Sri Sivasubramaniya Nadar College of Engineering

(An Autonomous Institution, Affiliated to Anna University, Chennai)

Regulation 2024

Curriculum and Syllabi

for

B. E in Computer Science and Engineering

Sri Sivasubramaniya Nadar College of Engineering
(An Autonomous institution, Affiliated to Anna University Chennai)

Department of Computer Science and Engineering

B. E in Computer Science and Engineering

VISION

- To emerge as a world class technology department through education, innovation and collaborative research.

MISSION

- To impart quality education to students.
- To create and disseminate knowledge for the betterment of mankind.
- To establish a center of excellence in collaboration with industries, research laboratories and other agencies to meet the changing needs of society.
- To provide individual attention and enable character building.
- To encourage entrepreneurship skills among students.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1:
Professional Success: Our graduates will excel in their career in industries associated with Computer Science and Engineering, or in research, or as entrepreneurs by applying their expertise in diverse domains.

PEO2:
Adaptability: Our graduates will adapt to emerging technologies and develop new skills to remain competitive.

PEO3:
Professionalism: Our graduates will maintain ethical and professional standards in their technical work keeping sustainable development of the society in view.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of

mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **Engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and teamwork:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs)

On successful completion of the program, our graduates will be able to

PSO 1: Apply foundational knowledge in discrete structures, algorithms, computer networks, databases, operating systems, Internet programming and Artificial Intelligence, to solve complex computing problems.

PSO 2: Design and implement software and hardware systems using contemporary information processing technologies by applying software engineering principles and practices.

PEOs mapping with POs and PSOs

PEOs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
PEO – I	3	3	3	3	2	1	1	1	2	3	2	3	3	3
PEO – II	1	2	3	2	3	3	3	1	2	1	2	3	2	3
PEO – III	2	2	2	2	1	2	2	3	2	1	3	2	2	3

CO-PO-PSO MAPPING

Semester	Course Name	POs												PSOs	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
I	Communicative English (TCP)						1			1	3		1		
	Algebra and Calculus for Engineers	3	2			1							1		
	Engineering Physics (TCP)	3	2		1						2				
	Engineering Chemistry (TCP)	3			1		1	1		1			1		
	Problem Solving and Python Programming (TCP)	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Engineering Graphics	3				1					3		1	1	1
II	Calculus of Vectors, Complex Functions and Laplace Transforms	3	2										1		
	Basic Electrical and Electronics Engineering	3	3	1	1		1	1	1	1	1	1	1		
	Program Development Using C (TCP)	3	3	3	3		2		3	3	3		3	2	2
	Environmental Science						2	3		1	1		1		
	Digital Principles and Design	3	2	3										2	2
	Design Thinking and Engineering Practices Laboratory						2		2	2	2		2		
	Digital Principles and Design Lab	3	2	3	3					3	3			2	2
	Fundamentals and Practice on Software Development (EFP)	3	3	3	3	3	3	3	3	3	3	3	3	3	3

TCP - Theory-cum Practical

First Year Curriculum – R-2024 (Choice Based Credit System)

SEMESTER I				Teaching and Learning Scheme (per semester)						
S. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	TW& SL#	TH	C
	THEORY									
1	UEN3186	Communicative English (TCP)	HS	4	30	0	15	45	90	3.0
2	UMA3176	Algebra and Calculus for Engineers	BS	4	45	15	0	60	120	4.0
3	UPH3186	Engineering Physics (TCP)	BS	5	45	0	15	60	120	4.0
4	UCY3186	Engineering Chemistry (TCP)	BS	5	45	0	15	60	120	4.0
5	UGE3188	Problem Solving and Python Programming (TCP)	ES	5	15	0	30	45	90	3.0
6	UGE3176	Engineering Graphics	ES	5	15	0	30	45	90	3.0
7	UGA3176	Heritage of Tamils	HS	1	15	0	0	15	30	1.0
	PRACTICALS									
-	-	-	-	-	-	-	-		-	-
TOTAL				**29**	**210**	**15**	**105**	**330**	**660**	**22.0**
	SKILL DEVELOPMENT									
8	UGEV301	SDG Experiential Laboratory I [$]	EEC	2	0	0	15	15	30	1.0

#TW & SL – Term Work & Self Learning per semester

SEMESTER II				Teaching and Learning Scheme (per semester)						
S. No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	TW& SL#	TH	C
	THEORY									
1	UMA3276	Calculus of Vectors, Complex Functions and Laplace Transforms	BS	4	45	15	0	60	120	4.0
2	UEE3276	Basic Electrical and Electronics Engineering	ES	3	45	0	0	45	90	3.0
3	UCS3281	Program Development Using C (TCP)	ES	5	15	0	30	45	90	3.0
4	UCY3276	Environmental Science	MC	3	15	0	0	15	30	1.0*
5		Humanities I-Elective	HS	4	30	0	15	45	90	3.0
6	UCS3262	Digital Principles and Design	ES	3	45	0	0	45	90	3.0
7	UGA3276	Tamils and Technology	HS	1	15	0	0	15	30	1.0
	PRACTICALS									
8	UGE3297	Design Thinking and Engineering Practices Laboratory	ES	3	0	0	30	15	45	1.5
9	UCS3211	Digital Principles and Design Laboratory	ES	3	0	0	30	15	45	1.5
10	UCS3212	Fundamentals and Practice on Software Development	EEC	2	0	0	15	45	60	2.0
TOTAL				**31**	**210**	**15**	**120**	**345**	**690**	**23.0**

	SKILL DEVELOPMENT									
11	UGEV302	SDG Experiential Laboratory II [$]	EEC	2	0	0	15	15	30	1.0

[$] Value added course – Credits will not be counted for CGPA Calculation.

L - Lecture periods per week, **T** - Tutorial periods per week, **P** - Practical periods per week, **EL** - Experiential learning periods per week, **C** – Credits and **TCP** - Theory-cum Practical

SEMESTER III				**Teaching and Learning Scheme (per semester)**						
S. No.	**COURSE CODE**	**COURSE TITLE**	**CATEGORY**	**CONTACT PERIODS**	**L**	**T**	**P**	**TW&SL#**	**TH**	**C**
THEORY										
1	UMA3352	Foundations of Discrete Mathematics	BS	4	45	15	0	60	120	4
2	UHS3386	Universal Human Values 2: Understanding Harmony	HS	3	30	0	30	30	90	3
3	UCS3301	Data structures	PC	3	45	0	0	45	90	3
4	UCS3302	Computer Organization and Architecture	PC	3	45	0	0	45	90	3
5	UCS3361	Object Oriented Programming	PC	4	30	0	60	30	120	4
6	UCS3303	Operating Systems	PC	3	45	0	0	45	90	3
7	UGE3386	Design Thinking, Innovation and Entrepreneurship	EEC	3	15	0	60	15	90	3
PRACTICALS										
8	UCS3311	Data structures Laboratory	PC	3	0	0	30	15	45	1.5
9	UCS3312	Operating Systems Laboratory	PC	3	0	0	30	15	45	1.5
TOTAL				**29**	**225**	**15**	**150**	**300**	**690**	**26**
SKILL DEVELOPMENT										
10	UCSV303	Skill Development Laboratory – I [$]	EEC	1	0	0	30	15	45	1

R-2024 CREDIT DISTRIBUTION SUMMARY

SEMESTER	HS	BS	ES	PC	PE	OE	EEC	MC	TOTAL
I	4	12	6						**22**
II	4	4	12				2	1	**23**
III		4		16					**20**
IV		4		17				1	**22**
V				21	3				**24**
VI	3			6	6	3	3		**21**
VII	3			7	6		5		**21**
VIII					3	3	8		**14**
TOTAL	**14**	**24**	**18**	**67**	**18**	**6**	**18**	**2**	**167**

HS – Humanities and Social Sciences, **BS** – Basic Sciences, **ES** – Engineering Sciences, **PC** – Professional Core, **OE** – Open Elective, **EEC** – Employability Enhancement Courses, **MC** – Mandatory Courses

HUMANITIES I-ELECTIVE (II-SEMESTER)

Course Code	COURSE TITLE	L	T	P	EL	C
UEN3286	Psychology and Communication	2	0	2	0	3
UEN3287	Human Relations and Communication Skills	2	0	2	0	3
UEN3288	Communication Through Media	2	0	2	0	3
UEN3289	Technical Writing	2	0	2	0	3
UHS3286	German Beginner Level	2	0	2	0	3

L - Lecture periods per week, **T** - Tutorial periods per week, **P** - Practical periods per week, **EL** - Experiential learning periods per week, **C** – Credits and **TCP** - Theory-cum Practical

COURSE CODE	COURSE TITLE	L	T	P	EL	C
UEN3186	COMMUNICATIVE ENGLISH (Common to all B.E./B.Tech. programs)	2	0	2	0	3

OBJECTIVES

The learners will be able to:

- Enhance conversation fluency and assertive communication in English
- Contribute efficiently to meetings and improve networking skills
- Participate and communicate meaningfully during group discussions
- Cultivate the ability to deliver structured and persuasive presentations
- Equip students with necessary skills to excel in job interviews

UNIT I CONVERSATION AND ASSERTIVENESS 9

Introducing yourself, peers and others. Conversation skills: starting a conversation; keeping the conversation going; closing the conversation; giving directions and instructions; learning functional language needed for everyday interactions. Imparting the basic language skills and techniques for telephonic conversations. Communication styles: passive, aggressive and assertive. Role-plays as a technique for practising conversation.

UNIT II MEETING SKILLS AND NETWORKING SKILLS 9

Setting up and holding meetings; organising and conducting effective meetings; learning the language used to lead a meeting; practising how to agree and disagree with ideas and people politely. Mock meetings. Making notes, summarising and reporting in meetings. Writing professional emails.

UNIT III GROUP DISCUSSION SKILLS AND TEAM SKILLS 9

Group discussion skills: Basic skills required for a GD; strategies for improving discussion skills; learning the language used for a GD; voicing an opinion and arguing a point effectively, leading a discussion; chairing a discussion; discussing to arrive at a consensus. Mock GDs for practice.

UNIT IV PRESENTATION SKILLS AND PERSUASIVE SKILLS 9

Making effective presentations: structure of a presentation; referring to visual data; describing visuals; non-verbal communication skills; examples of model presentations; and learning the language used to deliver effective and persuasive presentations. Developing cross-cultural communication skills. Mock presentations for practice.

UNIT V INTERVIEW SKILLS AND INTERPERSONAL SKILLS 9

Applying for jobs; writing resumes; and cover letters. Participating in job interviews and other interviews. Strategies for effective interviewing: preparing for the interview, during-the-interview and after-the-interview etiquette. Common interview questions and learning interviewing language skills. Mock interviews for practice.

TOTAL PERIODS: 45

COURSE OUTCOMES

At the end of the course, the learners will

1. Develop conversation skills and assertiveness in English
2. Cultivate proficiency in conducting meetings and networking
3. Articulate clearly and successfully during group discussions
4. Deliver engaging and professional presentations confidently
5. Communicate effectively during the interview process

TEXTBOOKS

1. Bovee, C. L.& Thill, J. V. (2016). *Business Communication Today, 15/e*. Pearson Education India.
2. Beebe, S. A., & Mottet, T. P. (2021). *Business and Professional Communication (3rd ed)*. Pearson Higher Education AU.
3. Herbert Hirsch. (2007). Essential Communication Strategies: For Scientists, Engineers, and Technology Professionals, 2nd edition. Wiley-IEEE Press.

REFERENCE BOOKS

1. Dodd, C. H. (2012). Managing business and professional communication (3rd ed). Allyn & Bacon/Pearson.
2. Dwyer, J. (2012). *Communication for Business and the Professions: Strategies and Skills* (7th ed). Pearson Higher Education AU.
3. Gill Hasson. (2012). Brilliant Communication Skills: What the Best Communicators Know, Do and Say. Ft Pr.
4. Jones, L., & Alexander, R. (2011). *New international business English updated edition student's book: Communication skills in English for business purposes* (Vol. 3). Cambridge university press.
5. Kerry Patterson, Joseph Grenny, Ron McMillan and Al Switzler. (2013). Crucial Conversations: Tools for Talking When Stakes Are High. Brilliance Audio.

