Scalar & vector product of three vectors, Product of four vectors, Reciprocal Vectors, Vector Differentiation, gradient, divergence and curl for a function at a given point.
CO2	Evaluate and Interpret line, surface and volume integrals. Evaluate integrals by using Green's theorem, Stokes theorem and Gauss Divergence theorem.
CO3	Describe the General equation of second degree, System of conics, Confocal conics, Polar equation of a conic.
CO4	Find and Interpret the various forms of the equations of a line, Plane, Sphere, Cone and Cylinder.
CO5	Find the Central Conicoids, Paraboliods, Plane sections of conicoids, reduction of second degree equations.

10. Unit wise detailed content

Unit-1	**Number of lectures = 08**	**Title of the unit:**
Scalar & vector product of three vectors. Product of four vectors. Reciprocal Vectors. Vector Differentiation. Gradient, Divergence, Curl.		
Unit-2	**Number of lectures =08**	**Title of the unit:**
Vector integration. Line integral, Surface integral, Volume integral, Gauss divergence theorem, Stokes theorem, Greens theorem.		
Unit-3	**Number of lectures = 08**	**Title of the unit:**
General equation of second degree. System of conics. Confocal conics. Polar equation of a conic.		
Unit-4	**Number of lectures = 08**	**Title of the unit:**
Straight Line: Introduction, Various forms of the equations of a line Plane: Introduction, particular planes, various forms of the equations of a plane, Sphere, Cone ,Cylinder		
Unit-5	**Number of lectures = 08**	**Title of the unit:**
Central Conicoids, Paraboliods, Plane sections of conicoids, reduction of second degree equations		

11. CO-PO mapping

COs	Attributes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	Find and interpret Scalar & vector product of three vectors, Product of four vectors, Reciprocal Vectors, Vector Differentiation, gradient, divergence and curl for a function at a given point.	**3**	**1**	**1**	**1**	**2**	**1**	**2**
CO2	Evaluate and Interpret line, surface and volume integrals. Evaluate integrals by using Green's theorem, Stokes theorem and Gauss Divergence theorem.	**3**	**2**	**1**	**1**	**2**	**1**	**2**

CO3	Describe the General equation of second degree, System of conics, Confocal conics and Polar equation of a conic.	**2**	**2**	**1**	**1**	**2**	**1**	**1**
CO4	Find and Interpret the various forms of the equations of a line, Plane, Sphere, Cone and Cylinder.	**3**	**2**	**2**	**1**	**1**	**1**	**1**
CO5	Find the Central Conicoids, Paraboliods, Plane sections of conicoids, reduction of second degree equations	**3**	**2**	**1**	**1**	**2**	**1**	**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=SZCsFS9izfQ**
2. **https://www.digimat.in/nptel/courses/video/111105122/L37.html**
3. **http://www.bhojvirtualuniversity.com/slm/bsc1_maths3.pdf**

13. Books recommended:

1. Murray R. Spiegel, Vector Analysis, Schaum Publishing Company, New York.
2. Shanti Narayan, A Text Book of Vector Calculus, S. Chand & Co. , New Delhi.
3. Gorakh Prasad & H.C.Gupta, Text Book on Coordinate Geometry, Pothishala Private Ltd., Allahabad.
4. R.J.T.Bill, Elementary Treatise on coordinate Geometry of three Dimensions, Macmillan India Ltd.
5. P.K.Jain & Khalil Ahmad, A Text Book of two dimensions , Wiley Eastern Ltd.
6. N.Saran & R.S.Gupta, Analytical Geometry of three dimensions, Pothishala Private Ltd., Allahabad.

1. Name of the Department: Mathematics						
2. Course Name	**Differential Equations**			**L**	**T**	**P**
3. Course Code	**MT124**			3	1	0
4. Type of Course (use tick mark)		**Core (□)**	**DSE ()**	**AEC ()**	**SEC ()**	**OE ()**
5. Pre-requisite (if any)	10+2 with PCM	**6. Frequency (use tick marks)**	Even ()			
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 ordinary and partial differential equations and their solutions. Students will be able to apply different methods to solve the different categories of equations. After successful completion of course, the student will be able to 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	Students will gain an understanding and formations of ordinary differential equations .They will be able to solve equations of first order and first degree homogeneous, linear and exact equations, along with higher order linear differential equations with constant coefficients & homogeneous linear differential equations.
CO2	Students will be able to understand and solve differential equations of the first order but not of the first degree, Clairaut's equations, simultaneous linear differential equations and linear differential equations of the second order (including the method of variation of parameters).
CO3	Students will gain an understanding of formations of partial differential equations and will be able to solve them by direct Integration, Lagrange's method for first order linear partial differential equations and first order non linear partial differential equations including Charpit's method.

