CALICUT UNIVERSITY – FOUR-YEAR UNDER GRADUATE PROGRAMME (CU-FYUGP)

BSc APPLIED PHYSICS HONOURS

Programme	**B.Sc. Applied Physics Honours**				
Course Title	**ELECTRODYNAMICS I**				
Type of Course	**Core in Major**				
Semester	**IV**				
Academic Level	**200 – 299**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	A strong foundation in mathematics, including algebra, trigonometry, and calculus. Additionally, a basic understanding of physics concepts such as electricity, magnetism, and mechanics would be beneficial for grasping the principles covered in the course.				
Course Summary	The course provides a foundational exploration of electromagnetism, encompassing topics like electric fields, magnetic fields and electromagnetic induction. Through simplified explanations, illustrative examples, and conceptual exercises, students gain insight into the behavior and interactions of electric and magnetic fields, preparing them for more advanced studies in physics or related fields at the undergraduate level.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Apply vector analysis techniques to solve problems in electromagnetics	Application	Conceptual Understanding	Problem-solving assignments, quizzes

CO2	Analyze and calculate electric fields and potentials for various charge distributions	Analysis	Procedural Knowledge	Homework assignments, exams, simulation exercises
CO3	Investigate the behavior of magnetic fields and solve problems involving magnetostatics	Evaluation	Conceptual Understanding	Laboratory reports, group projects, exams
CO4	Utilize electrical measurement instruments to quantify electric and magnetic phenomena	Application	Procedural Knowledge	Laboratory experiments, instrument operation tests, practical assessments
CO5	Demonstrate an understanding of Maxwell's equations and their implications in electromagnetism	Comprehension	Conceptual Understanding	Concept maps, oral presentations, written exams
CO6	Apply theoretical knowledge to analyze and design simple electromagnetic systems	Synthesis	Procedural Knowledge	Design projects, case studies, final projects
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (45 +30)	Marks (70)
I		**VECTOR ANALYSIS**	**12**	**20**
	1	Vector Algebra	2	
	2	Differential Calculus	4	
	3	Integral Calculus	4	
	4	Curvilinear Coordinates	2	
	Sections 1.1.1 – 1.1.4, 1.2.1 – 1.2.7, 1.3.1 – 1.3.6, 1.4.1 – 1.4.2 of chapter 1 of Book 1			
II		**ELECTROSTATICS**	**15**	**20**
	5	The Electric Field	3	
	6	Divergence and Curl of Electrostatic Field	4	

	7	Electric Potential; Electrostatic Boundary Conditions	4	
	8	Work and Energy in Electrostatics	2	
	9	Conductors	2	
	Sections 2.1.1 – 2.1.4, 2.2.1, 2.2.3, 2.2.4, 2.3.1 – 2.3.5, 2.4.1 – 2.4.4, 2.5.1 – 2.5.4 of chapter 2 of Book 1 (section 2.2.2 is excluded)			
III	**MAGNETOSTATICS**		**9**	**15**
	10	The Lorentz Force Law	2	
	11	The Biot – Savart Law	2	
	12	The Divergence and Curl of B (up to the derivation of Eqn. 5.50); Ampere's Law	2	
	13	Magnetic Vector Potential; Magnetostatic Boundary Conditions	3	
	Sections 5.1.1 – 5.1.3, 5.2.1, 5.2.2, 5.3.1 – 5.3.4, 5.4.1, 5.4.2 of chapter 5 of Book 1			
IV	**ELECTRICAL MEASUREMENTS**		**9**	**15**
	14	Kirchoff's laws and Wheatstone's Bridge	1	
	15	Carey Foster Bridge	1	
	16	Potentiometer	1	
	17	Network Analysis: Superposition Theorem	1	
	18	Thevenin's Theorem, Norton's theorem	1	
	19.	Maximum power transfer theorem	1	
	20	Maxwell's Loop Current Method	1	
	21	Torque on a Current loop in a Unifor, Magnetic field	1	
	22	Moving Coil Ballistic Galvanometer	1	
	Sections 6.6 – 6.8, 6.12 – 6.17 of chapter 6, and sections 10.10, 10.11 of chapter 10 of Book 2			
V	**PRACTICALS**		**30**	
	Conduct any 6 experiments from the given list (two from experiment 1-4 and four from 5-16) and 1 additional experiment, decided by the teacher-in-charge, related to the content of the course. The 7th experiment may also be selected from the given list. Other experiments listed here may be used as demonstrations of the concepts taught in the course.			
	1	**Plotting of the 2D functions using Python** ● Plot the 2D function in Problem 1.12 of Book 1 and find the maximum value and the location of maxima from the plot.		

		• Simulations of section 1.2 of Book 3 can be referred.		
	2	**Mapping of 2D vector fields using Python** • Map the vector fields in Example 1.4 and 1.5 of Book 1. • Map $\frac{\hat{r}}{r}$ and $\frac{\hat{r}}{r^2}$ • Simulations of section 3.1 of Book 3 can be referred.		
	3	**Mapping of electric and magnetic field lines using Python** • Plot the field of an electric charge, dipole and magnetic dipole. • Simulations of section 4.1, 4.2 and Appendix D of Book 3 can be referred.		
	4	**Simulation of particle trajectory under Lorentz force law using Python** • Simulate the trajectory of charged particle moving under Lorentz force law. • Problem 5.66 of Book 1 and Chapter 6 of Book 3 can be referred		
	5	**Mapping of the magnetic field lines of a bar magnet.** • Fix a paper on a drawing board kept on a table and place the bar magnet at the center along the magnetic meridian. • Using a small compass needle, map the magnetic field lines of the magnet placed with (a) north pole pointing south and (b) north pole pointing north. • Mark the null points (where the horizontal component of Earth's magnetic field, Bh cancels the field due to magnet) along the axial/equatorial line and measure the distance, 2d, between them. • Calculate the moment of the magnet. (a) $m = \frac{4\pi}{\mu_0}\frac{(d^2-l^2)^2}{2d}B_h$ (b) $m = \frac{4\pi}{\mu_0}(d^2+l^2)^{3/2}B_h$		
	6	**Study the variation of the magnetic field strength of a bar magnet using a smartphone magnetometer.** • Using a smartphone magnetometer, measure the strength of the magnetic field of a bar magnet, along the axial and equatorial lines and plot the data. • Magnetometer in the Phyphox app may be used to get the data after locating the approximate position of the magnetometer sensor. https://phyphox.org/wiki/index.php?title=Sensor:_Magnetic_field • Fit the theoretical formulae to the data and obtain magnetic dipole moment. Along the axial line $B = \frac{\mu_0}{4\pi}\frac{2md}{(d^2-l^2)^2}$ and along the equatorial line $B = \frac{\mu_0}{4\pi}\frac{m}{(d^2+l^2)^{3/2}}$		