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1								1	3		1		
CO2								1	3		1		
CO3								1	3		1		
CO4								0	3		1		
CO5								0	3		1		

COURSE CODE	COURSE TITLE	L	T	P	EL	C
UMA3176	ALGEBRA AND CALCULUS FOR ENGINEERS (Common to all B.E./B.Tech. programs)	3	1	0	0	4

OBJECTIVES

- To reduce quadratic to canonical form of a matrix and find the eigenvalues of a matrix numerically
- To study the concept of curvature, evolute and envelope
- Learn to find the extreme values for a function of two variables
- To compute area of closed surface and volume of solids using multiple integrals
- Learn to evaluate definite integrals numerically

UNIT I MATRICES 12

Characteristic equation - Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors, Cayley-Hamilton Theorem (simple problems only), Diagonalization of matrices – Similarity transformation - Quadratic form - Reduction of a quadratic form to canonical form by orthogonal transformation – Eigen values of matrices by Power method.

UNIT II DIFFERENTIAL CALCULUS AND ITS APPLICATIONS 12

Curvature, radius of curvature - Cartesian and parametric co-ordinates – Centre of curvature – Circle of curvature in Cartesian form, Evolutes, Envelopes (including two parameter family), Evolute as envelope of normal.

UNIT III FUNCTIONS OF SEVERAL VARIABLE 12

Partial derivatives – Total derivative – Differentiation of implicit functions – Jacobian and its properties – Taylor's series for functions of two variables – Maxima and minima of functionsof two variables – Lagrange's method of undetermined multipliers.

UNIT IV MULTIPLE INTEGRALS 12

Double integrals in Cartesian and polar coordinates – Change of order of integration, Area enclosed by plane curves – Change of variables in double integrals, Triple integrals.

UNIT V NUMERICAL INTEGRATION 12

Single integral - Trapezoidal, Simpson's 1/3 rule, Gaussian quadrature 2 point and 3- point formula - Double integral – Trapezoidal rule, Simpson's rule 1/3 rule.

TOTAL PERIODS: 60

COURSE OUTCOMES

On successful completion of this course, the student will be able to:

1: reduce quadratic form to canonical form and find the eigenvalues of a matrix numerically
2: find evolute of a given curve and envelope of family of curves
3: find the extrema of function of two variables
4: find the area and volume using double and triple integrals respectively
5: evaluate single and double definite integrals numerically

TEXTBOOKS

1. Grewal B.S, Higher Engineering Mathematics, Khanna Publishers, 45th Edition, 2020.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, Inc., 10th Edition, 2020.

REFERENCE BOOKS

1. Bali N. P and Manish Goyal, "A Text book of Engineering Mathematics", Ninth Edition, Laxmi Publications Pvt Ltd., 2016.
2. James Stewart, Calculus: Early Transcendental, Cengage Learning, New Delhi, 7^{th} Edition, 2013.
3. Dass, H.K., and Er. Rajnish Verma," Higher Engineering Mathematics", S. Chand Private Ltd., 2011.
4. Srimanta Pal and Subodh C. Bhunia, Engineering Mathematics, Oxford University Press, 2015.

CO-PO-PSO Mapping

PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2									
CO2	3	2									
CO3	3	2									
CO4	3	2									
CO5	3	2									
CO6	3	2									2

COURSE CODE	COURSE TITLE	L	T	P	EL	C
UPH3186	ENGINEERING PHYSICS (Common to all B.E./B.Tech. programs)	3	0	2	0	4

OBJECTIVES

Enable the students to

- Comprehend and identify different crystal structures and their imperfections.
- Understand the elastic and thermal properties of materials and understand their significance in engineering materials.
- Provide an overview of the characteristics of sound, architectural acoustics and the production and applications of ultrasound.
- Develop an understanding of quantum mechanical phenomena and their applications.
- Understand the origin of laser action, production of laser, fibre optics and their applications.

UNIT I CRYSTAL PHYSICS 15

Single crystalline, polycrystalline and amorphous materials– single crystals - Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment) - Crystal Imperfections with Examples – Point, line (Edge and Screw dislocations –Burger vectors) Surface (stacking faults) and Volume defects.

LABORATORY EXPERIMENT

1. Determination of the band gap of a semiconductor crystal.

UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS 15

Properties of matter: Elasticity- Hooke's law - different elastic moduli (conceptual)- Relationship between the three moduli of elasticity– stress -strain diagram– Poisson's ratio – Factors affecting elasticity. cantilever: theory and experiment–Extension to non-uniform bending- uniform bending theory and experiment, -Applications- I-shaped girders.

Thermal Physics: Transfer of heat energy - thermal expansion of solids and liquids - expansion joints-bimetallic strips, Modes of heat transfer – thermal conduction, convection and radiation – Newton's law of cooling - thermal conductivity- Lee's disc method for bad conductor – Heat transfer through compound media (series and parallel)-Applications -Heat Exchangers.

LABORATORY EXPERIMENTS

1. Determination of the Young's modulus of the material of the given beam by non-uniform bending method.
2. Determination of the rigidity modulus of the material of the given wire using torsion pendulum.

3. Determination of the coefficient of thermal conductivity of the given bad conductor using Lee's disc.

UNIT III ACOUSTICS AND ULTRASONICS 15

Acoustics: Classification and characteristics of Sound - decibel - Weber–Fechner law– Sabine's formula (conceptual) —factors affecting the acoustics of buildings and their remedies.

Ultrasonics: Production of ultrasonics by Magnetostriction and Piezoelectric methods – acoustic grating -Non-Destructive Testing – pulse echo system through transmission and reflection modes - A, B and C – scan displays- Phased Array Ultrasound and Time of Flight Diffraction techniques.

LABORATORY EXPERIMENTS

1. Determination of the velocity of sound in the given liquid and compressibility of the liquid using an Ultrasonic interferometer.

UNIT IV QUANTUM PHYSICS 15

Black body radiation – Planck's three-dimensional) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton Effect (Conceptual)– Photoelectric effect (conceptual)- Properties of Matter waves – wave particle duality - Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box and extension to three dimensional box – Degeneracy of electron energy states - Quantum tunneling (Qualitative)-Scanning tunneling microscopy.

LABORATORY EXPERIMENT

1. Determination of the Planck's constant and the work function using photoelectric effect.

UNIT V PHOTONICS AND FIBRE OPTICS 15

Photonics: Spontaneous and stimulated emission- Population inversion -Einstein's A and B coefficients –Conditions for Laser action - Types of lasers (Qualitative) – Nd: YAG, Basics of diode lasers-Industrial and Medical Applications.

Fibre optics: Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – Fibre Optical Communication system (Block diagram) - Active and passive fiber sensors - pressure and temperature- Applications.

LABORATORY EXPERIMENTS

1. Determination of the grating element/wavelength, and the particle size using a laser.
2. Determination of the Numerical Aperture and the acceptance angle of an optical fiber.

TOTAL PERIODS: 45L+30P

OTHER EXPERIMENTS

1. Determination of the wavelength of the characteristic lines of mercury spectrum using Spectrometer and grating. (Wave optics)
2. Determination of dispersive power of prism using Spectrometer. (Light/Optics)
3. Determination of thickness of a thin wire using interference fringes. (Light/Optics)
4. Determination of the coefficient of viscosity of the given liquid using Poiseuille's method. (Properties of Matter).

COURSE OUTCOMES:

At the end of this course, students will be able to

1. Analyze crystal structures and the influence of imperfections on their properties.
2. Demonstrate and explain the general concepts of elastic and thermal properties of materials used in various mechanical and civil structures.
3. Analyze the applications of acoustics and ultrasonics to engineering and medical disciplines.
4. Comprehend the quantum mechanical principles to correlate with experimental results and their applications.
5. Elucidate the principle and working of lasers and optical fibers, and their applications in the field of industry, medicine and telecommunication.

TEXTBOOKS:

1. Gaur, R.K., and Gupta, S.L., Engineering Physics, Dhanpat Rai Publishers, 2012.
2. S. Singaravadivelu and A. Chandrasekaran, Engineering Physics, Vedha Publications, Chennai, 2022
3. Serway, R.A., & Jewett, J.W., Physics for Scientists and Engineers, Cengage Learning, 2010.
4. Shatendra Sharma and Jyotsna Sharma, "Engineering Physics", Pearson, 2006

REFERENCE BOOKS

1. Halliday, D., Resnick, R. & Walker, J. Principles of Physics, Wiley, 2015.
2. Tipler, P.A. & Mosca, G. Physics for Scientists and Engineers with Modern Physics, WH Freeman, 2007.
3. Avadhanulu, M. N., Kshirsagar, P. G, A textbook of Engineering Physics, S. Chand &Co. Ltd., Ninth Revised Edition, 2012.
4. H.K. Malik and A. K. Singh, Engineering Physics, 2nd Edition, McGraw Hill, 2016
5. Pandey B.K., Chaturvedi.S. "Engineering Physics", Cengage Learning India Pvt. Ltd, 2012

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2		1										
CO2	3	2		1						2				
CO3	3	2		1						2				
CO4	3	2		1										
CO5	3	2		1										
Average	**3**	**2**		**1**						**2**				

COURSE CODE	COURSE TITLE	L	T	P	EL	C
UCY3186	ENGINEERING CHEMISTRY (Common to all B.E./B.Tech. programs)	3	0	2	0	4

OBJECTIVES

- To impart knowledge on various aspects of chemistry
- To improve the ability of students to think logically and solve the problems in industries and day-to-day life efficiently

UNIT I WATER AND ITS TREATMENT 15

Theory: Hardness of water – types – expression of hardness – units – estimation of hardness of water by EDTA – numerical, Water quality parameters - WHO guidelines and BIS guidelines.

Industry water treatment - External treatment – Ion exchange process, zeolite process. Domestic water treatment - Reverse Osmosis-Working of RO system – Advantages/limitations.

Practical:

Exp.1: Estimation of hardness of water

Exp.2: Hardness of different sources of water

Laboratory Demonstration:

Ion Exchange process

UNIT II ELECTROCHEMISTRY 15

Theory: Conductance- Conductometric titration and its applications -estimation of strong acid, estimation of mixture of strong and weak acids (numerical based on conductance).

Electrochemistry-redox reaction- types of Electrode-Ion selective electrodes –Glass electrodes-measurement of pH-potentiometry.

Energy systems for electric vehicles – Principle & Electrochemistry of a H2–O2 fuel cell, Li-ion battery, Na-ion battery, Green Hydrogen.

Practical:

Exp.3: Conductometric titrations- strength of mixture of acids

Exp.4: Estimation of strong acid-pH

Exp.5: Estimation of ferrous ion by potentiometry

UNIT III CORROSION 15

Theory: Corrosion - Types of corrosion - wet corrosion – mechanism –galvanic corrosion - differential aeration- Rate of corrosion, Corrosion control –Cathodic protection-electroless plating (Printed Circuit Board), Corrosion in different industries –concrete (reinforcing steel in concrete), boilers, electronic components

Practical:

Exp.6: Rate of corrosion

Industrial visit:

Plating industry- Electroless plating

UNIT IV POLYMERS IN EVERYDAY LIFE 15

Theory: Polymers and Polymerization: types of polymerization: addition and condensation – Properties: Crystallinity, Glass Transition temperature (Tg), Average Molecular weight-viscosity method &PDI, tacticity, polymer recycling-biodegradable polymers.

Practical:

Exp.7 : Molecular weight of water soluble polymer by viscosity method

Exp.8: Finding the Tg point of different polymer.

Laboratory Demonstration:

Chemical recycling of post consumed polymer

UNIT V ANALYTICAL TECHNIQUES 15

Theory: Spectroscopy: Beer-Lambert's law. Colorimetric estimation of Fe^{3+} , Principle, working and applications of IR, UV-Visible spectroscopy and Chromatography (TLC and column)

Practical:

Experiment 9: Colorimetric estimation of Fe^{3+} ions

Laboratory Demonstration:

Thin Layer Chromatography

TOTAL PERIODS: 45L+30P

COURSE OUTCOMES

Upon successful completion of the course, students will be able to

CO1: Analyze the water samples, categorize based on the nature of impurities and suggest suitable method of treatment for domestic and industrial usage (BL:L3).

CO2: Understand the principles of electrochemistry and apply the principles for zero-emission vehicles (BL: L3).

CO3: Identify the type of corrosion and analyze different preventive methods of corrosion in various industries (BL: L3).

