

| Course Code                                                                                |     |                                                                                  |     | Course Title              |      |     |     |     |     |     | L    | T    | P    | Credits |       |  |
|--------------------------------------------------------------------------------------------|-----|----------------------------------------------------------------------------------|-----|---------------------------|------|-----|-----|-----|-----|-----|------|------|------|---------|-------|--|
| ASH-MAT-101A                                                                               |     |                                                                                  |     | Engineering Mathematics-I |      |     |     |     |     |     | 3    | 1    | 0    | 4       |       |  |
|                                                                                            |     |                                                                                  |     |                           |      |     |     |     |     |     | CIE  |      | SEE  |         | Total |  |
|                                                                                            |     |                                                                                  |     |                           |      |     |     |     |     |     | 40   |      | 60   |         | 100   |  |
| Course Outcomes                                                                            |     |                                                                                  |     |                           |      |     |     |     |     |     |      |      |      |         |       |  |
| CO1                                                                                        |     | Understand the basics of matrices and solve the system of linear equations.      |     |                           |      |     |     |     |     |     |      |      |      |         |       |  |
| CO2                                                                                        |     | Utilize the concept of Eigen Values and Eigen Vectors in matrix transformations. |     |                           |      |     |     |     |     |     |      |      |      |         |       |  |
| CO3                                                                                        |     | Apply the concepts of differential calculus in finding area and curvature.       |     |                           |      |     |     |     |     |     |      |      |      |         |       |  |
| CO4                                                                                        |     | Utilize the fundamentals of differential calculus.                               |     |                           |      |     |     |     |     |     |      |      |      |         |       |  |
| Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High) |     |                                                                                  |     |                           |      |     |     |     |     |     |      |      |      |         |       |  |
|                                                                                            |     | PO1                                                                              | PO2 | PO3                       | PO4  | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |         |       |  |
|                                                                                            | CO1 | 3                                                                                | 3   | 2                         | 3    | -   | 1   | -   | -   | 1   | -    | -    | 1    |         |       |  |
|                                                                                            | CO2 | 3                                                                                | 3   | 3                         | 2    | -   | 1   | -   | -   | 1   | -    | -    | 1    |         |       |  |
|                                                                                            | CO3 | 3                                                                                | 2   | 1                         | 1    | -   | 1   | -   | -   | 1   | -    | -    | 1    |         |       |  |
|                                                                                            | CO4 | 3                                                                                | 2   | 1                         | 1    | -   | 1   | -   | -   | 1   | -    | -    | 1    |         |       |  |
|                                                                                            | Avg | 3                                                                                | 2.5 | 1.75                      | 1.75 | -   | 1   | -   | -   | 1   | -    | -    | 1    |         |       |  |

| Content                                                                                                                                                                                                                                                                                                                                                                                      |                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| <b>Unit-1: Matrices and System of Linear Equations</b>                                                                                                                                                                                                                                                                                                                                       | <b>Contact Hours: 10</b> |
| Rank of a matrix by Echelon form and Normal form, Inverse of matrices by Gauss-Jordan method; Linearly independent and dependent vectors; System of linear equations; solving system of Homogeneous and Non-Homogeneous equations; Consistency of systems of linear equations using rank, Gauss elimination method.                                                                          |                          |
| <b>Unit-2: Eigen Values and Eigen Vectors</b>                                                                                                                                                                                                                                                                                                                                                | <b>Contact Hours: 10</b> |
| Eigen values and Eigen vectors and their properties, Linear Transformation and Orthogonal Transformation: Diagonalization of a matrix; Cayley-Hamilton theorem(without proof); application of Cayley-Hamilton theorem to find inverse and power of a matrix; Quadratic forms and Nature of the Quadratic forms; Reduction of Quadratic form to canonical forms by Orthogonal Transformation. |                          |
| <b>Unit-3: Differential Calculus-I</b>                                                                                                                                                                                                                                                                                                                                                       | <b>Contact Hours: 12</b> |
| Indeterminate form, Taylor's and Maclaurin's series, extreme values of a function, Asymptote, Curvature, Radius of Curvature for Cartesian, parametric and polar curves, Center of Curvature and Chord of Curvature, Tracing of Cartesian and Polar Curves (Standard Curves), Rolle's theorem, Lagrange's Mean value theorem and Cauchy's Mean value Theorem.                                |                          |
| <b>Unit-4: Differential Calculus-I I</b>                                                                                                                                                                                                                                                                                                                                                     | <b>Contact Hours: 12</b> |
| Beta and Gamma functions with properties, Applications of definite integrals to evaluate surface areas and volumes of revolutions of curves (Only in Cartesian coordinates), Double integral: change of order of integration, Triple integral, Application to area and volume using double and triple integral.                                                                              |                          |

**Textbooks:**

1. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43e, 2014.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9e, John Wiley & Sons, 2006.

**Other References:**

1. N. P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. Ramana B. V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 2017.

| Course Code                                                                                |     |                                                                                       |      | Course Title              |     |     |     |     |     | L    | T    | P    | Credits |       |  |
|--------------------------------------------------------------------------------------------|-----|---------------------------------------------------------------------------------------|------|---------------------------|-----|-----|-----|-----|-----|------|------|------|---------|-------|--|
| BT- CSE-101A                                                                               |     |                                                                                       |      | Problem Solving using “C” |     |     |     |     |     | 3    | 0    | 0    | 3       |       |  |
|                                                                                            |     |                                                                                       |      |                           |     |     |     |     |     | CIE  |      | SEE  |         | Total |  |
|                                                                                            |     |                                                                                       |      |                           |     |     |     |     |     | 40   |      | 60   |         | 100   |  |
| Course Outcomes                                                                            |     |                                                                                       |      |                           |     |     |     |     |     |      |      |      |         |       |  |
| CO1                                                                                        |     | Explain the elements of computer system and various problem-solving techniques        |      |                           |     |     |     |     |     |      |      |      |         |       |  |
| CO2                                                                                        |     | Apply knowledge of C operators and control statements to solve computational problems |      |                           |     |     |     |     |     |      |      |      |         |       |  |
| CO3                                                                                        |     | Develop and implement functions in C to enhance code modularity and reusability       |      |                           |     |     |     |     |     |      |      |      |         |       |  |
| CO4                                                                                        |     | Analyze and handle arrays effectively in C programs                                   |      |                           |     |     |     |     |     |      |      |      |         |       |  |
| CO5                                                                                        |     | Utilize Structures, Union and Pointers for data manipulation and analysis tasks       |      |                           |     |     |     |     |     |      |      |      |         |       |  |
| CO6                                                                                        |     | Design and discuss the file manipulation techniques                                   |      |                           |     |     |     |     |     |      |      |      |         |       |  |
| Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High) |     |                                                                                       |      |                           |     |     |     |     |     |      |      |      |         |       |  |
|                                                                                            | PO1 | PO2                                                                                   | PO3  | PO4                       | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1    | PSO2  |  |
| CO1                                                                                        | 3   | 1                                                                                     | 2    | -                         | -   | -   | -   | -   | 1   | -    | -    | -    |         |       |  |
| CO2                                                                                        | 3   | -                                                                                     | 2    | -                         | -   | -   | -   | -   | -   | -    | -    | 2    | 2       |       |  |
| CO3                                                                                        | 3   | 2                                                                                     | 2    | 2                         | 1   | 1   | 1   | 1   | 1   | 1    | -    | 2    | 2       |       |  |
| CO4                                                                                        | 3   | 2                                                                                     | 3    | 2                         | 1   | 1   | 1   | -   | 2   | 1    | 2    | -    | 2       | 2     |  |
| CO5                                                                                        | 3   | 2                                                                                     | 2    | 2                         | 1   | 1   | 1   | 1   | 2   | 1    | 2    | 2    | 2       | 2     |  |
| CO6                                                                                        | 3   | 2                                                                                     | 3    | 2                         | 1   | 1   | 1   | 1   | 2   | 1    | 2    | 2    | 2       | 2     |  |
| Avg                                                                                        | 3   | 1.8                                                                                   | 2.33 | 2                         | 1   | 1   | 1   | 1   | 1.6 | 1    | 2    | 2    | 2       | 2     |  |

| Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
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| <b>Unit-1: Introduction</b> <span style="float: right;"><b>Contact Hours: 08</b></span><br><b>Overview of Computers:</b> Block diagram and its description.<br><b>Computer Hardware:</b> Printers, keyboard, mouse, storage devices.<br><b>Number systems:</b> Binary, octal, hexadecimal number system, arithmetic of number systems.<br><b>Introduction to programming language:</b> Different levels - high level language, assembly language, machine language; introduction to compiler, interpreter, debugger, linker, loader, and assembler.<br><b>Problem Analysis:</b> Problem solving techniques, algorithms, pseudocode and flowchart representation. |
| <b>Unit-2: Token, Operators and Decision making</b> <span style="float: right;"><b>Contact Hours: 10</b></span><br><b>Overview of C:</b> Elements of C, data types, storage classes in C.<br><b>Operators:</b> Arithmetic, relational, logical, bitwise, unary, assignment and conditional operators, precedence and associativity of operators.<br><b>Input/output:</b> Unformatted and formatted I/O function in C.<br><b>Control statements:</b> If statement, switch statement, for, while, and do-while loop; break, continue, go to statements.                                                                                                            |
| <b>Unit-3: Handling Arrays and Functions in C</b> <span style="float: right;"><b>Contact Hours: 08</b></span><br><b>Functions:</b> Definition, prototype, parameters passing techniques, recursion, built-in functions, passing arrays to functions, returning arrays from functions.                                                                                                                                                                                                                                                                                                                                                                            |

|                                                                                                                                                     |                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| <b>Arrays:</b> Definition, types, initialization, processing an array, string handling.                                                             |                          |
| <b>Unit-4: Pointers and Data files</b>                                                                                                              | <b>Contact Hours: 10</b> |
| <b>Structure &amp; Union:</b> Definition, use of structure, passing structures to functions, typedef with structure, use of union.                  |                          |
| <b>Pointers:</b> Declaration, operations on pointers, pointers and arrays, dynamic memory allocation, pointers and functions, pointers and strings. |                          |
| <b>File handling in C:</b> Creating, opening and closing a file, I/O operations on files.                                                           |                          |

### Textbooks:

1. Programming in ANSI C, E Balagurusamy, McGraw Hill Education (India) Private Limited, 8e, 2019.
2. Computer Basics and C Programming, Rajaraman V, Prentice Hall of India, 2007.
3. C Programming Language, 2e, Brian W. Kernighan, Dennis M. Ritchie, Pearson, 2015.

### Other References:

1. Computer Fundamentals and programming in C, Reema Thareja, 2e, Oxford University Press.
2. Computer Science: A Structured Programming Approach Using C, Behrouz A. Forouzan, Richard F. Gilbert, 3e, Cengage Learning, 2007.
3. Programming in C, Ashok Kamthane, 3e, Pearson Education India, 2011.
4. Let us C, Yashant Kanetkar, 18e, BPB Publications, 2021.
5. Basic Computation & Programming with C, Subrata Saha, Subhodip Mukherjee, Cambridge Univ. Press, 2016.
6. Programming in C - A Practical Approach, Ajay Mittal, Pearson, 2010.

| Course Code                                                                                |     |                                                                        |     | Course Title                                     |      |     |     |     |     |      | L    | T    | P    | Credits |  |
|--------------------------------------------------------------------------------------------|-----|------------------------------------------------------------------------|-----|--------------------------------------------------|------|-----|-----|-----|-----|------|------|------|------|---------|--|
| BT-ECE-102A                                                                                |     |                                                                        |     | Basics of Electrical and Electronics Engineering |      |     |     |     |     |      | 3    | 1    | 0    | 4       |  |
|                                                                                            |     |                                                                        |     |                                                  |      |     |     |     |     |      | CIE  | SEE  |      | Total   |  |
|                                                                                            |     |                                                                        |     |                                                  |      |     |     |     |     |      | 40   | 60   |      | 100     |  |
| Course Outcomes                                                                            |     |                                                                        |     |                                                  |      |     |     |     |     |      |      |      |      |         |  |
| CO1                                                                                        |     | Demonstrate an understanding of the concepts of semiconductor devices. |     |                                                  |      |     |     |     |     |      |      |      |      |         |  |
| CO2                                                                                        |     | Make use of AC fundamentals and solve series and parallel AC circuits. |     |                                                  |      |     |     |     |     |      |      |      |      |         |  |
| CO3                                                                                        |     | Understand and work with single phase transformers and DC Motors.      |     |                                                  |      |     |     |     |     |      |      |      |      |         |  |
| CO4                                                                                        |     | Demonstrate and understanding the concepts of semiconductor devices.   |     |                                                  |      |     |     |     |     |      |      |      |      |         |  |
| Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High) |     |                                                                        |     |                                                  |      |     |     |     |     |      |      |      |      |         |  |
|                                                                                            | PO1 | PO2                                                                    | PO3 | PO4                                              | PO5  | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2    |  |
| CO1                                                                                        | 3   | 3                                                                      | 2   | 2                                                | 1    | -   | -   | -   | -   | -    | -    | 1    | -    | -       |  |
| CO2                                                                                        | 3   | 3                                                                      | 2   | 2                                                | 2    | -   | -   | -   | -   | -    | -    | 1    | -    | -       |  |
| CO3                                                                                        | 3   | 2                                                                      | 2   | 1                                                | 2    | -   | -   | -   | -   | -    | -    | 1    | -    | -       |  |
| CO4                                                                                        | 3   | 2                                                                      | 2   | 1                                                | 2    | -   | -   | -   | -   | -    | -    | 1    | -    | -       |  |
| Avg                                                                                        | 3   | 2.5                                                                    | 2   | 1.5                                              | 1.75 | -   | -   | -   | -   | -    | -    | 1    | -    | -       |  |

| Content                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
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| <b>Unit-1: Electric Circuits</b> <span style="float: right;"><b>Contact Hours: 12</b></span>                                                                                                                                                                                                                                                                                                                                                                      |
| <p><b>DC Circuit Analysis:</b> Electrical circuit elements (R, L and C), voltage and current sources, Laws: Ohm's law, voltage and current division rule, Kirchhoff's Current and Voltage laws, Series &amp; parallel circuits, Star-Delta and Delta-Star conversions, Mesh and Nodal Analysis.</p> <p><b>Network Theorems:</b> Superposition theorem, Thevenin's theorem, Norton's Theorem, duality, reciprocity theorem and maximum power transfer theorem.</p> |
| <b>Unit-2: AC Fundamentals &amp; AC Circuit</b> <span style="float: right;"><b>Contact Hours: 11</b></span>                                                                                                                                                                                                                                                                                                                                                       |
| <p><b>AC signal;</b> Average and RMS values of sinusoidal AC; polar &amp; rectangular forms of representation of phasor quantities. Addition &amp; subtraction of two or more sinusoidal quantities using the component resolution method/ phasors.</p> <p><b>RLC Circuits:</b> Steady-state AC response of R/L/C, RL, RC series and parallel circuits, P.F.; active, reactive &amp; apparent powers.</p>                                                         |
| <b>Unit-3: Transformer and DC Motors</b> <span style="float: right;"><b>Contact Hours: 11</b></span>                                                                                                                                                                                                                                                                                                                                                              |
| <p><b>Single phase transformer (only qualitative analysis):</b> Working Principle, Construction, Emf equation, Losses in a transformer, Maximum efficiency condition.</p>                                                                                                                                                                                                                                                                                         |

