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

Unit-1: Matrices and System of Linear Equations **Contact Hours: 10**

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.

Unit-2: Eigen Values and Eigen Vectors **Contact Hours: 10**

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.

Unit-3: Differential Calculus-I **Contact Hours: 12**

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.

Unit-4: Differential Calculus-I I **Contact Hours: 12**

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
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

Unit-1: Water Treatment — Contact Hours: 10

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.

Unit-2: Fuels, Combustion and Corrosion — Contact Hours: 11

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.

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.

Unit-3: Spectroscopic Technique and Application	**Contact Hours: 10**
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).	
Unit-4: Material Chemistry and Green Chemistry	**Contact Hours: 10**
Polymers: 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. **Green Chemistry:** 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
Unit-1 Listening Skills **Contact Hours: 06**
Types of Listening, Active Listening: Gathering the main idea, sequencing, Note-making, Summarizing, Paraphrasing, Asking questions, Barriers of Listening ,Strategies for Effective Listening
Unit-2 Speaking Skills **Contact Hours: 06**
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.
Unit-3 Reading Skills **Contact Hours: 06**
Types of Reading: Skimming, Scanning, comprehending the main idea, understanding implications, analysing, Strategies for Effective Reading • Flowers for Algernon by Daniel Keyes(Case Study) • Of Studies by Francis Bacon(Essay) • The Proposal by Anton Chekov(One Act Play) • Toba Tek Singh by Saadat Hasan Manto(Short Story)
Unit-4 Writing Skills **Contact Hours: 06**
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 Traning, Iantuhovsky, Createspace Independent Pub, 2015.

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

Unit-1: Electric Circuits **Contact Hours: 12**

DC Circuit Analysis: 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 & parallel circuits, Star-Delta and Delta-Star conversions, Meshand Nodal Analysis.

Network Theorems: Superposition theorem,Thevenin's theorem,Norton's Theorem, duality, reciprocity theorem and maximum power transfer theorem.

Unit-2: AC Fundamentals & AC Circuit **Contact Hours: 11**

AC signal; Average and RMS values of sinusoidal AC; polar & rectangular forms of representation of phasor quantities. Addition & subtraction of two or more sinusoidal quantities using the component resolution method/ phasors.

RLC Circuits: Steady-state AC response of R/L/C, RL, RC series and parallel circuits, P.F.; active, reactive & apparent powers.

Unit-3:Transformer and DC Motors **Contact Hours: 11**

Single phase transformer (only qualitative analysis): Working Principle, Construction, Emf

equation, Losses in a transformer, Maximum efficiency condition.

DC motor characteristics: 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.

Unit-4: Semiconductor Devices and Applications **Contact Hours: 10**

PN Junction Diode: 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.

Bipolar Junction Transistor: 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.

Text Books:

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

Other References:

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

Course Code	Course Title	L	T	P	Credits
BT-ME-104A	Engineering Graphics and Design	1	2	0	3
		CIE	SEE		Total
		40	60		100

Course Outcomes	
CO1	Draw orthographic projections of an object using appropriate scales.
CO2	Draw projections of lines, lamina, and regular solid objects having any specified orientation with reference to the principal planes.
CO3	Visualize and draw sections of a regular solid.
CO4	Create developments of the lateral surfaces of a regular solid.
CO5	Draw isometric projections and views of an object.

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	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO4	3	3	3	-	-	-	-	-	-	-	-	-	-	-
Avg	**3**	**2.75**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**

Content	
Unit-1: Introduction to Engineering Drawing and Orthographic Projection	**Contact Hours: 9**

Drawing instruments and their use, drawing conventions, dimensioning, types of lines, Scales: plain, diagonal, and engineering scales, First and third-angle systems of Orthographic Projection.

Projection of points in different quadrants.

Projection of Straight Lines: Projection of lines inclined to one plane and both planes, true length, inclination with reference planes, traces of a line.

Unit-2: Projection of Planes and Solids	**Contact Hours: 9**

Projection of polygonal and circular lamina located in the first quadrant and inclined to one or both of the reference planes.

Classification of solids, Projection of solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane.

Unit-3: Sections of Regular Solids and Development of Lateral Surfaces	**(Contact Hours: 9)**

Sections of Solids: Auxiliary views for the true shape of the sections of right regular solids and such as prism, cylinder, pyramid, and cone.

Development of the lateral surfaces for various right regular solids such as prism, cylinder, pyramid, and

cone.	
Unit-4: Isometric Projection	**(Contact Hours: 9)**
Isometric scales, isometric projections of simple and combination of solids. Conversion of orthographic projection to isometric view and vice versa.	

