Integral University, Lucknow

Department of Mathematics & Statistics

Evaluation Scheme of Under Graduate & Post Graduate Program as per NEP-2020Guidelines

w.e.f. Session 2022-23

Certificate in Science (Mathematics, Physics, Computer Science) **Year: First / Semester: First (Odd Semester)**

S. N.	Course Code	Course Title	Theory / Practical	Course Type	Periods/ Per week			Continuous Assessment			End Semester Examination (ESE)	Subject Total	Total Credit Points	Attributes							United Nations Sustainable Development Goals (SDGs)
					Lecture (L)	Tutorial (T)	Practical (P)	Class Test (CT)	Teacher Assessment (TA)	Total				Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
1	B030101T/MT136	Differential Calculus & Integral Calculus	Theory	Core Major (Compulsory)	3	1	0	15	10	25	75	100	04	✓		✓					
2	B010101T/PY113	Mathematical Physics & Newtonian Mechanics	Theory		3	1	0	15	10	25	75	100	04	✓							
3	B070101T/CS127	Problem Solving using Computer	Theory		3	1	0	15	10	25	75	100	04	✓		✓					
4	B030102P/MT137	Practical using Mathematica /MATLAB	Practical		0	0	4	15	10	25	75	100	02	✓		✓					
5	B010102P/PY114	Mechanical Properties of Matter	Practical		0	0	4	15	10	25	75	100	02	✓		✓					
6	B070102P/CS128	Software Lab using Python	Practical		0	0	4	15	10	25	75	100	02	✓		✓					
7	I030103V/MT143	Introduction to LaTeX	Theory+ Practical	Vocational	2	0	2	-	-	-	100	100	03	✓		✓					
8	Z010101T	Food Nutrition and Hygiene	Theory	Co-curricular (Compulsory)	2	0	0	15	10	25	75	100	02	✓	✓	✓		✓	✓	✓	
TOTAL					**13**	**3**	**14**	**105**	**70**	**175**	**625**	**800**	**23**								

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	B030101T/MT136	**Title of the Course**	**Differential Calculus & Integral Calculus**	**L**	**T**	**P**	**C**
Year	**First**	**Semester**	First	4	0	0	4
Pre-Requisite	10+2 with Mathematics	**Co-requisite**					
Course Objectives	The purpose of this undergraduate course is to impart details and key knowledge of Differential Calculus & Integral Calculus. After successfully completion of course, the student will able to explore subject into their respective dimensions.						

Course Outcomes	
CO1	The students will be able to know about Indian Ancient Mathematics and Mathematicians. The students also will be able to know about sequences and their convergences/divergences.
CO2	The students will be able to define Limit, continuity and differentiability of function of single variable. Also, they will be able to prove some theorem e.g. Borel's theorem, boundedness theorem, Bolzano's theorem, Intermediate value theorem, extreme value theorem, Darboux's intermediate value theorem, Rolle's theorem, Lagrange and Cauchy Mean value theorems, Leibnitz theorem, Maclaurin's and Taylor's series, Partial differentiation, Euler's theorem on homogeneous function.
CO3	The students will be able to find about Tangent and normals, Asymptotes, Curvature, Envelops and evolutes. They will be able o trace tracing of curves in Cartesian and Polar forms.
CO4	The students will be able to solve finite integrals as limit of the sum, Riemann integral, Fundamental theorem of integral calculus, Mean value theorems of integral calculus,. Also they will be able to find Volumes and Surfaces of Solid of revolution, Pappus theorem, Multiple integrals.
CO5	The students will be able to solve/find Vector Differentiation, Gradient, Divergence and Curl, Normal on a surface, Directional Derivative, Vector Integration, Theorems of Gauss, Green, Stokes and related problems.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1		Indian Ancient Mathematics and Mathematicians: Aryabhatt, Brahmagupt, Mahavir Acharya, Varahmihir, Bhaskaracharaya, Madhavan, Parmeshvaran, Baudhayana Definition of a sequence, theorems on limits of sequences, bounded and monotonic sequences, Cauchy's convergence criterion, Cauchy sequence, limit superior and limit inferior of a sequence, subsequence, Series of non-negative terms, convergence and divergence, Comparison tests, Cauchy's integral test, Ratio tests, Root test, Raabe's logarithmic test, de Morgan and Bertrand's tests, alternating series, Leibnitz's theorem, absolute and conditional convergence.	9	1
2		Limit, continuity and differentiability of function of single variable, Cauchy's definition, Heine's definition, equivalence of definition of Cauchy and Heine, Uniform continuity, Borel's theorem, boundedness theorem, Bolzano's theorem, Intermediate value theorem, extreme value theorem, Darboux's intermediate value theorem for derivatives, Chain rule, indeterminate forms.	7	2
3		Rolle's theorem, Lagrange and Cauchy Mean value theorems, mean value theorems of higher order, Taylor's theorem with various forms of remainders, Successive differentiation, Leibnitz theorem, Maclaurin's and Taylor's series, Partial differentiation, Euler's theorem on homogeneous function.	7	2
4		Tangent and normals, Asymptotes, Curvature, Envelops and evolutes, Tests for concavity and convexity, Points of inflexion, Multiple points, Parametric representation of curves and tracing of parametric curves, Tracing of curves in Cartesian and Polar forms.	7	3
5		Definite integrals as limit of the sum, Riemann integral, Integrability of continuous and monotonic functions, Fundamental theorem of integral calculus, Mean value theorems of integral calculus, Differentiation under the sign of Integration.	9	4
6		Improper integrals, their classification and convergence, Comparison test, μ-test, Abel's test, Dirichlet's test, quotient test, Beta and Gamma functions.	7	4
7		Rectification, Volumes and Surfaces of Solid of revolution, Pappus theorem, Multiple integrals, change of order of double integration, Dirichlet's theorem, Liouville's theorem for multiple integrals.	7	5
8		Vector Differentiation, Gradient, Divergence and Curl, Normal on a surface, Directional Derivative, Vector Integration, Theorems of Gauss, Green, Stokes and related problems.	7	5

Reference Books:

R.G. Bartle & D.R. Sherbert, Introduction to Real Analysis, John Wiley & Sons

T.M. Apostal, Calculus Vol. I, John Wiley & Sons Inc.

S. Balachandra Rao & C. K. Shantha, Differential Calculus, New Age Publication.

H. Anton, I. Birens and S. Davis, Calculus, John Wiley and Sons, Inc.,2002.

G.B. Thomas and R.L. Finney, Calculus, Pearson Education,2007.

Bhartiya Mathematicians, Sharda Sanskrit Sansthan, Varanasi.

T.M. Apostal, Calculus Vol. II, John Wiley Publication

Shanti Narayan & Dr. P.K. Mittal, Integral Calculus, S.Chand

e-Learning Source:

Suggestive digital platforms web link/platform: NPTEL/SWAYAM/MOOCS

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**						**2**	**3**	**3**	**3**	**3**	**2**
CO2	**3**						**3**	**3**	**3**	**2**	**2**	**3**
CO3	**3**						**3**	**3**	**2**	**3**	**3**	**3**
CO4	**3**						**3**	**3**	**2**	**2**	**3**	**2**
CO5	**3**						**1**	2	1	3	2	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	B010101T/PY113	**Title of the Course**	**Mathematical Physics and Newtonian Mechanics**	**L**	**T**	**P**	**C**
Year	**First**	**Semester**	First	**4**	**0**	**0**	**4**
Pre-Requisite	10+2 with Physics	**Co-requisite**					
Course Objectives	This course aims to give students the competence in the methods and techniques of mathematical physics and Newtonian Mechanics. At the end of the course the students are expected to have hands on experience in modeling, implementation and calculation of physical quantities of relevance.						