	7	**Determine the moment of a bar magnet and Bh using a deflection magnetometer and a box type vibration magnetometer.** ● Determine m/Bh using deflection magnetometer in Tan A position and mBh using box type vibration magnetometer. Hence calculate the moment of the magnet and Bh. ● If the same magnet was used, compare the dipole moment with that of experiment 2 and 3.		
	8	**Circular coil- Verification of Biot Savart's law and determination of Bh.** ● Move a compass through a platform along the axis of the coil carrying a study current. Note the deflection of the needle and plot magnetic flux density ($B = B_h tan\theta$) as a function of distance. ● Optional: Smartphone magnetometer may be used to measure the strength of the magnetic field along the axial line and plot the data. https://phyphox.org/experiment/magnetic-field/ ● By varying current and (or) distance of the compass box along the axial line of the coil, note the deflection and hence determine the value of Bh.		
	9	**Reduction factor of TG using potentiometer.** ● Standardize the given potentiometer using a Danial cell or any other constant voltage source and use the standardized potentiometer to find the current through the TG. ● By observing the deflection in the TG for different currents, calculate the reduction factor. ● From the magnetic field at the center of a circular coil, deduce the value Bh.		
	10	**Verification of Kirchoff's laws / Superposition theorem.** ● Verify Kirchoff's current law at a junction where a minimum of three branches meet. ● Verify Kirchoff's current law for a network with two loops. **OR** ● Verify the superposition theorem for a network with two sources, S1 and S2. ● First set particular voltage values in S1 and S2 and note down the ammeter reading. ● Set the same voltage in S1 and short circuit S2 and vise versa, note down the ammeter readings and verify the superposition theorem.		
	11	**Verification of Thevenin's theorem and maximum power transfer theorem** **Thevenin's theorem** ● Measure the current through the load resistance of the network. ● Estimate the values of R_{TH} and V_{TH}, construct the Thevenin's equivalent circuit and measure the current through load		

		resistance and compare the two results with the theoretical values. **Maximum power transfer theorem** ● Measure the current through load resistance and estimate the power. Plot $R_L - P$ graph and find the R_L corresponding to the maximum power. ● Calculate the % of error with the theoretical value.		
	12	**Determination of resistivity of a thin wire using Carey-Foster's Bridge** ● Find the resistance per unit length of the bridge wire. ● Determine resistance of the thin wire using the bridge, thickness of the wire using screw gauge and hence determine the resistivity.		
	13	**Calibrate the ammeter using potentiometer** ● Standardize the potentiometer using a Danial cell or any other standard voltage source. ● Determine the current for at least 8 trials and draw the calibration graph.		
	14	**Conversion of Galvanometer to voltmeter and calibration using potentiometer** ● Determine the value of high resistance required to connect in series with the galvanometer so as it can read 0.1V or 0.2V per scale division. ● Standardize the potentiometer using a Danial cell or any other standard voltage source. ● Determine the voltage for at least 6 trials and draw the calibration graph.		
	15	**BG-Determination of the figure of merits for current** ● Determine the figure of merits for current of the given ballistic galvanometer. ● Measure a small current using BG and verify with ammeter.		
	16	**BG-Comparison of capacitance- Desauty's method** ● Compare the capacitance of two given capacitors by forming De-Sauty bridge.		

Book for Reference:

1. Introduction to Electrodynamics (5th Edn.) by David J Griffiths, Cambridge University Press (Book 1)
2. Electricity and Magnetism (10 Edn.) by R Murugeshan, S. Chand and Company (Book 2)
3. Electrodynamics Tutorials with Python Simulations by Taejoon Kouh, Minjoon Kouh -CRC Press 1st Edition (Book 3)
4. Electricity and Magnetism, Berkeley Physics Course Vol.2, by E M Purcell, Mc Graw Hill Edn.
5. Electricity and Magnetism, by D C Pandey, Arihand Prakashan Series
6. Classical Electromagnetism by H C Verma, Bharathi Bhavan Publishers and Distributers

7. The Feynman Lectures on Physics, Vol-2, Pearson Education India

8. NPTEL lectures on Electrodynamics/ Classical Electrodynamics
https://archive.nptel.ac.in/courses/115/105/115105132/

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO 4	PSO 5	PS O6	PO 1	PO2	PO 3	PO 4	PO 5	P O6	PO 7
CO 1	2	1	3	2	3	0	2	3	3	2	3	2	0
CO 2	1	3	2	3	3	0	2	3	3	2	3	2	0
CO 3	3	2	3	1	3	0	3	3	3	2	3	2	0
CO 4	1	3	2	3	2	1	2	3	3	2	3	2	0
CO 5	2	2	3	1	3	0	3	3	3	2	3	2	0
CO 6	3	1	3	3	3	0	3	3	3	2	3	2	0

Correlation Levels:

Level	Correlation
0	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Discussion / Seminar
- Internal Theory / Practical Exam
- Assignments / Viva
- End Semester Exam (70%)

Mapping of COs to Assessment Rubrics

	Internal Theory / Practical Exam	Assignment / Viva	Practical Skill Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6		✓	✓	

CALICUT UNIVERSITY – FOUR-YEAR UNDER GRADUATE PROGRAMME (CU-FYUGP)

BSc APPLIED PHYSICS HONOURS

Programme	**B.Sc. Applied Physics Honours**				
Course Title	**MECHANICS -II**				
Type of Course	**Core in Major**				
Semester	**IV**				
Academic Level	**200 - 299**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	PHY3CJ201: Mechanics -I				
Course Summary	This course explores Newton's Laws of Motion and how they can be applied to solve different mechanical systems.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Explain the principles of central force motion and derive key results related to Kepler's laws and planetary motion.	U	C	Instructor-created exams / Quiz
CO2	Apply Newton's laws and the work-energy theorem to solve problems involving rotational and oscillatory motion.	Ap	P	Instructor-created exams / Home Assignments
CO3	Analyze the dynamics of damped and forced harmonic oscillators.	An	C,P	Instructor-created exams / Home Assignments
CO4	Analyze travelling and standing waves and the transport of energy in wave motion.	An	C	Instructor-created exams / Home Assignments
CO5	Evaluate effects of accelerated and rotating frames, including fictitious forces.	E	C,P	Seminar Presentation / Group Tutorial Work