CO4: Acquire sound knowledge on polymeric material and understand the need for sustainable polymeric materials (BL: L3)

CO5: Apply analytical skills of techniques such as chromatography, spectroscopy to characterize materials to solve real life problems (BL: L3)

TEXTBOOKS

1. Jain P.C. and Monika Jain, 'Engineering Chemistry' 17th edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2023.

2. S.S.Dara, 'The Text Book of Engineering Chemistry, S.Chand & Co.Ltd,New Delhi, 2011.

REFERENCE BOOKS

1. N.F. Gray, 'Water Technology-An Introduction for Environmental Scientists and Engineers' Third Edition, Taylor & Francis, USA, 2010.
2. S. Glasstone,'An Introduction to Electrochemistry' East-West Press Pvt. Ltd., New Delhi, 2007.
3. Bengt Sundén, 'Hydrogen, Batteries and Fuel Cells' Academic Press Inc, USA, 2019
4. R. Gowariker, N. V. Viswanathan, Jayadev Sreedhar, 'Polymer Science' New Age International (P) Ltd, New Delhi, reprint, 2005.
5. R. Gopalan, K. Rangarajan, P.S. Subramanian, "Elements of Analytical Chemistry" Sultan Chand & Sons, 2003.
6. B.Viswanath, B, P.S. Raghavan, 'Practical Physical Chemistry',.ViVa Books Pvt. Ltd, New Delhi, 2012.

CO-PO-PSO Mapping

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3			1		1			1			1		
CO2	3			1					1			1		
CO3	3			1		1	1		1			1		
CO4	3			1		1	1		1			1		
CO5	3			1					1					
Average	**3**			**1**		**1**	**1**		**1**			**1**		

COURSE CODE	COURSE TITLE	L	T	P	EL	C
UGE3188	PROBLEM SOLVING AND PYTHON PROGRAMMING (Common to all B.E./B.Tech. programs)	1	0	4	0	3

OBJECTIVES

- To learn problem-solving strategies.
- To learn different types of statements in Python.
- To learn modularity in problem solving.
- To solve complex problems using sequenced data types and advanced constructs like dictionaries and files of Python.
- To develop simple software projects using Python.

UNIT I ALGORITHMIC PROBLEM SOLVING 3

Logical Thinking – Algorithmic Thinking; Problem Solving and Decomposition: Defining a Problem – Devising a Solution – Decomposition; Effective building blocks: Basic Algorithmic Constructs (pseudo code, flow chart) – Program State.

UNIT II CONDITIONAL AND ITERATION 3

Introduction to Python – Functional abstraction – Defining simple functions – Data abstractions and objects, built-in objects, Expressions and operators (methods), Variables and Assignment, conditional (if), alternative (if-else), case analysis (if-elif-else), pattern matching – Iteration: while, for, break, continue, pass.

UNIT III FUNCTION AND STRINGS 3

Functions: Local and global scope, Methods of passing arguments, Recursion, Lambda functions; Strings: string slices, immutability, string functions and pattern matching.

UNIT IV LISTS AND TUPLES 3

Lists: Operations, Slices, Methods, Iteration, Mutability, Aliasing, Cloning, Parameters, Nested lists, List comprehension; Tuples: Operations, Assignments, Return value.

UNIT V DICTIONARIES AND FILES 3

Dictionaries: operations and methods, looping and dictionaries, reverse lookup, dictionaries and lists; Files: Text files, reading and writing files, format operator, file names and paths, CSV files.

THEORY PERIODS: 15

LABORATORY COMPONENT: (10 x 4 = 40 hours)

1. Practice session on using Linux shell commands, Python in interactive mode, and using an IDE (integrated development environment)
2. (a) Case study: Area of the geometric shapes and Simple calculator.

(b) Develop programs using sequential statements (e.g. Temperature conversion, Currency conversion)

3. (a) Case study: Electricity bill generation.
   b) Develop programs using alternate statements (e.g. Counting people eligible to vote)
4. (a) Case study: Armstrong number, Prime number generation within a range and Pascal's triangle.
   b) Develop programs using iterative statements (e.g. n-way password verification problem)
5. (a) Case study: Finding square root.
   (b) Develop programs using functions (e.g. GPA calculation by considering internal and external marks)
6. (a) Case study: Fibonacci series and Palindrome.
   (b) Develop programs using recursion (e.g. Computation of sine series)
7. (a) Case study: Group anagrams.
   (b) Develop programs using strings without built-in functions (e.g. Finding longest common prefix among n strings)
8. (a) Case study: Sorting and Searching.
   (b) Develop programs using lists and tuples (e.g. Finding similarity between two documents by constructing one hot vectors)
9. (a) Case study: Top 'k' frequent words.
   (b) Develop simple programs using dictionaries (e.g. Constructing histogram)
10. (a) Case study: Exceptions and Assertions.
    (b) Develop programs using Files and exception handling (e.g. Finding top k most frequent words in a text file)

PROJECT COMPONENT **(5 x 4 = 20 hours)**

Software applications to be developed in teams using Python Graphical User Interface like Tkinter, QT for Python, PySimpleGUI, PyGame.

Sample Case Study: PACMAN GAME
Input: Maze, PacMan, Pellets, Ghosts
Output: Score display and lives display
Constraints:

- Pacman navigates through a maze, gobbling up pellets while avoiding the ghosts.
- The user plays in such a way that the Pacman consumes all the pellets scattered throughout the maze without being captured by ghosts.
- Automatic maze generation of different levels.
- Intelligence for enemies like Ghosts to move around the maze.
- Level progression.

PRACTICAL PERIODS: 60

TOTAL PERIODS: 15 + 60 = 75

COURSE OUTCOMES

On successful completion of this course, a student will be able to

CO1: Solve programming problems and express design solutions in pseudo code. (K3)
CO2: Apply sequential, alternate, and iterative approaches for solving problems. (K3)
CO3: Solve complex problems by using functions, strings, lists, tuples and dictionaries. (K3)
CO4: Apply files and exception handling concepts for handling large data. (K3)
CO5: Create simple software development projects in teams using best coding practices and communicate effectively through reflections, reports, and presentations. (K6)

TEXTBOOKS

1. Allen B. Downey, "Think Python"', 3rd edition, O'Reilly Media, 2024, Online Version: https://allendowney.github.io/ThinkPython/
2. Sridhar, Indumathi, Hariharan, "Python Programming", Pearson, 2023.

REFERENCE BOOKS

1. Karl Beecher, "Computational Thinking – A beginner's Guide to Problem Solving and Programming", British Computer Society (BCS), 2017.
2. John V Guttag, "Introduction to Computation and Programming Using Python"', 3rd edition, MIT Press, 2021.
3. Ashok Namdev Kamthane, Amit Ashok Kamthane, "Programming and Problem Solving with Python", McGraw Hill Education (India) Private Limited, 2018.
4. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach"', Pearson India Education Services Pvt. Ltd., 2016.
5. Timothy A. Budd, "Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.
6. Kenneth A. Lambert, "Fundamentals of Python: First Programs", 2nd Edition, CENGAGE Learning, 2018.
7. Alan D. Moore, "Python GUI programming with Tkinter", Second Edition, Packt Publishing Ltd., 2021.
8. Joshua M. Willman, "Beginning PyQt: A hands-on approach to GUI programming with PyQt6", Second Edition, APress, 2022.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3												
CO2	3	3			2									
CO3	3	3	3	3	2									
CO4	3	3	3	3	2									
CO5	3	3	3	3	3	3	3	3	3	3	3	3		
Average	3	3	3	3	3	3	3	3	3	3	3	3		

COURSE CODE	COURSE TITLE	L	T	P	EL	C
UGE3176	ENGINEERING GRAPHICS (Common to all B.E./B.Tech. programs)	1	0	4	0	3

OBJECTIVES

- To develop graphic skills for communication of concepts, ideas and design of engineering products.
- To expose them to existing national standards related to technical drawings.
- To visualize the job in three dimensions
- To draw 2D / 3D objects using computer drafting software

Concepts and Conventions (Not for Examinations) 1

Importance of Engineering Graphics in engineering applications - Drawing instruments and their uses, Types of lines, Lettering, General rules for dimensioning, Geometrical constructions using instruments.

Unit I PROJECTION OF POINTS, LINES AND PLANES 14

Orthographic projection principle – Reference planes - Layout of views. Projections of points when they are situated in different quadrants. Projections of a line parallel to one of the reference planes and inclined to the other, line inclined to both the reference planes. Determination of true lengths and true inclinations by rotating line method. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating plane method.

Unit II PROJECTION OF SOLIDS 15

Projections of solids like prisms, pyramids, cylinder and cone, whose axis is parallel to one of the reference planes and inclined to the other by rotating object method.

Unit III SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 15

Sectional planes – when the cutting plane is inclined to one of the principal planes and perpendicular to the other, Sectional views - Prism, pyramid, cylinder and cone, true shape of the section. Development of lateral surfaces of simple and truncated solids in vertical position– prisms, cylinders, pyramids, cones.

Unit IV FREEHAND SKETCHING AND FUNDAMENTALS OF COMPUTER AIDED DRAFTING 15

Visualization concepts and Free Hand sketching: Visualization principles–Representation of Three Dimensional objects – Layout of views- Freehand sketching of multiple views from pictorial views of objects. Introduction to CAD, DRAW tools, MODIFY tools, TEXT, DIMENSION and practicing two-dimensional modelling of simple objects by any free computer drafting software. (Assessment only through Assignments - Not for examination)

Unit V ISOMETRIC AND PERSPECTIVE PROJECTION 15

Principles of isometric projection – isometric scale – Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and practicing three-dimensional modelling of simple objects by any free CAD software (Assessment only through Assignment - Not for examination). Perspective projection of simple solids- Prisms, pyramids and cylinders by visual ray method.

TOTAL PERIODS: 75

COURSE OUTCOMES

Upon successful completion of the course, students will be able to

CO1: Construct the Orthographic projections of points, lines and plane surfaces.

CO2: Construct the Projection of solids.

CO3: Construct the details of an object through sectional views and development of surfaces.

CO4: Construct orthographic views of an object by free hand sketching.

CO5: Construct the three dimensional isometric view and perspective projection

TEXT BOOKS

1. Venugopal, K. and Prabhu Raja, V., Engineering Drawing + AutoCAD , New Age International (P) Limited, 2022, ISBN : [9788122472752].
2. Natarajan, K.V., A Textbook of Engineering Graphics, Dhanalakshmi Publishers, Chennai, 33rd Edition, 2020. [ISBN:9788190414089].
3. Ramesh babu. V, A Textbook on Engineering Graphics, VRB Publishers, Chennai , 2021. [ISBN : 9789389027211].

REFERENCES :

1. Bhatt, N.D., Engineering Drawing, Charotar Publishing House, 2023. [ISBN: 978-9385039706]
2. Prof. Sham Tickoo, *AutoCAD 2017 for Engineers & Designers*, 23ed, Dreamtech Press
3. Agarwal, B, Engineering Drawing, Second edition, McGraw Hill Education, 2015
4. Parthasarathy, N. S. and Vela Murali, “Engineering Drawing”, Oxford University Press,2015
5. Basant Agarwal, and Agarwal, C.M., Engineering Drawing, McGraw Hill, 3rd Edition, 2019. [ISBN: 9789353167448]

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3				1					3		1	1	1
CO2	3				1					3		1	1	1
CO3	3				1					3		1	1	1
CO4	3				1					3		1	1	1
CO5	3				1					3		1	1	1
Average	**3**				**1**					**3**		**1**	**1**	**1**

COURSE CODE	COURSE TITLE	L	T	P	EL	C
UGA3176	HERITAGE OF TAMILS (Common to all B.E./B.Tech. programs)	1	0	0	0	1

UNIT I LANGUAGE AND LITERATURE 3

Language Families in India - Dravidian Languages – Tamil as a Classical Language – Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry -Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART SCULPTURE 3

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of templecar making - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT III FOLK AND MARTIAL ARTS 3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV THINAI CONCEPT OF TAMILS 3

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - AncientCities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over theother parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL PERIODS: 15

TEXT – CUM – REFERENCE BOOKS

1. Social Life of Tamils (Dr. K.K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies.

3. Historical Heritage of the Tamils (Dr. S.V. Subaramanian, Dr. K.D. Thirunavukkarasu)(Published by: International Institute of Tamil Studies).
4. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)
5. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K.K. Pillay)(Published by: The Author)
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil NaduText Book and Educational Services Corporation, Tamil Nadu)
8. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book.

COURSE CODE	COURSE TITLE	L	T	P	EL	C
UGEV301	SDG Experiential Laboratory I (Common to all B.E./B.Tech. programs)	0	0	2	0	1

PREAMBLE

Sustainable Development Goals (SDGs), an essential guide to understanding and engaging with the global framework designed to achieve a better and more sustainable future for all. In 2015, the United Nations adopted the 2030 Agenda for Sustainable Development, which includes 17 SDGs, recognizing that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests…

OBJECTIVES

- To understand the basics of 17 SDGs.
- To acquire knowledge of the target and indicators of all SDGs.