Course Outcomes	
CO1	Recognize the difference between types of scalars and vectors, pseudo-scalars and understand the physical interpretation of gradient, divergence and curl.
CO2	Comprehend the difference and connection between different coordinate systems and know the meaning of 4-vectors, Kronecker delta and Epsilon (Levi Civita) tensors.
CO3	Study the origin of pseudo forces in rotating frame and study the response of the classical systems to external forces and their elastic deformation.
CO4	Understand the dynamics of planetary motion and the working of Global Positioning System (GPS).
CO5	Comprehend the different features of Simple Harmonic Motion (SHM) and wave propagation.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Vector Algebra	Coordinate rotation, reflection and inversion as the basis for defining scalars, vectors, pseudo-scalars and pseudo-vectors (include physical examples). Component form in 2D and 3D. Geometrical and physical interpretation of addition, subtraction, dot product, wedge product, cross product and triple product of vectors. Position, separation and displacement vectors.	7	CO1
2	Vector Calculus	Geometrical and physical interpretation of vector differentiation, Gradient, Divergence and Curl and their significance. Vector integration, Line, Surface (flux) and Volume integrals of vector fields. Gradient theorem, Gauss-divergence theorem, Stoke-curl theorem, Greens theorem and Helmholtz theorem (statement only). Introduction to Dirac delta function.	8	CO2
3	Coordinate Systems	2D and 3D Cartesian, Spherical and Cylindrical coordinate systems, basis vectors, transformation equations. Expressions for displacement vector, arc length, area element, volume element, gradient, divergence and curl in different coordinate systems. Components of velocity and acceleration in different coordinate systems. Examples of non-inertial coordinate system and pseudo-acceleration.	8	CO3
4	Introduction to Tensors	Principle of invariance of physical laws w.r.t. different coordinate systems as the basis for defining tensors. Coordinate transformations for general spaces of nD, contravariant, covariant and mixed tensors and their ranks, 4-vectors. Index notation and summation convention. Symmetric and skew-symmetric tensors. Invariant tensors, Kronecker delta and Epsilon (Levi Civita) tensors. Examples of tensors in physics..	7	CO4
5	Dynamics of a System of Particles	Review of historical development of mechanics up to Newton. Background, statement and critical analysis of Newton's axioms of motion. Dynamics of a system of particles, centre of mass motion, and conservation laws and their deductions. Rotating frames of reference, general derivation of origin of pseudo forces (Euler, Coriolis and centrifugal) in rotating frame, and effects of Coriolis force.	8	CO5
6	Dynamics of a Rigid Body	Angular momentum, Torque, Rotational energy and the inertia tensor. Rotational inertia for simple bodies (ring, disk, rod, solid and hollow sphere, solid and hollow cylinder, rectangular lamina). The combined translational and rotational motion of a rigid body on horizontal and inclined planes. Elasticity, relations between elastic constants, bending of beam and torsion of cylinder.	8	CO6
7	Motion of Planets and Satellites	Two particle central force problem, reduced mass, relative and centre of mass motion. Newton's law of gravitation, gravitational field and gravitational potential. Kepler's laws of planetary motion and their deductions. Motions of geo-synchronous and geo-stationary satellites and basic idea of Global Positioning System (GPS).	7	CO7
8	Wave Motion	Differential equation of simple harmonic motion and its solution, use of complex notation, damped and forced oscillations, Quality factor. Composition of simple harmonic motion, Lissajous figures. Differential equation of wave motion. Plane progressive waves in fluid media, reflection of waves and phase change, pressure and energy distribution. Principle of superposition of waves, stationary waves, phase and group velocity.	7	CO8

Reference Books:

1. Murray Spiegel, Seymour Lipschutz, Dennis Spellman, "Schaum's Outline Series: Vector Analysis", McGraw Hill, 2017, 2e
2. A.W. Joshi, "Matrices and Tensors in Physics", New Age International Private Limited, 1995, 3e
3. Charles Kittel, Walter D. Knight, Malvin A. Ruderman, Carl A. Helmholz, Burton J. Moyer, "Mechanics (In SI Units): Berkeley Physics Course Vol 1", McGraw Hill, 2017, 2e.
4. Richard P. Feynman, Robert B. Leighton, Matthew Sands, "The Feynman Lectures on Physics - Vol. 1", Pearson Education Limited, 2012
5. Hugh D. Young and Roger A. Freedman, "Sears and Zemansky's University Physics with Modern Physics", Pearson Education Limited, 2017, 14e
6. D.S. Mathur, P.S. Hemne, "Mechanics", S. Chand Publishing, 1981, 3e

e-Learning Source:

1. MIT Open Learning - Massachusetts Institute of Technology, https://openlearning.mit.edu/
2. National Programme on Technology Enhanced Learning (NPTEL), https://www.youtube.com/user/nptelhrd
3. Uttar Pradesh Higher Education Digital Library, http://heecontent.upsdc.gov.in/SearchContent.aspx
4. Swayam Prabha - DTH Channel, https://www.swayamprabha.gov.in/index.php/program/current_he/8

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)										
PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	-	-	-	-	-	1	2	-	1	-
CO2	3	-	-	-	-	-	2	3	-	1	-
CO3	3	-	-	-	-	-	3	3	-	2	-
CO4	3	-	-	-	-	-	3	3	-	3	-
CO5	3	-	-	-	-	-	3	3	-	3	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	B070101T/CS127	**Title of the Course**	**Problem Solving using Computer**	**L**	**T**	**P**	**C**
Year	**First**	**Semester**	**First**	**4**	**0**	**0**	**4**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	Student will learn to develop algorithmic solution to simple computational problems using Python programs. This course will demonstrate programs using simple Python statements, expression, conditional statement, python data structure and loops. It will also illustrate concept of , modules and packages in python used for solving problems.						

Course Outcomes	
CO1	Understand hardware components of computer system such as memory system organization, input/output devices, aware of software components of computer system, and windows operating system concepts.
CO2	Develops basic understanding of computers, the concept of algorithm and algorithmicthinking.
CO3	Develops the ability to analyze a problem, develop an algorithm to solve it.
CO4	Develops the use of the Python programming language to implement various algorithms,and develops the basic concepts and terminology of programming in general.
CO5	Introduces more advanced features of the Python language.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Computer Fundamentals**	Introduction to Computers: Characteristics of Computers, Uses of computers, Types and generations of Computers.	7	C01
2	**Basic Computer Organization**	Units of a computer, CPU, ALU, memory hierarchy, registers, I/O devices. **Planning the Computer Program:** Concept of problem solving, Problem definition, Program design, Debugging, Types of errors in programming, Documentation.	8	CO2
3	**Techniques of Problem Solving**	Flowcharting, decision table, algorithms, Structured programming concepts, Programming methodologies viz. top-down and bottom-up programming.	7	CO2
4	**Overview of Programming**	Structure of a PythonProgram, Elements of Python, IDEs for python, Python Interpreter, Using Python as calculator, Python shell,Indentation.	8	CO3
5	**Introduction to Python**	Atoms, Identifiers and keywords,Literals, Strings, Operators (Arithmetic operator, Relational operator, Logical or Boolean operator, Assignment, Operator, Ternary operator, Bit wise operator, Increment orDecrement operator).	8	CO4
6	**Creating Python Programs**	Input and OutputStatements, Control statements (Looping- while Loop, for Loop, Loop Control, Conditional Statement- if...else,Difference between break, continue and pass).	7	CO4
7	**Structures**	Numbers, Strings, Lists, Tuples, Dictionary, Date &Time, Modules, Defining Functions, Exit function, default arguments. File handling in python.	7	CO5
8	**Introduction to Advanced Python**	Objects and Classes, Inheritance, Regular Expressions, Event Driven Programming, GUI Programming. Basic concepts of concepts of Package and modules	8	CO5

Reference Books:

1. P. K. Sinha & Priti Sinha, “Computer Fundamentals”, BPB Publications, 2007.
2. Dr. Anita Goel, Computer Fundamentals, Pearson Education, 2010.
3. T. Budd, Exploring Python, TMH, 1st Ed, 2011
4. Python Tutorial/Documentation www.python.or 2010
5. Allen Downey, Jeffrey Elkner, Chris Meyers , How to think like a computerscientist: learning with Python , Freely available online.2012
6. Rober Sedgewick, K Wayne -Introduction to Programming in Python: Aninterdisciplinary Approach" Pearson India

e-Learning Source:

https://www.pearsoned.co.in/prc/book/anita-goel-computer-fundamentals-1e- 1/9788131733097

http://docs.python.org/3/tutorial/index.html

http://interactivepython.org/courselib/static/pythonds

http://www.ibiblio.org/g2swap/byteofpython/read/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	1	-	-	-	-	-	-	-	-	-	-	-	-	3	2	-	-	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	3	2	-	1	-	-
CO3	-	3	-	-	-	-	-	-	-	-	-	-	2	-	1	3	-	-
CO4	2	3	-	-	-	-	-	-	-	-	-	-	3	2	-	1	-	-
CO5	3	1	-	-	-	-	-	-	-	-	-	-	3	1	-	-	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	B030102P/MT137	**Title of the Course**	**Practical Using Mathematica/MATLAB**	**L**	**T**	**P**	**C**
Year	**First**	**Semester**	First	0	0	4	2
Pre-Requisite	10+2 with Mathematics	**Co-requisite**					
Course Objectives	The main objective of the course is to equip the student to plot the different graph and solve the different types of equations by plotting the graph using different computer software such as Mathematica /MATLAB /Maple /Scilab/Maxima etc.						