CO6	Design and perform experiments and computational simulations related to mechanics, using smartphone-based sensors and Python tools.	Ap	P	Practical Assignment / Observation of Practical Skills / Viva Voce
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F), Conceptual Knowledge (C), Procedural Knowledge (P), Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (45 +30)	Marks (70)
I	**CENTRAL FORCE MOTION: THE KEPLER PROBLEM**		**14**	**20**
	1	Kepler's Laws	1	
	2	Central Forces	2	
	3	The Equation of Motion	2	
	4	Energy and the Effective Potential Energy	2	
	5	Solving the Radial Equation of Motion	1	
	6	The Equation of the Obit	2	
	7	The Equation of an Ellipse	2	
	8	Kepler's Laws Revisited	2	
	Sections 10.1 – 10.9 of chapter 10 of Book 1			
II	**HARMONIC MOTION**		**13**	**20**
	9	Springs and Pendulums	1	
	10	Solving the Differential Equation – Undamped Harmonic Oscillator	2	
	11	Damped Harmonic Oscillator – Underdamped, Overdamped and Critically Damped Oscillators	4	
	12	The Forced Harmonic Oscillator – Forced Undamped and Forced Damped Oscillators	4	
	13	The Q Factor	1	
	14	Resonance in Electrical Circuits	1	
	Sections 11.1 – 11.4 of chapter 11 of Book 1			

III	**WAVES**		**8**	**14**
	15	A Wave in a Stretched String	1	
	16	Direct Solution of the Wave Equation	1	
	17	Fourier Series	1	
	18	Standing Waves and Traveling Waves	2	
	19	Standing Waves as a Special Case of Traveling Waves	1	
	20	Energy and Energy Flow	2	
	Sections 13.1 – 13.6 of chapter 13 of Book 1			
IV	**ACCELERATED REFERENCE FRAMES**		**10**	**16**
	21	A Linearly Accelerating Reference Frame	1	
	22	A Rotating Coordinate Frame	1	
	23	Fictitious Forces	2	
	24	Centrifugal Force and the Plumb Bob	1	
	25	The Coriolis Force – A Falling Body and A Projectile	3	
	26	The Foucault Pendulum	2	
	Sections 15.1 – 15.6 of chapter 15 of Book 1			
V	**PRACTICALS**		**30**	
	Conduct any 6 experiments from the given list and 1 additional experiment, decided by the teacher-in-charge, related to the content of the course. The 7th experiment may also be selected from the given list. ● The necessary theory of the experiments can be given as an Assignment/ Seminar. ● Calculate the percentage error and standard deviation in each experiment. ● Plot the graphs using Python. ● Smartphones are exclusively intended for educational lab use. Necessary care should be taken to safeguard them during the experiments. ● Smartphone experiments primarily serve demonstration purposes, with result accuracy contingent upon the precision of phone sensors and experimental setups.			
	1	**Flywheel- Determination of the Moment of Inertia.** ● This experiment aims to help students grasp the concept of energy conservation and the dynamics of rotation. ● Do at least 9 trials for different masses and number of turns wound on the axil.		

	2	**Torsion Pendulum- Determination of the Moment of Inertia and Rigidity Modulus.** ● Using identical masses on the disc, determine the moment of inertia of the disc. ● Verify the moment of inertia by direct method, $I = \frac{1}{2}MR^2$ ● Using I, calculate rigidity modulus of the material of the wire, $n = \frac{8\pi I}{r^4}\frac{L}{T^2}$		
	3	**Compound Pendulum- Acceleration Due to Gravity and Moment of Inertia and Verification of Parallel Axis Theorem.** ● Plot a graph of distance of knife edge from one end Vs period of oscillations. Using the measurement from the graph, calculate g. ● Calculate the radius of gyration and hence the moment of inertia about CM. Compare the result obtained by the direct calculation $I_{CM} = \frac{ML^2}{12}$ ● Measure the period of oscillation about an arbitrary pivot point which is at a distance d from the CM. Calculate $I_{pivot} = mgd\frac{T^2}{4\pi^2}$. ● Verify the result using parallel axes theorem, $I_{pivot} = I_{CM} + md^2$		
	4	**Kater's Pendulum- Determination of Earth's Gravity.** ● To determine g for both the cases (a) T1 ≈ T2 and (b) T1 ≠ T2 and discuss the relative merits of both cases by estimation of error in the two cases.		
	5	**Melde's String - Determination of the Frequency of the Turing Fork** ● Determine the frequency of electrically maintained tuning fork by means of Melde's apparatus in longitudinal and transverse mode of vibration. ● Verify $\lambda^2 - T$ law.		
	6	**Sonometer - Determine the Frequency of AC.** ● Estimate the linear mass density of the wire. ● Draw $L^2 - m$ graph and from the slope calculate the frequency.		
	7	**Fourier Analysis of the Modes of Vibration in a Stretched String.** ● Record the sound produced by guitar string (or similar arrangement) using a microphone and analyze the spectrum by taking Fast Fourier Transform (FFT). ● Audio Spectrum in the Pyphox, Audacity, ExpEYES or any other tools can be used to record the sound and get the FFT. ● Vary the length and tension of the string and analyze the harmonics. ● https://phyphox.org/experiment/audio-spectrum/		

		• https://www.youtube.com/watch?v=bl7jf2myEvM • https://expeyes.in/experiments/sound/beats.html		
	8	**Determination of the Velocity of Sound in Air.** • Sound wave of known frequency is generated using a wave generator(WG) and piezo buzzer and are recorded using a microphone(MIC). • Phase differences between the WG and MIC waveforms were analyzed in a CRO and the distance between them were adjusted to make both of them in phase and hence calculate velocity of sound. • Phase difference can be analyzed from the Lissajous figure obtained by X-Y plotting of WG and MIC waves. • ExpEYES may be used. • https://expeyes.in/experiments/sound/velocity.html • https://expeyes.in/experiments/electrical/xyplot.html		
	9	**Transformation of Energy from One Form to Another.** • Roll a hollow cylinder from a height, in an inclined plane, without pushing. • Measure radius of the cylinder and record the velocity of the cylinder using the gyroscope of the phone inserted into the cylinder. • Calculate the total energy before the cylinder starts to roll (Potential Energy, mgh) • Calculate the total energy (Translational KE + Rotational KE) when the cylinder reaches the bottom of the plane. • Estimate the energy lost as heat and sound. Repeat the experiment for different heights. • Experiment 23 for Book 2 • https://phyphox.org/experiment/roll/#more-509		
	10	**Pendulum- Limits on Angular Displacement and Study of Damped Oscillations.** • Estimate limits on angular displacement for SHM by measuring the time period at different angular displacements and compare it with the expected value of time period for SHM. Example 12.1 of Book 1. • Study damped oscillations. Plot amplitude as a function of time and determine the damping coefficient and Q factor. • Digitized data can be used for the study. • https://www.youtube.com/watch?v=jcpvm95bhXw • https://expeyes.in/experiments/school-level/sr04.html • https://phyphox.org/experiment/pendulum/		
	11	Realize the computational Projects in chapters 10, 11, 12, 13, 15 of Book 1 or any other related projects using Python		
Books and References: 1. Intermediate Dynamics (Edn.2) by Patrick Hamill (Book 1)				