METHODOLOGY

Students shall study any external course on Introduction to SDG, on a Self-Learning mode. Will be assessed at the end by a Seminar presentation on a possible project proposal in SDG.

COURSE OUTCOMES

On successful completion of this course, the student will be able to
CO1: Understand the history, scope, and challenges of the SDGs.
CO2: Analyze the interlinkages and synergies between different goals.
CO3: Evaluate the progress made towards achieving the SDGs globally and locally.
CO4: Develop strategies to implement and monitor the SDGs in various contexts.

REFERENCE BOOKS

1.Hazra, Somnath., Bhukta, Anindya (2020) Sustainable Development Goals An Indian Perspective, Springer International Publishing, Switzerland
2. Ziai, Aram (2016) Development Discourse and Global History from colonialism to the sustainable development goals. Routledge, London & New York
3. OECD (2019), Sustainable Results in Development: Using the SDGs for Shared Results and Impact, OECD Publishing, Paris, https://doi.org/10.1787/368cf8b4-en.
4. Sachs, J., Schmidt-Traub, G., Kroll, C., Lafortune, G., Fuller, G., Woelm, F. 2020. The Sustainable Development Goals and COVID-19. Sustainable Development Report 2020. Cambridge: Cambridge University Press.
5. https://www.un.org/sustainabledevelopment

COURSE CODE	COURSE TITLE	L	T	P	E	C
UMA3276	CALCULUS OF VECTORS, COMPLEX FUNCTIONS AND LAPLACE TRANSFORMS (Common to all B.E./B.Tech. programs)	3	1	0	0	4

OBJECTIVES

- Solve second order ordinary differential equations
- Evaluate line, surface and volume integrals.
- Understand the concept of analytic functions and its construction and apply the same in evaluating contour integrals.
- Find the Laplace Transforms of standard functions.
- Find the Inverse Laplace Transform of standard functions and solve second order linear ordinary differential equations with constant coefficients.

UNIT I ORDINARY DIFFERENTIAL EQUATIONS 12

Solution of second and higher order linear differential equations with constant coefficients (RHS functions - $e^{mx}, sinmx, cosmx, x^n, x^n f(x),\ e^{mx} f(x)$), Application to harmonic oscillation of an undamped Mass-Spring system- Method of variation of parameters- Simultaneous linear differential equations with constant coefficients of first order.

UNIT II VECTOR CALCULUS 12

Gradient and directional derivative – Divergence and curl – Irrotational and Solenoidal vector fields, Line integrals, Path independence of line integrals, Surface integral - Area of a curved surface, Volume integral. Green's theorem in the plane, Gauss divergence and Stoke's theorems – Verification and application in evaluating line, surface and volume integrals.

UNIT III CALCULUS OF COMPLEX FUNCTIONS 12

Complex functions – Limit and Continuity, Derivative, Analytic functions – necessary and sufficient conditions – Cauchy-Riemann equations in Cartesian form (with proof) – Properties - Harmonic functions, Construction of analytic function, Bilinear transformation.
Cauchy's integral theorem – Taylor's and Laurent's series – Singularities – Residues – Residue theorem – Application of residue theorem for evaluation of real integrals – Use of circular contour and semicircular contour (except the poles on the real axis).

UNIT IV LAPLACE TRANSFORMS 12

Definition, properties, existence conditions – Transforms of elementary functions – Transform of unit step function and unit impulse function – Shifting theorems – Transforms of derivatives and integrals – Initial and final value theorems, Evaluation of integrals by Laplace transforms, Periodic functions.

UNIT V INVERSE LAPLACE TRANSFORMS 12

Inverse transforms – Definition, Properties, Method of Partial Fractions, Inverse Laplace transforms

of derivatives and integrals - Convolution theorem - Applications of Convolution theorem. Applications to solving linear second order ordinary differential equations with constant coefficients using Laplace Transform.

TOTAL PERIODS: 60

COURSE OUTCOMES

On successful completion of this course, the student will be able to:

1. Solve second order ordinary differential equations
2. Evaluate line, Surface and Volume integrals and verify Green's, Gauss divergence and Stoke's theorems
3. Construct analytic functions and apply the same in evaluating contour integrals.
4. Obtain the Laplace Transforms of standard functions.
5. Obtain the Inverse Laplace Transforms of standard functions

TEXTBOOKS

1. Grewal B.S, Higher Engineering Mathematics, Khanna Publishers, 45th Edition, 2020.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, Inc., 10th Edition, 2020.

REFERENCE BOOKS

1. Bali, N.P., Goyal, M., Watkins, C., Advanced Engineering Mathematics, Laxmi Publications Pvt. Limited, 2007.
2. Boyce, W.E., and DiPrima, R.C., Elementary Differential Equations and Boundary Value Problems, Wiley India, 2012.
3. George B. Thomas Jr., Maurice D. Weir, Joel R. Hass, Thomas' Calculus: Early Transcendental, 13th Edition, Pearson Education, 2013.
4. O'Neil. P. V., Advanced Engineering Mathematics, 7th Edition, Cengage Learning India Pvt., Ltd, New Delhi, 2011.
5. Howard Anton, Irl C. Bivens, Stephen Davis, Calculus Early Transcendentals, 11th Edition, John Wiley & Sons, Inc., 2016.
6. Srimanta Pal and Subodh C. Bhunia, Engineering Mathematics, Oxford University Press, 2015.
7. Srivastava, A.C., and Srivastava, P.K., Engineering Mathematics Volume I and II, PHI learning Pvt. Ltd, 2011.

CO-PO-PSO Mapping

PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2									
CO2	3	2									
CO3	3	2									
CO4	3	2									
CO5	3	2									
CO6	3	2									2

COURSE CODE	COURSE TITLE	L	T	P	EL	C
UEE3276	BASIC ELECTRICAL AND ELECTRONICS ENGINEERING (Common to Civil, Mech, CSE and IT)	3	0	0	0	3

COURSE OBJECTIVES:

- To learn the basic concepts of electric circuits.
- To know the operation of various electrical machines.
- To study the basic concepts of electrical power system
- To comprehend the working principle of electronic devices and its applications.
- To grasp the working principle of various sensors and transducers

UNIT I ELECTRICAL CIRCUITS 9

DC Circuits: Ohm's Law- Kirchhoff's laws - Series parallel connections, Voltage divider and Current divider Rule. Mesh current and Node voltage methods (Analysis with only independent source).

AC circuit: Waveforms and RMS value, Phasor diagram, Inductance, Capacitance, concept of reactance and impedance, Power, Power factor in series RLC circuits. Three phase supply – Star connection, Delta connection (Balanced Loads).

UNIT II ELECTRICAL MACHINES 9

Construction and Working Principle – DC Generators, EMF Equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Transformer - Construction, Working, Types and Applications- Three Phase Induction Motor and Alternator

UNIT III FUNDAMENTALS OF POWER SYSTEMS 9

General structure of electrical power systems using single line diagram approach, Power rating of household appliances. Energy measurement, Electricity tariff, Equipment Safety measures: Working principle of Fuse and Miniature circuit breaker (MCB), Personal safety measures: Electric Shock, Earthing**.**

UNIT IV ELECTRONIC DEVICES AND APPLICATIONS 9

Operation of PN junction diodes, VI characteristics, Half wave and full wave rectifier, capacitive filters, Zener diode, Zener voltage regulator, BJT, Transistor configurations, CE, input and output characteristics, Applications of BJT as a switch and amplifier. Introduction to FET

UNIT V SENSORS AND TRANSDUCERS 9

Sensors: Capacitive and resistive sensors, Hall effect sensors, Ultrasonic sensors**,** IR sensors, Accelerometer and Gyro sensors.

Transducers: Classification of transducers, strain gauges, Thermocouples, RTD, Thermistors, Piezo-electric and LVDT.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

On successful completion of this course, the students will be able to
CO1: Analyse DC and AC circuits (K4)
CO2: Understand the operating principle of AC and DC machines (K2)
CO3: Understand the fundamentals of electric power systems (K2)
CO4: Describe the working principle of electronic devices and its applications (K2)
CO5: Describe the working principle of sensors and transducers (K2)

TEXTBOOKS

1. Kothari DP and I.J Nagrath, "Basic Electrical and Electronics Engineering", McGraw Hill Education,2014.
2. V.K Mehta , Rohit Mehta, "Principles Of Power System" S Chand Publishing, 2022.
3. Edward Hughes, John Hiley, Keith Brown and Ian McKenzie Smith "Electrical And Electronic Technology" Pearson Education Ltd, 10th Edition, 2008.
4. S.Salivahanan, R.Rengaraj and G.R.Venkatakrishnan, "Basic Electrical, Electronics and Measurement Engineering", McGraw-Hill, 2017.

REFERENCE BOOKS

1. S.B. Lal Seksena and Kaustuv Dasgupta, "Fundaments of Electrical Engineering", Cambridge, 2016.
2. M.S. Sukhija and T.K. Nagsarkar, "Basic Electrical and Electronic Engineering", Oxford, 2016.
3. S.K.Sahdev, "Basic of Electrical Engineering", Pearson, 2015.
4. H.Cotton, "Electrical Technology", 7th Edition, CBS; 2005
5. Murty D.V. S "Transducers and Instrumentation", 2nd Edition, Prentice Hall India Learning Private Limited, 2008

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	2	3		1		1	1	1		1		
CO2	3			1		1		1	1	1		1		
CO3	3		1	1		1	1	1	1	1	1	1		
CO4	3		1	1		1	1	1	1	1		1		
CO5	3		1	1		1	1	1	1	1		1		
Average	**3**	**3**	**1**	**1**		**1**	**1**	**1**	**1**	**1**	**1**	**1**		

COURSE CODE	COURSE TITLE	L	T	P	EL	C
UCS3281	PROGRAM DEVELOPMENT USING C	1	0	4	0	3

OBJECTIVES

- Build a foundation for C Programming.
- Develop programs using C constructs.
- Practice writing clean and maintainable code.

UNIT I BASICS OF PROGRAM DEVELOPMENT 3

Basic data types -- Operators and expressions -- Data input and output statements -- Control statements.

UNIT II FUNCTIONS 3

Function prototype -- Function definition and call -- Passing arguments to a function -- Recursion -- Standard library functions -- Storage classes.

UNIT III ARRAYS AND STRINGS 3

Arrays: Declaration, Initialization, Multi-dimensional arrays, Passing arrays to functions, Arrays and Strings, String library functions.

UNIT IV POINTERS 3

Pointer declarations -- Passing pointers to functions -- Pointers and one-dimensional arrays -- Dynamic memory allocation -- Operations on pointers -- Array of pointers – Pointer to pointer.

UNIT V STRUCTURES AND FILES 3

Structures: User-defined data types (typedef) – Array of structures -- Structures and pointers – Passing structures to functions -- Self-referential structures -- Files -- Choosing suitable data types and programming constructs.

LECTURE PERIODS: 15

SUGGESTED EXPERIMENTS

1. Programs using conditional constructs (E.g. Grade calculator, checking leap year)
2. Programs using looping constructs (E.g. Generating prime numbers within a range, printing patterns)
3. Programs using functions with different parameter passing techniques: Call by value, call by reference; Recursive functions (E.g. Towers of Hanoi, Find GCD)
4. Programs using one-dimensional, two-dimensional arrays and passing arrays to functions (E.g. rotating matrix by 90 degrees, finding longest subarray with sum zero)

5. Programs using strings and string library functions (E.g. concatenation of strings, extracting a substring, checking for the palindrome)
6. Programs using pointers (E.g. Create an array dynamically and find the maximum element in the array, matrix addition using pointers)
7. Programs to demonstrate simple structure manipulations and passing structures to a function (E.g. generating a transcript with CGPA and class obtained, operations on complex numbers, difference between times)
8. Programs using self-referential structures (E.g. Representing a point in 2D space and calculating its reflection, creating a short chain of books where one book refers to another)
9. Programs to demonstrate file handling techniques (E.g. Writing student records to a file, Manipulating text file)
10. Mini Project (Tic-tac-toe game, Data encryption-decryption, quiz game)

LABORATORY PERIODS: 60
TOTAL PERIODS: 15 + 60 =75

COURSE OUTCOMES

On successful completion of this course, the student will be able to:

1. Solve problems using suitable programming constructs and employ modular programming. (K3)
2. Apply the concept of arrays, strings, and pointers to solve complex problems efficiently. (K3)
3. Develop applications using structures and file handling techniques. (K3)

TEXTBOOKS

1. Bryon Gottfried, Programming with C (Schaum's Outline Series), McGraw-Hill Education, 4th Edition, 2018.
2. Brian W Kernighan and Dennis M Ritchie, The C Programming Language, Pearson Education India, 2nd Edition, 2015.
3. Maureen Sprankle, Jim Hubbard, "Problem Solving & Programming Concepts", Pearson Education, 9th edition, 2011.