Course Outcomes	
CO1	The students will be able to plot the different graphs of the functions: ax, [x] , x^{2n} , x = e^x, $x^2 + 1 = e^x$,$1 - x^2 = e^x$, x = log10(x) , cos(x) = x, sin(x) = x, cos(y) = cos(x) , sin(y) = sin(x) etc . Also they will be able to plot the graphs of polynomial of degree 2,3, 4 and 5, and their first and second derivatives and tracing of conic in Cartesian coordinates.
CO2	After completion of this course student would be able to know the convergence of sequences through plotting, verify Bolzano-Weierstrass theorem through plotting the sequence, Cauchy's root test by plotting n^{th} roots and Ratio test by plotting the ratio of n^{th} and $(n + 1)^{th}$ term.
CO3	Student would be able to plot Complex numbers and their representations, Operations like addition, substraction, Multiplication, Division, Modulus and Graphical representation of polar form.
CO4	Student would be able to perform following task of matrix as Addition, Multiplication, Inverse, Transpose, Determinant, Rank, Eigenvectors, Eigen values, Characteristic equation and verification of the Cayley-Hamilton theorem, Solving the systems of linear equations.
CO5	The students will be able to know about study the convergence/divergence of infinite series by plotting their sequences of partial sum.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1		Plotting the graphs of the following functions: (i) ax , [x] (greatest integer function) , x^{2n} ; n ∈ N, x^{2n-1} ; n ∈ N, **; n ∈ N, |ax + b|, c ± |ax + b|, sin (, xsin (, for , e^{ax+b}, log(ax + b) sin**(ax + b), cos(ax + b) , |sin(ax + b)|, |cos(ax + b)|., (ii) Observe and discuss the effect of changes in the real constants **a** and **b** on the graphs	4	1
2		By plotting the graph find the solution of the equations x = e^x, $x^2 + 1 = e^x$,$1 - x^2 = e^x$, x = log10(x) , cos(x) = x, sin(x) = x, cos(y) = cos(x) , sin(y) = sin(x) etc	4	1
3		Plotting the graphs of polynomial of degree 2,3, 4 and 5, and their first and second derivatives.	4	1
4		Sketching parametric curves, e.g., Trochoid, Cycloid, Epicycloid and Hypocycloid etc.	4	1
5		Tracing of conic in Cartesian coordinates.	4	1
6		Graph of circular and hyperbolic functions.	4	1
7		Obtaining surface of revolution of curves	4	1
8		Complex numbers and their representations, Operations like addition, Multiplication, Division, Modulus. Graphical representation of polar form.	4	3
9		Find numbers between two real numbers and plotting of finite and infinite subset of R.	4	3
10		Matrix Operations: Addition, Multiplication, Inverse, Transpose, Determinant, Rank, Eigen vectors, Eigen values, Characteristic equation and verification of the Cayley-Hamilton theorem, Solving the systems of linear equations.	4	4
11		Study the convergence of sequences through plotting.	4	5
12		Verify Bolzano-Weierstras's theorem through plotting of sequences and hence identify convergent subsequences from the plot.	4	2
13		Study the convergence/divergence of infinite series by plotting their sequences of partial sum.	4	5
14		Cauchy's root test by plotting n-th roots.	4	5
15		Ratio test by plotting the ratio of n-th and $(n + 1)$-th term.	4	5

Reference Books:

1. Suggested Readings: A Guide to MATLAB®: For Beginners and Experienced Users 3rd Edition, Kindle Edition by Brian R. Hunt

e-Learning Source:

Teaching Calculus with MATLAB - MATLAB & Simulink (mathworks.com)

Course Articulation Matrix: (Mapping of COs with POs and PSOs)												
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**						**2**	**3**	**2**	**3**	**3**	**3**
CO2	**3**						**3**	**3**	**3**	**2**	**2**	**2**
CO3	**3**						**3**	**3**	**3**	**2**	**3**	**3**
CO4	**3**						**3**	**3**	**3**	**3**	**3**	**3**
CO5	**3**						**2**	**3**	**2**	**3**	**2**	**2**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	B010102P/PY114	**Title of the Course**	**Mechanical Properties of Matter**	**L**	**T**	**P**	**C**
Year	**First**	**Semester**	First	**0**	**0**	**4**	**2**
Pre-Requisite	10+2 with Physics	**Co-requisite**					
Course Objectives	The purpose of this undergraduate course is to impart practical knowledge/measurements in mechanics through different experiments related to its theoretical course.						

Course Outcomes	
CO1	Understand the Moment of Inertia and find the MI of an irregular body.
CO2	Determine elastic properties of rigid materials.
CO3	Understand the surface tension and viscosity of fluid.
CO4	Analyse waves and oscillations and understand the dynamics and gravitation
CO5	Demonstrate uses of Sextant by measuring dimensions of a given object.

Experiment No.	**Title of the Experiment**	**Content of Unit (*Offline)**	**Contact Hrs.**	**Mapped CO**
1	Flywheel	Moment of inertia of a flywheel	6	CO1
2	Inertia Table	Moment of inertia of an irregular body by inertia table	6	CO1
3	Statitcal Method	Modulus of rigidity by statical method (Barton's apparatus)	6	CO2
4	Maxwell's Needle	Modulus of rigidity by dynamical method (sphere / disc / Maxwell's needle)	6	CO2
5	Flexure Method	Young's modulus by bending of beam	6	CO2
6	Searle's Method	Young's modulus and Poisson's ratio by Searle's method	6	CO2
7	Poisson's Ratio	Poisson's ratio of rubber-by-rubber tubing	6	CO2
8	Capillary Rise Method	Surface tension of water by capillary rise method	6	CO3
9	Jaeger's Method	Surface tension of water by Jaeger's method	6	CO3
10	Poiseuille's Method	Coefficient of viscosity of water by Poiseuille's method	6	CO3
11	Compound Pendulum	Acceleration due to gravity by bar pendulum	6	CO4
12	Sonometer	Frequency of AC mains by Sonometer	6	CO4
13	Sextant	Height of a building by Sextant	6	CO5
14	C.R.O.	Study the waveform of an electrically maintained tuning fork / alternating current source with the help of cathode ray oscilloscope.	6	CO4
Unit No.	**Title of the Unit**	**Content of Unit (*Online Virtual Lab)**	**Contact Hrs.**	**Mapped CO**
1	Flywheel	Torque and angular acceleration of a flywheel	6	CO1
2	Torsion	Torsional oscillations in different liquids.	6	CO4
3	Flywheel	Moment of inertia of flywheel.	6	CO1
4	Newton's Second Law	Newton's second law of motion.	6	CO4
5	Ballistic Pendulum	Ballistic pendulum.	6	CO4
6	Collision Balls	Collision balls.	6	CO2
7	Projectile Motion	Projectile motion.	6	CO4
8	Collision	Elastic and inelastic collision.	6	CO2

Reference Books:

1. B.L. Worsnop, H.T. Flint, "Advanced Practical Physics for Students", Methuen & Co., Ltd., London, 1962, 9e
2. S. Panigrahi, B. Mallick, "Engineering Practical Physics", Cengage Learning India Pvt. Ltd., 2015, 1e
3. R.K. Agrawal, G. Jain, R. Sharma, "Practical Physics", Krishna Prakashan Media (Pvt.) Ltd., Meerut, 2019
4. S.L. Gupta, V. Kumar, "Practical Physics", Pragati Prakashan, Meerut, 2014, 2e

e-Learning Source:

1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=74
2. Digital Platforms /Web Links of other virtual labs may be suggested / added to this lists by individual Universities.