2. Smartphones as Mobile Minilabs in Physics(Edn. 1) by Jochen Kuhn & Patrik Vogt, Springer, (Book 2)
3. An Introduction to Mechanics by Daniel Kleppner and Robert J. Kolenkow
4. Mechanics by Keith R. Symon
5. Mechanics: Berkeley Physics Course, Volume 1 by Charles Kittel, Walter D. Knight and Malvin A. Ruderman
6. Mechanics: From Newton's Laws to Deterministic Chaos by Florian Scheck
7. NPTEL video lectures: https://nptel.ac.in/courses/115106090

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PSO 6	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO 1	2	0	2	0	0	0	2	0	0	0	0	0	0
CO 2	2	2	2	0	0	0	2	2	0	0	0	0	0
CO 3	0	2	2	0	0	0	0	2	0	0	0	0	0
CO 4	0	2	2	2	0	0	0	2	2	0	0	0	0
CO 5	0	0	2	0	0	0	0	0	2	0	0	0	0
CO 6	0	2	2	2	0	2	0	2	2	0	0	0	0

Correlation Levels:

Level	Correlation
0	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Discussion / Seminar
- Internal Theory / Practical Exam
- Assignments / Viva
- End Semester Exam (70%)

Mapping of COs to Assessment Rubrics

	Internal Theory / Practical Exam	Assignment / Viva	Practical Skill Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6		✓	✓	

CALICUT UNIVERSITY – FOUR-YEAR UNDER GRADUATE PROGRAMME (CU-FYUGP)

BSc APPLIED PHYSICS HONOURS

IMPORTANT: This course is for the Double Major pathway only.

Programme	**B.Sc. Applied Physics Honours**				
Course Title	**SCIENCE COMMUNICATION**				
Type of Course	**Value-Added Course 2**				
Semester	**IV**				
Academic Level	**100 - 199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	-	-	45
Pre-requisites	Basic computer operating knowledge.				
Course Summary	This course introduces Latex programming for preparing scientific documents and presentations. This paper also introduces formal science communication, of which presentation and document writing forms a part.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Learn the basic structure of a LaTeX document, creating a new latex document	U	F	Instructor-created exams / Quiz / Practical Assignment
CO2	Understanding how to split a document into logical parts.	U	F	Instructor-created exams / Quiz /

				Practical Assignment
CO3	Understand text and paragraph formatting in Latex, including insertion of numbered and bulleted lists.	U	F	Instructor-created exams / Quiz / Practical Assignment
CO4	Understand how to insert tables, pictures, table of contents and equations in latex document.	U	F	Instructor-created exams / Quiz / Practical Assignment
CO5	Understand how to prepare a presentation using Latex.	U, Ap	F	Instructor-created exams / Quiz / Practical Assignment
CO6	Acquire the skillset required for formal science communication, including knowledge about journals, presentation skills and time management.	U	C	Instructor-created exams / Quiz
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (36 +9)	Marks (50)
I		**Document structure and basic commands**	**5**	**7**
	1	Structure of a latex document: preamble, body/document environment. Creating a document by declaring its type: article, report, book, presentation (beamer), letter.	1	

	2	Options for the \documentclass command. The \title, \author, and \date commands. Creating abstract for articles: the abstract environment.	2	
	3	Starting and ending the body of our document: the \begin{document} and \end{document} commands. Splitting our document into segments: \part, \section, \subsection, \subsubsection commands. Creating numbered and non-numbered segments.	1	
	4	Optimizing space between words and sentences - quote-marks, slash marks, text mode superscript and subscript - dashes and hyphens, ellipsis, ready-made strings. font styles: bold, italic and underline text commands.	1	
Sections 5.1 - 5.3.4, 6.1, 6.3, 6.5, 6.7, 6.10, 6.12, 6.13 of Book 1				
II	**Page, text & paragraph formatting**		**9**	**13**
	5	Using Latex packages, two-sided documents, page dimensions, page size, margins, page orientation, margins, page size and rotation of a specific page, page styles, page background, multi-column pages, manual page formatting. (Chapter 16, Book1)	2	
	6	Paragraph formatting: paragraph alignment, paragraph indent and break, line spacing, manual breaks, verbatim text. Changing size of text, input encoding, escape codes. (Chapter 7, Book 1)	3	
	7	Less than (<) and greater than (>) symbols, degree symbol for temperature and math, other symbols in special environments. (Chapter 7, Book 1)	1	
	8	List Structures: itemize, enumerate, description environments. Nested lists, creating horizontal list using tasks package. (Chapter 10, Book 1).	3	
Sections 7.1 - 7.7, 10.1-10.3, 16.1 -16.13 of Book 1				
III	**Inserting pictures and tables, mathematics**		**12**	**15**
	9	Inserting table of contents.	1	
	10	Inserting pictures: The graphicx package, \includegraphics command, options for \includegraphics command: the scale, angle, options, supported image formats for compiling with pdflatex. The figure environment, captions for figures.	2	

	11	Mathematics environments, Symbols, Greek letters, Operators, Powers and indices, Fractions and Binomials, Roots, Sums and integrals, Brackets, braces and delimiters, Matrices and arrays, Adding text to equations, Formatting mathematics symbols, Colour	2	
	12	Plus and minus signs, Controlling horizontal spacing, dots in formulas, Equation numbering, Vertically aligning displayed mathematics, Indented Equations, Page breaks in math environments, Boxed Equations, Advanced formatting, Text in aligned math display, Changing font size.	2	
	13	Tables: The tabular environment, row specification, spanning, controlling table size, colors, width and stretching, table across several pages, partial vertical lines, vertically centred images, footnotes in tables, professional tables, sideways tables.	2	
	14	Presentations in Latex using Beamer: frames, title page, using presentation themes, frame customization, piece-wise presentation of slides, table and figure in presentation (21.1, 21.3.1, 21.4, 21.4.1, 21.5-21.5.6 of chapter 21, 22.1-22.1.4, 22.3 of chapter 22, Book 2). Dividing a Frame Column-Wise, Repeating Slides in Presentation, Numbering slides, Navigation buttons in beamer	3	
Sections 16.1 - 16.1.4, 21.1, 21.3.1, 21.4, 21.4.1, 21.5 - 21.5.6, 22.1 - 22.1.4, 22.3 - 22.5 of Book 2 Sections 14.1 - 14.12, 17.1 - 17.10, 18.1 - 18.1.1, 27.1 - 27.22, 28.1 - 28.12, 41.1.5 , 41.1.10 of Book 1				
IV	**Science communication**		**10**	**15**
	15	Types of Science Communications- Research Publications, Conference Proceedings, Patents, Different Types Journals, The Process of Peer Review.	1	
	16	Quality Factors of a Journal, Subscribed Journals Versus Open Access Journals, Predatory Journals, Open Access to Scientific Knowledge, Popular Science Communication	2	
	17	Parts of a Research Paper: Writing the Introduction Section, Material and Methods, Experimental Methods, Results and Discussion.	2	