CO4	Students will create the own understanding to classify of linear partial differential equations of second order and to obtain the solutions of linear partial differential equations with constant coefficients of second order.
CO5	Students will gain an understanding of power series and series solution of differential equations for ordinary point and singular points by Frobenius method.

10. Unit wise detailed content

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

Formation of a differential equation (D.E.), Degree, order and solution of a D.E. Equations of first order and first degree : Separation of variables method, Solution of homogeneous equations, linear equations and exact equations, Linear differential equations with constant coefficients, Homogeneous linear differential equations.

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

Differential equations of the first order but not of the first degree, Clairaut's equations and singular solutions, Simultaneous linear differential equations, Linear differential equations of the second order (including the method of variation of parameters).

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

Partial differential equations, Order, Method of forming Partial Differential Equations, Solution of Equations by Direct Integration, First order Linear Partial Differential Equations, Lagrange's Method, First order non linear Partial differential equations, Charpit's method.

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

Classification of linear partial differential equations of second order, linear partial differential equations with constant coefficients of second order, Homogeneous & non homogeneous partial differential equations.

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

Power Series, Solution of Differential Equations, Ordinary Point, Singular point, Frobenius Method.

11. CO-PO mapping

COs	**Attributes**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	Students will gain an understanding and formations of ordinary differential equations .They will be able to solve equations of first order and first degree homogeneous, linear and exact equations, along with higher order linear differential equations with constant coefficients & homogeneous linear differential equations.	**3**	**2**	**2**	**1**	**1**	**1**	**2**
CO2	Students will be able to understand and solve differential equations of the first order but not of the first degree, Clairaut's equations, simultaneous linear differential equations and linear differential equations of the second order (including the method of variation of parameters).	**3**	**2**	**2**	**1**	**1**	**1**	**2**
CO3	Students will gain an understanding of formations of partial differential equations and will be able to solve them by direct Integration, Lagrange's method for first order linear partial differential equations and first order non linear partial differential equations including Charpit's method.	**3**	**2**	**2**	**1**	**1**	**1**	**2**
CO4	Students will create the own understanding to classify of linear partial differential equations of second order and to obtain the solutions of linear partial differential equations with constant coefficients of second order.	**3**	**2**	**2**	**1**	**1**	**1**	**2**
CO5	Students will gain an understanding of power series and series solution of differential equations for ordinary point and singular points by Frobenius method.	**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://nptel.ac.in/courses/111107111/
2. https://www.digimat.in/nptel/courses/video/111105093/L01.html
3. https://www.library.gscgandhinagar.in/assets/admin/images/MAT-102(UNIT1,2).pdf

13. Books recommended:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons Inc.,New York.
2. D.A. Murray, Introductory Course on Differential Equations, Orient Longman,(India) .
3. A.R.Forsyth, A Treatise on Differential Equations, Macmillan & Co. Ltd., London.
4. Ian N. Sneddon, Elements of Partial Differential Equations, McGraw-Hill Book Company.
5. D.G Zill, A First Course In Differential Equations with Modelling Applications, Cengage Learning
6. G.F Simmons Differential Equations with Applications and Historical Notes McGraw Hill Education; 2 edition

M.D Raisinghania, *Ordinary and Partial Differential Equations, S. Chand Publishing, Twentieth edition.*

1. Name of the Department: Physics						
2. Course Name	**Physical Optics and Lasers**			**L**	**T**	
3. Course Code	**PY108**			3	1	
4. Type of Course (use tick mark)		**Core (√)**	**Foundation Course ()**		**Departmental**	
5. Pre-requisite (if any)	10+2 with Physics	**6. Frequency (use tick**	Even (√)	Odd ()	Either Sem ()	Ev ery
7. Total Number of Lectures, Tutorials, Practicals						
Lectures = 30		**Tutorials = 10**		**Practical = Nil**		

8. COURSE OBJECTIVES: This course provides students with a working knowledge of optical physics, including diffraction, polarization and laser physics.