*** A student has to perform at least 7 experiments from the Offline Experiment List and 3 from the Online Virtual Lab Experiment List / Link.**

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)										
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**2**						**3**	**3**			**3**
CO2	**2**						**3**	**3**			**3**
CO3	**3**						**2**	**3**			**3**
CO4	**2**						**3**	**3**			**3**
CO5	**3**						**2**	**3**		**2**	**3**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	B070102P/CS128	**Title of the Course**	**Software Lab using Python**	**L**	**T**	**P**	**C**
Year	**First**	**Semester**	**First**	**0**	**0**	**4**	**2**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	The objective of this course understands the practical applicability of Python.						

Course Outcomes	
CO1	To learn and understand Python programming basics.
CO2	To learn and understand python looping, control statements and string manipulations.
CO3	Students should be made familiar with the concepts of GUI controls and designing GUIapplications.
CO4	To learn and know the concepts of file handling, exception handling and databaseconnectivity.

S. No.	Title of the Experiment	Content of Experiment	Mapped CO
1	**Experiment-1**	Write a menu driven program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice	1
2	**Experiment-2**	WAP to calculate total marks, percentage and grade of a student. Marks obtained in each of the three subjects are to be input by the user. Assign grades according to the following criteria: Grade A: Percentage >=80 Grade B: Percentage>=70 and <80 Grade C: Percentage>=60 and <70 Grade D: Percentage>=40 and <60 Grade E: Percentage<40	2
3	**Experiment-3**	Write a menu-driven program, using user-defined functions to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.	3
4	**Experiment-4**	WAP to display the first n terms of Fibonacci series.	3
5	**Experiment-5**	WAP to find factorial of the given number.	2
6	**Experiment-6**	WAP to find sum of the following series for n terms: 1 – 2/2! + 3/3! n/n!	2
7	**Experiment-7**	WAP to calculate the sum and product of two compatible matrices.	1
8	**Experiment-8**	Write a menu-driven program to create mathematical 3D objects: I. curve II. sphere III. cone IV. arrow V. ring VI. Cylinder.	4
9	**Experiment-9**	WAP to read n integers and display them as a histogram.	1
10	**Experiment-10**	WAP to display sine, cosine, polynomial and exponential curves.	2
11	**Experiment-11**	WAP to plot a graph of people with pulse rate p vs. height h. The values of p and h are to be entered by the user	1
12	**Experiment-12**	WAP to calculate the mass m in a chemical reaction. The mass m (in gms) disintegrates according to the formula m=60/(t+2), where t is the time in hours. Sketch a graph for t vs. m, where t>=0	2
13	**Experiment-13**	A population of 1000 bacteria is introduced into a nutrient medium. The population p grows as follows: $P(t) = (15000(1+t))/(15+ e)$ where the time t is measured in hours. WAP to determine the size of the population at given time t and plot a graph for P vs t for the specified time interval.	2
14	**Experiment-14**	Input initial velocity and acceleration, and plot the following graphs depicting equations of motion: I. velocity wrt time (v=u+at) II. distance wrt time (s=u*t+0.5*a*t*t) III. distance wrt velocity (s=(v*v-u*u)/2*a)	1

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2		1		2							3		2			
CO2		3		1	2		1							1	3	2	1	
CO3	3		1			1	2						2		3	1		
CO4		2	1		3		1						3	3	2		1	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	MT143	**Title of the Course**	**Introduction to LaTeX**	**L**	**T**	**P**	**C**
Year	**First**	**Semester**	First	2	0	2	3
Pre-Requisite	Basic usage of a Windows PC or a Mac	**Co-requisite**					
Course Objectives	The course aims to teach the basic features. By attending the course students should acquire all necessary skills to be able to prepare a moderate scientific paper and a short mathematical presentation using LaTeX.						

Course Outcomes	
CO1	Introduction of LaTeX, Basic commands of LaTeX, understanding of different types of fonts.
CO2	Create sectional units, texts alignment, tiles, mini pages, foot notes, new paragraph.
CO3	Create and interpret the page layout, page style, running header, page numbering.
CO4	Find and interpret the listing texts, numbered listing, unnumbered listing, nesting, Tabbing texts.
CO5	Find and interpret the table environment, adjusting column width in tables, table wrapped by texts, footnotes in tables.
CO6	Find and interpret the command and environments of inserting simple figure, side by side figures, figures drawing.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Introduction	LaTeX, LaTeX input file, compilation, LaTeX syntax; commands, environment, packages, keyboard characters, Font selection; Text – mode fonts, Math – mode fonts, Emphasized fonts, coloured fonts.	9	1
2	Formatting Texts	Sectional units, labelling and referring numbered items, texts alignment, quoted texts, new lines and paragraph; filling blank spaces, preventing lines break, increasing depth of sectional units, titles, multiple columns, mini pages, foot notes, marginal notes.	7	2
3	Page Layout and Style	Page layout; standard page layout, formatting page layout, increasing the height of a page, page style, running header and footer, page breaking and adjustment, page numbering.	7	2
4	Listing and Tabbing Texts	Listing Texts; numbered listing, unnumbered listing, nesting, Tabbing texts; Adjusting column width, Adjusting alignment of column	7	3
5	Table Preparation	Table through tabular environment, tabular environment, vertical positioning, side ways texts, adjusting column width in tables, marging rows and columns, table wrapped by texts, table with colour background, nested tables, side by side tables, side ways table, long table, footnotes in tables.	9	5
6	Figure Insertion	Command and environments, inserting simple figure, side by side figures, sub – numbering a group of figures, figure wrapped by texts, rotated figures, mathematical notations in figures, figures in table, figures in multi – column documents, figures drawing; circle, circular arcs, straight lines, vector curves and oval boxes, texts in figures, compound figures.	7	6

Reference Books:

1. Stefen Kottwitz, LaTeX – Beginner's Guide, Packt Publishing, Birmingum (2011).
2. H. Kopka and P. W. Daly, A Guide to LaTeX, Addison Wesley Publishing.
3. Dilip Dutta: LaTeX in 24 Hours, Springer.

e-Learning Source:

1. https://www.overleaf.com/learn/latex/Free_online_introduction_to_LaTeX_(part_1)
2. https://spoken-tutorial.org/tutorial-search/?search_foss=LaTeX&search_language=English
3. https://swayam.gov.in/explorer?searchText=LaTeX

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**						**2**	**3**	**3**	**3**	**3**	**2**
CO2	**3**						**3**	**3**	**3**	**2**	**2**	**3**
CO3	**3**						**3**	**3**	**2**	**3**	**3**	**3**
CO4	**3**						**3**	**3**	**2**	**2**	**3**	**2**
CO5	**3**						**1**	2	1	3	2	1
CO6	**3**						**1**	2	1	3	2	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Department of Mathematics & Statistics

Evaluation Scheme of Under Graduate & Post Graduate Program as per NEP-2020 Guidelines

w.e.f. Session 2022-23

Certificate in Science (Mathematics, Physics, Computer Science) **Year: First / Semester: Second (Even Semester)**

S. N.	Course Code	Course Title	Theory / Practical	Course Type	Periods/ Per week			Continuous Assessment			End Semester Examination (ESE)	Subject Total	Total Credit Points	Attributes							United Nations Sustainable Development Goals (SDGs)
					Lecture (L)	Tutorial (T)	Practical (P)	Class Test (CT)	Teacher Assessment (TA)	Total				Employability	Entrepreneurship	Skill Development	Gender Equality	Environment & Sustainability	Human Value	Professional Ethics	
1	B030201T/MT138	Matrices and Differential Equations & Geometry	Theory	Core Major (Compulsory)	4	2	0	15	10	25	75	100	06	✓		✓					
2	B010201T/PY115	Thermal Physics & Semiconductor Devices	Theory		3	1	0	15	10	25	75	100	04	✓							
3	B070201T/CS129	Database Management Systems	Theory		3	1	0	15	10	25	75	100	04	✓		✓					
4	B010202P/PY116	Thermal Properties of Matter & Electronic Circuits	Practical		0	0	4	15	10	25	75	100	02	✓							
5	B070202P/CS130	Database Management Systems Lab	Practical		0	0	4	15	10	25	75	100	02	✓		✓					
6	B150101T/EVS125	Basics of Environmental Sciences	Theory	Minor	3	1	0	15	10	25	75	100	04	✓	✓	✓		✓	✓	✓	
7	I030202V/MT144	LaTeX – Scientific Writing	Theory+ Practical	Vocational	2	0	2	-	-	-	100	100	03	✓		✓					
8	Z020201	First Aid and Health	Theory	Co-curricular (Compulsory)	2	0	0	15	10	25	75	100	02	✓	✓	✓		✓	✓	✓	
				TOTAL	**17**	**5**	**10**	**105**	**70**	**175**	**625**	**800**	**27**								

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	B030201T/MT138	**Title of the Course**	**Matrices and Differential Equations & Geometry**	**L**	**T**	**P**	**C**
Year	**First**	**Semester**	Second	6	0	0	**6**
Pre-Requisite	10+2 with Mathematics	**Co-requisite**					
Course Objectives	The purpose of this undergraduate course is to impart details and key knowledge of Matrices and Differential Equations & Geometry. After successfully completion of course, the student will able to explore subject into their respective dimensions.						