	18	Tables, Graphs, Images, Analysis, Justification, Validation, Limitation and Scope, Conclusion, Conflicts of Interest, References, Abstract, Ethics of Scientific Communication, Plagiarism.	2	
	19	Presentation Skills: Effective Oral Presentation, Norms for Preparing Slides and Presenting the Same, Converting a research paper to a presentation, Time Management in a Presentation.	3	
Relevant sections from Book 3 and Book 4				
V	**Open Ended Module**		**9**	
	Advanced beamer features, Designing of book			
	Sections from References: Relevant sections from Book 1 and Book 2			

Books and References:

1. Latex, wikibooks. Free download from: https://upload.wikimedia.org/wikipedia/commons/2/2d/LaTeX.pdf (Book 1)
2. LaTeX in 24 Hours: A Practical Guide for Scientific Writing, Dilip Datta, Springer 2017.(Book 2)
3. Effective Science Communication (Second Edition), Sam Illingworth and Grant Allen, IOP
4. Science Communication: A Practical Guide, MIT OpenCourseWare, John Durant and Bina Venkataraman https://ocw.mit.edu/courses/sts-034-science-communication-a-practical-guide-fall-2011/pages/lecture-notes/

Mapping of COs with PSOs and POs :

	PSO 1	PSO 2	PSO 3	PSO4	PS O5	PSO 6	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7
CO 1	0	1	0	0	0	0	3	3	2	0	3	3	1
CO 2	0	1	0	0	0	0	3	3	2	0	3	3	1
CO 3	0	1	0	0	0	0	3	3	2	0	3	3	1
CO 4	0	1	0	0	0	0	3	3	2	0	3	3	1
CO 5	0	1	0	0	0	0	3	3	2	0	3	3	1
CO 6	0	1	0	0	0	0	3	3	2	0	3	3	1

Correlation Levels:

Level	Correlation
0	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Discussion / Seminar
- InternalTheory/Practical Exam
- Assignments /Viva
- End Semester Exam (70%)

Mapping of COs to Assessment Rubrics

	Internal Theory/ Practical Exam	Assignment /Viva	Practical Skill Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6		✓	✓	

CALICUT UNIVERSITY – FOUR-YEAR UNDER GRADUATE PROGRAMME (CU-FYUGP)

BSc APPLIED PHYSICS HONOURS

SEC2 consists of 3 hrs. of lecture and hands-on work per week.

Evaluation: Considering the nature of the SEC2 course, the internal evaluation for the 25 marks, including the 5 marks in the open ended module, may be entirely based on the performance of the student during the hands-on work and viva.

Programme	**B.Sc. Applied Physics Honours**				
Course Title	**PYTHON FOR DATA ANALYSIS**				
Type of Course	**Skill Enhancement Course 2**				
Semester	**V**				
Academic Level	**100-199**				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	-	-	45
Pre-requisites	1. Fundamentals of Programming Concepts				
Course Summary	This course explores the fundamental concepts of algorithms, control statements, functions, Numpy arrays, Matplotlib, and Seaborn for data visualization and practical application.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Demonstrate Python for data analysis, including numerical operations, file handling, control flow, functions, and NumPy arrays.	U	C	Instructor-created exams / Quiz

CO2	Understand and master Pandas functionalities for data manipulation, sorting, handling missing data, statistical analysis, time series operations, and data merging/concatenation techniques in Python.	Ap	P	Instructor-created exams / Home Assignments
CO3	Master the visualisation tools in Pandas and Seaborn libraries using physics data. Draw various plots, interpret findings, and utilise the Seaborn library for advanced visualisation techniques.	Ap	P	Seminar Presentation / Group Tutorial Work
CO4	Understand the various data file formats and learn to read and handle data files in Jupyter Notebooks, including CSV, XLS, TAB, and DAT formats.	U	C	Instructor-created exams / Home Assignments
CO5	Demonstrate problem-solving skills to solve practical physics problems by creating programs for real data analysis and utilise the different functionalities available in Pandas and Seaborn Python Packages.	Ap	P	One Minute Reflection Writing assignments/Viva Voce
CO 6	Develop skills in data manipulation and analysis using the pandas library, including dataframe creation, data wrangling, descriptive statistics, and visualization techniques using matplotlib and seaborn	Ap	P	Practical Assignment / Observation of Practical Skills
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus:

Module	Unit	Content	Hrs (36 +9)	Marks (50)
I	**Review of Python Core programme**		**9**	**12**
	1	Python - variable, operators, data types - numerical - int, float, complex - list - list operations	2	
	2	Tuples - Set - Dictionary, input(), file operations - open() - close()	2	
	3	Conditional & control statements - break & continue	2	
	4	Functions:define functions - Passing Arguments - Return Values **Demonstration/ Practical:** Write a function that accepts a list of numbers and returns the largest and smallest numbers in the list.	1	
	5	Numpy - Arrays - creation, access, array operations **Demonstration/ Practical:** Create a 3x3 NumPy array with random integers between 1 and 10. Perform and print the results of basic arithmetic operations (addition, subtraction, multiplication, division) on this array with another 3x3 array.	2	
	Sections from References: 1. Sections of Chapter 3 pages 46 - 62, Chapter 4 pages 73 - 87, Chapter 6 pages 117 - 139, Chapter 7 pages 151 - 174, Chapter 17 pages 441 - 451 of Book 1 2. Sections of Chapter 8 pages 129 - 140 of Book 2 [Topic 4 from this book]			
II	**Pandas Dataframe**		**12**	**15**
	6	Python Dataframe - Create Dataframe	1	
	7	Dataframe attributes - Pivoting dataframe - Sort - Sort by labels	2	
	8	Missing Data - fill, drop and replace missing values - Combining Data Frame - Descriptive statistics - describe() - min and max index values	3	
	9	Statistical values - count and mode function - Covariance - Correlation - Quantles - pipe() - apply()	2	