Textbooks:

1. Bhatt N. D., Panchal V. M. and Ingle P. R., 2014, Engineering Drawing, Charotar Publishing House.
2. Shah, M. B. and Rana B. C., 2008, Engineering Drawing and Computer Graphics, Pearson Education.

Other References:

3. Agrawal B. and Agrawal C. M., 2012, Engineering Graphics, TMH Publication.
4. Engineering Graphics and Design, A. P. Gautam and Pradeep Jain, Khanna Publishing House.
5. Narayana, K. L. and P. Kannaiah, 2008, Text book on Engineering Drawing, Scitech Publishers.

Note: Students are required to prepare drawings containing solutions to the problems under different units during the tutorial classes and also under their home assignments.

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 Traning, Iantuhovsky, Createspace Independent Pub, 2015.

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 $KMnO_4$ 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-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	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	-	-

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-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.

Textbooks:

5. Internet of Things, 2e, 2020, Shriram K. Vasudevan, Abhishek S. Nagarajan, R. M. D. Sundaram, Wiley India.
6. Internet of Things: Architecture and Design Principles, 2e, 2022, Raj Kamal, McGraw Hill.
7. Internet of Things – A Hands-On-Approach, 2015, Arsheep Bahga, Vijay Madisetti, Orient Blackswan Private Limited, Delhi.
8. 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.

Course Code	Course Title	L	T	P	Credits
BT-ME-154A	Engineering Graphics and Design Lab	0	0	2	1
		CIE	SEE		Total
		50	50		100

Course Outcomes

CO1	Demonstrate the usage of CAD software.
CO2	Use the orthographic projection to draw views of the lamina, regular solids, and the sections of solids.
CO3	Draw the surfaces of regular solids.
CO4	Draw the isometric views of solids.

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**	**-**	**3**
CO2	**3**	**3**	**3**		**2**	**-**	**-**	**-**	**3**	**3**	**-**	**-**
CO3	**3**	**3**	**2**	**3**	**3**	**-**	**-**	**-**	**3**	**3**	**-**	**-**
CO4	**3**	**2**	**3**	**2**	**3**	**-**	**-**	**-**	**2**	**2**	**-**	**2**
Avg	**3**	**2.66**	**2.66**	**2.5**	**2.75**				**2.5**	**2.75**		**2.5**

List of Experiments

Unit-1: CAD software: Review of graphic interface. **Contact Hours: 6**

Layout of the software, standard tool bar/menus, most commonly used tool bars, navigational tools. Co-ordinate system and reference planes (HP, VP, RPP & LPP). Selection of drawing size and scale. Commands and creation of lines, co-ordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. tangency, parallelism, inclination and perpendicularity. Dimensioning, line conventions, material conventions and lettering.

Unit-2: Computer Aided Engineering-Drawing **Contact Hours: 18**

Projection of planes and solids. Sections of regular solids. Development of the lateral surfaces of regular solids. Isometric projection.

Note: ***Students to keep a record of the computer printouts of their own work:***

Textbooks:

1. M. H. Annaiah, C. N. Chandrappa and B. Sudheer Premkumar, Computer Aided Engineering Drawing, 5e, New Age International Publishers.
2. T. Jeyapoovan, Engineering Graphics using AutoCAD 2000, Vikas Publishing House, 2015.
3. A Primer on computer aided engineering drawing, VTU, Belgam, 2007.
4. Kulkarni D. M., et. al. Engineering Graphics with AutoCAD, PHI, 2010.
5. S. Trymbakaa Murthy, A Text Book of Computer Aided Machine Drawing, CBS Publishers, New Delhi, 2007.
6. Goutarri Pohit and Goutam Ghosh, Machine Drawing with Auto CAD, Pearson Education, 2005.

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

Unit-1:Ordinary Differential Equations **Contact Hours:11**

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.

Ordinary differential equations of higher order (up to 4^{th} order): linear differential equations with constant coefficients, method of variation of parameters, Cauchy's and Legendre's linear differential equations.

Unit-2: Partial Differentiation **Contact Hours:11**

Functions of two or more variables, Partial derivatives, Derivatives of composite and implicit functions, Change of variables. Homogeneous functions, Euler's theorem.

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.

Unit-3: Measure of Central Tendencies and Dispersions **Contact Hours: 10**

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.

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.
Unit-4: Probability and Probability Distributions **Contact Hours: 10**
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, 12th edition, 2022.
3. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10th 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'd Edition, Willey, 1968.
4. S. Ross, A First Course in Probability, 6th Edition Pearson Education India 2002.