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| <b>DC motor characteristics:</b> Constructional parts & principles of working of DC Machines, Generated and back EMF, Types of DC machines, Speed Control of DC shunt Motor, braking of dc motors, four quadrant operation of DC motor, applications.                                                                                                                                                                                                                                                                                                         |                          |
| <b>Unit-4: Semiconductor Devices and Applications</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>Contact Hours: 10</b> |
| <p><b>PN Junction Diode:</b> Active and passive components, Introduction of Semiconductors, doping, PN junction diode, breakdown, barrier potential, diode as a switch, Basic rectifier circuits: half wave and full wave, Zener diode, Voltage regulator using Zener Diode, Avalanche diode.</p> <p><b>Bipolar Junction Transistor:</b> Different types of transistors, Principle of Operation of transistor, Input and Output characteristics of Common Emitter, Common Base and Common Collector Configurations, Transistor as a switch and amplifier.</p> |                          |

### Text Books:

1. Charles K. Alexander, Matthew N. O. Sadiku, "Fundamentals of Electric Circuits", McGraw Hill Education, 6<sup>th</sup> Edition, 2019.
2. B.L. Theraja, A. K. Theraja, "A Textbook of Electrical Technology", S Chand Publication, 23<sup>rd</sup> Edition, 1959.
3. Vijay Kumar Garg, "Basic Electrical Engg: A complete Solution", Wiley India Ltd, 1<sup>st</sup> Edition, 2017.
4. S Salivahanan, N Naresh Kumar, "Electronics devices and circuits", McGraw Hill, 4<sup>th</sup> Edition, 2017.
5. Vincent Del Toro, "Electrical Engineering Fundamentals", Pearson, 2<sup>st</sup> Edition, 2015.
6. N N Bhargava, "Basic Electronics and Linear Circuits", McGraw Hill, 2<sup>nd</sup> Edition, 2017.
7. Joseph A. Edminister, "Schaum's Outline of Electric Circuits", McGraw Hill, 7<sup>th</sup> Edition, 2018.

### Other References:

1. Rajendra Prasad, "Electrical Engg. Fundamentals", PHI Pub, 1<sup>st</sup> Edition, 2017.
2. Millman, Halkias, "Integrated Electronics", TMH, 2<sup>nd</sup> Edition, 2017.
3. Boylestad, Nashelsky, "Electronic Devices & Circuit Theory", PHI, 11<sup>th</sup> Edition, 2015.

| Course Code                                                                                |                                                                                                                                                                                             | Course Title          |     |     |     |      |      |     |     | L    | T    | P    | Credits |      |
|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----|-----|-----|------|------|-----|-----|------|------|------|---------|------|
| ASH-CHE-108A                                                                               |                                                                                                                                                                                             | Engineering Chemistry |     |     |     |      |      |     |     | 3    | 1    | 0    | 4       |      |
|                                                                                            |                                                                                                                                                                                             |                       |     |     |     |      |      |     |     | CIE  | SEE  |      | Total   |      |
|                                                                                            |                                                                                                                                                                                             |                       |     |     |     |      |      |     |     | 40   | 60   |      | 100     |      |
| Course Outcomes                                                                            |                                                                                                                                                                                             |                       |     |     |     |      |      |     |     |      |      |      |         |      |
| CO1                                                                                        | Develop an understanding of various water impurities, key water quality parameters, and the methods for treating water to meet desired standards.                                           |                       |     |     |     |      |      |     |     |      |      |      |         |      |
| CO2                                                                                        | Understand the key characteristics of different fuels and their estimation methods, along with the types of corrosion and their control measures in industrial and environmental contexts.  |                       |     |     |     |      |      |     |     |      |      |      |         |      |
| CO3                                                                                        | Understand the fundamental principles, instrumentation, and applications of spectroscopic techniques.                                                                                       |                       |     |     |     |      |      |     |     |      |      |      |         |      |
| CO4                                                                                        | Explore the principles and apply various green chemistry techniques, alternative solvents, and the chemical structure of polymers in industrial processes and environmental sustainability. |                       |     |     |     |      |      |     |     |      |      |      |         |      |
| Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High) |                                                                                                                                                                                             |                       |     |     |     |      |      |     |     |      |      |      |         |      |
|                                                                                            | PO1                                                                                                                                                                                         | PO2                   | PO3 | PO4 | PO5 | PO6  | PO7  | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1    | PSO2 |
| CO1                                                                                        | 3                                                                                                                                                                                           | 3                     | 2   | 3   | 1   | 2    | 2    | -   | -   | -    | -    | 2    |         |      |
| CO2                                                                                        | 3                                                                                                                                                                                           | 3                     | 2   | 3   | 1   | 2    | 2    | -   | -   | -    | -    | 2    |         |      |
| CO3                                                                                        | 3                                                                                                                                                                                           | 3                     | 3   | 3   | 2   | 2    | 2    | -   | -   | -    | -    | 3    |         |      |
| CO4                                                                                        | 3                                                                                                                                                                                           | 3                     | 3   | 3   | 2   | 3    | 3    | 2   | -   | -    | -    | 3    |         |      |
| Avg                                                                                        | 3                                                                                                                                                                                           | 3                     | 2.5 | 3   | 1.5 | 2.25 | 2.25 | 2   | -   | -    | -    | 2.5  |         |      |

| Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
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| <b>Unit-1: Water Treatment</b> <span style="float: right;"><b>Contact Hours: 10</b></span>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Hardness, types of hardness, units and interconversions of units, estimation of hardness by EDTA method, alkalinity & its determination, numerical problems based on EDTA method & alkalinity, scale and sludge formation, disadvantages, and its prevention. Water softening methods-Lime-Soda process, ion-exchange method, desalination of water - reverse osmosis and electrodialysis, related numerical problems based on Lime-Soda process.                                                                                                                                                                                                                                                                                                |
| <b>Unit-2: Fuels, Combustion and Corrosion</b> <span style="float: right;"><b>Contact Hours: 11</b></span>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Fuels and Combustion: Definition, classification (solid fuels, liquid fuels, gaseous fuels) characteristics of a good fuel. Calorific value, gross and net calorific value, determination of calorific value by Bomb Calorimeter, ranking of coal, analysis of coal by proximate and ultimate analysis method, Flash Point and Fire Point of the liquid fuel. Numerical problems.<br>Corrosion: Introduction, classification, dry or chemical corrosion, wet corrosion or electrochemical corrosion, galvanic corrosion, differential aeration corrosion, pitting Corrosion, waterline corrosion, stress corrosion. Factor affecting corrosion. Corrosion control by proper designing, sacrificial anodic protection method, protective coating. |

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| <b>Unit-3: Spectroscopic Technique and Application</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Contact Hours: 10</b> |
| Introduction, types, principles of Spectroscopy and selection rule, electronic spectroscopy (UV-Visible spectroscopy)- Lambert- Beer Law, Different electronic transition levels, principle, instrumentation, and applications of UV spectroscopy. Fluorescence spectroscopy, nuclear magnetic resonance (NMR) spectroscopy- shielding and deshielding of protons, chemical shift, applications of NMR spectrum (MRI).                                                                                                                                                                               |                          |
| <b>Unit-4: Material Chemistry and Green Chemistry</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Contact Hours: 10</b> |
| <b>Polymers:</b> Introduction, classification, preparation, properties, and Industrial application of thermoplastic (Teflon, Polyethylene), thermosetting plastic (UF resin, Phenol Formaldehyde Resin), Polymeric composites, biodegradable polymer (PHBV) conducting polymer (polyacetylene), inorganic polymer (silicone), Environmental impact of polymers on society. <b>Green Chemistry:</b> Introduction, twelve basic principles of green chemistry, use of alternative feedstock in biofuel production, various biodiesel production methods, alternative solvents used in green chemistry. |                          |

### Text Books:

1. A Text Book of Engineering Chemistry, Shashi Chawla, Dhanpat Rai & Co., 2017
2. Chemistry for Engineers, B K Ambasta, University Science Press, Laxmi Publications Pvt. Ltd., 2012
3. Engineering Chemistry, Jain & Jain, Dhanpat Rai Publishing Co., 2020
4. Engineering Chemistry, O G Palanna, McGrawHill, 2017

### Other References:

1. Chemistry in Engineering and Technology - Vol. 1 & 2, J.C. Kuriacose, J. Rajaram, McGraw Hill Education, 2001
2. Instrumental Methods of Analysis, Willard Merritt, CBS, 2004
3. Physical Chemistry, Peter Atkins, Julio de Paula, James Keeler, Oxford University Press, 2018



| Course Code  | Course Title                   | L   | T   | P     | Credits |
|--------------|--------------------------------|-----|-----|-------|---------|
| ASH-HUM-106A | Basics of Communication Skills | 2   | 0   | 0     | 2       |
|              |                                | CIE | SEE | Total |         |
|              |                                | 40  | 60  | 100   |         |

#### Course Outcomes

|     |                                                                                                                    |
|-----|--------------------------------------------------------------------------------------------------------------------|
| CO1 | Develop their listening skills by practicing active listening techniques and overcoming common listening barriers. |
| CO2 | Demonstrate speaking skills in various contexts, overcoming communication barriers. .                              |
| CO3 | Analyse to comprehend main ideas and implications effectively.                                                     |
| CO4 | Produce clear, effective writing across various genres, applying strategies to avoid redundancy and cliches        |

#### Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9  | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | -   | -   | -   | -   | -   | -   | -   | 1   | 3    | 3    | -    | 3    | -    | -    |
| CO2 | -   | -   | -   | -   | -   | -   | -   | 2   | 3    | 3    | -    | 3    | -    | -    |
| CO3 | -   | -   | -   | -   | -   | -   | -   | 3   | 2    | 3    | -    | 2    | -    | -    |
| CO4 | -   | -   | -   | -   | -   | -   | -   | 2   | 1    | 3    | -    | 3    | -    | -    |
| Avg | -   | -   | -   | -   | -   | -   | -   | 2   | 2.25 | 3    | -    | 2.75 | -    | -    |

| Content                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Unit-1 Listening Skills</b> <span style="float: right;"><b>Contact Hours: 06</b></span>                                                                                                                                                                                                                                                                                                                                |
| Types of Listening, Active Listening: Gathering the main idea, sequencing, Note-making, Summarizing, Paraphrasing, Asking questions, Barriers of Listening ,Strategies for Effective Listening                                                                                                                                                                                                                            |
| <b>Unit-2 Speaking Skills</b> <span style="float: right;"><b>Contact Hours: 06</b></span>                                                                                                                                                                                                                                                                                                                                 |
| Essentials of Speaking skills: Confidence, Brevity, pronunciation, appropriate vocabulary, Clarity, tone, pace, body language (gestures), facial expressions, Speaking in different situations: Everyday situations, Academic (in classroom, before seniors, teachers etc.) , Public speaking, Participating in debates and discussions, Storytelling, Barriers to effective speaking ,Strategies for Effective Speaking. |
| <b>Unit-3 Reading Skills</b> <span style="float: right;"><b>Contact Hours: 06</b></span>                                                                                                                                                                                                                                                                                                                                  |
| Types of Reading: Skimming, Scanning, comprehending the main idea, understanding implications, analysing, Strategies for Effective Reading <ul style="list-style-type: none"> <li>Flowers for Algernon by Daniel Keyes(Case Study)</li> <li>Of Studies by Francis Bacon(Essay)</li> <li>The Proposal by Anton Chekov(One Act Play)</li> <li>Toba Tek Singh by Saadat Hasan Manto(Short Story)</li> </ul>                  |

|                                                                                                                                                                                                                                                           |                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| <b>Unit-4 Writing Skills</b>                                                                                                                                                                                                                              | <b>Contact Hours: 06</b> |
| Types of Writing: Descriptive, Narrative, Expository , Argumentative & Persuasive and Creative Writing, Redundancy and cliché in Writing, Strategies for Effective Writing, Writing messages, mails, blogs, editorial, assignments, Critical reviews etc. |                          |