9. COURSE OUTCOMES (CO):

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

COURSE OUTCOME	ATTRIBUTES
CO1	The student will be introduced to the design of optical systems and aberrations, with an emphasis on image forming systems.
CO2	The wave optics part of the course will give the student a thorough fundamental knowledge within interferometry and coherence. They will be able to determine the wavelengths of light sources using concepts of interference.
CO3	Students will be able to determine the wavelength of light using the phenomena of diffraction and Resolving power of various optical instruments.
CO4	Students will learn to analyse the polarization in optical systems and will be able to represent polarized light using Jones formalism.
CO5	The students will be introduced to lasers. They will be able to explain various applications and working of different types of lasers.

10. Unit wise detailed content

Unit-1	**Number of lectures = 08**	**Title of the unit: Geometrical Optics and Nature of Light**

Fermat's principle and its application to obtain laws of reflection and refraction, cardinal points of an optical system, chromatic and spherical aberrations, coma, astigmatism. Idea of wave, electromagnetic and quantum theory of light, Definition and properties of wave front, Huygens' Principle.

Unit-2	**Number of lectures =08**	**Title of the unit: Interference of light**

The principle of superposition, two-slit interference, coherence requirement for the sources, optical path retardations, lateral shift of fringe, thin films, applications for precision measurements for displacements, Haidinger fringes: Fringes of equal inclination, Michelson interferometer, its application for precisional determination of wavelength, wavelength difference, Newton's rings, Fabry- Perrot interferometer and etalon.

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

Fresnel half-period zones, plates, straight edge, rectilinear propagation, Fraunhoffer diffraction: diffraction at a slit, half-period zones, the intensity distribution, diffraction at a circular aperture and a circular disc, resolution of images, Rayleigh criterion, resolving power of telescope and microscopic systems, reflection grating, Resolving power of a grating and comparison with resolving powers of prism.

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

Double refraction in uniaxial crystals, Nicol prism, polaroids and retardation plates, Babinet's compensator, Analysis of polarized light, Optical activity and Fresnel's explanation, Half shade and Biquartz polarimeters, Matrix representation of plane polarized waves, matrices for polarizers, retardation plates and rotators.

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

Purity of a special line, coherence length and coherence time, spatial coherence of a source, Einstein's A and B coefficients, spontaneous and induced emissions, conditions for laser action, population inversion, 3 and 4 Level Systems (Ruby, Nd:YAG, CO_2, liquid dye and He-Ne laser), Properties and applications of laser.

11. CO-PO mapping

COs	**Attributes**	**PO1**	**PO2**	**PO3**	**PO 4**	**PO5**	**PO**	**PO 7**
CO1	The student will be introduced to the design of optical systems and aberrations, with an emphasis on image forming systems.	**3**	**1**			**2**		**1**
CO2	The wave optics part of the course will give the student a thorough fundamental knowledge within interferometry and coherence. They will be able to determine the wavelengths of light sources using concepts of interference.	**3**	**2**			**2**		**1**
CO3	Students will be able to determine the wavelength of light using the phenomena of diffraction and Resolving power of various optical instruments.	**3**	**1**			**2**	**1**	**3**
CO4	Students will learn to analyse the polarization in optical systems and will be able to represent polarized light using Jones formalism.	**3**	**1**			**2**		**1**
CO5	The students will be introduced to lasers. They will be able to explain various applications and working of different types of lasers.	**3**	**1**			**2**	**1**	**3**

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

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

1. http://textofvideo.nptel.ac.in/104105033/lec39.pdf.
2. http://nptel.ac.in/courses/104101006/downloads/lecture-notes/mod10/lec3.pdf
3. https://www.youtube.com/watch?v=1jRo5fTg0KY

13. Books recommended:

1. A. K. Ghatak, "Physical Optics" (Tata McGrew Hill).
2. D. P. Khandelwal; "Optics and Atomic Physics" (Himalaya, Publishing House, Bombay, 1988).
3. F. Smith and J.H Thomson; "Manchester Physics sries; Optics" (English Language Book Society and John Wiley, 1977).
4. Born and Wolf; "Optics" (University of Rochester, New York)
5. K. D. Moltey; "Optics" (Oxford University Press).
6. Jenkins and White; "Fundamental of Optics" (McGraw-Hill).
7. Smith and Thomson; "Optics" (John Wiley and Sons).
8. B.B. Laud; "Lasers" (New Age).