	10	Aggregation() - Grouping columns - Data wrangling - merging data - concatenating dataframes - Time series data structures **Demonstration/ Practical:** Example problem showing the operations of pandas dataframe- Illustrate the operations of table read, merge and groupby() in pandas using the data generated by charging three different capacitors using ExpEYES or the raw data of phone sensors using Phyphox/Physics Toolbox Sensor Suite app.	4	
	Sections of Chapter 5.1 - 5.11 of Book 4 https://phyphox.org/sensors/ https://www.vieyrasoftware.net/			
III	**Visualisation Tools**		**10**	**15**
	11	Importance of data Visualisation - Bar chart **Demonstration/ Practical:** practice the generation of a bar chart using the data generated for three capacitors using ExpEYES or the raw data of phone sensors using Phyphox/Physics Toolbox Sensor Suite app	2	
	12	Histogram - frequency polygon - Box plot - Scatter Plot - markers - xlabel - ylabel - title - different arguments in scatterplot **Demonstration/ Practical:** Illustrate the operations of box plot using the data generated by finding the refractive index of a convex lens by liquid lens arrangement.	2	
	13	Correlation Matrix Plot - Calculate the correlations - correlation matrix - correlation plot **Demonstration/ Practical:** Plot the values obtained from sonometer mass versus length*2. Find the correlation matrix for the graph	1	
	14	Seaborn library - features - color palette -univariate distribution plot	1	
	15	Seaborn - Histogram - density plot - Bivariate Distribution plots - hexbin plot - violin plots **Demonstration/ Practical:** Example plot using the standard data set, Iris (https://archive.ics.uci.edu/dataset/53/iris)	2	

	16	Statistical estimation - bar plot - Plotting categorical data - pair grid - Linear relationships - regplot() and implot() - Heatmap - cmap attribute - bubble chart - time series data plots	1	
	Sections 6.1 - 6.22 of Book 4			
IV	**Data File Formats**		**5**	**8**
	17	Series and Dataframes - Introducing different data file formats: csv, xls, tab, dat formats. Create Dataframe from the above mentioned format.	2	
	18	Viewing Data frame using loc and iloc - Operations on Dataframes	2	
	19	Jupyter Notebooks using Anaconda and Google Colab: introduction - Familiarization with Google Colab and Anaconda	1	
	Sections from References: Chapter 12 - Page 232 - 248 of Book 3 https://colab.google/ https://www.anaconda.com/			
V	**OPEN ENDED MODULE: Additional Training on Data Analysis**		**9**	
	Implement the following: **1. Data File Creation and File Operations:** ***Example1:*** Write a python program to generate a CSV file using the data generated from Simple Pendulum Experiment as two separate columns as Length and Period using Pandas Dataframe. **2. File Read & Plot Data:** ***Example2***: Write a Python program to read the data generated using example 1 and calculate the mean period for each pendulum length. Use Seaborn to plot a regression line and analyze the relationship between period and length. **3. Pandas merge, group by:** ***Example3***: Use the data generated by verifying Hooke's Law by measuring the relationship between the force applied to a spring and its resulting extension. Also, use different materials to see how Spring Constant changes with material properties. **4. Learn different visualisation tools in Pandas:** Plot Histogram, Barchart, Scatter plot and their functionalities **5. Learn different visualisation tools in Seaborn:**			

	Example4: Using the data generated by example3, draw the linear relationship between the force applied and extension using regplot functions.		
	Sections from References: 1. Example plots can be seen in https://www.geeksforgeeks.org/pandas-built-in-data-visualization-ml/ 2. https://www.datacamp.com/tutorial/types-of-data-plots-and-how-to-create-them-in-python 3. https://www.datacamp.com/tutorial/seaborn-python-tutorial 4. https://www.geeksforgeeks.org/data-visualisation-in-python-using-matplotlib-and-seaborn/		

Books and References:

1. *Core Python Programming* 2nd edition or higher, Dr. R. Nageswara Rao, Dreamtech press, 2020 (Book 1)
2. Python Crash Course - 3rd Edition by Eric Matthes (Book 2)
3. Machine Learning in Data Science using Python by Dr R Nageswara Rao (Book 3)
4. Data Science and Machine Learning using Python by Dr Reema Thareja (Book 4)

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	2	1	1	0	2	1	1	1	1	1	1	0
CO 2	2	1	1	0	2	1	1	1	1	1	1	0
CO 3	2	1	1	0	2	1	1	1	1	1	1	0
CO 4	1	1	1	0	2	1	1	1	1	1	1	0
CO 5	2	2	3	1	2	1	1	1	1	1	1	0
CO 6	2	2	1	1	2	1	1	1	1	1	1	0

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments/Viva
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Course Title		Database Management System				
Type of Course	**Major**	Academic Level	200 - 299			
Pre-requisites	Discrete Mathematics, Data structures and Programming Basics					
Semester	IV					
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours	
	4	3	-	2	75	
Course Summary	This course provides an introduction to database management systems. The topics covered include the concept of Database Management System, ER Model, Relational model, SQL, Database design, Transactions, concepts of other data model-NoSQL and practical session to implement Database Concepts.					

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	A comprehensive understanding of fundamental concepts in database management systems and its application	U	C	Instructor-created exams / Quiz
CO2	Understand concepts of Relational Data Model and Normalization Techniques	U	C	Instructor-created exams / Quiz
CO3	Apply principles of entity-relationship modeling and normalization techniques to design efficient and well-structured databases that meet specified requirements.	Ap	P	Practical Assignment / Observation of Practical Skills
CO4	Acquire expertise in crafting and executing SQL queries for the retrieval, updating, and manipulation	Ap	p	Practical Assignment /
	of data, showcasing adept skills in database querying and data manipulation			Observation of Practical Skills
CO5	Comprehend and apply strategies for managing transactions and implementing mechanisms for controlling concurrency, ensuring the database's consistency and reliability in environments with multiple users.	Ap	P	Practical Assignment / Observation of Practical Skills
CO6	Explore and analyze recent trends in database management systems, with a focus on unstructured databases, NoSQL technologies	An	P	Practical Assignment / Observation of Practical Skills

Detailed Syllabus:

Module	Unit	Content	Hrs	Mark
I		**Database System- Concept**	**10**	**15**
	1	Introduction, Characteristics of the Database Approach	2	

	2	Actors on the Scene, Workers behind the Scene, Advantages of Using the DBMS Approach, File system vs Database	2	
	3	Data Models, Schemas, and Instances , Three-Schema Architecture and Data Independence	3	
	4	Database Languages and Interfaces	2	
	5	Structured, Semi Structured and Unstructured Database	1	
II	**Database Design**		**14**	**20**
	6	ER Model- Basic concepts, entity set & attributes, notations	2	
	7	Relationships and constraints, cardinality, participation, notations, weak entities	2	
	8	Relational Model Concepts-Domains, Attributes, Tuples, and Relations, Values and NULLs in the Tuple	2	
	9	Relational Model Constraints and Relational Database Schemas	2	
	10	Relational Database Design- Atomic Domain and Normalization-INF, 2NF,3NF,BCNF	4	
	11	4NF,5NF	2	
III	**Query Languages**		**11**	**20**
	12	SQL-, introduction to Structured Query Language (SQL)	1	
	13	Data Definition Language (DDL), Table definitions and operations	2	
	14	SQL DML (Data Manipulation Language) - SQL queries on single and multiple tables	4	
	15	Nested queries (correlated and non-correlated), Aggregation and grouping, Views, assertions, Triggers, SQL data types.		
	16	Introduction to NoSQL Databases	2	
	17	Main characteristics of Key-value DB (examples from: Redis), Document DB (examples from: MongoDB)	2	
IV	**Transaction Processing,Concurrency Control**		**10**	**15**
	18	Transaction Processing: Introduction, Transaction and System Concepts	3	
	19	Desirable Properties of Transactions	1	
	20	Characterizing Schedules Based on Recoverability & Serializability	2	
	21	Transaction Support in SQL.	1	
	22	Introduction to Concurrency Control: Two-Phase Locking Techniques	3	
V	**DBMS LAB**		**30**	
	1	Students should decide on a case study and formulate the problem statement.	3	
	2	Based on Identified problem Statement, Design ER Diagram (Identifying entities, attributes, keys and relationships between entities, cardinalities, generalization, specialization etc.) Note: Student is required to submit a document by drawing ER Diagram to the Lab teacher.	3	
	3	Converting ER Model to Relational Model (Represent entities and relationships in Tabular form, Represent attributes as columns, identifying keys) Note: Student is required to submit a document showing the database tables created from ER Model.	2	