Course Outcomes	
CO1	The students will be able to define types of Matrices, Rank of a Matrix, System of linear homogeneous and non-homogeneous equations, Theorems on consistency of a system of linear equations. Also, students will be able to find Eigen values, Eigen vectors , Cayley-Hamilton theorem, real and imaginary parts, Exponential and Logarithmic functions Inverse trigonometric and hyperbolic functions.
CO2	The student will be able to learn and visualize the fundamental ideas about formation of differential equations, Geometrical meaning of a differential equation
CO3	The students will be to learn and visualize first order higher degree equations solvable for x, y, p, Clairaut's equation and singular solutions, orthogonal trajectories, Linear differential equation of order greater than one with constant coefficients.
CO4	On successful completion of the course students have gained knowledge about to trace of conics, Confocal conics, Polar equation of conics and its properties, Three-Dimensional Coordinates system.
CO5	The student will be able to describe Sphere, Cone and Cylinder, Central conicoid, Paraboloids, lines, Confocal conicoid, Reduction of second degree equations.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1		Types of Matrices, Elementary operations on Matrices, Rank of a Matrix, Echelon form of a Matrix, Normal form of a Matrix, Inverse of a Matrix by elementary operations, System of linear homogeneous and non-homogeneous equations, Theorems on consistency of a system of linear equations.	12	1
2		Eigen values, Eigen vectors and characteristic equation of a matrix, Cayley-Hamilton theorem and its use in finding inverse of a matrix, Complex functions and separation into real and imaginary parts, Exponential and Logarithmic functions Inverse trigonometric and hyperbolic functions.	11	1
3		Formation of differential equations, Geometrical meaning of a differential equation, Equation of first order and first degree, Equation in which the variables are separable, Homogeneous equations, Exact differential equations and equations reducible to the exact form, Linear equations.	11	2
4		First order higher degree equations solvable for x, y, p, Clairaut's equation and singular solutions, orthogonal trajectories, Linear differential equation of order greater than one with constant coefficients, Cauchy- Euler form.	11	3
5		General equation of second degree, System of conics, Tracing of conics, Confocal conics, Polar equation of conics and its properties.	12	4
6		Three-Dimensional Coordinates, Projection and Direction Cosine, Plane (Cartesian and vector form), Straight line in three dimension (Cartesian and vector form).	11	4
7		Sphere, Cone and Cylinder.	11	5
8		Central conicoid, Paraboloids, Plane section of conicoid, Generating lines, Confocal conicoid, Reduction of second degree equations.	11	5

Reference Books:

1.Stephen H. Friedberg, A.J Insel & L.E. Spence, Linear Algebra, Person

2.B. Rai, D.P. Choudhary & H. J. Freedman, A Course in Differential Equations, Narosa

3.D.A. Murray, Introductory Course in Differential Equations, Orient Longman

4 Robert J.T Bell, Elementary Treatise on Coordinate Geometry of three dimensions, Macmillan India Ltd.

5. P.R. Vittal, Analytical Geometry 2d & 3D, Pearson.

6. S.L. Loney, The Elements of Coordinate Geometry, McMillan and Company,London.

7. R.J.T. Bill, Elementary Treatise on Coordinate Geometry of Three Dimensions, McMillan India Ltd., 1994.

e-Learning Source:

Suggestive digital platforms web links/platform: NPTEL/SWAYAM/MOOCS

Course Articulation Matrix: (Mapping of COs with POs and PSOs)												
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**						**2**	**3**	**3**	**2**	**3**	**3**
CO2	**3**						**3**	**3**	**2**	**3**	**3**	**2**
CO3	**3**						**3**	**2**	**2**	**3**	**3**	**2**
CO4	**3**						**3**	**3**	**3**	**2**	**3**	**3**
CO5	**3**						**2**	**3**	**2**	**2**	**2**	**3**

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	B010201T/PY115	**Title of the Course**	**Thermal Physics and Semiconductor Devices**	**L**	**T**	**P**	**C**
Year	**First**	**Semester**	Second	**4**	**0**	**0**	**4**
Pre-Requisite	10+2 with Physics	**Co-requisite**					
Course Objectives	The objective of this undergraduate course is to impart the knowledge of basic and advance concepts of thermodynamics, circuit fundamentals and basic electronics.						

Course Outcomes	
CO1	Recognize the difference between reversible and irreversible processes and understand the physical significance of thermodynamical potentials.
CO2	Comprehend the kinetic model of gases w.r.t. various gas laws.
CO3	Study the implementations and limitations of fundamental radiation laws.
CO4	Understand the utility of AC bridges and recognize the basic components of electronic devices.
CO5	Design simple electronic circuits and understand the applications of various electronic instruments.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	0^{th} & 1^{st} Law of Thermodynamics	State functions and terminology of thermodynamics. Zeroth law and temperature. First law, internal energy, heat and work done. Work done in various thermodynamical processes. Enthalpy, relation between CP and CV. Carnot's engine, efficiency and Carnot's theorem. Efficiency of internal combustion engines (Otto and diesel).	8	CO1
2	2^{nd} & 3^{rd} Law of Thermodynamics	Different statements of second law, Clausius inequality, entropy and its physical significance. Entropy changes in various thermodynamical processes. Third law of thermodynamics and unattainability of absolute zero. Thermodynamical potentials, Maxwell's relations, conditions for feasibility of a process and equilibrium of a system. Clausius- Clapeyron equation, Joule-Thompson effect.	8	CO2
3	Kinetic Theory of Gases	Kinetic model and deduction of gas laws. Derivation of Maxwell's law of distribution of velocities and its experimental verification. Degrees of freedom, law of equipartition of energy (no derivation) and its application to specific heat of gases (mono, di and poly atomic).	7	CO3
4	Theory of Radiation	Blackbody radiation, spectral distribution, concept of energy density and pressure of radiation. Derivation of Planck's law, deduction of Wien's distribution law, Rayleigh-Jeans law, Stefan-Boltzmann law and Wien's displacement law from Planck's law.	7	CO4
5	DC & AC Circuits	Growth and decay of currents in RL circuit. Charging and discharging of capacitor in RC, LC and RCL circuits. Network Analysis - Superposition, Reciprocity, Thevenin's and Norton's theorems. AC Bridges - measurement of inductance (Maxwell's, Owen's and Anderson's bridges) and measurement of capacitance (Schering's, Wein's and de Sauty's bridges).	7	CO5
6	Semiconductors & Diodes	P and N type semiconductors, qualitative idea of Fermi level. Formation of depletion layer in PN junction diode, field & potential at the depletion layer. Qualitative idea of current flow mechanism in forward & reverse biased diode. Diode fabrication. PN junction diode and its characteristics, static and dynamic resistance. Principle, structure, characteristics and applications of Zener, Tunnel, Light Emitting, Point Contact and Photo diodes. Half and Full wave rectifiers, calculation of ripple factor, rectification efficiency and voltage regulation. Basic idea about filter circuits and voltage regulated power supply.	8	CO6
7	Transistors	Bipolar Junction PNP and NPN transistors. Study of CB, CE & CC configurations w.r.t. active, cutoff & saturation regions; characteristics; current, voltage & power gains; transistor currents & relations between them. Idea of base width modulation, base spreading resistance & transition time. DC Load Line analysis and Q-point stabilisation. Voltage Divider Bias circuit for CE amplifier. Qualitative discussion of RC coupled amplifier (frequency response not included).	7	CO7
8	Electronic Instrumentation	Multimeter: Principles of measurement of dc voltage, dc current, ac voltage, ac current and resistance. Specifications of a multimeter and their significance. Cathode Ray Oscilloscope: Block diagram of basic CRO. Construction of CRT, electron gun, electrostatic focusing and acceleration (no mathematical treatment). Front panel controls, special features of dual trace CRO, specifications of a CRO and their significance. Applications of CRO to study the waveform and measurement of voltage, current, frequency & phase difference.	8	CO8