### **Text Books:**

1. Technical Communication Principles and Practice by Meenakshi Raman and Sangeeta Sharma  
by Oxford Publication

### **Reference Books:**

1. On Writing Well. William Zinsser. Harper Resource Book. 2000.
2. Technical Communication. John Wiley. Wiley India Pvt. Ltd.
3. Communication Skills for Engineers by C. Muralikrishna and Sunita Mishra, Pearson Pub
4. Communication Skills Training, Iantuhovsky, Createspace Independent Pub, 2015.

| Course Code                                                                                |     |                                                                           |     | Course Title                                                                                   |     |     |     |     |     |      | L    | T    | P    | Credits |  |
|--------------------------------------------------------------------------------------------|-----|---------------------------------------------------------------------------|-----|------------------------------------------------------------------------------------------------|-----|-----|-----|-----|-----|------|------|------|------|---------|--|
| BT-CSE-171A                                                                                |     |                                                                           |     | Problem Solving using “C” Lab<br>(Lab based on the theory subject – Problem Solving using “C”) |     |     |     |     |     |      | 0    | 0    | 2    | 1       |  |
|                                                                                            |     |                                                                           |     |                                                                                                |     |     |     |     |     |      | CIE  | SEE  |      | Total   |  |
|                                                                                            |     |                                                                           |     |                                                                                                |     |     |     |     |     |      | 50   | 50   |      | 100     |  |
| Course Outcomes                                                                            |     |                                                                           |     |                                                                                                |     |     |     |     |     |      |      |      |      |         |  |
| CO1                                                                                        |     | Implement programs to familiarize with C programming.                     |     |                                                                                                |     |     |     |     |     |      |      |      |      |         |  |
| CO2                                                                                        |     | Develop programs based on control statements.                             |     |                                                                                                |     |     |     |     |     |      |      |      |      |         |  |
| CO3                                                                                        |     | Develop and utilize functions to modularize code and improve reusability. |     |                                                                                                |     |     |     |     |     |      |      |      |      |         |  |
| CO4                                                                                        |     | Implement data structures such as array, strings.                         |     |                                                                                                |     |     |     |     |     |      |      |      |      |         |  |
| CO5                                                                                        |     | Design programs exploring structures, union and pointers.                 |     |                                                                                                |     |     |     |     |     |      |      |      |      |         |  |
| CO6                                                                                        |     | Design and implement the file manipulation techniques.                    |     |                                                                                                |     |     |     |     |     |      |      |      |      |         |  |
| Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High) |     |                                                                           |     |                                                                                                |     |     |     |     |     |      |      |      |      |         |  |
|                                                                                            | PO1 | PO2                                                                       | PO3 | PO4                                                                                            | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2    |  |
| CO1                                                                                        | 3   | 1                                                                         | 2   | -                                                                                              | -   | -   | -   | -   | 1   | -    | -    | -    | -    | -       |  |
| CO2                                                                                        | 3   | 1                                                                         | 2   | -                                                                                              | 1   | -   | -   | -   | 1   | 1    | -    | 2    | 2    | -       |  |
| CO3                                                                                        | 3   | 2                                                                         | 2   | 2                                                                                              | 1   | 1   | 1   | -   | 1   | 1    | -    | 2    | 2    | -       |  |
| CO4                                                                                        | 3   | 2                                                                         | 3   | 2                                                                                              | 1   | 1   | 1   | 1   | 2   | 1    | 2    | -    | 2    | 2       |  |
| CO5                                                                                        | 3   | 2                                                                         | 3   | 2                                                                                              | 1   | 1   | 1   | 1   | 2   | 1    | 2    | 2    | 2    | 2       |  |
| CO6                                                                                        | 3   | 2                                                                         | 3   | 2                                                                                              | 1   | 1   | 1   | 1   | 2   | 2    | 2    | 2    | 2    | 2       |  |
| Avg                                                                                        | 3   | 1.66                                                                      | 2.5 | 2                                                                                              | 1   | 1   | 1   | 1   | 1.5 | 1.2  | 2    | 2    | 2    | 2       |  |

### List of Experiments

|                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------|
| 1. Write a program to find area of a circle.                                                                       |
| 2. Write a program to swap two numbers with and without using a third variable.                                    |
| 3. Write a program to find the sum of individual digits of a positive integer.                                     |
| 4. Write a program to generate all the prime numbers between 1 and $n$ , where $n$ is the input given by the user. |
| 5. Write a function to generate Pascal's triangle.                                                                 |
| 6. Write a program to find the roots of a quadratic equation.                                                      |
| 7. Program to calculate the sum of first $n$ natural numbers.                                                      |
| 8. Write a program to print different pyramid patterns.                                                            |
| 9. Write programs to find the factorial of a given integer by using both recursive and non-recursive functions.    |
| 10. Write a program to implement user defined function.                                                            |
| 11. Write a program to generate the first $n$ terms of the Fibonacci sequence.                                     |

|                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------|
| 12. Write a program to calculate the following series without pow() function $x - x^3/3! + x^5/5! - x^7/7! \dots x^n/n!$ |
| 13. Write a program for addition of two matrices.                                                                        |
| 14. Write a program for calculating transpose of a matrix.                                                               |
| 15. Write a program for matrix multiplication by checking compatibility.                                                 |
| 16. Write a program to concatenate two strings.                                                                          |
| 17. Write a program to implement Structure for storing information of a student.                                         |
| 18. Write a program to implement Union.                                                                                  |
| 19. Write a program to print the element of array using pointers.                                                        |
| 20. Write a program to print the elements of a structure using pointers.                                                 |
| 21. Write a program to explore malloc and calloc.                                                                        |
| 22. Write a program to create a file.                                                                                    |
| 23. Write a program which copies one file to another.                                                                    |
| 24. Write a program that counts the number of characters and number of lines in a text file.                             |
| 25. Write a program that changes every 5th character of data file into uppercase.                                        |

**Note:** *Students must conduct at least eighteen experiments covering all COs.*

| Course Code                                                                                |     |                                                                                                                               |     | Course Title                                         |      |     |     |     |     |      | L    | T        | P    | Credits |       |  |
|--------------------------------------------------------------------------------------------|-----|-------------------------------------------------------------------------------------------------------------------------------|-----|------------------------------------------------------|------|-----|-----|-----|-----|------|------|----------|------|---------|-------|--|
| BT-ECE-172A                                                                                |     |                                                                                                                               |     | Basics of Electrical and Electronics Engineering Lab |      |     |     |     |     |      | 0    | 0        | 2    | 1       |       |  |
|                                                                                            |     |                                                                                                                               |     |                                                      |      |     |     |     |     |      | CIE  |          | SEE  |         | Total |  |
|                                                                                            |     |                                                                                                                               |     |                                                      |      |     |     |     |     |      | 50   |          | 50   |         | 100   |  |
| Course Outcomes                                                                            |     |                                                                                                                               |     |                                                      |      |     |     |     |     |      |      |          |      |         |       |  |
| CO1                                                                                        |     | Apply basic electrical laws & theorems to solve DC circuits.                                                                  |     |                                                      |      |     |     |     |     |      |      |          |      |         |       |  |
| CO2                                                                                        |     | Make use of AC fundamentals & basic mathematical principles to solve AC circuits.                                             |     |                                                      |      |     |     |     |     |      |      |          |      |         |       |  |
| CO3                                                                                        |     | Examine O.C. and S.C. tests, load vs. efficiency calculation of single-phase transformers and speed control of the DC motors. |     |                                                      |      |     |     |     |     |      |      |          |      |         |       |  |
| CO4                                                                                        |     | Examine the VI characteristics of various diodes such as p-n diode, Zener diode and input/output characteristics of BJT's.    |     |                                                      |      |     |     |     |     |      |      |          |      |         |       |  |
| Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High) |     |                                                                                                                               |     |                                                      |      |     |     |     |     |      |      |          |      |         |       |  |
|                                                                                            | PO1 | PO2                                                                                                                           | PO3 | PO4                                                  | PO5  | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO1<br>2 | PSO1 | PSO2    |       |  |
| CO1                                                                                        | 3   | 3                                                                                                                             | 2   | 2                                                    | 1    | -   | -   | -   | -   | -    | -    | 1        | -    | -       |       |  |
| CO2                                                                                        | 3   | 3                                                                                                                             | 2   | 2                                                    | 2    | -   | -   | -   | -   | -    | -    | 1        | -    | -       |       |  |
| CO3                                                                                        | 3   | 2                                                                                                                             | 2   | 1                                                    | 2    | -   | -   | -   | -   | -    | -    | 1        | -    | -       |       |  |
| CO4                                                                                        | 3   | 2                                                                                                                             | 2   | 1                                                    | 2    | -   | -   | -   | -   | -    | -    | 1        | -    | -       |       |  |
| Avg                                                                                        | 3   | 2.5                                                                                                                           | 2   | 1.5                                                  | 1.75 | -   | -   | -   | -   | -    | -    | 1        | -    | -       |       |  |

### List of Experiments

|                                                                                                                                                                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. To verify KVL and KCL.                                                                                                                                                                                                                           |
| 2. To verify the Superposition theorem on a linear circuit with at least one voltage & one current source.                                                                                                                                          |
| 3. To verify Thevenin's Theorem on a linear circuit with at least one voltage & one current source.                                                                                                                                                 |
| 4. To verify Norton's Theorem on a linear circuit with at least one voltage & one current source.                                                                                                                                                   |
| 5. To study frequency response characteristics of a series R-L-C circuit on CRO and determine BW, resonant frequency & maximum current.                                                                                                             |
| 6. To study frequency response characteristics of a parallel R-L-C circuit on CRO and determine resonant frequency & minimum current.                                                                                                               |
| 7. To perform O.C. and S.C. tests on a single-phase transformer to determine core losses and copper losses.                                                                                                                                         |
| 8. To perform a direct load test on a single-phase transformer and plot load v/s efficiency characteristics.                                                                                                                                        |
| 9. To perform speed control of the DC shunt motor.                                                                                                                                                                                                  |
| 10. Identification, Specifications, Testing of R, L, C Components (Color Codes), Bread Boards, Diodes, BJTs, JFETs, MOSFETs, Power Transistors, SCRs and LEDs.                                                                                      |
| 11. To study the operation of Digital Multi Meter, Function / Signal Generator, Regulated Power Supply (RPS), Cathode Ray Oscilloscopes/ Digital storage oscilloscope; Amplitude, Phase and Frequency measurement of Sinusoidal Signals on CRO/DSO. |
| 12. To study & perform the Experimental Verification of V-I characteristics of PN- diode in forward and reverse bias & study of various parameters of diode like threshold voltage and breakdown voltage etc.                                       |

|                                                                                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13. To study & perform the Experimental Verification of V-I characteristics of Zener Diode.                                                                         |
| 14. To study & perform the experimental verification of the input and output characteristics of BJT in common-base configuration & calculate all its parameters.    |
| 15. To study & perform the experimental verification of the input and output characteristics of BJT in common-emitter configuration & calculate all its parameters. |

**Note:** *Students must conduct at least ten experiments covering all COs.*

| Course Code | Course Title              | L   | T   | P | Credits |
|-------------|---------------------------|-----|-----|---|---------|
| BT-ASH-158A | Engineering Chemistry Lab | 0   | 0   | 2 | 1       |
|             |                           | CIE | SEE |   | Total   |
|             |                           | 50  | 50  |   | 100     |

#### Course Outcomes

|     |                                                                                                                   |
|-----|-------------------------------------------------------------------------------------------------------------------|
| CO1 | Assess water quality and its suitability for industrial and domestic purposes                                     |
| CO2 | Assess the quality and combustion properties of the given fuel sample.                                            |
| CO3 | Assess the corrosion resistance of different metals and alloys                                                    |
| CO4 | Apply spectroscopic technique to determine the required concentration in a sample.                                |
| CO5 | Understand the principles and challenges involved in synthesizing the polymeric molecules and their stabilization |
| CO6 | Estimate a few physical/chemical properties of different samples/solutions.                                       |
| CO7 | Calculate the strength of an acid solution using a conductometric and pH meter approach.                          |

#### Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

|     | PO1 | PO2 | PO3 | PO4 | PO5  | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3   | 3   | 2   | 3   | 2    | 2   | 2   | -   | -   | -    | -    | 2    | -    | -    |
| CO2 | 3   | 3   | 2   | 3   | 1    | 1   | 2   | -   | -   | -    | -    | 2    | -    | -    |
| CO3 | 3   | 3   | 2   | 3   | 2    | 2   | 2   | -   | -   | -    | -    | 2    | -    | -    |
| CO4 | 3   | 3   | 3   | 3   | 2    | 2   | 3   | -   | -   | -    | -    | 3    | -    | -    |
| CO5 | 3   | 3   | 3   | 3   | 2    | 3   | 3   | -   | -   | -    | -    | 3    | -    | -    |
| CO6 | 3   | 3   | 3   | 3   | 2    | 2   | 2   | -   | -   | -    | -    | 2    | -    | -    |
| CO7 | 3   | 3   | 3   | 3   | 2    | 2   | 2   | -   | -   | -    | -    | 2    | -    | -    |
| Avg | 3   | 3   | 2.5 | 3   | 1.85 | 2   | 2.2 | -   | -   | -    | -    | 2.28 | -    | -    |