REFERENCE BOOKS

1. Reema Thareja, Programming in C, Oxford University Press, 2nd Edition, 2016.
2. Yashwant Kanetkar, Let Us C, BPB Publications, 14th Edition, 2016.
3. King, K.N., C Programming A Modern Approach, W. W. Norton & Company, II Ed. 2008.
4. Yashwant Kanetkar, Understanding Pointers in C and C++, 2019.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3	3	3									2	2
CO2	3	3	3	3				3	3	3		3	2	2
CO3	3	3	3	3		2		3	3	3		3	2	2
Average	**3**	**3**	**3**	**3**		**2**		**3**	**3**	**3**		**3**	**2**	**2**

COURSE CODE	COURSE TITLE	L	T	P	EL	C
UCY3276	ENVIRONMENTAL SCIENCE (Common to all B.E./B.Tech. programs)	3	0	0	0	3

OBJECTIVES

- To develop a better understanding of human relationship with environment
- To explain the importance of conservation of resources
- To create awareness on pollution and environmental degradation
- To acquire knowledge on sustainable development
- To apply technical skills for solving environmental problems

UNIT I FUNFAMENTALS OF ENVIRONMENTAL SCIENCE 9

Definition, scope and importance of environment and function of an ecosysytem-Terrestrial(Forest)-Aquatic(lake)-ecological succession – ecological pyramids – Biodiversity in the environment- Types and Values of biodiversity- hot-spots of biodiversity – threats to biodiversity-In-situ and ex-situ conservation of biodiversity.

Field Trip: Zoo/Botanical Garden

UNIT II NATURAL RESOURCES 9

Forest resources: deforestation– Water resources: over- utilization of surface water and, conflicts over water, dams-benefits and problems – Mineral resources: environmental effects of mining– Food resources: fertilizer-pesticide problems– Energy resources: Need for renewable energy sources, use of alternate energy sources (Wind, Solar, Geothermal)– Land resources: soil erosion and desertification.

UNIT III CURRENT ENVIRONMENTAL ISSUES 9

Planetary boundaries-Environmental issues– causes, effects and control measures of Pollution of (a) Air (Smog, acid rain, climate change, ozone layer depletion) (b) Water (waste water treatment) (c) Soil

Solid waste management -wasteland reclamation, Electronic waste management

Population explosion- Population growth among nations-– Disaster management

Case study-Air Pollution in Delhi, Cooum river pollution, Chennai municipal waste management

Field Trip: Wastewater Treatment Plant

UNIT IV SUSTAINABLE DEVELOPMENT 9

Origin, purpose, and importance of the SD- Key issues and challenges of Environmental sustainability- 2030 Agenda for Sustainable Development- Indicators and metrics for tracking progress of sustainable development- Circular economy Rainwater Harvesting--Principles - Green Buildings-Advantages of green buildings over conventional buildings-smart city-Electric and Hybrid Electric Vehicles (HEV)

UNIT V ENGINEERING INTERVENTIONS TO REDUCE ENVIRONMENTAL STRESSES **9**

Role of technology in environment studies and human health- Use of Artificial Intelligence and Internet of Things- Environment database management system. Real-time data collection and analysis-Environmental Modelling and Simulation- Geographical Information Systems (GIS)- Remote Sensing- satellites and sensors-Use of Drones of Aerial mapping and Surveying.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon successful completion of the course, students will be able to

CO1: Acquire the basic concepts of ecosystems; understand the importance of biodiversity and conservation strategies (BL-L2).
CO2: Develop knowledge on natural resources and equitable use of natural resources (BL: L2).
CO3: Analyse the current environmental problems and its plausible solutions (BL: L2)
CO4: Explain the concept of sustainable development, its importance and key challenges in implementation of sustainability goals (BL: L2)
CO5: Describe the role of technology for assessment and management of environment and human health (BL: L2).

TEXTBOOKS

1. Anubha Kaushik and Kaushik, C. P. "Environmental Science and Engineering", New Age International Publishers, 14thEdition, 2014.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006

REFERENCE BOOKS

1. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition,Pearson Education, 2004.
2. Tyler Miller G. , and Scott E. Spoolman, "Environmental Science", Cengage Learning India PVT, LTD, Delhi, 2014.
3. M.H. Fulekar, Bhawana Pathak and R.K.Kale, 'Environment and Sustainable Development' Springer Nature, 2013.

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1							3							
CO2							3							
CO3							3		1	1		1		
CO4						2	3		1	1		1		
CO5						2	3		1	1		1		
Average						**2**	**3**		**1**	**1**		**1**		

COURSE CODE	COURSE TITLE	L	T	P	EL	C
UCS3262	DIGITAL PRINCIPLES AND DESIGN	3	0	0	0	3

OBJECTIVES

- To introduce the fundamental principles of Boolean algebra and demonstrate the relationships between Boolean expressions.
- To introduce the methods for simplifying Boolean function.
- To analyze and design combinational circuits.
- To analyze and design sequential circuits.
- To understand the design of memory.

UNIT I NUMBER SYSTEM AND BOOLEAN ALGEBRA 9

Binary Numbers – Number-Base Conversions – Octal and Hexadecimal Numbers – Complements of Numbers – Signed Binary Numbers – Binary Code – Binary Storage and Registers – Binary Logic; Basic Theorems and Properties of Boolean Algebra – Boolean Functions – Canonical and Standard Forms – Digital Logic Gates.

UNIT II SIMPLIFICATION OF BOOLEAN EXPRESSION 9

Minterm – Maxterm – Sum of Products (SOP) – Product of Sums (POS) – Simplification of Boolean Functions using Karnaugh Map – Four Variable K-Map – Five Variable K -Map Logic Don't-Care Conditions, NAND–NOR implementations.

UNIT III COMBINATIONAL LOGIC 9

Combinational Circuits – Analysis and Design Procedures – Binary Adder–Subtractor – Decimal Adder – Binary Multiplier – Decoders – Encoders – Multiplexers.

UNIT IV SEQUENTIAL LOGIC 9

Sequential Circuits – Storage Elements: Latches, Flip–Flops; Analysis of Clocked Sequential Circuits – State Reduction and Assignment – Design Procedure – Registers, Counters

UNIT V MEMORY 9

RAM – Memory Decoding – Error Detection and Correction - ROM – PROM – Programmable Logic Array – Programmable Array Logic.

TOTAL PERIODS: 45

COURSE OUTCOMES

On successful completion of this course, the student will be able to:

1. Explain the fundamental principles of Boolean algebra and relationships between logic gates (K2)
2. Utilize K-Map to simplifying Boolean function (K3)
3. Analyze and construct Combinational Circuits (K4)

4. Analyze and construct Synchronous Sequential Circuits (K4)
5. Build various memories and Boolean functions using Programmable Logic Devices (K3)

TEXT BOOKS

1. Morris R Mano, Michael D Ciletti, "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog", 6th Edition, Pearson Education, 2018.

REFERENCE BOOKS

1. S Salivahanan, S Arivazhagan, "Digital Circuits and Design", 5th edition, Oxford University Press, 2018.
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", 6th Edition, Tata McGraw Hill, 2012.
3. G K Kharate, "Digital Electronics", Oxford University Press, 2010.
4. John F Wakerly, "Digital Design Principles and Practices", 5th Edition, Pearson Education, 2017.
5. Charles H Roth Jr, Larry L Kinney, "Fundamentals of Logic Design", 6th Edition,Cengage Learning, 2013.

CO-PO-PSO Mapping

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2											2	
CO2	3	2											2	2
CO3	3	2	3										2	2
CO4	3	2	3										2	2
CO5	3	2	3										2	2
Average	**3**	**2**	**3**										**2**	**2**

COURSECODE	COURSE TITLE	L	T	P	EL	C
UGA3276	TAMILS AND TECHNOLOGY (Common to all B.E./B.Tech. programs)	1	0	0	0	1

UNIT I WEAVING AND CERAMIC TECHNOLOGY 3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries(BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3

Designing and Structural construction House & Designs in household materials during SangamAge - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)-Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY 3

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold - Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stonetypes described in Silappathikaram.

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

TOTAL PERIODS: 15

TEXT – CUM – REFERENCE BOOKS

1. Social Life of Tamils (Dr. K.K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies.
3. Historical Heritage of the Tamils (Dr. S.V. Subaramanian, Dr. K.D. Thirunavukkarasu)

(Published by: International Institute of Tamil Studies).

4. The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)
5. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
6. Studies in the History of India with Special Reference to Tamil Nadu (Dr. K.K. Pillay) (Published by: The Author)
7. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil NaduText Book and Educational Services Corporation, Tamil Nadu)
8. Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book.

COURSE CODE	COURSE TITLE	L	T	P	EL	C
UGE3297	DESIGN THINKING AND ENGINEERING PRACTICES LABORATORY (Common to all B.E./B.Tech. programs)	0	0	3	0	1.5

OBJECTIVES

- To provide exposure to the students with hands on experience on various basic engineering practices in Civil, Mechanical, Electrical and Electronics Engineering
- To train the students to dismantle, understand the functional / aesthetic aspects of the product, prepare the part functional model, and to assemble the different engineering components

LIST OF EXPERIMENTS

GROUP A (CIVIL & MECHANICAL ENGINEERING PRACTICE) I CI VIL ENGINEERING PRACTICE.

Buildings:
Study of plumbing and carpentry components of residential and industrial buildings - Safety aspects. Plumbing Works:

1. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, and elbows in household fittings.
2. Preparation of plumbing line sketches for water supply and sewage works.
3. Hands-on-exercise:

• Basic pipe connections - Mixed pipe material connection - Pipe connections with different joining components.
• Plumbing with basic connections for washing basin and sink

Carpentry using Power Tools only:
1. Study of the joints in roofs, doors, windows and furniture.
2. Hands-on-exercise: Woodwork, joints by sawing, planning and cutting.
   (a) Fabrication of different models of pencil box and pen stand.
   (b) Fabrication of wooden wall shelf
3. Demonstration of wood working machinery

II MECHANICAL ENGINEERING PRACTICE
Basic Machining:
• Drilling Practice (holes of various diameters - steel sheet metal, wood, hylam/plywood sheet) Sheet Metal Work:
• Forming & Bending
• Different type of joints.
   – Fabrication of mobile phone metal stand
   – Fabrication of electrical control panel box

Design thinking practices: To dismantle, understand the functional / aesthetic aspects of the product, prepare the part functional model, and to assemble the following components.

- Pedestal Fan head swing mechanism - Reserve mechanism (Two-wheeler) - Tyre

removal and Mounting for four wheeler.

- - Flush tank container mechanism - Hand pump - washer Mechanism

GROUP B (ELECTRICAL & ELECTRONICS ENGINEERING PRACTICE)

1. Residential house wiring, staircase wiring and tube light wiring with single phase AC two wire system.
2. Energy measurement with RLC Load.
3. Earth resistance measurement.
4. Measurement of AC parameters using CRO and half wave and Full wave rectifier.
5. Study of logic gates AND, OR, EX-OR & NOT.
6. Soldering practice – Components Devices and Circuits – Using PCB.