Reference Books:

1. M.W. Zemansky, R. Dittman, "Heat and Thermodynamics", McGraw Hill, 1997, 7e
2. F.W. Sears, G.L. Salinger, "Thermodynamics, Kinetic theory & Statistical thermodynamics", Narosa Publishing House, 1998
3. Enrico Fermi, "Thermodynamics", Dover Publications, 1956
4. S. Garg, R. Bansal, C. Ghosh, "Thermal Physics", McGraw Hill, 2012, 2e
5. Meghnad Saha, B.N. Srivastava, "A Treatise on Heat", Indian Press, 1973, 5e
6. R.L. Boylestad, L. Nashelsky, "Electronic Devices and Circuit Theory", Prentice-Hall of India Pvt. Ltd., 2015, 11e
7. J. Millman, C.C. Halkias, Satyabrata Jit, "Electronic Devices and Circuits", McGraw Hill, 2015, 4e
8. B.G. Streetman, S.K. Banerjee, "Solid State Electronic Devices", Pearson Education India, 2015, 7e
9. J.D. Ryder, "Electronic Fundamentals and Applications", Prentice-Hall of India Private Limited, 1975, 5e
10. A. Sudhakar, S.S. Palli, "Circuits and Networks: Analysis and Synthesis", McGraw Hill, 2015, 5e
11. S.L. Gupta, V. Kumar, "Hand Book of Electronics", Pragati Prakashan, Meerut, 2016, 43e

e-Learning Source:

1. Swayam - Government of India, https://swayam.gov.in/explorer?category=Physics
2. National Programme on Technology Enhanced Learning (NPTEL), https://nptel.ac.in/course.html
3. Coursera, https://www.coursera.org/browse/physical-science-and-engineering/physics-and-astronomy
4. edX, https://www.edx.org/course/subject/physics
5. MIT Open Course Ware - Massachusetts Institute of Technology, https://ocw.mit.edu/courses/physics/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)										
PO-PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	3		2			2	3	3		1	
CO2	3						3	3		1	
CO3	3		2			2	3	3		1	
CO4	3		1				3	3		2	
CO5	3		2				3	3		2	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session:							
Course Code	B070201T	**Title of the Course**	**Database Management Systems**	**L**	**T**	**P**	**C**
Year	**First**	**Semester**	**Second**	**4**	**0**	**0**	**4**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	The objective of this course is to present an introduction to database management systems, with an emphasis on how to organize, maintain and retrieve- efficiently and effectively – information from a DBMS. Student will understand to design E-R models to represent simple database application scenarios and get familiar with basic database storage structures and database security.						

Course Outcomes	
CO1	Understands the basic concepts of data base management systems.
CO2	Design E-R diagrams for real world applications.
CO3	Formulate relational algebraic expressions using relational data models and languages.
CO4	Apply normalization transaction properties and concurrency control to design database
CO5	Analyze the security algorithms for database protection.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	**Introduction**	Database System Concepts, File system vs. database system, Database system architecture, Data models and their types, Data base scheme and instances, Data independence, Database Languages and Interfaces.	7	CO1
2	**Data Modeling Concepts**	ER model concepts: Notations for ER diagram, Extended E-R diagram,Extended E-R model, E-R model design issues, constraints, and keys: Weak entity set strong entity set, Relationships of higher degree	8	CO2
3	**Relational model concepts**	Code rules, constraints, Relational Algebra operations, Extended relational algebra operations, RelationalCalculus, Tuple and Domain relational calculus	7	CO3
4	**Database Design**	Functional dependencies, Normal forms, First, second, and thirdnormal forms, BCNF, Multi-valued dependencies and Fourth Normal form, Join Dependencies and Fifth Normal form.	8	CO3
5	**Transaction, Query Processing**	Transaction and system concepts: transaction states, ACID properties of transactions, concurrent execution schedules and Recoverability, Serializability of schedules. Query Processing and Optimization: Measures of Query cost, Cost, Evaluation of expression. Optimization: Transformation of relational expression, Choice of evaluation plan.	7	CO4
6	**Concurrency Control**	Concurrency Control Techniques: Two phaseLocking Techniques for Concurrency Control; Time stamping in Concurrency control.	8	CO4
7	**Introduction to SQL**	Basic Structure of SQL Query, set operators, SELECT, UNION, INTERSECT, and EXCEPT, Nested queries, Aggregate function, Null values, Derived Relations, Modification of the Database, Joined relations and up-dates in SQL.	8	CO4
8	**Database Security**	Importance of data, Threats and risks, Users and database privileges,Access Control, Security for Internet Applications, Role of Database Administrator.	7	CO5

Reference Books:

1. Henry F. Korth and Abraham Silberschatz, "Database System Concepts," Second Edition,McGraw Hill, 1991.
2. AtulKahate, "Introduction to Database Management Systems," Pearson India, 2004.
3. Raghu Ramakrishnan and Johannes Gehrike, "Database Management Systems," ThirdMcGraw Hill, Edition, 2003
4. R. Elmasri, S.B. Navathe Database Systems Models, Languages, Design and applicationProgramming, 6 Edition, Pearson Education,2013
5. A. Silberschatz, H.F. Korth, S. Sudarshan, Database System Concepts 6th Edition,McGraw Hill, 2010

e-Learning Source:

https://www.javatpoint.com/dbms-tutorial

https://www.geeksforgeeks.org/introduction-of-dbms-database-management-system-set-1

https://www.javatpoint.com/database-security

https://www.techtarget.com/searchdatamanagement/definition/database-management-system

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	2	1	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO2	2	3	-	-	-	-	-	-	-	-	-	-	1	3	2	-	-	-
CO3	1	3	-	-	-	-	-	-	-	-	-	-	-	1	3	2	-	-
CO4	1	2	-	-	-	-	-	-	-	-	-	-	-	-	2	3	-	-
CO5	1	3	-	-	-	-	-	-	-	-	-	-	1	3	2	-	-	-

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	Sign & Seal of HoD

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	B010202P/PY116	**Title of the Course**	**Thermal Properties of Matter & Electronic Circuits**	**L**	**T**	**P**	**C**
Year	**First**	**Semester**	Second	**0**	**0**	**4**	**2**
Pre-Requisite	10+2 with Physics	**Co-requisite**					
Course Objectives	The purpose of this undergraduate course is to impart practical knowledge/measurements in mechanics through different experiments related to its theoretical course.						

Course Outcomes	
CO1	Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the thermal properties.
CO2	Experimental physics has the most striking impact on the industry wherever the instruments are used to study and determine the electronic properties.
CO3	Measurement precision and perfection is achieved through Lab Experiments.
CO4	Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling.

Experiment No.	**Title of the Unit**	**Content of Unit (*Offline)**	**Contact Hrs.**	**Mapped CO**
1	Callender and Barne's Method	Mechanical Equivalent of Heat by Callender and Barne's method	6	CO1/3
2	Searle's Apparatus	Coefficient of thermal conductivity of copper by Searle's apparatus	6	CO1/3
3	Thermal Conductivity	Coefficient of thermal conductivity of rubber	6	CO1/3
4	Lee and Charlton's disc method	Coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method	6	CO1/3
5	Stefan's Constant	Value of Stefan's constant	6	CO1/3
6	Stefan's Law	Verification of Stefan's law	6	CO1/3
7	Thermocouple	Variation of thermo-emf across two junctions of a thermocouple with temperature	6	CO2/3
8	Platinum Resistance Thermometer	Temperature coefficient of resistance by Platinum resistance thermometer	6	CO2/3
9	Charging and Discharging	Charging and discharging in RC and RCL circuits	6	CO2/3
10	A. C. Bridges	A.C. Bridges: Various experiments based on measurement of L and C	6	CO2/3
11	Series and Parallel Resonance	Resonance in series and parallel RCL circuit	6	CO2/3
12	Semiconductor Diodes	Characteristics of PN Junction, Zener, Tunnel, Light Emitting and Photo diode	6	CO2/3
13	Transistors	Characteristics of a transistor (PNP and NPN) in CE, CB and CC configurations	6	CO2/3
14	Half wave and Full Wave Rectifies	Half wave & full wave rectifiers and Filter circuits	6	CO2/3
15	Power Supply	Unregulated and Regulated power supply	6	CO2/3
16	CRO	Various measurements with Cathode Ray Oscilloscope (CRO)	6	CO2/3
Unit No.	**Title of the Unit**	**Content of Unit (*Online Virtual Lab)**	**Contact Hrs.**	**Mapped CO**
1	Heat transfer	Heat transfer by radiation	6	CO1/3/4
2	Heat transfer	Heat transfer by conduction	6	CO1/3/4
3	Heat transfer	Heat transfer by natural convection	6	CO1/3/4
4	Phase Change	The study of phase change	6	CO1/3/4
5	Stefan's Constant	Black body radiation: Determination of Stefan's constant	6	CO1/3/4
6	Law of Cooling	Newton's law of cooling	6	CO1/3/4
7	Lee's disc apparatus	Lee's disc apparatus	6	CO1/3/4
8	Thermocouple	Thermo-couple: Seebeck effects	6	CO1/3/4
9	Familiarisation with resistor	Familiarisation with resistor	6	CO2/3/4
10	Familiarisation with capacitor	Familiarisation with capacitor	6	CO2/3/4
11	Familiarisation with inductor	Familiarisation with inductor	6	CO2/3/4
12	Ohm's Law	Ohm's Law	6	CO2/3/4
13	RC Differentiator and integrator	RC Differentiator and integrator	6	CO2/3/4
14	Semiconductor Diodes	VI characteristics of a diode	6	CO2/3/4
15	Half wave and Full Wave Rectifies	Half & Full wave rectification	6	CO2/3/4
16	Capacitative rectification	Capacitative rectification	6	CO2/3/4