#### List of Experiments

|    |                                                                         |
|----|-------------------------------------------------------------------------|
| 1. | To determine the total hardness of given water sample by EDTA method.   |
| 2. | Determination of alkalinity of water sample.                            |
| 3. | Determination of surface tension of given liquid by drop number method. |
| 4. | Determine the viscosity of given liquid by using Ostwald's viscometer.  |
| 5. | Determination of chloride content in given water sample.                |
| 6. | Proximate analysis of a sample of Coal.                                 |

|     |                                                                                                                      |
|-----|----------------------------------------------------------------------------------------------------------------------|
| 7.  | To determine flash point & fire point of given fuel sample by Pensky -Marten's flash point apparatus.                |
| 8.  | To determine the corrosion rate of metal surface by weight loss method.                                              |
| 9.  | To determine the concentration of Allura Red Dye in soft drinks/ health drinks using UV Spectrophotometer.           |
| 10. | Determination of refractive index of given organic liquid by Abbe's refractometer.                                   |
| 11. | Determination of concentration of given sample of $\text{KMnO}_4$ using spectrophotometer                            |
| 12. | To prepare the sample of phenol formaldehyde (Bakelite).                                                             |
| 13. | Determination of strength of given Hydrochloric acid solution by titrating it with NaOH solution conductometrically. |
| 14. | Determination of strength of given Hydrochloric acid solution by titrating it with NaOH solution using pH meter.     |
| 15. | To prepare the sample of urea formaldehyde resin.                                                                    |
| 16. | Determination of viscosity of lubricating oil by Redwood Viscometer.                                                 |

***Note: Students must conduct at least ten experiments covering the entire COS.***

**Text Books:**

1. A Text book on Experiments and Calculation in Engineering Chemistry, S S Dara, S. Chand & Company Ltd., 2015
2. Essential of Experimental Engineering Chemistry, Shashi Chawla, Dhanpat Rai Publishing Co., 2020

**Other References:**

1. Theory & Practice Applied Chemistry, O P Virmani, A K Narula, New Age Int. Pub., 2017
2. Engineering Chemistry, K Sesha Maheswaramma and Mridula Chugh, Pearson Education, 2015



| Course Code                                                                                |                                                                                                         |     | Course Title                       |     |     |     |     |     |      |      | L    | T    | P    | Credits |       |  |
|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|-----|------------------------------------|-----|-----|-----|-----|-----|------|------|------|------|------|---------|-------|--|
| BT-ASH-156A                                                                                |                                                                                                         |     | Basics of Communication Skills Lab |     |     |     |     |     |      |      | 0    | 0    | 2    | 1       |       |  |
|                                                                                            |                                                                                                         |     |                                    |     |     |     |     |     |      |      | CIE  |      | SEE  |         | Total |  |
|                                                                                            |                                                                                                         |     |                                    |     |     |     |     |     |      |      | 50   |      | 50   |         | 100   |  |
| Course Outcomes                                                                            |                                                                                                         |     |                                    |     |     |     |     |     |      |      |      |      |      |         |       |  |
| CO1                                                                                        | Demonstrate effective speaking skills through conversations, extempore sessions, and group discussions. |     |                                    |     |     |     |     |     |      |      |      |      |      |         |       |  |
| CO2                                                                                        | Evaluate spoken content from news, lectures, and public speeches.                                       |     |                                    |     |     |     |     |     |      |      |      |      |      |         |       |  |
| CO3                                                                                        | Analyze texts from newspapers, electronic sources, and prescribed textbooks.                            |     |                                    |     |     |     |     |     |      |      |      |      |      |         |       |  |
| CO4                                                                                        | Synthesize written responses based on the analysis of video/audio recordings, lectures, and texts..     |     |                                    |     |     |     |     |     |      |      |      |      |      |         |       |  |
| Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High) |                                                                                                         |     |                                    |     |     |     |     |     |      |      |      |      |      |         |       |  |
|                                                                                            | PO1                                                                                                     | PO2 | PO3                                | PO4 | PO5 | PO6 | PO7 | PO8 | PO9  | PO10 | PO11 | PO12 | PSO1 | PSO2    |       |  |
| CO1                                                                                        | -                                                                                                       | -   | -                                  | -   | -   | -   | -   | 3   | 3    | 3    | -    | -    | -    | 2       |       |  |
| CO2                                                                                        | -                                                                                                       | -   | -                                  | -   | -   | -   | -   | 2   | 3    | 3    | -    | -    | -    | 3       |       |  |
| CO3                                                                                        | -                                                                                                       | -   | -                                  | -   | -   | -   | -   | 3   | 2    | 3    | -    | -    | -    | 3       |       |  |
| CO4                                                                                        | -                                                                                                       | -   | -                                  | -   | -   | -   | -   | 2   | 3    | 3    | -    | -    | -    | 2       |       |  |
| Avg                                                                                        | -                                                                                                       | -   | -                                  | -   | -   | -   | -   | 2.5 | 2.75 | 3    | -    | -    | -    | 2.5     |       |  |

### List of Experiments

|                                                                                                                                                                                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Listening Comprehension practice through recorded/online news readings, lectures, public speeches                                                                                        |
| 2. Speaking practices through Common Everyday Situations: Conversations and Dialogues                                                                                                       |
| 3. Jam sessions (Extempore)                                                                                                                                                                 |
| 4. Group discussion session                                                                                                                                                                 |
| 5. Reading practice sessions(Newspaper/Electronic/Prescribed Text books)                                                                                                                    |
| 6. Writing Practices after listening, interpreting and analysing Video/Oral Recordings, lectures Power Point Presentations and after reading written/printed excerpts, essays, stories etc. |

**Note: Students must conduct at least four experiments covering all Cos.**

**Text Books:**

1. Technical Communication Principles and Practice by Meenakshi Raman and Sangeeta Sharma by Oxford Publication

**Reference Books:**

1. On Writing Well. William Zinsser. Harper Resource Book. 2000.
2. Technical Communication. John Wiley. Wiley India Pvt. Ltd.
3. Communication Skills for Engineers by C. Muralikrishna and Sunita Mishra, Pearson Pub
4. Communication Skills Training, Iantuhovsky, Createspace Independent Pub, 2015.

| Course Code                                                                                |      |                                                                        | Course Title           |     |     |     |     |     |     |      | L    | T    | P    | Credits |       |  |
|--------------------------------------------------------------------------------------------|------|------------------------------------------------------------------------|------------------------|-----|-----|-----|-----|-----|-----|------|------|------|------|---------|-------|--|
| BT-ECE-174A                                                                                |      |                                                                        | Internet of Things Lab |     |     |     |     |     |     |      | 0    | 0    | 2    | 1       |       |  |
|                                                                                            |      |                                                                        |                        |     |     |     |     |     |     |      | CIE  |      | SEE  |         | Total |  |
|                                                                                            |      |                                                                        |                        |     |     |     |     |     |     |      | 50   |      | 50   |         | 100   |  |
| Course Outcomes                                                                            |      |                                                                        |                        |     |     |     |     |     |     |      |      |      |      |         |       |  |
| CO1                                                                                        |      | Get familiarize with various electrical parameter-measuring equipment. |                        |     |     |     |     |     |     |      |      |      |      |         |       |  |
| CO2                                                                                        |      | Explore the use of Arduino board.                                      |                        |     |     |     |     |     |     |      |      |      |      |         |       |  |
| CO3                                                                                        |      | Explore IOT devices designed to operate within cloud frameworks.       |                        |     |     |     |     |     |     |      |      |      |      |         |       |  |
| CO4                                                                                        |      | Use Arduino and ESP 32 to interface various sensors/devices.           |                        |     |     |     |     |     |     |      |      |      |      |         |       |  |
| Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High) |      |                                                                        |                        |     |     |     |     |     |     |      |      |      |      |         |       |  |
|                                                                                            | PO1  | PO2                                                                    | PO3                    | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2    |       |  |
| CO1                                                                                        | 3    | 2                                                                      | 2                      | -   | 3   | -   | -   | -   | 2   | 2    | -    | 2    | -    | -       |       |  |
| CO2                                                                                        | 3    | 3                                                                      | 2                      | 2   | 3   | -   | -   | -   | 2   | 2    | -    | 2    | -    | -       |       |  |
| CO3                                                                                        | 3    | 3                                                                      | 3                      | 3   | 3   | 2   | 2   | -   | 2   | 2    | 3    | 3    | -    | -       |       |  |
| CO4                                                                                        | 2    | 2                                                                      | 2                      | 3   | 3   | -   | 2   | 2   | -   | 2    | 2    | 3    | -    | -       |       |  |
| Avg                                                                                        | 2.75 | 2.5                                                                    | 2.25                   | 2   | 3   | 2   | 2   | 2   | 2   | 2    | 2.5  | 2.5  | -    | -       |       |  |

### List of Experiments

|                                                                                           |
|-------------------------------------------------------------------------------------------|
| 1. Measure different electrical parameters of a circuit with various measuring equipment. |
| 2. Install the Arduino IDE and configure it to control the flashing of an LED.            |
| 3. To connect and control a buzzer using Arduino for sound output.                        |
| 4. Display a character string on the LCD using Arduino with and without I2C.              |
| 5. Integrate an ultrasonic sensor with Arduino to explore distance sensing capabilities.  |
| 6. Experiment with IOT by exploring the interconnection of devices and systems.           |
| 7. To explore the ESP 32/NodeMCU8266 in basic IOT solutions.                              |
| 8. Setup an LED interface with ESP32/NodeMCU8266.                                         |
| 9. Interface LCD using ESP32/NodeMCU8266 with and without I2C.                            |
| 10. Control the switching of LED using a mobile phone and ESP32/NodeMCU8266.              |

**Note:** *Students must conduct at least eight experiments covering all the COs.*

**Textbooks:**

1. Internet of Things, 2e, 2020, Shriram K. Vasudevan, Abhishek S. Nagarajan, R. M. D. Sundaram, Wiley India.
2. Internet of Things: Architecture and Design Principles, 2e, 2022, Raj Kamal, McGraw Hill.
3. Internet of Things – A Hands-On-Approach, 2015, Arsheep Bahga, Vijay Madisetti, Orient Blackswan Private Limited, Delhi.
4. The Internet of Things: Do-it-Yourself at Home Projects for Arduino, Raspberry Pi, and Beagle Bone Black, 1e, 2015, Donald Norris, McGraw-Hill Education.

# **Semester II**

| Course Code                                                                                |                                                                                        |     |     | Course Title               |      |     |     |     |     |     | L    | T    | P    | Credits |       |  |
|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|-----|-----|----------------------------|------|-----|-----|-----|-----|-----|------|------|------|---------|-------|--|
| ASH-MAT-102A                                                                               |                                                                                        |     |     | Engineering Mathematics-II |      |     |     |     |     |     | 3    | 1    | 0    | 4       |       |  |
|                                                                                            |                                                                                        |     |     |                            |      |     |     |     |     |     | CIE  |      | SEE  |         | Total |  |
|                                                                                            |                                                                                        |     |     |                            |      |     |     |     |     |     | 40   |      | 60   |         | 100   |  |
| Course Outcomes                                                                            |                                                                                        |     |     |                            |      |     |     |     |     |     |      |      |      |         |       |  |
| CO1                                                                                        | Identify use of various measures of central tendencies in comprehensive manner.        |     |     |                            |      |     |     |     |     |     |      |      |      |         |       |  |
| CO2                                                                                        | Apply the basics of probability in solving problems.                                   |     |     |                            |      |     |     |     |     |     |      |      |      |         |       |  |
| CO3                                                                                        | Understand various properties of multi variable functions and partial differentiation. |     |     |                            |      |     |     |     |     |     |      |      |      |         |       |  |
| CO4                                                                                        | Solve different types of ordinary differential equations.                              |     |     |                            |      |     |     |     |     |     |      |      |      |         |       |  |
| Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High) |                                                                                        |     |     |                            |      |     |     |     |     |     |      |      |      |         |       |  |
|                                                                                            |                                                                                        | PO1 | PO2 | PO3                        | PO4  | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |         |       |  |
|                                                                                            | CO1                                                                                    | 3   | 3   | 2                          | 3    | -   | 1   | -   | -   | 1   | -    | -    | 1    |         |       |  |
|                                                                                            | CO2                                                                                    | 3   | 3   | 3                          | 2    | -   | 1   | -   | -   | 1   | -    | -    | 1    |         |       |  |
|                                                                                            | CO3                                                                                    | 3   | 2   | 1                          | 1    | -   | 1   | -   | -   | 1   | -    | -    | 1    |         |       |  |
|                                                                                            | CO4                                                                                    | 3   | 2   | 1                          | 1    | -   | 1   | -   | -   | 1   | -    | -    | 1    |         |       |  |
|                                                                                            | Avg                                                                                    | 3   | 2.5 | 1.75                       | 1.75 | -   | 1   | -   | -   | 1   | -    | -    | 1    |         |       |  |

| Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Unit-1: Ordinary Differential Equations</b> <b>Contact Hours: 11</b><br><br>First order ordinary differential equations: Formation of ordinary differential equation, Exact Differential equations, reducible to exact differential equations, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: Clairaut's equation.<br>Ordinary differential equations of higher order (up to 4 <sup>th</sup> order): linear differential equations with constant coefficients, method of variation of parameters, Cauchy's and Legendre's linear differential equations. |
| <b>Unit-2: Partial Differentiation</b> <b>Contact Hours: 11</b><br><br>Functions of two or more variables, Partial derivatives, Derivatives of composite and implicit functions, Change of variables. Homogeneous functions, Euler's theorem.<br>Taylor's and Maclaurin's series for functions of two variables (without proof), Maxima-Minima of functions of two variables, Lagrange's method of undermined multipliers. Differentiation under integral sign.                                                                                                                                  |
| <b>Unit-3: Measure of Central Tendencies and Dispersions</b> <b>Contact Hours: 10</b><br><br>Measures of central tendency: Mean, Median, Quartiles, Mode, Geometric Mean and Harmonic Mean, Measures of Dispersion: Range, Quartile Deviation, Mean Deviation, Standard Deviation, Coefficient of variation, First four moments, skewness and Kurtosis.<br>Covariance of X and Y, Correlation: Karl Pearson's coefficient of Correlation, Rank Correlation,                                                                                                                                      |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| Regression: Regression line Y on X and X on Y, Coefficient of regression.                                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |
| <b>Unit-4: Probability and Probability Distributions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Contact Hours: 10</b> |
| Introduction, Application of Additive and Multiplicative laws of probability, Dependent and Independent Events, Introduction of conditional probability, Baye's Theorem (Without proof) and its applications, Discrete and Continuous random variables and their properties, distribution functions, density and mass functions. Probability distribution: Discrete distribution (Binomial, Poisson), Continuous distribution (Normal), mean, variance and standard deviation of the distributions and their properties. |                          |

### **Text Books:**

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43th Edition, 2014.
2. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan, Chand & Sons, 12<sup>th</sup> edition, 2022.
3. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10<sup>th</sup> Edition, 2011.