	4	Normalization -To remove the redundancies and anomalies in the above relational tables, Normalize up to Third Normal Form	3	
	5	Creation of Tables using SQL- Overview of using SQL tool, Data types in SQL, Creating Tables (along with Primary and Foreign keys), Altering Tables and Dropping Tables	3	
	6	Practicing DML commands-Insert, Select, Update, Delete	2	
	7	Experiment 7:Practicing Queries using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, CONSTRAINTS etc.	2	
	8	Practicing Sub queries (Nested, Correlated) and Joins (Inner, Outer and Equi).	2	
	9	Practice Queries using COUNT, SUM, AVG, MAX, MIN, GROUP BY, HAVING, VIEWS Creation and Dropping.	4	
	10	Install and Configure MongoDB to execute NoSQL Commands.	6	

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	3	2	-	-	-	-						
CO 2	3	2	1	-	-	-						
CO 3	1	-	2	3	-	-						
CO 4	-	-	-	3	3	-						
CO 5	-	-	-	3	3	-						
CO 6	-	-	-	-	2	3						

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3		✓	✓	✓
CO 4		✓	✓	✓
CO 5	✓	✓		✓
CO 6		✓	✓	✓

Text books

1. Database System Concepts (Sixth Edition) Avi Silberschatz, Henry F. Korth, S. Sudarshan McGraw-Hill 2011 ISBN 978-0071325226/ 0-07-352332-1
2. Database Management Systems, Third Edition Raghu Ramakrishnan and Johannes Gehrke McGraw-Hill ©2003 ISBN: 978-0072465631/ 0-07-246563-8

Programme	B. Sc. Computer Science				
Course Title	**Fundamentals of Python Programming**				
Type of Course	Major				
Semester	IV				
Academic Level	200 - 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	4	3	-	2	75
Pre-requisites	1. CSC2CJ101 – Fundamentals of Programming				
Course Summary	This course explores the versatility of Python language in programming and teaches the application of various data structures using Python. The course also gives an introduction to scientific computing using popular Python packages.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Understand the basic concepts of Python programming language.	U	C	Instructor-created exams / Quiz
CO2	Apply problem-solving skills using the basic constructs in Python programming	Ap	P	Coding Assignments/ Code reading and review
CO3	Apply modular programming using functions in Python	Ap	P	Coding Assignments/ Code reading and review
CO4	Analyse the various data structures and operations on it using Python	An	C	Instructor-created exams / Case studies
CO5	Apply various packages available in Python	Ap	P	Coding Assignments/ Case studies
CO5	Apply visualization tools in Python	Ap	P	Coding Assignments/ Case studies

* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)

Detailed Syllabus:

Module	Unit	Content	Hrs
I	**Fundamentals of Python (15 Marks)**		**12**
	1	Features of Python, Identifiers, Keywords, Variables, Operators, Operands, Expressions and Data types	3
	2	Precedence and Associativity, Indentation, Comments	1
	3	Input, Output and Import functions, Mathematical functions, range function, Type Conversions	1
	4	Decision-making Structures	3
	5	Looping Structures	3
	6	Control Statements	1
II	**Functions & Modules (15 Marks)**		**8**
	7	Function Definition, Function Calling, Flow of Execution, Parameters and Arguments	2
	8	Types of Function Arguments – Required, Keyword, Positional and Variable length arguments	2
	9	Scope and lifetime of variables	1
	10	Types of Functions – Recursive, Anonymous, Functions with more than one return value, Void Functions	2
	11	Built in modules, User defined modules and packages	1
III	**Data Structures in Python (20 Marks)**		**15**
	13	Strings - Indexing, Traversal, Slicing, Joining, and Splitting of Strings, Formatting Strings, Operation and Methods of Strings	5
	14	Lists- Indexing and Traversal, Slicing, Joining, and Splitting of Lists, Operations and Methods of Lists	4
	15	Tuples – Indexing and Traversal, Operations and Methods of Tuples	2
	16	Dictionaries – Accessing and Modifying *key-value* pairs in Dictionary, Operations and Methods	3
	17	Sets - Creation and Operations of Sets	1
IV	**Introduction to Scientific Computing in Python (20 Marks)**		**10**
	18	Introduction to NumPy Arrays – Advantage of NumPy Arrays, Creation of NumPy Arrays	2
	19	Computation on NumPy Arrays - Universal Functions, Broadcasting, Fancy Indexing	3
	20	Introduction to Pandas - Pandas Series and Pandas Data Frames. Series - Construction from arrays, explicit indices, and dictionaries. **Data Frames-** Construction from arrays and dictionaries.	3
	21	Introduction to Matplotlib Basic plotting - Line plots, Scatter plots, Bar plots ,Histograms and Pie charts.	2
V	**Hands-on Data Structures: Practical Applications, Case Study and Course Project**		**30**

	1	**Basics of Python** 1. Demonstrate basic data types in python using interactive Interpreter. 2. Write a Python script that reads two integers and perform all arithmetic operations on these two numbers. 3. Write a program to compute distance between two points. 4. Write a program to calculate the area of a circle. **Control Structures** 5. Write a program to check whether a number is odd or even. 6. Write a program that reads a positive integer, *n*, from the user and then displays the sum of the first n natural numbers.	20
		7. Write a Python program to check whether a given year is a leap year or not. 8. Develop a program that reads a four-digit integer from the user and displays the sum of the digits in the number. For example, if the user enters 2151 then your program should display 2+1+5+1=9. **Function** 9. Write a program to find the largest of three numbers using functions. The program should pass three numbers as arguments and should return the result. 10. Write a function to check whether a given number is prime or not. 11. Write a recursive function to find the factorial of a number. **Python Data Structures: Strings, Sets, Lists , Tuples and Dictionaries** 12. Create a program that checks whether a given string is a palindrome or not. 13. Write a program to check whether an item exists in a tuple. 14. Write a program to create intersection, union, set difference, and symmetric difference of sets. 15. Write a program to create a telephone directory using a dictionary and display its contents. Also check for a specific phone number in the dictionary. **NumPy, Pandas and Matplotlib** 16. Write a program to implement matrix multiplication using NumPy. 17. Create a pandas series from a dictionary of values, and an ndarray. 18. Write a program to draw a line plot for the given heights and weights of a group of people. height=[145,155,165,175,185,195] weight=[43, 56, 60,69, 78,95]	
	2	**Case Study**	3
	3	**Capstone (/Course) Project:** Build a practical application using any one package and demonstrate using visualization tools.	7