17	Zener Diode	Zener Diode voltage regulator	6	CO2/3/4
18	Common Emitter Characteristics	BJT common emitter characteristics	6	CO2/3/4
19	Common Base Characteristics	BJT common base characteristics	6	CO2/3/4
20	Common Emitter Amplifier	Studies on BJT CE amplifier	6	CO2/3/4

Reference Books:
1. B. L. Worsnop, H. T. Flint, “Advanced Practical Physics for Students”, Methuen & Co. Ltd., London, 1962, 9e
2. S. Panigrahi, B. Mallick, “Engineering Practical Physics”, Cengage Learning India Pvt. Ltd., 2015, 1e
3. R. L. Boylestad, L. Nashelsky, “Electronic Devices and Circuit Theory”, Prentice-Hall of India Pvt. Ltd., 2015, 11e
4. A. Sudhakar, S. S. Palli, “Circuits and Networks: Analysis and Synthesis”, McGraw Hill, 2015, 5e
e-Learning Source:
1. Virtual Labs at Amrita Vishwa Vidyapeetham, https://vlab.amrita.edu/?sub=1&brch=194
2. Virtual Labs an initiative of MHRD Govt. of India, http://vlabs.iitkgp.ac.in/be/#
3. Digital Platforms/Web Links of other virtual labs may be suggested/added to this list by individual Universities.

* A student has to perform at least 7 experiments from the Offline Experiment List and 3 from the Online Virtual Lab Experiment List / Link.

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)										
PO-PSO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**2**						**3**	**3**			**3**
CO2	**2**						**3**	**3**			**3**
CO3	**3**						**2**	**3**			**2**
CO4	**2**						**3**	**2**			**2**

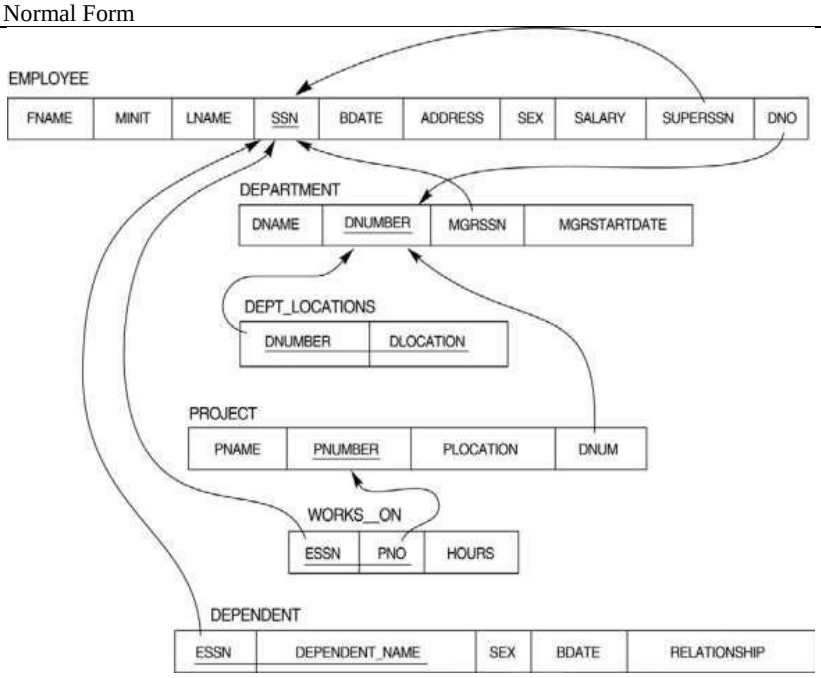
1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	B070202P	**Title of the Course**	Database Management Systems Lab	**L**	**T**	**P**	**C**
Year	**First**	**Semester**	**Second**	**0**	**0**	**4**	**2**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	The objective of this course understands the practical applicability of database management system concept. Working on existing database systems, designing database creating relational database, analysis of table design. Understand various advance queries execution such as joins, set operations, trigger, aggregate functions and embedded SQL.						

Course Outcomes	
CO1	Understand, analyze and apply common SQL statements including DDL, DML and DCLstatements to perform different operations.
CO2	Design and implement a database schema for a given problem.
CO3	Do connectivity of PHP and MySQL to develop applications.

S. No.	Title of the Experiment	Content of Experiment	Mapped CO
1	**Experiment-1**	Creation of databases and execution of SQL queries.	1
2	**Experiment-2**	Creation of Tables using MySQL: Data types, Creating Tables (along with Primary and Foreign keys),Altering Tables and Dropping Tables	1
3	**Experiment-3**	Practicing DML commands- Insert, Select, Update, Delete.	1
4	**Experiment-4**	Practicing Queries using ANY, ALL, IN, EXISTS, NOT, EXISTS, UNION, INTERSECT, and CONSTRAINTS, etc.	2
5	**Experiment-5**	Practice Queries using COUNT, SUM, AVG, MAX, MIN, GROUP BY, HAVING, VIEWS Creation andDropping	2
6	**Experiment-6**	Use of COMMIT, ROLLBACK and SAVEPOINT.	1
7	**Experiment-7**	Practicing on Triggers - creation of trigger, Insertion using trigger, Deletion using trigger, Updating usingtrigger	2
8	**Experiment-8**	To remove the redundancies and anomalies in the above relational tables, Normalizeup to Third Normal Form	2
9	**Experiment -9**	 **Relational Database Schema - COMPANY**	
		Questions to be performed on above schema: 1.Create tables with relevant foreign key onstraints 2.Populate the tables with data 3.Perform the following queries on the database : 1.Display all the details of all employees working in the company. 2.Display ssn, lname, fname, address of employees who work in department no 7. 3.Retrieve the birthdate and address of the employee whose name is 'Franklin T. Wong' 4.Retrieve the name and salary of every employee 5.Retrieve all distinct salary values	**1**

6.Retrieve all employee names whose address is in ‘Bellaire’

7.Retrieve all employees who were born during the 1950s

8.Retrieve all employees in department 5 whose salary is between 50,000 and 60,000(inclusive)

9.Retrieve the names of all employees who do not have supervisors

10.Retrieve SSN and department name for all employees

11.Retrieve the name and address of all employees who work for the 'Research' department

12.For every project located in 'Stafford', list the project number, the controlling department number, and the department manager's last name, address, and birthdate.

13.For each employee, retrieve the employee's name, and the name of his or her immediate supervisor.

14.Retrieve all combinations of Employee Name and Department Name

15.Make a list of all project numbers for projects that involve an employee whose last name is 'Narayan’ either as a worker or as a manager of the department that controls the project.

16.Increase the salary of all employees working on the 'ProductX' project by 15%. Retrieve employee name and increased salary of these employees.

17.Retrieve a list of employees and the project name each works in, ordered by the employee's department, and within each department ordered alphabetically by employee first name.

18.Select the names of employees whose salary does not match with salary of any employee in department 10.