### **Other References:**

1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint 2008.
2. BV Ramana, Higher Engineering Mathematics, Tata McGraw-Hill, 2017.
3. W. Feller, An Introduction to Probability Theory and its Applications, Vol.1, 3<sup>rd</sup> Edition, Willey, 1968.
4. S. Ross, A First Course in Probability, 6<sup>th</sup> Edition Pearson Education India 2002.

| Course Code                                                                                |     |                                                                                                                                                                                |     | Course Title                    |      |     |     |      |     |     | L    | T    | P    | Credits |       |  |
|--------------------------------------------------------------------------------------------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---------------------------------|------|-----|-----|------|-----|-----|------|------|------|---------|-------|--|
| ASH-PHY-103A                                                                               |     |                                                                                                                                                                                |     | Semiconductor & Quantum Physics |      |     |     |      |     |     | 3    | 1    | 0    | 4       |       |  |
|                                                                                            |     |                                                                                                                                                                                |     |                                 |      |     |     |      |     |     | CIE  |      | SEE  |         | Total |  |
|                                                                                            |     |                                                                                                                                                                                |     |                                 |      |     |     |      |     |     | 40   |      | 60   |         | 100   |  |
| Course Outcomes                                                                            |     |                                                                                                                                                                                |     |                                 |      |     |     |      |     |     |      |      |      |         |       |  |
| CO1                                                                                        |     | Understand the principles of quantum mechanics                                                                                                                                 |     |                                 |      |     |     |      |     |     |      |      |      |         |       |  |
| CO2                                                                                        |     | Apply free electron theories, Fermi-Dirac statistics, and energy band concepts to analyze electronic properties and distinguish between metals, insulators, and semiconductors |     |                                 |      |     |     |      |     |     |      |      |      |         |       |  |
| CO3                                                                                        |     | Explain the basics of semiconductor materials and devices.                                                                                                                     |     |                                 |      |     |     |      |     |     |      |      |      |         |       |  |
| CO4                                                                                        |     | Discuss the basics and applications of lasers and optical fibers.                                                                                                              |     |                                 |      |     |     |      |     |     |      |      |      |         |       |  |
| Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High) |     |                                                                                                                                                                                |     |                                 |      |     |     |      |     |     |      |      |      |         |       |  |
|                                                                                            |     | PO1                                                                                                                                                                            | PO2 | PO3                             | PO4  | PO5 | PO6 | PO7  | PO8 | PO9 | PO10 | PO11 | PO12 |         |       |  |
|                                                                                            | CO1 | 3                                                                                                                                                                              | 3   | 2                               | 2    | 1   | 1   | 1    | 1   | 1   | 1    | 1    | 2    |         |       |  |
|                                                                                            | CO2 | 3                                                                                                                                                                              | 3   | 2                               | 2    | 2   | 1   | 1    | 1   | 1   | 1    | 1    | 2    |         |       |  |
|                                                                                            | CO3 | 3                                                                                                                                                                              | 2   | 2                               | 3    | 2   | 2   | 1    | 1   | 1   | 1    | 1    | 2    |         |       |  |
|                                                                                            | CO4 | 3                                                                                                                                                                              | 3   | 2                               | 2    | 2   | 2   | 2    | 1   | 1   | 1    | 1    | 2    |         |       |  |
|                                                                                            | Avg | 3                                                                                                                                                                              | 2.8 | 2                               | 2.25 | 1.8 | 1.5 | 1.25 | 1   | 1   | 1    | 1    | 2    |         |       |  |

| Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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| <b>Unit-1: Introduction to Quantum Mechanics</b> <b>Contact Hours: 10</b><br>Basics of quantum mechanics, wave-particle dualism, de-Broglie hypothesis, phase velocity, and group velocity. Heisenberg's uncertainty principle, application of uncertainty principle, wave function properties and physical significance, probability density, normalization, Eigen values and Eigen functions. Quantum mechanical operators, postulates of quantum mechanics, time- dependent and time-independent Schrödinger wave equation, particle in a box-energy levels, Eigen values and probability densities, numerical problems. |
| <b>Unit-2: Free Electron and Band Theory of Solids</b> <b>Contact Hours: 10</b><br>Classical free electron theory (qualitative), Drude theory of conduction, quantum free electron theory, Fermi-Dirac distribution function, density of states, Fermi energy, and its importance.<br>Bloch theorem, Kronig-Penney model (qualitative), E versus k diagram-Brillouin zones, concept of effective mass of electron, energy levels and energy bands, distinction between metals, insulators, and semiconductors.                                                                                                              |
| <b>Unit-3: Semiconductor Physics</b> <b>Contact Hours: 12</b><br>Introduction, direct and indirect band gap semiconductors, intrinsic semiconductors, carrier                                                                                                                                                                                                                                                                                                                                                                                                                                                               |



concentration in intrinsic semiconductors; extrinsic semiconductors: n-type semiconductors, p-type semiconductors, carrier concentration in extrinsic semiconductors, variation of carrier concentration with temperature, fundamental of semiconductor diode. Hall effect and its applications.

**Unit-4: Lasers and Fiber Optics**

**Contact Hours: 12**

**Laser:** Basics of interference, diffraction, and polarization. Lasers and characteristics, pre-requisites of lasers, Einstein's coefficients, types of lasers, He-Ne laser, semiconductor laser, applications of lasers.

**Fiber Optics:** Principle and construction of optical fiber, numerical aperture, acceptance cone, step index and graded index fibers, principle of optic fiber communication, optical fiber loss and attenuation, advantages, applications of optical fiber in communication and industries.

**Textbooks:**

1. Applied Physics for Engineers, P. K. Diwan, 1e, Wiley, 2014.
2. Fiber Optics and Lasers - The Two Revolutions, Ajoy Ghatak and K. Thyagarajan, 1e, Macmillan India, 2006.
3. Modern Physics for Engineers, S.P. Taneja, R. Chand & CO, New Delhi, 2011

**Other References:**

1. Introduction to Solid State Physics, Charles Kittel, 8e, Wiley, 2012.
2. Quantum Mechanics: Concepts & Applications, N. Zettili, 3e, Wiley, 2022.

| Course Code                                                                                |                                                                                                                           |      |      | Course Title            |     |     |      |      |      |      | L    | T    | P    | Credits |  |
|--------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|------|------|-------------------------|-----|-----|------|------|------|------|------|------|------|---------|--|
| BT-CSE-102A                                                                                |                                                                                                                           |      |      | Programming with Python |     |     |      |      |      |      | 3    | 0    | 0    | 3       |  |
|                                                                                            |                                                                                                                           |      |      |                         |     |     |      |      |      |      | CIE  | SEE  |      | Total   |  |
|                                                                                            |                                                                                                                           |      |      |                         |     |     |      |      |      |      | 40   | 60   |      | 100     |  |
| Course Outcomes                                                                            |                                                                                                                           |      |      |                         |     |     |      |      |      |      |      |      |      |         |  |
| CO1                                                                                        | Demonstrate competence in fundamental Python programming concepts, control statements, data types and string manipulation |      |      |                         |     |     |      |      |      |      |      |      |      |         |  |
| CO2                                                                                        | Apply knowledge of Python data structures such as lists, tuples, sets, and dictionaries to solve computational problems   |      |      |                         |     |     |      |      |      |      |      |      |      |         |  |
| CO3                                                                                        | Develop and implement functions in Python to enhance code modularity and reusability.                                     |      |      |                         |     |     |      |      |      |      |      |      |      |         |  |
| CO4                                                                                        | Apply exception handling techniques to analyze and handle errors effectively in Python programs.                          |      |      |                         |     |     |      |      |      |      |      |      |      |         |  |
| CO5                                                                                        | Utilize Python libraries such as NumPy and Pandas for data manipulation and analysis tasks.                               |      |      |                         |     |     |      |      |      |      |      |      |      |         |  |
| CO6                                                                                        | Demonstrate the use of Matplotlib and Seaborn libraries for data visualization                                            |      |      |                         |     |     |      |      |      |      |      |      |      |         |  |
| Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High) |                                                                                                                           |      |      |                         |     |     |      |      |      |      |      |      |      |         |  |
|                                                                                            | PO1                                                                                                                       | PO2  | PO3  | PO4                     | PO5 | PO6 | PO7  | PO8  | PO9  | PO10 | PO11 | PO12 | PSO1 | PSO2    |  |
| CO1                                                                                        | 3                                                                                                                         | 2    | 1    | 1                       | 1   | 1   | 1    | 1    | 1    | 1    | 1    | 1    | 1    | 1       |  |
| CO2                                                                                        | 3                                                                                                                         | 2    | 2    | 2                       | 2   | 2   | 2    | 2    | 2    | 2    | 2    | 2    | 2    | 2       |  |
| CO3                                                                                        | 3                                                                                                                         | 2    | 2    | 2                       | 2   | 2   | 2    | 2    | 2    | 1    | 2    | 2    | 2    | 2       |  |
| CO4                                                                                        | 2                                                                                                                         | 2    | 1    | -                       | -   | -   | 1    | 1    | 2    | 1    | 2    | 2    | 2    | 2       |  |
| CO5                                                                                        | 3                                                                                                                         | 2    | 2    | 3                       | 3   | 2   | 2    | 2    | 3    | 3    | 3    | 2    | 3    | 3       |  |
| CO6                                                                                        | 3                                                                                                                         | 3    | 3    | 3                       | 3   | 2   | 2    | 2    | 3    | 3    | 3    | 3    | 3    | 3       |  |
| Avg                                                                                        | 2.83                                                                                                                      | 2.16 | 1.83 | 2.2                     | 2.2 | 1.8 | 1.66 | 1.66 | 2.16 | 1.83 | 2.16 | 2    | 2.16 | 2.16    |  |

| Content                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| <b>Unit-1: Python Fundamentals</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Contact Hours: 10</b> |
| <p><b>Overview of Python:</b> History of Python and its importance, Python installation, variables, constants, identifiers, comments, reserved keywords.</p> <p><b>Basic data types:</b> Numeric, string, Boolean, list, tuple, dictionary, sets, literals, type conversion.</p> <p><b>Python Operators:</b> Arithmetic, comparison, logical, bitwise, assignment, membership operator, expression, input and output statements.</p> <p><b>Control statements:</b> If-elif-else statement, match-case statement.</p> <p><b>Loops:</b> While, for, nested loops, break, continue and pass statement.</p> <p><b>String:</b> Creating string, length of a string, indexing and slicing in strings, concatenation of strings, finding substring, Splitting and joining strings, changing case of a string, checking starting and ending of a string, inserting substring into a string.</p> |                          |
| <b>Unit-2: Python Data Structures</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Contact Hours: 10</b> |
| <p><b>Lists:</b> Characteristics, creating list, indexing and slicing, operations on lists, list methods, list comprehension.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                          |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| <p><b>Tuples:</b> Tuples vs lists, creating and accessing tuples, tuple operations and methods, iterating over tuples.</p> <p><b>Sets:</b> Creating and modifying sets, set operations, set methods, iterating over sets.</p> <p><b>Dictionaries:</b> Characteristics of dictionaries, key-value pairs, creating and accessing dictionaries, dictionary operations, dictionary methods, dictionary comprehension.</p>                                                                                                                                                            |                         |
| <b>Unit-3: Functions and Error Handling in Python</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Contact Hours: 8</b> |
| <p><b>Functions:</b> Defining function, calling function, parameters and arguments, docstrings; <b>Lambda Functions:</b> Syntax and usage, using lambdas with map, filter and reduce functions.</p> <p><b>Error Handling:</b> Types of errors: Syntax and exceptions, user-defined exceptions and built-in exceptions, exception handling with try, except, else, and finally, raising exceptions.</p>                                                                                                                                                                           |                         |
| <b>Unit-4: Python Data Analysis Essentials</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Contact Hours: 8</b> |
| <p><b>Python Libraries:</b> Numpy: Creating Numpy Array, Mathematical operations on Numpy, Slicing and Indexing in numpy Arrays, Attributes of an Array: ndim, shape, size, dtype, itemsize.</p> <p><b>Pandas:</b> Series, dataframe, operations on dataframe, combining datasets: merge and join, aggregation and grouping.</p> <p><b>Data Visualization:</b> Necessity of data visualization; <b>Matplotlib:</b> Line plot, bar chart, histogram, scatter plot, boxplot.</p> <p><b>Seaborn:</b> Box plot, bar chart, scatter plot, pair plot, heatmaps, distribution plot.</p> |                         |

### Textbooks:

1. Core Python Programming, R. Nageswara Rao, ISBN: 9789351199427, Dreamtech Press, 2017.
2. Data Visualization with Python, Dr. Pooja, ISBN: 978-93-55515-384, BPB Publications, 2023.
3. Let Us Python, Yashavant Kanetkar, Aditya Kanetkar, 6e, ISBN: 9789355515414, BPB Publication, 2023.