Course Code	Course Title	L	T	P	Credits
ASH-PHY-104A	Mechanics and Mechanical properties of Materials	3	1	0	4
		CIE	SEE		Total
		40	60		100

Course Outcomes

CO1	Demonstrate an understanding of fundamental mechanics concepts to analyze motion, forces, and trajectories in physical systems.
CO2	Apply concepts of non-inertial reference frames and rigid body mechanics to analyze forces, motion, and rotational dynamics in complex systems.
CO3	Interpret the types of mechanical vibrations and their applications, the role of Shock waves in various fields.
CO4	Understanding the mechanical and elastic properties of materials for engineering applications

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**	**2.75**	**2**	**2.25**	**1.75**	**1.5**	**1.25**	**1**	**1**	**1**	**1**	**2**

Content

Unit-1: Mechanics of Particles (Contact Hours: 10)

Review of Newtonian Mechanics: Equilibrium forces and free body diagram with example, Newton's laws, equations of motion in polar form, examples – Conservative and non-conservative systems – system of particles, Center of Mass.

Central Forces: Central Forces, Kepler's Law, trajectories in Gravitational systems, Satellite manoeuvres.

Unit-2: Non-Inertial Frames and Rigid Body Mechanics (Contact Hours: 10)

Non-inertial frames: Motion in non-inertial frames, Coriolis and Centrifugal forces, Weather systems, Foucault pendulum.

Rigid Body Mechanics: Independent Coordinates for a rigid body, Moment of inertia, radius of gyration, Parallel and perpendicular axis theorems, examples of moment of inertia of uniform bodies (rod, rectangular plane, ring, disc, and cylinder sphere), Polar moment of inertia, Euler angles – The Inertia tensor and Moment of Inertia – Principal Axis transformation, Introduction to three-dimensional rigid body motion.

Unit-3: Oscillations and Wave (Contact Hours: 10)

Free Oscillations: Basics of SHM, derivation of differential equation for SHM, Mechanical simple harmonic oscillators (spring constant by series and parallel combination), Equation of motion for free oscillations, Natural frequency of oscillations.

Damped and Forced Oscillations: Theory of damped oscillations (derivation), over damping, critical & under damping (only graphical representation), quality factor; Theory of forced oscillations (derivation) and resonance, sharpness of resonance.

Shock waves: Mach number, Properties of Shock waves, Construction and working of Reddy shock tube, applications of shock waves, Numerical problems.

Unit-4: Mechanical and Physical Properties of Materials (Contact Hours: 10)

Mechanical properties : Concept of elasticity, plasticity, stress, strain, tensile stress, shear stress, compressive stress, strain hardening and strain softening, failure (fracture/fatigue), Hooke's law, different elastic moduli: Poisson's ratio, Expression for Young's modulus (Y), Bulk and β. Relation between Y, n and K,αmodulus (K) and Rigidity modulus (n) in terms of Limits of Poisson's ratio.

Physical Properties: Density, specific heat, melting and boiling point, thermal expansion and conductivity, electrical and magnetic properties

Textbooks:

1. Engineering Physics-Gaur and Gupta-Dhanpat Rai Publications-2017.
2. Engineering Mechanics-MK Harbola-Cengage India Private Limited; 2nd edition-2012
3. Introduction to Mechanics -MK Verma-CRC Press; 1st edition-2009
4. Shock waves made simple- Chintoo S Kumar, K Takayama & KPJ Reddy- Willey India Pvt. Ltd.-2014.

.

Other References:

1. Introduction to Classical Mechanics: With Problems and Solutions-David Morin-1st Cambridge University Press; 1st edition-2008.
2. Physics-Robert Resnick , David Halliday, Kenneth S. Krane-Wiley; Fifth edition-2007
3. An Introduction to Mechanics-Daniel Kleppner,Robert J. Kolenkow-McGraw Hill Education-1st edition 2017
4. Ginsberg - Engineering Dynamics-Cambridge University Press-2008)

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

Unit-1: Phonetics (Contact Hours: 8)

Speech Mechanism, Introduction to English Speech Sounds and Phonetic Alphabets, Description of English Speech Sounds, Activities related to phonetics

Unit-2: Syntax (Contact Hours: 10)

Parts of Speech, Articles and Determiners, Prepositions , Conjunctions, Voice, Gerund, Infinitives and Participle, Activities Related to Syntax

Unit-3: Vocabulary Building (Contact Hours: 8)