Design thinking practices:

1. Assemble a single phase 3 wire circuit for connecting household appliances and explain through schematic diagram
2. Measure the energy consumed by the household appliances and verify it theoretically
3. Analyze the fault occurring in electrical appliances
4. Design, assemble and test a cell phone charger
5. Design, assemble and test relay logic to control electrical appliances.
6. Design, assemble and test a dc power supply using PCB

TOTAL PERIODS: 45

COURSE OUTCOMES

On successful completion of this course, the student will be able to:

1. Draw pipeline plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household woodwork (K2)
2. Practice machining to make holes on different materials; fabricate sheet metal components (K2)
3. Dismantle, understand the functional / aesthetic aspects of the product, prepare the part functional model of various components (K2)
4. Construct domestic electrical circuits and verify their output parameters (K3)
5. Construct electronics circuits and verify their output (K3**)**

REFERENCE BOOKS

1. S Gowri, T Jeyapoovan, “Engineering Practices Laboratory Manual”, 5th Edition, Vikas Publishing, 2016.
2. V Ramesh Babu, Engineering Practices Laboratory, VRB Publications, 2006.
3. Willis H Wagner, Howard "Bud" Smith, Mark W Huth, “Modern Carpentry”, 12th Edition, 2015
4. P C Sharma, “Production Technology: Manufacturing Process”, S Chand publisher, 2006
5. Robert W Messler, “Reverse Engineering: Mechanisms, Structures, Systems & Materials”, McGraw-Hill Education, 2014
6. David W Rongey, “A Complete Guide to Home Electrical Wiring”, 2013
7. K Jeyachandran, S Natarajan, S Balasubramanian, “A Primer on Engineering Practices Laboratory, Anuradha Publications, 2007

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1						2		2	2	2		2		
CO2						2		2	2	2		2		
CO3						2		2	2	2		2		
CO4						2		2	2	2		2		
CO5						2		2	2	2		2		
Average						**2**		**2**	**2**	**2**		**2**		

COURSE CODE	COURSE TITLE	L	T	P	EL	C
UCS3211	DIGITAL PRINCIPLES AND DESIGN LABORATORY	0	0	3	0	1.5

COURSE OBJECTIVES

- To understand the various basic logic gates
- To design and implement the various combinational circuits
- To design and implement combinational circuits using MSI devices.
- To design and implement sequential circuits
- To understand and code with HDL programming

SUGGESTED EXPERIMENTS

1. Verification of Boolean Theorems using basic gates
2. Design and implementation of combinational circuits using basic gates for arbitrary functions
3. Design and implement code converters
4. Design and implement 4-bit binary adder/subtractor
5. Design and implement parity generator/checker
6. Design and implement encoder, decoder and priority encoder
7. Design and implement 2*2 multiplier
8. Design and implement boolean function using multiplexers
9. Design and implement shift-registers
10. Design and implement synchronous counter
11. Design and implement ripple counter
12. Coding combinational circuits using HDL
13. Coding sequential circuits using HDL

Total Periods: 45

COURSE OUTCOMES

After the completion of this course, students will be able to

1. Use Boolean simplification techniques to design a combinational circuit using logic gates and MSI devices (K3)
2. Construct different registers and counters using flip-flops (K3)
3. Construct combinational circuits and sequential circuits using Verilog HDL (K3)

LABORATORY REQUIREMENT FOR BATCH OF 25 STUDENTS

Hardware:

1. Digital trainer kits - 25
2. Digital ICs required for the experiments in sufficient numbers

Software:

1. HDL simulator

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2		3					3	3			2	2
CO2	3	2	3	3					3	3			2	2
CO3	3	2	3	3					3	3			2	2
Average	3	2	3	3					3	3			2	2

COURSE CODE	COURSE TITLE	L	T	P	EL	C
UCS3212	FUNDAMENTALS AND PRACTICE ON SOFTWARE DEVELOPMENT	0	0	2	3	2

OBJECTIVES

- Learn the stages of software development, from requirements gathering to maintenance.
- To link system building to computing fundamentals.
- Understand the ethical considerations in software development.

SAMPLE PROJECT

Students will be divided into teams. Each team will be given problem specifications to develop a system. Teams will be mentored to follow the best software engineering practices to develop simple software projects. A sample problem specification is as follows:

Title: Software System for University Course Registration

Problem Statement: To develop a software system for course registration and course allotment in a university. The system should have the following features:

- Each student should log into the system to register for the chosen courses in each semester.
- Once the student logs in, a list of courses that are offered in that semester should be displayed along with the information about faculty members who are teaching each section of the course.
- Assume that each core course will have 3 sections and each elective course will have two sections.
- Students can choose the courses in which they would like to register.
- Each student should register for a minimum of 4 and a maximum of 6 courses per semester
- At the end of the registration process, the list of successfully allotted courses along with the name of the teacher for each course should be displayed for each student. In addition, the list of waitlisted courses along with the waitlist number should also be displayed.

Constraints

- A student should be able to register in a particular course only if he/she has already completed all prerequisites for that course.
- Each course can be offered by multiple faculty members.
- Every section will have a fixed strength. If the section fills up, further registration should not be allowed.
- A waitlist (10% of the class strength) will be maintained in case the allotment is not possible in the first round.
- If a student wants to add or drop any course after initial registration, it should be allowed only within the first two weeks after the semester starts.
- Students from the waitlist can be allotted their choice after the processing of drop requests.

Input

- Student-id
- Number of courses the student wishes to register for
- For each course

- Course Code
- Course Name
- Name of the Faculty Member

Output

A list for each student where each entry comprises the following:

- Course Code
- Course Name
- Name of the Faculty Member
- Allotment Status (Yes/No)
- Waitlist Number if Allotment Status is "No"

PROJECT PERIODS: 30
EXPERIENTIAL EARNING: 45
TOTAL PERIODS: 30 + 45 = 75

COURSE OUTCOMES

On successful completion of this course, the student will be able to:

1. Formulate the problem elaborating the requirements, identifying the scope and boundaries. (K6)
2. Design and develop solutions adapting technologies, tools, and techniques. (K6)
3. Work effectively in teams to develop and integrate modules, communicate through reports and presentations, and consider the impact on health, safety, society, environment, and any legal and ethical issues.

Rubrics for evaluating the project:

Assessment tool	Project Execution	Viva-Voce	Presentation	Project Report	Weightage
Review 1	--	10%	60% Problem formulation, scope, related work, limitations.	30% A report on design of various modules, detailed plan, and tools.	20%
Review 2	90% for Implementation & Demo	10%	--	--	30%
Review 3	50% (Exploration, solution, quality of implementation)	10%	20%	20% Design, implementation, testing and results	50%

CO-PO-PSO Mapping

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	3											3	3
CO2	3		3	3	3								3	3
CO3						3	3	3	3	3	3	3		3
Average	3	3	3	3	3	3	3	3	3	3	3	3	3	3

COURSE CODE	COURSE TITLE	L	T	P	EL	C
UGEV302	SDG Experiential Laboratory II (Common to all B.E./B.Tech. programs)	0	0	2	0	1

PREAMBLE

This course explores the principles and practices of sustainability within the context of a college campus. Through hands-on projects and collaboration with campus facilities, students will identify, design, and implement sustainability initiatives aimed at improving the environmental, social, and economic health of the campus community. The "Live in Lab" approach provides students with the opportunity to apply theoretical knowledge in real-world settings, working directly with campus stakeholders to achieve measurable sustainability outcomes.

OBJECTIVES

By the end of this course, students will:

1. Understand the principles of sustainability and their application to campus environments.
2. Analyze the current sustainability practices of the campus.
3. Develop and implement projects aimed at enhancing campus sustainability.
4. Collaborate with campus stakeholders to achieve project goals.
5. Evaluate the impact of sustainability initiatives on the campus community.

METHODOLOGY

Students shall work in teams of not more than four, on a project related to the SDG theme. Teams will be guided by faculty. assessment at the end of the semester will be on a project evaluation mode

COURSE OUTCOMES

Students who successfully complete this course will be able to:

1. Conduct sustainability assessments of campus facilities and operations.
2. Develop project proposals with clear objectives, timelines, and expected outcomes.
3. Implement sustainability projects in collaboration with campus partners.
4. Monitor and report on the progress and impact of sustainability initiatives.
5. Communicate sustainability concepts and project results effectively to diverse audiences.

List of Experiments/activities/projects

1. **Sustainability Tours** – Visit to Solar Farms, Substation and Power plant Lakes, and wells in and around the campus

2. **Sustainability Project ideas**

   Priority Areas: Projects support - priority framework areas ensuring a climate-ready, liveable planet, in terms of health and wellbeing of people, for global prosperity, and supporting our academic mission and purpose.

   Choose a sustainability project/ propose a sustainability project/ adopt a sustainability project'

   Sample list of Projects

- Social Media campaign for student climate action
- Campus Metabolism – (Energy)
- Social media Campaign for student Purchase Behaviour
- SSN Waste Stationeries/ Data Management
- Energy Management and control system Portal for SSN
- Sustainable Design of Future SSN Campus – Carbon neutrality
- Creating a Campus Sustainability Map
- Tree survey on the Campus
- Alternative Transportation ideas for students, Faculty
- Study the Department wise waste generation pattern in the Campus
- Ideas to Recycle the waste generated on the campus
- Ideas to upcycle the waste generated on the campus
- Design new Recycling signage suitable for the campus
- Creating awareness of Recycling and waste reduction on the campus beyond or the no-waste campaign
- Create a sustainable low-impact event plan
- Green Skilling – working with sustainable agriculture collaborate
  Choose a sustainability project/ propose a sustainability project/ adopt a sustainability project'

COURSE CODE	COURSE TITLE	L	T	P	EL	C
UEN3286	PSYCHOLOGY AND COMMUNICATION (Common to all B.E./B.Tech. programs)	2	0	2	0	3

OBJECTIVES

The learners will be able to:

- Recall, recognize, and regulate their emotions effectively, and understand the various factors that motivate human behaviour
- Articulate and understand the underlying principles of social psychology, group work and leadership skills
- Demonstrate and apply the principles of personality, learning, memory and thinking
- Discuss and analyse the concepts of developmental psychology and stress management
- Describe and differentiate between various psychological disorders - personality disorders and clinical disorders

UNIT I EMOTION AND MOTIVATION 9

Recognizing emotions - Emotions, feelings, and behaviour - Regulating Emotions - Emotional intelligence - Motivation - Basic definitions - different types of motivation - Intrinsic and Extrinsic motivation - Defence Mechanisms - Self-actualization and Maslow's hierarchy of needs

UNIT II SOCIAL PSYCHOLOGY 9

Psychology and social behaviour - Forming and maintaining relationships - Liking and attachment - Social Life - Communicating one to one - Communicating in a group - Stages of group formation - Team building - Factors that affect group performance: Social loafing, Polarisation and Groupthink - Attitudes, Prejudice, and stereotypes - Booting group performances - Leadership skills and traits - transformational and transactional leadership

UNIT III PERSONALITY AND LEARNING 9

Personality -- Freud's psychoanalytic theory - Personality traits – The Big Five - Self-esteem, self-confidence, and self-efficacy - -- Conditioning and learning – Classical and operant conditioning - Building memory - Types of memory - Types of thinking – Problem solving, making good and bad decisions - Creative thinking

UNIT IV DEVELOPMENTAL PSYCHOLOGY 9

The lifespan - Infancy and Childhood - Attachment - insecure-avoidant, anxious-ambivalent and secure - Adolescent - Types of Love: intimacy, passion, and commitment - Adulthood - Cognitive development, moral development, and social development - Sex, gender and sexuality - Stress - Coping with stress - Managing stress - Happiness

UNIT V PSYCHOLOGICAL DISORDERS 9

Personality disorders: antisocial; avoidant; borderline; dependent; histrionic; narcissistic; obsessive compulsive; paranoid; schizoid; schizotypal - Clinical disorders: Anxiety disorders, Disorders of mood, Schizophrenia, Dissociative Identity Disorder (DID) - Self-help - Therapeutic help

TOTAL PERIODS: 45

COURSE OUTCOMES

At the end of the course, the learners will learn to:

1. Communicate and apply the psychological theories of emotion and motivation to their everyday lives effectively
2. Summarise and practice the principles of social psychology to improve interpersonal relationships, group dynamics and leadership roles with confidence and ease
3. Articulate and demonstrate a comprehensive understanding of personality, learning, memory and thinking
4. Discuss and interpret developmental psychology principles and effective stress management technique to handle life's challenges
5. Debate and realise the impact of psychological disorders in an individual's life, and the effectiveness of available treatment options

TEXTBOOKS

1. Myers, D. G. & DeWall, C. N. (2020). *Psychology in everyday life*. (5 eds). Macmillan.
2. Strongman, K. T. (2006). *Applying psychology to everyday life: A beginner's guide*. John Wiley & Sons.

REFERENCES

1. Morgan, C., King, R., Weisz, J., Schopler, J. *Introduction to Psychology.* McGraw Hill Education, 7th edition
2. Ralls, E., & Riggs, C. (2021). *The Little Book of Psychology: An Introduction to the Key Psychologists and Theories You Need to Know*. Simon and Schuster.