### Other References:

1. Introduction to Computing and Problem Solving Using Python, E. Balagurusamy, ISBN: 9789352602582, McGraw Hill Education, 2017.
2. Python the Complete Reference, Martin C. Brown, ISBN: 978-9387572942, McGraw Hill, 2018.
3. Beginning Programming with Python for Dummies, John Paul Mueller, 2e, ISBN: 978-1-119-45787-9, John Wiley & Sons, 2018.
4. Data Analytics using Python, Bharti Motwani, ISBN: 9788126502950, Wiley India Pvt. Ltd., 2020.

| Course Code                                                                                |     |                                                                                                                                                         |     | Course Title                   |     |     |     |     |     |      | L    | T    | P    | Credits |  |       |  |
|--------------------------------------------------------------------------------------------|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------|-----|--------------------------------|-----|-----|-----|-----|-----|------|------|------|------|---------|--|-------|--|
| ASH-HUM-105A                                                                               |     |                                                                                                                                                         |     | Essentials of English Language |     |     |     |     |     |      | 2    | 1    | 0    | 3       |  |       |  |
|                                                                                            |     |                                                                                                                                                         |     |                                |     |     |     |     |     |      | CIE  |      | SEE  |         |  | Total |  |
|                                                                                            |     |                                                                                                                                                         |     |                                |     |     |     |     |     |      | 40   |      | 60   |         |  | 100   |  |
| Course Outcomes                                                                            |     |                                                                                                                                                         |     |                                |     |     |     |     |     |      |      |      |      |         |  |       |  |
| CO1                                                                                        |     | Understand the speech mechanism to analyze and produce accurate pronunciations.                                                                         |     |                                |     |     |     |     |     |      |      |      |      |         |  |       |  |
| CO2                                                                                        |     | Apply various parts of speech while demonstrating an understanding of voice in sentence construction.                                                   |     |                                |     |     |     |     |     |      |      |      |      |         |  |       |  |
| CO3                                                                                        |     | Execute their vocabulary by using prefixes, suffixes, synonyms, antonyms, one-word substitutions, homonyms, homophones, and technical jargon correctly. |     |                                |     |     |     |     |     |      |      |      |      |         |  |       |  |
| CO4                                                                                        |     | Use phrases, clauses, tenses, verb patterns and sentences correctly, while avoiding common errors.                                                      |     |                                |     |     |     |     |     |      |      |      |      |         |  |       |  |
| Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High) |     |                                                                                                                                                         |     |                                |     |     |     |     |     |      |      |      |      |         |  |       |  |
|                                                                                            | PO1 | PO2                                                                                                                                                     | PO3 | PO4                            | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2    |  |       |  |
| CO1                                                                                        | -   | -                                                                                                                                                       | -   | -                              | -   | -   | -   | 1   | 3   | 3    | -    | 2    |      |         |  |       |  |
| CO2                                                                                        | -   | -                                                                                                                                                       | -   | -                              | -   | -   | -   | 2   | 2   | 3    | -    | 3    |      |         |  |       |  |
| CO3                                                                                        | -   | -                                                                                                                                                       | -   | -                              | -   | -   | -   | 2   | 3   | 3    | -    | 3    |      |         |  |       |  |
| CO4                                                                                        | -   | -                                                                                                                                                       | -   | -                              | -   | -   | -   | 3   | 3   | 3    | -    | 3    |      |         |  |       |  |
| Avg                                                                                        | -   | -                                                                                                                                                       | -   | -                              | -   | -   | -   | 2   | 2.7 | 3    | -    | 2.75 |      |         |  |       |  |

| Content                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Unit-1: Phonetics</b> <b>(Contact Hours: 8)</b><br>Speech Mechanism, Introduction to English Speech Sounds and Phonetic Alphabets, Description of English Speech Sounds, Activities related to phonetics                         |
| <b>Unit-2: Syntax</b> <b>(Contact Hours: 10)</b><br>Parts of Speech, Articles and Determiners, Prepositions , Conjunctions, Voice, Gerund, Infinitives and Participle, Activities Related to Syntax                                 |
| <b>Unit-3: Vocabulary Building</b> <b>(Contact Hours: 8)</b><br>Prefixes and suffixes, One Word Substitution, Standard Abbreviations, Synonyms, Antonyms, Homonyms, Homophones, Technical Jargons, Activities Related to Vocabulary |
| <b>Unit-4: Basics of Composition</b> <b>(Contact Hours: 10)</b><br>Phrases, Clauses and sentences, Tenses, Verb Patterns, Punctuation and common Errors, Activities Related to Composition                                          |

**Text Books:**

1. Essential English Grammar, Raymond and Murphy, Cambridge University Press.
2. English Phonetics for Indian Students, T. Balasubramanian, Trinity Press 2017

**Other References:**

1. Practical English Usage. Michael Swan.OUP.1995.
2. English Grammar and Usage, R.P. Sinha, Oxford University Press, 2011.
3. English grammar, Richard A Hudson, Routledge 1998.
4. Course in Phonetics, Peter Ladefoged and Keith Jhonson,Cengage Learning 2014.
5. English Grammar and Composition, Wren and Martin, S.Chand 2020.

| Course Code                                                                                |     |                                                                                                                          |      | Course Title           |     |     |     |     |     |      | L    | T    | P    | Credits |       |  |
|--------------------------------------------------------------------------------------------|-----|--------------------------------------------------------------------------------------------------------------------------|------|------------------------|-----|-----|-----|-----|-----|------|------|------|------|---------|-------|--|
| ASH-HUM-107A                                                                               |     |                                                                                                                          |      | Universal Human Values |     |     |     |     |     |      | 2    | 0    | 0    | 2       |       |  |
|                                                                                            |     |                                                                                                                          |      |                        |     |     |     |     |     |      | CIE  |      | SEE  |         | Total |  |
|                                                                                            |     |                                                                                                                          |      |                        |     |     |     |     |     |      | 40   |      | 60   |         | 100   |  |
| Course Outcomes                                                                            |     |                                                                                                                          |      |                        |     |     |     |     |     |      |      |      |      |         |       |  |
| CO1                                                                                        |     | Understand the importance of value, types and roles of values in personal and societal development.                      |      |                        |     |     |     |     |     |      |      |      |      |         |       |  |
| CO2                                                                                        |     | Understand and apply principles of inner harmony to enhance overall well-being and foster balanced personal development. |      |                        |     |     |     |     |     |      |      |      |      |         |       |  |
| CO3                                                                                        |     | Understand principles of harmonious relationships to promote unity and cooperation within families, society and nature.  |      |                        |     |     |     |     |     |      |      |      |      |         |       |  |
| CO4                                                                                        |     | Understand the difference between ethical and unethical practices.                                                       |      |                        |     |     |     |     |     |      |      |      |      |         |       |  |
| Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High) |     |                                                                                                                          |      |                        |     |     |     |     |     |      |      |      |      |         |       |  |
|                                                                                            | PO1 | PO2                                                                                                                      | PO3  | PO4                    | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2    |       |  |
| CO1                                                                                        | -   | -                                                                                                                        | 1    | -                      | -   | 1   | -   | -   | -   | -    | -    | 1    |      |         |       |  |
| CO2                                                                                        | -   | -                                                                                                                        | -    | -                      | -   | 1   | -   | -   | 1   | -    | -    | 1    |      |         |       |  |
| CO3                                                                                        | -   | -                                                                                                                        | 2    | -                      | -   | 1   | 1   | -   | 1   | 1    | -    | 1    |      |         |       |  |
| CO4                                                                                        | -   | -                                                                                                                        | 1    | -                      | -   | 1   | 1   | 2   | 1   | 1    | 1    | 1    |      |         |       |  |
| Avg                                                                                        | -   | -                                                                                                                        | 1.33 | -                      | -   | 1   | 1   | 2   | 1   | 1    | 1    | 1    |      |         |       |  |

| Content                                                                                                                                                                                                                                                                                                                                        |                         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| <b>Unit-1: Introduction to Value Education</b>                                                                                                                                                                                                                                                                                                 | <b>Contact Hours: 6</b> |
| Value Education - Definition, concept and need, the content and process of value education, basic guidelines for value education, Self-exploration as a means of value education, happiness and prosperity as parts of value education.                                                                                                        |                         |
| <b>Unit-2: Harmony in the Human Being</b>                                                                                                                                                                                                                                                                                                      | <b>Contact Hours: 6</b> |
| Human being is more than just the body, harmony of the self ('I') with the body, understanding myself as co-existence of the self and the body, understanding needs of the self and the needs of the body, understanding the activities in the self and the activities in the body.                                                            |                         |
| <b>Unit-3: Harmony in the Family and Society and Harmony in the Nature</b>                                                                                                                                                                                                                                                                     | <b>Contact Hours: 6</b> |
| Family as a basic unit of human interaction and values in relationships; The basics for respect and today's crisis: affection, guidance, reverence, glory, gratitude and love; Comprehensive human goal: the five dimensions of human endeavor; Harmony in nature: the four orders in nature, the holistic perception of harmony in existence. |                         |
| <b>Unit-4: Social and Professional Ethics</b>                                                                                                                                                                                                                                                                                                  | <b>Contact Hours: 6</b> |
| The basics for ethical human conduct, defects in ethical human conduct, holistic alternative and universal order, universal human order and ethical conduct. Value based life and profession, professional ethics and right understanding, competence in professional ethics; Issues in professional ethics – the current scenario.            |                         |

### **Practice Sessions for Students:**

- Unit-1:** To discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation.
- Unit-2:** To discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.
- Unit-3:** To reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives. To discuss human being as cause of imbalance in nature.
- Unit-4:** To explore ethical human conduct and steps of transition towards universal human order.

### **Textbooks:**

1. A. N. Tripart, Human Values, New Age International Publishers, 2003.
2. Bajpai, B. L., Indian Ethos and Modern Management: Amalgam of the Best of the Ideas from the East and the West New Royal Book Co, Lucknow, Reprinted, 2004.

### **Other References:**

1. Gaur. R. R., Sangal R., Bagaria. G. P., A Foundation Course in Value Education, Excel Books, 2009.
2. I. C. Sharma. Ethical Philosophy of India, Nagin & Co., Jalandhar.

| Course Code                                                                                |      |                                                                                                                              |      | Course Title        |     |     |     |     |     |      | L    | T    | P    | Credits |       |  |
|--------------------------------------------------------------------------------------------|------|------------------------------------------------------------------------------------------------------------------------------|------|---------------------|-----|-----|-----|-----|-----|------|------|------|------|---------|-------|--|
| BT-ME-171A                                                                                 |      |                                                                                                                              |      | Design Thinking Lab |     |     |     |     |     |      | 0    | 0    | 3    | 1.5     |       |  |
|                                                                                            |      |                                                                                                                              |      |                     |     |     |     |     |     |      | CIE  |      | SEE  |         | Total |  |
|                                                                                            |      |                                                                                                                              |      |                     |     |     |     |     |     |      | 50   |      | 50   |         | 100   |  |
| Course Outcomes                                                                            |      |                                                                                                                              |      |                     |     |     |     |     |     |      |      |      |      |         |       |  |
| CO1                                                                                        |      | Understand the main ideas and steps involved in design thinking.                                                             |      |                     |     |     |     |     |     |      |      |      |      |         |       |  |
| CO2                                                                                        |      | To prepare the mindset and discipline to identify new sources of ideas.                                                      |      |                     |     |     |     |     |     |      |      |      |      |         |       |  |
| CO3                                                                                        |      | To create a space for the students with state of the art perspectives, ideas, concepts, and solutions using design thinking. |      |                     |     |     |     |     |     |      |      |      |      |         |       |  |
| CO4                                                                                        |      | Apply design thinking ideas to improve everyday tasks and work challenges.                                                   |      |                     |     |     |     |     |     |      |      |      |      |         |       |  |
| Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High) |      |                                                                                                                              |      |                     |     |     |     |     |     |      |      |      |      |         |       |  |
|                                                                                            | PO1  | PO2                                                                                                                          | PO3  | PO4                 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2    |       |  |
| CO1                                                                                        | 1    | 1                                                                                                                            | 1    | 1                   | 1   | 1   | 1   | 1   | 1   | 1    | 1    | 1    | 1    | 1       |       |  |
| CO2                                                                                        | 1    | 2                                                                                                                            | 2    | 2                   | 1   | 2   | 2   | 2   | 2   | 2    | 2    | 2    | 2    | 1       |       |  |
| CO3                                                                                        | 2    | 3                                                                                                                            | 2    | 3                   | 1   | 3   | 2   | 2   | 3   | 2    | 2    | 2    | 2    | 1       |       |  |
| CO4                                                                                        | 1    | 2                                                                                                                            | 2    | 2                   | 1   | 2   | 1   | 1   | 2   | 1    | 1    | 1    | 1    | 1       |       |  |
| Avg                                                                                        | 1.25 | 2                                                                                                                            | 1.75 | 2                   | 1   | 2   | 1.5 | 1.5 | 2   | 1.5  | 1.5  | 1.5  | 1.5  | 1       |       |  |