Prefixes and suffixes, One Word Substitution, Standard Abbreviations, Synonyms, Antonyms, Homonyms, Homophones, Technical Jargons, Activities Related to Vocabulary

Unit-4:Basics of Composition (Contact Hours: 10)

Phrases, Clauses and sentences, Tenses, Verb Patterns, Punctuation and common Errors, Activities Related to Compostion

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	PO 4	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	
Unit-1: Introduction to Value Education	**Contact Hours: 6**
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.	
Unit-2: Harmony in the Human Being	**Contact Hours: 6**
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.	
Unit-3: Harmony in the Family and Society and Harmony in the Nature	**Contact Hours: 6**
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.	
Unit-4: Social and Professional Ethics	**Contact Hours: 6**
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. Triparty, 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- 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

Unit-1: Introduction — Contact Hours: 08

Overview of Computers: Block diagram and its description.

Computer Hardware: Printers, keyboard, mouse, storage devices.

Number systems: Binary, octal, hexadecimal number system**,** arithmetic of number systems.

Introduction to programming language: Different levels - high level language, assembly language, machine language; introduction to compiler, interpreter, debugger, linker, loader, and assembler.

Problem Analysis: Problem solving techniques, algorithms, pseudocode and flowchart representation.

Unit-2: Token, Operators and Decision making — Contact Hours: 10

Overview of C: Elements of C, data types, storage classes in C.

Operators: Arithmetic, relational, logical, bitwise, unary, assignment and conditional operators, precedence and associativity of operators.

Input/output: Unformatted and formatted I/O function in C.

Control statements: If statement, switch statement, for, while, and do-while loop; break, continue, go to statements.

Unit-3: Handling Arrays and Functions in C — Contact Hours: 08

Functions: Definition, prototype, parameters passing techniques, recursion, built-in functions, passing arrays to functions, returning arrays from functions. **Arrays:** Definition, types, initialization, processing an array, string handling.
Unit-4: Pointers and Data files **Contact Hours: 10**
Structure & Union: Definition, use of structure, passing structures to functions, typedef with structure, use of union. **Pointers:** Declaration, operations on pointers, pointers and arrays, dynamic memory allocation, pointers and functions, pointers and strings. **File handling in C:** 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 Kanetker, 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
ASH-PHY-174A	Mechanics and Mechanical Properties of Materials Lab	0	0	2	1
		CIE	SEE		Total
		50	50		100

Course Outcomes

CO1	Develop practical skills to measure fundamental physical constants like acceleration due to gravity and Young's modulus through various experimental methods.
CO2	Understand the principles of rotational motion, wave theory, and thermal properties by performing experiments on inertia, standing waves, and specific heat.
CO3	Apply theoretical concepts to determine material properties such as rigidity, dielectric constant, and thermal conductivity through hands-on experiments.
CO4	Enhance problem-solving and analytical abilities by interpreting experimental data and understanding the relationship between force, motion, and material properties..

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**	**-**	**-**	**-**	**-**	**-**		
CO2	**3**	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**		
CO3	**3**	**2**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**		
CO4	**3**	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**			
Avg	**3**	**2.5**	**2**	**2.5**	**1.75**							

List of Experiments

1.	To determine acceleration due to gravity using a simple pendulum.
2.	To determine force required for rotation using centripetal Force Apparatus
3.	To determine acceleration due to gravity using bar pendulum
4.	To determine moment of inertia of a fly wheel.
5.	To demonstrate Earth's rotation using Foucault's pendulum.
6.	To Study standing waves in a stretched string.
7.	To study Young's Modulus by Searle's Method.
8.	To find Young's modulus by bending of beam
9.	To determine modulus of rigidity by Maxwell's needle.
10.	To study thermocouple.
11.	To determine the dielectric constant of different dielectric materials.
12.	To determine specific heat of materials.
13.	To determine thermal conductivity of a good conductor using Searle's method
14.	To Study the deflection of beams under various loads (bending of beam).
15.	To find the spring constant using Hook's law.

Note: ***Students must conduct a minimum of eight experiments covering the entire COs.***

Textbooks:

1. Practical Physics, G.L. Squires, Cambridge University Press, 4th Edition-2001.
2. Practical Physics, R.K. Shukla and Anchal Srivastava, New Age international (P) limited Publishers, 2006
2. Practical Physics, S. L. Arora, 2010, S. Chand.