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1								1	3		2		
CO2								2	3		2		
CO3								1	3		1		
CO4								1	3		1		
CO5								1	3		1		

COURSE CODE	COURSE TITLE	L	T	P	EL	C
UEN3287	HUMAN RELATIONS AND COMMUNICATION SKILLS (Common to all B.E./B.Tech. programs)	2	0	2	0	3

OBJECTIVES

The learners will be able to:

- Describe and understand the impact of personality, attitudes, self-esteem, perception, emotional intelligence and stress on human relations
- Explain and recognize the importance of motivation, teamwork and communication strategies in career development
- Demonstrate and gain insights into decision-making processes and ethical considerations at the workplace
- Communicate and learn conflict management styles and negotiation strategies for effective workplace interactions
- Discuss and analyse leadership management styles to manage career growth opportunities

UNIT I MANAGING YOURSELF 9

The importance of human relations - Personality and Attitude - Perception skills - Self-Esteem and Self-confidence - Emotional intelligence - Goal setting - Continuous learning - Managing stress - Types of stress - Symptoms of stress - Sources of stress - Reducing stress

UNIT II MANAGING TEAMS 9

Communication strategies - Verbal and non-verbal communication strategies - Human motivation at work - Strategies used to increase motivation - Work effectively in groups - Types of groups - Group development process - Group member roles - Positive and negative roles - Team building skills

UNIT III MANAGING DECISION MAKING 9

Making good decisions - Understanding decision - Making faulty decision - Decision making in groups - Ethics at work - An Ethics framework - Making ethical decisions - Social responsibility

UNIT IV MANAGING CONFLICT AND NEGOTIATION 9

Handling conflict and negotiation - Understanding conflict - Causes and outcomes of conflict - Conflict management - Negotiations - Ethical and cross-cultural negotiations - Managing diversity at work - Diversity and Multiculturalism

UNIT V MANAGING CAREER 9

Leadership and management skills - Leadership styles - Career growth - Power positioning and power sources - Behaviour and change - Impression management - Personality and strategies

TOTAL PERIODS: 45

COURSE OUTCOMES

At the end of the course, the learners will learn to:

1. Explain and recognise how personality, attitudes, self-esteem, perception, emotional intelligence, and stress influence human relations
2. Discuss and apply motivation, teamwork, and communication strategies to enhance career development
3. Express and evaluate decision-making processes and ethical standards in professional settings
4. Defend and practice conflict management styles and negotiation tactics in academic settings
5. Debate and develop leadership abilities and career management skills

TEXTBOOKS

1. Laura Portolese Dias (2012). *Human Relations*. Saylor Foundation. https://open.umn.edu/opentextbooks/textbooks/132

REFERENCES

1. DuBrin, A. J. (2011). *Human relations for career and personal success: Concepts, applications, and skills*. Prentice Hall/Pearson.
2. McCann, V. (2016). *Human relations: The art and science of building effective relationships*. Pearson.

CO – PO/PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1							0	1	3		1		
CO2							0	3	3		1		
CO3							1	1	3		1		
CO4							1	1	3		1		
CO5							0	1	3		1		

COURSE CODE	COURSE TITLE	L	T	P	EL	C
UEN3288	COMMUNICATION THROUGH MEDIA (Common to all B.E./B.Tech. programs)	2	0	2	0	3

OBJECTIVES

The learners will be able to:

- Describe the developments in the history of films over the centuries
- Comprehend the basic film terminologies and theories to understand the structure and components of films
- Examine the role of regional and global films in reflecting the various aspects of society
- Acquire the necessary writing skills to analyze and critically appreciate films as a creative art form
- Learn the art of storytelling through films, from crafting short and long narratives to producing and presenting a compelling short film

UNIT I HISTORY OF FILMS 9

- Origins, contribution of Lumiere brothers, Cinema Verite
- Early cinema: Silent Films
- Evolution from Motion Pictures to Feature Films
- Social and political context of films
- The Indian Film Industry and the Hollywood

UNIT II STRUCTURE AND COMPONENTS OF FILMS 9

- Basic film vocabulary: story, plot, character, tagline, logline, dramatic question
- Three Act Structure
- Film Theory: Auteur's Theory, Realist Theory
- Components of cinematography: Camera angle, Shots, Movements, Equipment, Film Technology
- Process and People in Film Making: Cast, Production, Distributor, Director, Editor

UNIT III FILM AND SOCIETY 9

- Films and their influence on the language of people
- Aspects of gender in films
- Regional cinema and global cinema
- Cultural impact of films in society: Case studies from Indian cinema
- Film as tool of social criticism

UNIT IV FILM APPRECIATION 9

- Film Genres, Types, Documentaries
- Creating character profiles
- Mise-en-scene
- Web Series, OTT: sample case studies
- Writing film Reviews

UNIT V FILM AS CREATIVE EXPRESSION 9

- Creating short stories 250 words
- Creating long stories 700 words
- Designing storyboard / screenplay
- Types of scripts, creating film script
- Producing and presenting a short film (5 to 10 minutes)

TOTAL PERIODS: 45

COURSE OUTCOMES

At the end of the course, the students will:

1. Read and comprehend resources that trace the history and evolution of films in the global context over the centuries
2. Listen to lectures and study materials to understand and apply basic film vocabulary and film theory
3. Speak effectively on the larger impact of the role of films in the society
4. Write film reviews, stories and film scripts by learning to appreciate the various nuances and aspects involved in the filmmaking process
5. Present their artistic abilities by creating their own short films based on the takeaways from the course

TEXTBOOKS

1. *Film Studies: An Introduction* - Ed Sikov
2. *Understanding the Film: An Introduction to Film Appreciation* - Jan Bone and Ron Johnson

REFERENCE BOOKS

1. *Bollywood: A Guidebook to Popular Hindi Cinema* - Tejaswini Ganti
2. *Introduction to Film Studies* - Jill Nelmes
3. *The 5 C's of Cinematography: Motion Picture Filming Techniques* - Joseph V. Mascelli
4. *The Film Book: A Complete Guide to the World of Film* - Ronald Bergan

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1							1	0	3		1		
CO2							0	0	3		1		
CO3							1	0	3		1		
CO4							0	1	3		1		
CO5							0	1	3		1		

COURSE CODE	COURSE TITLE	L	T	P	EL	C
UEN3289	TECHNICAL WRITING (Common to all B.E./B.Tech. programs)	2	0	2	0	3

OBJECTIVES

The learners will be able to:

1. Prepare effective instructions, checklists and emails
2. Write different kinds of paragraphs and argumentative essays
3. Develop and revise effective resumes, cover letters and SOPs
4. Document and organise various kinds of reports, case studies and white papers
5. Create well-structured proposals and press releases

UNIT I WRITING INSTRUCTIONS, CHECKLISTS AND EMAILS 9

Writing instructions and checklists; using bulleted lists and numbered lists. Writing professional emails: appropriate greetings, subject line, writing three-body paragraphs – introduction, body, and closing paragraph; discussion of samples.
Language skills: Tenses – present and past

UNIT II WRITING ARGUMENTATIVE PARAGRAPHS AND ESSAYS 9

Writing paragraphs. Structure of a paragraph: basic, compare and contrast. Product descriptions and process descriptions. Interpreting charts and graphs. Writing argumentative essays; handling three types of arguments: Classical, Rogerian, Toulmin; structure of an argumentative essay: introduction, building the thesis, body paragraphs with three arguments or claims and supporting evidence, conclusion. Sample essays.
Language skills: Connectors and definitions

UNIT III WRITING JOB APPLICATIONS AND SUMMARIES 9

Writing job applications; resumes and cover letters. Writing the statement of purpose (SOP): Outline – professional narrative, previous experience, research interests, and career goals. Writing summaries: reading the text; identifying the main ideas and supporting details. Writing paraphrases: step by step paraphrasing; text comparison; sentence analysis.
Language skills: subject-verb agreements

UNIT IV WRITING REPORTS, CASE STUDIES AND WHITE PAPERS 9

Writing datasheets: outline – descriptions, graphics, benefits, features and specifications, requirements, and contact information. Writing abstracts. Writing technical reports; practising IMRAD structure; Engineering reports & Feasibility reports. Writing case studies and white papers: main components of an issue case study – problems, search for solutions, implementation of the solution and results.
Language skills: Active voice, passive voice

UNIT V WRITING PROPOSALS AND PRESS RELEASES 9

Writing business proposals: format -- title page, table of contents, executive summary, project details, deliverables and milestones, budget, conclusion. Writing for Websites: Inverted pyramid style; headings and subheading; bulleted lists; short paragraphs with one idea.
Writing press releases: outline – headline, date of publication, contact information, summary, intro paragraph, detail paragraphs, and about section.
Language skills: Correction of errors, proofreading and editing

TOTAL PERIODS: 45

COURSE OUTCOMES

At the end of the course, the learners will be able to:

1. Write instructions, checklists and emails with clarity and readability
2. Compose paragraphs, and structure an argumentative essay effectively
3. Create and edit resumes, cover letters and SOPs concisely
4. Document well-structured reports, case studies and white papers
5. Develop effective proposals and press releases

TEXTBOOKS

1. Laplante, P. A. (2018). *Technical writing: A practical guide for engineers, scientists, and nontechnical professionals*. CRC Press.
2. David Bonamy. (2013) Technical English Level 2 Course Book. Pearson

REFERENCE BOOKS

1. Kmiec, D., & Longo, B. (2017). *The IEEE guide to writing in the engineering and technical fields*. John Wiley & Sons.
2. Lewis Lansford; Peter Astley. (2013). Oxford English for Careers: Engineering 1: Student's Book. Oxford University Press.
3. Mark Ibbotson. (2008). Cambridge English for Engineering, 2008, Cambridge University Press.
4. Rubens, P. (2002). *Science and technical writing: A manual of style*. Routledge.

CO-PO-PSO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1								0	3		1		
CO2								0	3		1		
CO3								0	3		1		
CO4								1	3		2		
CO5								1	3		2		

COURSE CODE	COURSE TITLE	L	T	P	EL	C
UHS3286	GERMAN BEGINNER LEVEL (Common to all) B.E./B.Tech. programs)	2	0	2	0	3

OBJECTIVES

1. Introduce students to the fundamentals of German language.
2. Develop basic language skills: listening, speaking, reading, and writing.
3. Equip students to achieve A1 level language proficiency certification.
4. Cultivate intercultural understanding and appreciation for diverse linguistic and cultural perspectives.
5. Understand the Grammatical structure of the German language.

UNIT I LANGUAGE AND CULTURE 9

Greetings – Self Introduction – Numbers and Alphabets – Names Of Countries And Continents

UNIT II BASIC GRAMMAR 9

Definite And Indefinite Articles – Simple Verbs and Conjugation – Pronouns – Possessive Pronoun – W Questions

UNIT III READING SKILLS 9

Reading Simple Passages – Context-Based Learning – Professions – Language and Country – Freetime Activities – Daily Routine

UNIT IV LISTENING SKILLS 9

Comprehending Real-Time Situation-Based Dialogues – Travel Announcements – Supermarket – Plans For Vacations – Dialogues At Work

UNIT V WRITING AND SPEAKING SKILLS 9

Introducing Self – Describing Daily Routine – At the Café, Restaurant – Ordering Food – Weather and Clothing - Family

TOTAL PERIODS: 45

COURSE OUTCOMES

By the end of this course, learners will be able to:

1. Understand the Relationship Between Language and Culture
2. Apply Basic Grammar Rules
3. Develop Effective Reading Skills
4. Enhance Listening Skills
5. Communicate Effectively in Writing and Speaking

TEXTBOOKS

1. Netzwerk a1 deutsch als fremdsprache by stephanie dengler (2012)
2. Studio d a1 deutsch als fremdsprache by hermann funk (2011)

REFERENCES

1. Password Deutsch 1 By Ulrike Albrecht

CO-PO-PSO Mapping

COs	**POs**												**PSOs**		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1						1			1	3		1			
CO2						1			1	3		1			
CO3						1			1	3		1			
CO4						1			1	3		1			
CO5						1			1	3		1			
Average						**1**			**1**	**3**		**1**			

COURSE CODE	COURSE TITLE	L	T	P	TW & SL	C
UMA3352	FOUNDATIONS OF DISCRETE MATHEMATICS	45	15	0	60	4

OBJECTIVES

- To equip the students with the concepts of classical logic, normal forms and its applications.
- To solve problems using counting techniques and graph theory
- To study the algebraic structures and Boolean algebra and their applications.

UNIT I MATHEMATICAL LOGIC 12

Introduction to logic: Multivalued logic – three-valued logic, connectives – Two valued logic: Propositions – Propositional equivalences – Normal forms - Predicates and quantifiers – Nested quantifiers – Rules of inference – Introduction to proofs – Proof methods and strategy.

UNIT II COMBINATORICS 12

Mathematical induction – The pigeonhole principle – Recurrence relations – Solving linear recurrence relations using generating functions – Principle of Inclusion and Exclusion – Divisibility – Primes – The Chinese remainder theorem.

UNIT III GRAPHS 12

Graphs: basic definitions – special types of graphs – Subgraphs – Matrix representation of graphs – Connectivity – Eulerian and Hamilton graphs – Trees: Properties – Distance and Centres – Spanning Tree.