### List of Experiments/Activities

|                                                                                                                                                                                                                                      |                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| <b>The Foundation: Think About problems effectively</b>                                                                                                                                                                              | <b>Contact Hours: 3</b> |
| 1. Identify the Problem- Reducing Plastic waste in college campuses.                                                                                                                                                                 |                         |
| <b>Building Empathy: Mapping User Insights</b>                                                                                                                                                                                       | <b>Contact Hours: 9</b> |
| 2. Building Empathy (Qualitative) - Reducing Plastic Waste on College Campuses<br>3. Building Empathy (Quantitative) - Reducing Plastic Waste on College Campuses<br>4. Empathy Mapping - Reducing Plastic Waste on College Campuses |                         |
| <b>Problem Definition</b>                                                                                                                                                                                                            | <b>Contact Hours: 3</b> |
| 5. Defining the Problem: Reducing Plastic Waste on College Campuses                                                                                                                                                                  |                         |
| <b>Ideation: Guide to creative problem solving</b>                                                                                                                                                                                   | <b>Contact Hours: 6</b> |
| 6. Ideation (Divergent): Reducing Plastic Waste on College Campuses<br>7. Ideation (Convergent): Reducing Plastic Waste on College Campuses                                                                                          |                         |
| <b>Prototyping</b>                                                                                                                                                                                                                   | <b>Contact Hours: 3</b> |
| 8. Prototyping: Reducing Plastic Waste on College Campuses                                                                                                                                                                           |                         |
| <b>Testing and Refinement</b>                                                                                                                                                                                                        | <b>Contact Hours: 3</b> |
| 9. Testing: Reducing Plastic Waste on College Campuses                                                                                                                                                                               |                         |



|                                                                                                          |                         |
|----------------------------------------------------------------------------------------------------------|-------------------------|
| <b>Case Studies</b>                                                                                      | <b>Contact Hours: 3</b> |
| 10. A detailed analysis of a design project that includes the design process, results, and key learnings |                         |

**Note:** *Students must conduct at least eight experiments /activities covering all COs.*

### **Text Books**

1. Cross, Nigel. Design thinking: Understanding how designers think and work. Bloomsbury Publishing, 2023.
2. Soni, Pavan. Design your thinking: The mindsets, toolsets and skill sets for creative problem-solving. Penguin Random House India Private Limited, 2020.
3. E Balagurusamy. Soni. Design Thinking: A beginner's perspective. The mindsets, toolsets and skill sets for creative problem-solving. McGraw Hill, 2024.
4. "Den Dekker, Teun. Design thinking, Taylor and Francis group, 2020

### **Reference Books**

1. Pressman, Andrew. Design thinking: A guide to creative problem solving for everyone. Taylor and Francis group, 2018.
2. Brown, Tim. "Design thinking." Harvard business reviews 86, no. 6 (2008): 84.
3. Lockwood, T. Design thinking: Integrating innovation, customer experience, and brand value. Simon and Schuster, 2010.

| Course Code                                                                                |                                                                                                                                                                                                                                                    | Course Title                        |     |      |     |     |     |     |     | L   | T    | P    | Credits |       |  |
|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-----|------|-----|-----|-----|-----|-----|-----|------|------|---------|-------|--|
| ASH-PHY-173A                                                                               |                                                                                                                                                                                                                                                    | Semiconductor & Quantum Physics Lab |     |      |     |     |     |     |     | 0   | 0    | 2    | 1       |       |  |
|                                                                                            |                                                                                                                                                                                                                                                    |                                     |     |      |     |     |     |     |     | CIE |      | SEE  |         | Total |  |
|                                                                                            |                                                                                                                                                                                                                                                    |                                     |     |      |     |     |     |     |     | 50  |      | 50   |         | 100   |  |
| Course Outcomes                                                                            |                                                                                                                                                                                                                                                    |                                     |     |      |     |     |     |     |     |     |      |      |         |       |  |
| CO1                                                                                        | Develop practical skills in electrical and physical measurements (including Argon's ionization potential, capacitance of an unknown capacitor, temperature coefficient of a Pt, , and magnetic field variation using Stewart and Gee’s apparatus). |                                     |     |      |     |     |     |     |     |     |      |      |         |       |  |
| CO2                                                                                        | Understand the quantum and electron behavior through experiments on photoelectric effect, thermionic emission, and electron charge-to-mass ratio.                                                                                                  |                                     |     |      |     |     |     |     |     |     |      |      |         |       |  |
| CO3                                                                                        | Conduct experiments for the determination of the wavelength of a light source/laser using grating.                                                                                                                                                 |                                     |     |      |     |     |     |     |     |     |      |      |         |       |  |
| CO4                                                                                        | Measure the attenuation and determine the numerical aperture of an optical fiber to evaluate its performance characteristics in optical communication systems.                                                                                     |                                     |     |      |     |     |     |     |     |     |      |      |         |       |  |
| Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High) |                                                                                                                                                                                                                                                    |                                     |     |      |     |     |     |     |     |     |      |      |         |       |  |
|                                                                                            |                                                                                                                                                                                                                                                    | PO1                                 | PO2 | PO3  | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12    |       |  |
|                                                                                            | CO1                                                                                                                                                                                                                                                | 3                                   | 3   | 3    | 3   | 2   | 1   | 1   | 1   | 1   | 1    | 1    | 2       |       |  |
|                                                                                            | CO2                                                                                                                                                                                                                                                | 3                                   | 3   | 3    | 3   | 2   | 1   | 1   | 1   | 1   | 1    | 1    | 2       |       |  |
|                                                                                            | CO3                                                                                                                                                                                                                                                | 3                                   | 2   | 2    | 3   | 3   | 1   | 1   | 1   | 1   | 1    | 1    | 2       |       |  |
|                                                                                            | CO4                                                                                                                                                                                                                                                | 3                                   | 2   | 3    | 3   | 3   | 1   | 1   | 1   | 1   | 1    | 1    | 2       |       |  |
|                                                                                            | Avg                                                                                                                                                                                                                                                | 3                                   | 2.5 | 2.75 | 3   | 2.5 | 1   | 1   | 1   | 1   | 1    | 1    | 2       |       |  |

### List of Experiments

|     |                                                                                                                                                                     |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.  | To determine the energy band gap of a given semiconductor material using four probe method.                                                                         |
| 2.  | To determine the Hall coefficient and density of majority charge carriers.                                                                                          |
| 3.  | To study the variation of magnetic field with distance and to find the radius of coil by Stewart and Gee's apparatus.                                               |
| 4.  | Measure the time it takes for a diode to switch from conducting (forward-biased) to non-conducting (reverse-biased) state when the polarity of the voltage changes. |
| 5.  | To find the ionization potential of Argon/Mercury using a Thyatron tube.                                                                                            |
| 6.  | To find the value of e/m for electrons by helical method.                                                                                                           |
| 7.  | To find the value of Planck's constant by using a photoelectric cell.                                                                                               |
| 8.  | To find the flashing and quenching potential of Argon and to find the capacitance of an unknown capacitor.                                                          |
| 9.  | To find the temperature coefficient of resistance by using a Pt resistance thermometer by post office box.                                                          |
| 10. | Determination of the wavelength of a He-Ne laser or any standard laser using diffraction grating.                                                                   |
| 11. | Measurement of wavelength of a source of light using grating.                                                                                                       |

|     |                                                                                          |
|-----|------------------------------------------------------------------------------------------|
| 12. | Calculate the numerical aperture and study the losses that occur in optical fiber cable. |
| 13. | To measure the acceptance angle and attenuation of a fiber cable.                        |

**Note:** *Students must conduct at least ten experiments covering all Cos.*

### **Textbooks:**

1. Experiments in Engineering Physics, M. N. Avadhanulu, A. A. Dani and Pokely P. M., S.Chand&Co.
2. Engineering Physics Practicals, S. K. Gupta, Krishna Prakashan Pvt. Ltd.
3. Practical Physics, P. R. Sasi Kumar, PHI Ltd., 2011.
4. Practical Physics, S. L. Gupta and V. Kumar, 2018, Pragati Prakashan.
5. Practical Physics, S. L. Arora, 2010, S. Chand.

| Course Code | Course Title                | L   | T   | P     | Credits |
|-------------|-----------------------------|-----|-----|-------|---------|
| BT-CSE-172A | Programming with Python Lab | 0   | 0   | 2     | 1       |
|             |                             | CIE | SEE | Total |         |
|             |                             | 50  | 50  | 100   |         |

#### Course Outcomes

|     |                                                                                                                           |
|-----|---------------------------------------------------------------------------------------------------------------------------|
| CO1 | Demonstrate competence in fundamental Python programming concepts, control statements, data types and string manipulation |
| CO2 | Apply knowledge of Python data structures such as lists, tuples, sets, and dictionaries to solve computational problems   |
| CO3 | Develop and implement functions in Python to enhance code modularity and reusability.                                     |
| CO4 | Apply exception handling techniques to analyze and handle errors effectively in Python programs.                          |
| CO5 | Utilize Python libraries such as NumPy and Pandas for data manipulation and analysis tasks.                               |
| CO6 | Demonstrate the use of Matplotlib and Seaborn libraries for data visualization                                            |

#### Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High)

|     | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9  | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| CO1 | 2   | 2   | 2   | 1   | 1   | 1   | 1   | 1   | 1    | 1    | 1    | 1    | 1    | 1    |
| CO2 | 2   | 2   | 2   | 1   | 1   | 1   | 1   | 1   | 1    | 1    | 1    | 1    | 1    | 1    |
| CO3 | 3   | 2   | 3   | 2   | 2   | 2   | 2   | 2   | 2    | 2    | 2    | 2    | 2    | 2    |
| CO4 | 3   | 2   | 3   | 2   | 2   | 2   | 2   | 2   | 2    | 1    | 2    | 2    | 2    | 2    |
| CO5 | 3   | 2   | 3   | 3   | 3   | 2   | 2   | 2   | 3    | 3    | 3    | 3    | 3    | 3    |
| CO6 | 2   | 2   | 2   | -   | -   | -   | 1   | 1   | 2    | 1    | 1    | 2    | 2    | 1    |
| Avg | 2.5 | 2   | 2.5 | 1.8 | 1.8 | 1.6 | 1.5 | 1.5 | 1.83 | 1.5  | 1.66 | 1.83 | 1.83 | 1.66 |

#### List of Experiments

|    |                                                                                                                                   |
|----|-----------------------------------------------------------------------------------------------------------------------------------|
| 1. | Write a Python program to accept three sides of a triangle as the input and print whether the triangle is valid or not.           |
| 2. | Write a Python program to find the largest among three numbers.                                                                   |
| 3. | Write a program to check if the given number is a palindrome number.                                                              |
| 4. | Write a Program to reverse a user entered number and determine whether the original and reversed numbers are equal or not.        |
| 5. | Write a program to count the number of alphabets and number of digits in a string.                                                |
| 6. | Write a Python function that takes a string as input and returns a new string where the first letter of each word is capitalized. |

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7.  | Write a program to accept a string from the user, delete all vowels from the string and display the result.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 8.  | Given a string, write a Python program to find the largest substring of uppercase characters and print the length of that substring.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 9.  | Suppose you want to know the total score of the Indian cricket team in a given match. To do so, your task is to find the sum of all the scores of the Indian team players. The scores are provided as a list, with each element as an individual score of the players. Also, there is a condition that if the number of elements in the list is more than 11, then it is an invalid input and the output should be -1.                                                                                                                                                                                                                                                                                                                                                                                            |
| 10. | Write a program to create following 3 lists:<br>A list of names.<br>A list of employee's ids.<br>A list of salaries.<br>From these lists, generate 3 tuples - one containing all names, another containing all ids and third containing all salaries. Also, from the three created lists, generate and print a list of tuples containing name, ids and salaries.                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 11. | Write a program to create a set containing 10 randomly generated numbers in the range 15 to 45. Count how many of these numbers are less than 30. Delete all numbers which are greater than 35.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 12. | Write a Python program to check whether an element exists within a tuple.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 13. | Create a dictionary of 10 usernames and passwords. Receive the username and password from keyboard and search for them in the dictionary. Print appropriate message on the screen based on whether a match is found or not.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 14. | You are provided with a dictionary containing the names of different football clubs as keys and the name of the main player of the corresponding team as values. When the main player of a team retires, one of their teammates steps up to fill in their role as the main player.<br>You're also provided with a list which contains the names of the football clubs for which the current main players are retiring and the names of the corresponding new main player. Your task is to update the values in the original dictionary with the names of the new main players.                                                                                                                                                                                                                                    |
| 15. | Write a program that defines a function compute ( ) that calculates the value of $n + nn + nnn + nnnn$ , where n is digit received by the function. Test the function for digits 4 and 7.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 16. | Create a lambda function 'greater', which takes two arguments x and y and return x if $x > y$ otherwise y.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 17. | Write a Python program to demonstrate the use of lambda functions with map, filter, and reduce.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 18. | Write a Python program to handle a Zero Division Error exception when dividing a number by zero.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 19. | Write a Python program that prompts the user to input an integer and raises a Value Error exception if the input is not a valid integer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 20. | Implement an interactive calculator in which user input is assumed to be a formula that consist of a number, an operator (at least + and -), and another number, separated by white space (e.g. 1 + 1). Split user input using str.split(), and check whether the resulting list is valid: <ul style="list-style-type: none"> <li>• If the input does not consist of 3 elements, raise a Formula Error, which is a custom Exception.</li> <li>• Try to convert the first and third input to a float (like so: float_value = float(str_value)). Catch any Value Error that occurs, and instead raise a Formula Error.</li> <li>• If the second input is not '+' or '-', again raise a Formula Error.</li> </ul> If the input is valid, perform the calculation and print out the result. The user is then prompted |

|     |                                                                                                          |
|-----|----------------------------------------------------------------------------------------------------------|
|     | to provide new input, and so on, until the user enters quit.                                             |
| 21. | Write a Python program to create a numpy array of given shape and perform basic mathematical operations. |
| 22. | Write a Python program to perform group by and aggregation on a Pandas dataframe.                        |
| 23. | Create Box plot, Scatter Plot and Histogram with Matplotlib.                                             |
| 24. | Create Pair plot, Heatmap and Distribution plot with Seaborn.                                            |

**Note:** *Students must conduct at least eighteen experiments covering all Cos.*

### **Textbooks:**

1. Core Python Programming, R. Nageswara Rao, ISBN: 9789351199427, Dreamtech Press, 2017.
2. Data Visualization with Python, Dr. Pooja, ISBN: 978-93-55515-384, BPB Publications, 2023.
3. Let Us Python, Yashavant Kanetkar, Aditya Kanetkar, 6e, ISBN: 9789355515414, BPB Publication, 2023.