19.Retrieve the name of each employee who has a dependent with the same first name and same sex as the employee.

20.Retrieve the employee numbers of all employees who work on project located in Bellaire, Houston, or Stafford.

21.Find the sum of the salaries of all employees, the maximum salary, the minimum salary, and the average salary. Display with proper headings.

22.Find the sum of the salaries and number of employees of all employees of the ‘Marketing’ department, as well as the maximum salary, the minimum salary, and the average salary in this department.

23.Select the names of employees whose salary is greater than the average salary of all employees in department 10.

24.For each department, retrieve the department number, the number of employees in the department, and their average salary.

25.For each project, retrieve the project number, the project name, and the number of employees who work on that project.

26.Change the location and controlling department number for all projects having more than 5 employees to ‘Bellaire’ and 6 respectively.

27.For each department having more than 10 employees, retrieve the department no, no of employees drawing more than 40,000 as salary.

28.Insert a record in Project table which violates referential integrity constraint with respect to Department number. Now remove the violation by making necessary insertion in the Department table.

29.Delete all dependents of employee whose ssn is ‘123456789’.

30.Delete an employee from Employee table with ssn = ‘12345’(make sure that this employee has some dependents, is working on some project, is a manager of some department and is supervising some employees). Check and display the cascading effect on Dependent and Works on table. In Department table MGRSSN should be set to default value and in Employee table SUPERSSN should be set to NULL

31.Perform a query using alter command to drop/add field and a constraint in Employee table.

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)																	
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2				1							3		2			
CO2		3	3		2		1							3	1	1		
CO3	3		2			2	1						2		3	1		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2022-2023							
Course Code	**B150101T/ES125**	**Title of the Course**	**Basics of Environmental Science**	**L**	**T**	**P**	**C**
Year	**First**	**Semester**	Second	**3**	**1**	**0**	**4**
Pre-Requisite	10+2 with Physics, Chemistry & (Mathematics/ Biology)	**Co-requisite**					
Course Objectives	This course provides students with a working knowledge of concept of environment and the relation between human and its relation with the environment.						

Course Outcomes	
CO1	Gain knowledge about origin of life and related theories.
CO2	Learn fundamental concept of environmental science.
CO3	Develop the understanding about environmental education and able to understand the relationship between human and environment.
CO4	Understand the concept of sustainable development and SDG and also able to understand the current scenario of environmental degradation.
CO5	Learn the significance and importance of environmental management and have the practical knowledge about the affected areas of environment.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Evolution**	Origin of life and speciation, Darwinism and modern synthetic theory of evolution, Natural Selection; Biochemical basis of origin of life; Hardy Weinberg Equilibrium; Genetic drift.	8	CO1
2	**Concept of Environment**	Definition, Principles and Scope of Environmental Science; Environment, its components and segments; Moral and Aesthetic Nature of Environmental Science; Objectives and Historic roots of the subject; for Public Awareness.	8	CO2
3	**Environmental**	Goals of environmental education; Environmental Literacy, Environmental Careers, Environmental Justice, Individual Organisms, Environmentalism, Environmental Education at Primary, Secondary level.	6	CO3
4	**Man and Environment:**	Man-Environment relationships; Impacts of human activity on environment (Agriculture, transportation, mining, urbanization, industrialization); Environmental Degradation and Conservation Issues, Modern concept of environmental conservation	8	CO3
5	**Sustainable development**	Concept and Significance of sustainable development, Core elements of sustainable development, Over-view of SDG (Sustainable Development Goals).	6	CO4
6	**Current Environmental Issues**	Ill effects of fireworks and environmental degradation, Climate change and its effects on human health, Deforestation and its impacts on human communities and flora and fauna of the Environment.	8	CO4
7	**Environmental Management**	Significance of Environment Management, Resettlement and rehabilitation of project affected areas, Environmental ethics: Role of Indian's religions and cultures in environmental conservation, Communication and public awareness programmes for environment management.	8	CO5
8	**Field Survey**	Assessment of impacts of anthropogenic activities in the surrounding environment; Evaluation of the consequences rising from agricultural and commercial logging practices to preserve environment, case study, Reclamation and monitoring of the affected area by developmental activities: case study.	8	CO5

Reference Books:

1. Environmental Science by William P. Cunningham and Mary Ann Cunningham; McGraw-Hill Publications.
2. Environmental Science: Earth as a Living Planet by Botkin and Keller; JOHN WILEY & SONS, INC
3. A text Book of Environment Studies, Asthana, D. K. and Asthana, M. 2006, S. Chand & Co.
4. Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p

e-Learning Source:

1. Environmental Science, Dr. Y. K. Singh, https://www.hzu.edu.in/bed/E%20V%20S.pdf
2. Textbook for Environmental Studies, Erach Bharucha, https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf
3. Fundamentals of Environmental Studies, https://www.jkcprl.ac.in/download/11567250727.pdf

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2						2	2			
CO2	3	3						3	2			
CO3	2	2						2	3			
CO4	3	3						2	2			
CO5	2	1						3	2			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	MT144	**Title of the Course**	**LaTeX – Scientific Writing**	**L**	**T**	**P**	**C**
Year	**First**	**Semester**	Second	2	0	2	3
Pre-Requisite	Basic knowledge of LaTeX	**Co-requisite**					
Course Objectives	The course aims to teach the basic features. By attending the course students should acquire all necessary skills to be able to prepare a moderate scientific paper and a short mathematical presentation using LaTeX.						

Course Outcomes	
CO1	Create and interpret the mathematical notations, mathematical operators, mathematical expressions.
CO2	Create and interpret the bibliography, citing bibliographic, BIBTEX, natbib package.
CO3	Create and interpret the list of Contents and Index, rules, dots, hyperlinking, watermarking.
CO4	Create and interpret the letter writing, article preparation, preparation of book, report writing.
CO5	Create and interpret frames in presentation, presentation structure, environments in Beamer class.
CO6	Understand and interpret the Error messages, removal of errors, warning messages, tips for debugging

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Equation Writing	Basic mathematical notations and delimiters, mathematical operators, mathematical expressions, simple equations, equation numbering, array equations, left aligning, sub – numbering, texts and blank spaces, splitting an equation, vector and matrix, overlining and underlining, stacking terms, side by side equations.	9	1
2	Bibliography	Preparation of bibliography, citing bibliographic reference, bibliography with the BIBTEX program, BIBTEX compatible reference database, standard bibliography styles, natbib package, multiple bibliography.	7	2
3	List of Contents and Index	Lists of contents; Information to the list of contents, formatting list of contents, multiple list of contents, making index, rotated items, rules, dots, hyperlinking, current date and time, highlighted texts, verbatime, watermarking, logo in header and footer, paragraph in different forms.	7	2
4	Letter, Article, Books and Report	Letter writing, Article preparation, list of authors, title and abstract, left aligned title, article in multiple columns, section wise numbering, dividing an article, template of a book, preparation of book, dividing a book into parts, report writing.	8	3
5	Slide Preparation	Frames in presentation, sectional units, presentation structure; title page, appearance of a presentation, themes, frame customization, piece wise presentation, environments in Beamer class, table and figures, dividing frame column wise, repeating slides, jumping to other slides.	8	5
6	Error and Warning Messages	Error messages, removal of errors, warning messages, error without any message, tips for debugging, commonly generated errors, errors due to packages, errors in equation environment.	6	6

Reference Books:

1. Stefen Kottwitz, LaTeX – Beginner's Guide, Packt Publishing, Birmingum (2011).
2. H. Kopka and P. W. Daly, A Guide to LaTeX, Addison Wesley Publishing.
3. Dilip Dutta: LaTeX in 24 Hours, Springer.

e-Learning Source:

1. https://www.overleaf.com/learn/latex/Free_online_introduction_to_LaTeX_(part_1)
2. https://spoken-tutorial.org/tutorial-search/?search_foss=LaTeX&search_language=English
3. https://swayam.gov.in/explorer?searchText=LaTeX

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**3**						**2**	**3**	**3**	**3**	**3**	**2**
CO2	**3**						**3**	**3**	**3**	**2**	**2**	**3**
CO3	**3**						**3**	**3**	**2**	**3**	**3**	**3**
CO4	**3**						**3**	**3**	**2**	**2**	**3**	**2**
CO5	**3**						**1**	2	1	3	2	1
CO6	**3**						**1**	2	1	3	2	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**