Course Code	Course Title	L	T	P	Credits
BT-CSE-171A	Problem Solving using "C" Lab (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 - x3/3! +x5/5! - x7/7! ... xn/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-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

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

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
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

Welding Shop **Contact Hours: 4**

1. Practice deposition of proper weld beads with a variation of welding current for a given work piece and identify defects in it.
2. Prepare the following joints with metal arc welding:
   - Butt Joint.
   - Lap Join with fillet welds.

(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.)

Carpentry Shop **Contact Hours: 4**

3. Prepare a cross half lap joint.
4. Prepare Mortise Tenon joint.

(Students are to study and know about different types of woods, joints, carpentry tools, and safety measures in the shop.)

Fitting Shop **Contact Hours: 4**

5. Perform metal removal, finishing operations, and prepare a threaded hole in the center of a square mild steel plate.

(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.)

Sheet-Metal Shop **Contact Hours: 4**

6. Create development markings on the sheet metal to fabricate:

- A funnel from the given G.I. sheet.
- A tray, tool box, or electric panel box from the given G.I. sheet.

(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.)

Machine Shop **Contact Hours: 4**

7. Practice basic operations on the lathe, e.g., facing, plane turning, and step turning with the calculation of MRR.

8. Practice operations on lathe, e.g., taper turning, threading, knurling, and parting off.

(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.)

CNC Shop **Contact Hours: 4**

9. Perform different operations on metal components using any CNC machines.

(Students are to study and know the main features, working parts of a CNC machine, and the G and M codes.)

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:

1. 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

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

Course Code	Course Title	L	T	P	Credits
10. 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 Vondriska, 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.

BT-CE-102A	Environment Studies	3	0	0	0
		CIE	SEE		Total
		40	60		100

Course Outcomes	
CO1	The students will be able to understand the importance of natural resources.
CO2	To learn the theoretical concepts of ecosystem and biodiversity conservation.
CO3	Students will be able to understand about pollution and its control.
CO4	The students will be able to understand the basic concept of sustainable development.

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	-	-	-	-	-	-
CO2	-	-	-	-	-	-	3	-	-	-	-	2	-	-
CO3	-	-	3	-	-	-	3	-	-	-	-	3	-	-
CO4	-	-	2	-	-	-	3	3	-		-	3	-	-
Avg	-	2	2.5	-	-	-	2.7	2.5	-	-	-	2.6	-	-

Content	
Unit-1:The multidisciplinary nature of environmental studies	**(Contact Hours: 8)**
Definition, Scope and Importance. Need for public awareness. Natural Resources: Renewable and Non-Renewable Resources: Natural resources and associated problems. (a) Forest Resources: Use and over-exploitation, deforestation, case studies. (b) Energy Resources- Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies. (c) Land Resources- Land as a resource, land, degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyle.	
Unit-2: Ecosystem and Biodiversity Concept	**(Contact Hours: 8)**
Ecosystem: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem. Food Chains, food webs. Biodiversity and its conservation: Introduction, Definition: genetic, species and ecosystem diversity. Bio-geographical classification of India, Value of biodiversity, Hot spots of Biodiversity. Threats to biodiversity: Habitat loss, poaching of wild life, man-wildlife conflicts. Endangered and endemic species of India, Conservation of Biodiversity- In situ and Ex-Situ conservation of biodiversity.	
Unit-3: Environmental Pollution	**(Contact Hours: 10)**
Definition, Cause, effects and control measures of- (a) Air Pollution (b) Water Pollution (c) Soil Pollution (d) Marine Pollution. Visit to a local polluted site- Urban /Rural/Industrial/Agricultural. (Field work equal to 5 lecture hours).	

Solid waste management- cause, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution, E- waste management, plastic waste. Disaster management- Natural: floods, earthquake, cyclone and landslides etc. Man made Disaster: Fire, industrial pollution, nuclear disaster, biological Disaster, Disaster preparedness plans.
Unit-4: Social Issues and the Environment **(Contact Hours: 10)**
From unsustainable to sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people: Its problems and concerns. Environmental ethics-issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, Case studies, Concept of green building, carbon foot printing. Environment Protection Act (Air,water,wildlife,forest), Environment and human health, Role of Information Technology in Environment and Human Health, Case Studies. Emerging technologies for Environmental management.

Textbooks:

1. Environmental Studies- Deswal and Deswal. Dhanpat Rai & Co.
2. Environmental Science & Engineering Anandan, P. and Kumaravelan, R. 2009. ScitechPublications (India) Pvt. Ltd., India

Other References:

3. Environmental Studies. Daniels Ranjit R. J. and Krishnaswamy. 2013. Wiley India.
4. Environmental Science- Botkin and Keller. 2012. Wiley, India.