### **Other References:**

1. Introduction to Computing and Problem Solving Using Python, E. Balagurusamy, ISBN: 9789352602582, McGraw Hill Education, 2017.
2. Python the Complete Reference, Martin C. Brown, ISBN: 978-9387572942, McGraw-Hill, 2018.
3. Beginning Programming with Python for Dummies, John Paul Mueller, 2e, ISBN: 978-1-119-45787-9, John Wiley & Sons, 2018.
4. Data Analytics using Python, Bharti Motwani, ISBN: 9788126502950, Wiley India Pvt. Ltd., 2020.

| Course Code                                                                                |      |                                                                                                                                 |     | Course Title         |     |     |     |     |     |      | L    | T    | P    | Credits |       |  |
|--------------------------------------------------------------------------------------------|------|---------------------------------------------------------------------------------------------------------------------------------|-----|----------------------|-----|-----|-----|-----|-----|------|------|------|------|---------|-------|--|
| BT-ME-173A                                                                                 |      |                                                                                                                                 |     | Engineering Workshop |     |     |     |     |     |      | 0    | 0    | 2    | 1       |       |  |
|                                                                                            |      |                                                                                                                                 |     |                      |     |     |     |     |     |      | CIE  |      | SEE  |         | Total |  |
|                                                                                            |      |                                                                                                                                 |     |                      |     |     |     |     |     |      | 50   |      | 50   |         | 100   |  |
| Course Outcomes                                                                            |      |                                                                                                                                 |     |                      |     |     |     |     |     |      |      |      |      |         |       |  |
| CO1                                                                                        |      | Know the workshop materials, theoretical background, and principles of various manufacturing processes used in different shops. |     |                      |     |     |     |     |     |      |      |      |      |         |       |  |
| CO2                                                                                        |      | Safely use various measuring, marking, inspection, checking, hand tools, and machines used in different shops.                  |     |                      |     |     |     |     |     |      |      |      |      |         |       |  |
| CO3                                                                                        |      | Prepare simple jobs using hand tools, machines, etc. in different shops.                                                        |     |                      |     |     |     |     |     |      |      |      |      |         |       |  |
| CO4                                                                                        |      | Perform basic operations on a lathe and CNC machines.                                                                           |     |                      |     |     |     |     |     |      |      |      |      |         |       |  |
| Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High) |      |                                                                                                                                 |     |                      |     |     |     |     |     |      |      |      |      |         |       |  |
|                                                                                            | PO1  | PO2                                                                                                                             | PO3 | PO4                  | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2    |       |  |
| CO1                                                                                        | 1    | -                                                                                                                               | -   | -                    | -   | -   | -   | -   | -   | -    | -    | -    | 1    | 1i      |       |  |
| CO2                                                                                        | 2    | 3                                                                                                                               | -   | -                    | -   | -   | -   | -   | -   | -    | -    | -    | 1    | 1       |       |  |
| CO3                                                                                        | 2    | 2                                                                                                                               | 2   | -                    | -   | -   | -   | -   | -   | -    | -    | -    | 1    | 1       |       |  |
| CO4                                                                                        | 2    | 3                                                                                                                               | 2   | -                    | -   | -   | -   | -   | -   | -    | -    | 3    | 1    | 1       |       |  |
| Avg                                                                                        | 1.75 | 1                                                                                                                               | 2   | -                    | -   | -   | -   | -   | -   | -    | -    | 3    | 1    | 1       |       |  |

### List of Experiments

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| <b>Welding Shop</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Contact Hours: 4</b> |
| <ol style="list-style-type: none"> <li>Practice deposition of proper weld beads with a variation of welding current for a given work piece and identify defects in it.</li> <li>Prepare the following joints with metal arc welding: <ul style="list-style-type: none"> <li>Butt Joint.</li> <li>Lap Join with fillet welds.</li> </ul> </li> </ol> <p>(Students are to study and know about types and principles of welding, effects of current and voltage in metal arc welding, IS-816:1969 (1998), welding defects, types of welding joints, and safety measures in the welding shop.)</p> |                         |
| <b>Carpentry Shop</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Contact Hours: 4</b> |
| <ol style="list-style-type: none"> <li>Prepare a cross half lap joint.</li> <li>Prepare Mortise Tenon joint.</li> </ol> <p>(Students are to study and know about different types of woods, joints, carpentry tools, and safety measures in the shop.)</p>                                                                                                                                                                                                                                                                                                                                      |                         |

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| <b>Fitting Shop</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Contact Hours: 4</b> |
| <p><b>5.</b> Perform metal removal, finishing operations, and prepare a threaded hole in the center of a square mild steel plate.</p> <p>(Students are to study and know different metals and alloys used in workshops, e.g., mild steel, medium carbon steel, high carbon steel, high speed steel, cast iron, etc., different types of fits, IS 919(Part 1):1993, operation of drilling machines, use of taps for preparing internal threads, marking and measuring tools, and safety measures in the shop.)</p> |                         |
| <b>Sheet-Metal Shop</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Contact Hours: 4</b> |
| <p><b>6.</b> Create development markings on the sheet metal to fabricate:</p> <ul style="list-style-type: none"> <li>• A funnel from the given G.I. sheet.</li> <li>• A tray, tool box, or electric panel box from the given G.I. sheet.</li> </ul> <p>(Students are to study and know the development of the lateral surface of a solid on the sheet metal; different types of sheet metal joints; marking, measuring, cutting tools; and safety measures in the shop.)</p>                                      |                         |
| <b>Machine Shop</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Contact Hours: 4</b> |
| <p><b>7.</b> Practice basic operations on the lathe, e.g., facing, plane turning, and step turning with the calculation of MRR.</p> <p><b>8.</b> Practice operations on lathe, e.g., taper turning, threading, knurling, and parting off.</p> <p>(Students are to study and know various parts, accessories, and their functions in a lathe machine, operations performed on a lathe machine, and safety measures in the shop.)</p>                                                                               |                         |
| <b>CNC Shop</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Contact Hours: 4</b> |
| <p><b>9.</b> Perform different operations on metal components using any CNC machines.</p> <p>(Students are to study and know the main features, working parts of a CNC machine, and the G and M codes.)</p>                                                                                                                                                                                                                                                                                                       |                         |

### Textbooks:

1. Raghuwanshi B. S., Workshop Technology Vol. I & II, Dhanpath Rai & Sons.
2. Rajender Singh, Introduction to Basic Manufacturing Processes and Workshop Technology, New Age International (P) Ltd., Publishers, 2006.
3. P. M. Agrawal, Dr. V. J. Patel, CNC Fundamentals and Programming, 2022, Charotar Publishing House Pvt. Ltd.
4. Jeyapoovan T. and Pranitha S., Engineering Practices Lab Manual, 3e, Vikas Pub., 2008.

### Other References:

6. H. S. Bawa, Workshop Practices, Tata McGraw Hill.



| Course Code                                                                                |                                                                                                          |     |     | Course Title |     |     |     |     |     |      | L    | T    | P    | Credits |
|--------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|-----|-----|--------------|-----|-----|-----|-----|-----|------|------|------|------|---------|
| BT-ME-175A                                                                                 |                                                                                                          |     |     | Idea Lab     |     |     |     |     |     |      | 0    | 0    | 2    | 1       |
|                                                                                            |                                                                                                          |     |     |              |     |     |     |     |     |      | CIE  | SEE  |      | Total   |
|                                                                                            |                                                                                                          |     |     |              |     |     |     |     |     |      | 50   | 50   |      | 100     |
| Course Outcomes                                                                            |                                                                                                          |     |     |              |     |     |     |     |     |      |      |      |      |         |
| CO1                                                                                        | Learn the process of 3D scanning, its applications, and its limitations.                                 |     |     |              |     |     |     |     |     |      |      |      |      |         |
| CO2                                                                                        | Create a 3D model in CAD software and convert into an STL file.                                          |     |     |              |     |     |     |     |     |      |      |      |      |         |
| CO3                                                                                        | Print a 3D model with suitable filament material; identify its defects and effects of process variables. |     |     |              |     |     |     |     |     |      |      |      |      |         |
| CO4                                                                                        | Learn the basics operations and use of a CNC wood router and laser cutter.                               |     |     |              |     |     |     |     |     |      |      |      |      |         |
| CO5                                                                                        | Understand the basics of drone design and operations.                                                    |     |     |              |     |     |     |     |     |      |      |      |      |         |
| Course Outcomes (CO) to Programme Outcomes (PO) mapping (scale 1: low, 2: Medium, 3: High) |                                                                                                          |     |     |              |     |     |     |     |     |      |      |      |      |         |
|                                                                                            | PO1                                                                                                      | PO2 | PO3 | PO4          | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2    |
| CO1                                                                                        | 3                                                                                                        | 3   | -   | 3            | -   | -   | -   | -   | -   | -    | -    | 3    | 3    | 3       |
| CO2                                                                                        | 3                                                                                                        | 3   | -   | 2            | -   | -   | -   | -   | -   | -    | -    | 3    | 3    | -       |
| CO3                                                                                        | 3                                                                                                        | 3   | -   | 3            | -   | -   | -   | -   | -   | -    | -    | 2    | -    | 2       |
| CO4                                                                                        | 3                                                                                                        | 3   | 2   | 3            | -   | -   | -   | -   | -   | -    | -    | 3    | 3    | 3       |
| CO5                                                                                        | 3                                                                                                        | 3   | 3   | 2            | -   | -   | -   | -   | -   | -    | -    | 3    | 2    | 3       |
| Avg                                                                                        | 3                                                                                                        | 3   | 2.5 | 2.6          | -   | -   | -   | -   | -   | -    | -    | 2.8  | 2.7  | 2.7     |

### List of Experiments

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                         |
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| <b>3D Scanning</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Contact Hours: 4</b> |
| 1. Review the use of 3D scanning technology in part inspection and replication. Prepare a review report.<br>2. Evaluate the resolution and accuracy of 3D scanning technology under various settings and conditions.                                                                                                                                                                                                                                                                                            |                         |
| <b>3D Printing</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Contact Hours: 6</b> |
| 3. Create a 3D model in CAD software of an engineering component and convert it to STL format.<br>4. Explore the effect of STL file resolution and process parameters, e.g., layer thickness, orientation, and infill, on printing time using software.<br>5. Explore the mechanical properties, surface finish, and printability of different materials (e.g., PLA, ABS, PETG) used in 3D printing and prepare a brief report.<br>6. Identify the defects in 3D-printed components and prepare a brief report. |                         |
| <b>CNC Routing</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Contact Hours: 4</b> |
| 7. Explore how different materials (e.g., wood, plastics) respond to CNC routing processes in terms of cutting speed, tool wear, and finish quality.<br>8. Produce shapes and contours using advanced CNC routing techniques.                                                                                                                                                                                                                                                                                   |                         |
| <b>Laser Cutting</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Contact Hours: 4</b> |
| 10. Investigate and optimize cutting parameters for different materials using a laser cutter.                                                                                                                                                                                                                                                                                                                                                                                                                   |                         |

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| <b>Drones</b>                                                                                                                        | <b>Contact Hours: 4</b> |
| 11. Explore the basics of a drone and identify the components of a working drone with specifications and understanding of their use. |                         |

**Note:** *Students must conduct at least eight experiments covering all COs.*

### **Text Books:**

1. Gary C. Confalone, John Smits, Thomas Kinnare, 3D Scanning for Advanced Manufacturing, Design, and Construction, Wiley.
2. Amit Bandyopadhyay, Susmita Bose, Additive Manufacturing, 2e, CRC Press, 2020.
3. Fused Deposition Modeling Based 3D Printing, Editors: Harshit K. Dave, J. Paulo Davim, Springer.
4. CNC Router Essentials, Randy Johnson, George Vondrisk, Cedar Lane Press.
5. Beginner's Guide to CNC Machining in Wood, Ralph Bagnall, Fox Chapel Publishing.
6. CO2 Laser Cutting, John Powell, Springer.
7. Dharna Nar, Dr. Radhika Kotecha, Dinesh Sain, Drone Technology for Beginners - Learn | Build | Fly Drones, 2024, Drone School India and Ane Books Pvt. Ltd.