Mapping of COs with PSOs and POs :

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	3	-	-	-	-	-						
CO 2	2	-	2	-	1	-						
CO 3	2	-	2	1	-	-						
CO 4	1	-	1	-	-	-						
CO 5	-	2	2	2	2	2						
CO 6	-	2	2	-	2	2						

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓	✓		✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	

Reference Books:

1. Jose, Jeeva. Taming Python By Programming. Khanna Book Publishing, 2017. Print.
2. S, Gowrishankar, and A, Veena. Introduction to Python Programming. Chapman & Hall/CRC Press, 2018.
3. Downey, Allen. Think Python. Green Tea Press, 2nd ed. 2009
4. VanderPlas, Jake. Python Data Science Handbook: Essential Tools for Working with Data. United States, O'Reilly Media, 2016.
5. Stephenson, Ben. *The Python Workbook*. SPRINGER INTERNATIONAL PU, 2016.

Programme	B. Sc. Computer Science				
Course Title	Introduction to Content Management Systems				
Type of Course	VAC				
Semester	IV				
Academic Level	100-199				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours
	3	3	-	-	45
Pre-requisites	1. Familiarity with web content management systems (CMS). 2. Basic knowledge of internet technologies provides a foundation for learning web design.				
Course Summary	The course covers fundamental web design concepts including HTML and CMS principles, focusing on Drupal as a robust Content Management System. Students will learn to create and customize websites using Drupal, exploring its features such as content types, themes, and modules to build dynamic and interactive web pages.				

Course Outcomes (CO):

CO	CO Statement	Cognitive Level*	Knowledge Category#	Evaluation Tools used
CO1	Cultivate a robust understanding of web design fundamentals, laying a strong foundation for their journey into the dynamic world of digital design and development.	U	C	Assignment / Instructor-created exams / Quiz
CO2	Attain comprehensive knowledge and practical proficiency in Content Management Systems (CMS), empowering to navigate and excel in the ever-evolving landscape of digital content creation and management.	U	C	Assignment / Instructor-created exams / Quiz
CO3	Develop expertise in Drupal, a widely used CMS platform, gaining comprehensive understanding of its features, configuration, and installation processes, thus preparing them for proficient and innovative web development endeavors.	Ap	P	Practical Assignment / Instructor-created exams / Quiz
CO4	Impart a comprehensive understanding of website development using Drupal and facilitate the acquisition of expertise across various options within the Drupal ecosystem.	Ap	P	Practical Assignment / Instructor-created exams / Quiz
CO5	Gain an understanding of how to apply web design concepts to real-world scenarios, effectively designing and developing functional and aesthetically	C	P	Practical Assignment / Instructor-created exams /

	pleasing websites utilizing the Drupal CMS.			Quiz
CO6	Develop proficiency in advanced website management skills, including installing and configuring modules, managing menus, and more, to effectively navigate and optimize the functionality of websites built on the Drupal platform.	C	P	Practical Assignment / Instructor-created exams / Quiz
* - Remember (R), Understand (U), Apply (Ap), Analyse (An), Evaluate (E), Create (C) # - Factual Knowledge(F) Conceptual Knowledge (C) Procedural Knowledge (P) Metacognitive Knowledge (M)				

Detailed Syllabus

Module	Unit	Content	Hrs	Marks
I		**Introduction to Web Designing**	**8**	**10**
	1	Basics of Web Designing -World Wide Web (WWW), W3C, Web Browser	1	
	2	Web Server, Web Hosting, Web Pages	1	
	3	DNS, URL	2	
	4	Overview of HTML (Concept only) and its role in Web Development	2	
	5	Open Source S/W, Open Source vs Closed Source Software, Open Source Licenses (Concept only)	2	
II		**Introduction to CMS**	**6**	**10**
	6	Introduction to Content Management Systems (CMS) - Features of CMS	2	
	7	Web Content Management System	2	
	8	Components of Content Management System	2	
III		**Introduction to Drupal**	**10**	**15**
	10	Drupal - Features, Advantages and Disadvantages	1	
	11	Installation and Configuration	1	
	12	Content types and Field	2	
	13	Drupal Architecture	1	
	14	User Management, Managing Comments	2	
	15	Creating and Customizing Themes	3	
IV		**Building Website**	**12**	**15**
	16	Website Development - Working with Templates and Template files	2	
	17	Articles, Creating Web Forms	2	
	18	Managing blocks, Add Links to Blocks, Moving Elements within Block	2	
	19	Blocks and Regions	2	
	20	Creating and Customizing Views	1	
	21	Installing and Configuring Modules	1	
	22	Static Pages, Creating Pages, Menu Management.	2	
V		**Open Ended Module – Website Development**	**9**	
	23	Develop a simple Website using Drupal.	9	

Mapping of COs with PSOs and POs:

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PO1	PO2	PO3	PO4	PO5	PO6
CO 1	1	3	1	1	3	1						
CO 2	1	3	2	1	3	1						
CO 3	1	3	1	1	3	2						
CO 4	1	3	3	1	3	2						
CO 5	3	3	3	1	3	2						
CO 6	1	3	3	1	3	2						

Correlation Levels:

Level	Correlation
-	Nil
1	Slightly / Low
2	Moderate / Medium
3	Substantial / High

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar
- Midterm Exam
- Programming Assignments (20%)
- Final Exam (70%)

Mapping of COs to Assessment Rubrics:

	Internal Exam	Assignment	Practical Evaluation	End Semester Examinations
CO 1	✓	✓		✓
CO 2	✓	✓		✓
CO 3	✓	✓		✓
CO 4	✓	✓		✓
CO 5	✓	✓		✓
CO 6	✓	✓		✓

References:

1. Jennifer Campbell, Jennifer T Campbell, Web Design: Introductory, Course Technology.

2. Jason Beaird and Alex Walker, The Principles of Beautiful Web Design, SitePoint.

3. Bob Boiko, Content Management Bible, Wiley.

4. Daniel Sipos, Drupal 9 Module Development, Packt Publishing Limited.