UNIT IV ALGEBRAIC STRUCTURES 12

Algebraic systems – Semi groups and monoids – Groups–Subgroups – Homomorphisms – Normal subgroup and cosets – Lagrange's theorem – Rings and Fields: Definitions and examples.

UNIT V LATTICES AND BOOLEAN ALGEBRA 12

Relations – Equivalence relation – Partial ordering – Posets – Lattices as Posets – Properties of lattices – Lattices as algebraic systems – Sublattices – Boolean algebra – Stone's representation Theorem.

Lecture hours (L) : 45 Periods
Tutorial hours (T) : 15 Periods
Term work & Self-Learning hours (TW + SL) : 60 Periods
Total hours (TH) : 120 Periods

COURSE OUTCOMES

On successful completion of this course, the student will be able to

CO1: Apply logical inferences in deriving decisions in engineering problems (K3)
CO2: Formulate and solve problems using recurrence relation and various counting techniques.(K5)

CO3: Apply graph theoretical techniques in network analysis. (K3)
CO4: Identify various algebraic structures and solve problems using their properties.(K3)
CO5: Identify and solve problems using Boolean algebra. (K3)

TEXTBOOKS

1. Kenneth H Rosen, "Discrete Mathematics and its Applications",8th Edition, Special Indian edition, Tata McGraw Hill, New Delhi, 2021.
2. Tremblay J P and Manohar R, "Discrete Mathematical Structures with Applications to Computer Science", 35th Reprint, Tata McGraw Hill, New Delhi, 2008.

REFERENCE BOOKS

1. Ralph P Grimaldi, "Discrete and Combinatorial Mathematics: An Applied Introduction",4th Edition, Pearson Education Asia, 2007.
2. Eric Lehman, F Tom Leighton, Albert R Meyer, Mathematics for Computer Science, Samurai Media Limited, 2017.
3. Thomas Koshy,"Discrete Mathematics with Applications", Elsevier Publications, 2004.
4. C.L. Liu, DP Mohapatra,"Elements of Discrete Mathematics: A Computer Oriented Approach",4th Edition, McGraw Higher Education, 2017.
5. John M Harris, Jeffry L Hirst, Michael J Mossinghoff, "Combinatorics and Graph Theory", Springer Verlag New York, 2008.

CO-PO-PSO Mapping

PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	2									
CO2	3	2									
CO3	3	2									
CO4	3	2									
CO5	3	2									

.

COURSE CODE	COURSE TITLE	L	T	P	TW + SL	TH	C
UHS3386	UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY (Common to all B.E./B.Tech. programs)	30	0	30	30	90	3

OBJECTIVES

- To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education
- To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession
- To help students understand the meaning of happiness and prosperity for a human being
- To facilitate the students to understand harmony at all the levels of human living and live accordingly.
- To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life course

UNIT I INTRODUCTION TO VALUE EDUCATION 9

Value Education - Need, Basic Guidelines, Content and Process, Self-Exploration - meaning, importance and process, Continuous Happiness and Prosperity - A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities - the basic requirements, Understanding Happiness and Prosperity - A critical appraisal of the current scenario, Method to fulfill the above human aspirations - understanding and living in harmony at various levels.

UNIT II HARMONY IN THE HUMAN BEING 9

Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

UNIT III HARMONY IN THE FAMILY AND SOCIETY 9

Understanding harmony in the Family- the basic unit of human interaction , Understanding values in human to human relationship; Understanding Trust the foundational value in relationship, Difference between intention and competence, Understanding Respect - as the right evaluation, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society - comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society, Universal Order - from family to world family!

UNIT IV HARMONY IN THE NATURE AND EXISTENCE 9

Understanding the harmony in the Nature, Interconnectedness, self-regulation and mutual fulfilment among the four orders of nature- recyclability, Understanding Existence as Co- existence of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.

UNIT V IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS 9

Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics - augmenting universal human order, the scope and characteristics of people-friendly and eco-friendly, Holistic Technologies, production systems and management models - Case studies, Strategy for transition from the present state to Universal Human Order - At the level of individual: as socially and ecologically responsible engineers, technologists and managers, At the level of society: as mutually enriching institutions and organizations.

Lecture hours (L)	**: 30 Periods**
Practical hours (P)	**: 30 Periods**
Term work & Self-Learning hours (TW + SL)	**: 30 Periods**
Total hours (TH)	**: 90 Periods**

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

CO1 - Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society.

CO2 - Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co- existence of Self and Body.

CO3 - Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society.

CO4 - Understand the harmony in nature and existence and work out their mutually fulfilling participation in the nature.

CO5 - Distinguish between ethical and unethical practices and start working out the strategy to actualize a harmonious environment wherever they work.

TEXTBOOKS

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics, Excel Books, New Delhi, 2nd Revised Edition, 2019

REFERENCES

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa

8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

CO-PO-PSO Mapping

COs	**POs**											**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**
CO1							3	2	3		1		
CO2							3	2	3		1		
CO3							3	3	3		1		
CO4							3	2	3		1		
CO5							3	2	3		1		
Average							**3**	**2**	**3**		**1**		

COURSE CODE	COURSE TITLE	L	T	P	TW & SL	C
UCS3301	DATA STRUCTURES	45	0	0	45	3

OBJECTIVES

- To comprehend the notion of linear and non-linear data structures.
- To apply the linear and non-linear data structures to various problems.
- To learn hashing techniques and disjoint set operations.
- To choose suitable data structure to solve the given problem.

UNIT I LINEAR DATA STRUCTURES – LIST 9

Abstract Data Type (ADT); List ADT: Array based and Linked List based Implementations; Doubly Linked List; Circular Linked List; Applications of List: Polynomial Manipulation; Asymptotic Notations: big-Oh; Efficiency of algorithms: Notion of time and space complexity; Analysis of non-recursive and recursive algorithms.

UNIT II LINEAR DATA STRUCTURES – STACKS AND QUEUES 9

Stack ADT: Stack model – Implementation of stacks – Applications: Balancing symbols – Infix to postfix conversion – Evaluating postfix expressions; Queue ADT: Queue model – Implementation of queues – Applications of queues.

UNIT III NON LINEAR DATA STRUCTURES – TREES 9

Tree Preliminaries; Binary Tree: Traversal on Trees, Expression Tree; Threaded Binary Tree; Binary Search Tree ADT; AVL Tree operations and implementation; Priority queues using Binary Heap, Binomial heap, and Fibonacci heap; Tries.

UNIT IV NON LINEAR DATA STRUCTURES – GRAPHS 10

Graphs: Basic definition and Representation of Graphs; Graph Traversals: Breadth First Search and Depth First Search; Topological Sort; Shortest Path: Dijkstra's Algorithm, Floyd Warshall Algorithm; Traversal Applications.

UNIT V HASHING AND DISJOINT SET 8

Hash ADT: Hash function, Separate chaining, Open addressing, Rehashing, Extendible hashing, Cuckoo Hashing; Applications of Hashing technique; Algorithms for Disjoint Set operations.

Lecture hours (L) : 45 Periods
Term work & Self-Learning hours (TW + SL) : 45 Periods
Total hours (TH) : 90 Periods

COURSE OUTCOMES

CO1: Use linear data structures namely arrays and linked lists for developing applications by analysing their time complexity. (K4)

CO2: Use Stack and Queue data structures to develop solutions for various problems. (K3)
CO3: Solve problems using different types of tree data structures (K3)
CO4: Choose appropriate graph algorithms to solve the given problems. (K5)
CO5: Solve problems applying hashing and using disjoint sets (K3)
CO6: Choose appropriate data structures and algorithms demonstrating the ability for independent and life-long learning, critical thinking, and contributing to quality education in the context of evolving technologies. (K6)

TEXTBOOKS

1. M A Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, 2002. (All Units)
2. Richard F Gilberg, Behrouz A Forouzan, "Data Structures: A Pseudocode Approach with C", 2nd Edition, Cengage India, 2007.

REFERENCE BOOKS

1. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest, Clifford Stein, "Introduction to Algorithms", 3rd Edition, PHI Learning Private Limited, April 2022.
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekar, "Fundamentals of Computer Algorithms", 2nd Edition, University Press, 2017.
3. S Sridhar, "Design and Analysis of Algorithms", 1st Edition, Oxford University Press, 2015.
4. Byron Gottfried, "Schaum's Outline of Programming with C", 4th edition, 2019, McGraw Hill Education (India)
5. A V Aho, J E Hopcroft, J D Ullman, "Data Structures and Algorithms", Pearson Education, 1st Edition Reprint, 2003.

CO-PO-PSO Mapping

COs	**POs**											**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**
CO1	3											3	
CO2	3											3	
CO3	3											3	
CO4	3	3	3									3	2
CO5	3											3	
CO6	3	3	3		2						3	3	2
Average	**3**	**3**	**3**		**2**						**3**	**3**	**2**

COURSE CODE	COURSE TITLE	L	T	P	TW & SL	C
UCS3302	COMPUTER ORGANIZATION AND ARCHITECTURE	45	0	0	45	3

OBJECTIVES

- To learn the fundamental building blocks and arithmetic operations in computer systems.
- To understand MIPS instruction set architecture and the language of computers.
- To explore the design and implementation of processors including non-pipelining and pipelining.
- To understand memory hierarchy and input/output mechanisms including IO modes and DMA.
- To provide insights into parallel architectures and their challenges in modern computing.

UNIT I BASIC STRUCTURES OF COMPUTERS & ARITHMETIC DESIGN 9

Functional Units, Basic Operational Concepts, Adder and subtraction, Multiplication (Booths and modified Booths), Division (restoring and non-restoring), Floating Point Representation, Floating Point Operations.

UNIT II PERFORMANCE & MIPS INSTRUCTION SET ARCHITECTURE 9

Performance, Language of the Computers, Operations and Operands of the Computer Hardware, Representing Instructions in the Computer, Logical Operations Instructions for Making Decisions, Addressing Modes.

UNIT III PROCESSOR DESIGN 10

Logic Design Conventions, building a Data path, A Simple Implementation Scheme, An Overview of Pipelining, Pipelined Data path and Control, Data Hazards: Forwarding versus Stalling, Control Hazards, Exceptions, Parallelism via Instructions.

UNIT IV MEMORY UNIT AND I/O MODES 9

Memory Hierarchy, Memory Technologies (SRAM & DRAM), The Basics of Caches, Measuring and Improving Cache Performance, Cache Replacement Techniques, Cache Coherence, IO Modules, Programmed IO, Interrupt Driven IO, Direct Memory Access.

UNIT V PARALLEL PROCESSOR ARCHITECTURES 8

Parallel processing challenges, Flynn's classification, Vector Architectures, Hardware Multithreading, Multi-core processors and other shared memory, Multiprocessors, Introduction to Graphics Processing Units.

Lecture hours (L) : 45 Periods
Term work & Self-Learning hours (TW + SL) : 45 Periods
Total hours (TH) : 90 Periods

COURSE OUTCOMES

On successful completion of this course, the students will be able to

CO1 Illustrate the structure and function of basic components in a computer system, and develop arithmetic operations, and floating-point operations. (K3)

CO2 Analyze and apply the MIPS instruction set to represent and implement low-level programs. (K4)
CO3 Construct a datapath design with non-pipelining and pipelining architecture. (K3)
CO4 Develop memory organization and apply techniques to improve memory and I/O performance using appropriate modes. (K3)
CO5 Explain parallel processing architectures (K2)
CO6 Choose engineering tools (e.g., MIPS Simulator, Logisim, VHDL/Verilog) to model, simulate, and validate arithmetic and memory designs, while collaboratively developing solutions and presenting the outcomes in a structured report. (K5)

TEXTBOOKS

1. David A Patterson, John L Hennessy, "Computer Organization and Design: The Hardware/Software Interface", 5th Edition, Morgan Kaufmann / Elsevier, 2014. (Unit -1, 2, 3, 4: Memory Part)
2. William Stallings, "Computer Organization and Architecture: Designing for Performance", 10th edition, Pearson Series, 2016. (Unit-4: IO Modules, Programmed IO, Interrupt Driven IO, Direct Memory Access.)
3. John L Hennessey, David A Patterson, "Architecture – A Quantitative Approach", 5th edition, Morgan Kaufmann, Elsevier, 2012 (Unit-5)

REFERENCE BOOKS

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", 6th Edition, Tata McGraw Hill, 2022.
2. Morris Mano M, "Computer System Architecture", Revised 3rd Edition, Pearson Publication, 2017
3. Chakraborty P, "Computer Architecture and Organization", JAICO Publishing House, 2010.
4. John P Hayes, "Computer Architecture and Organization", 3rd Edition, Tata McGraw Hill, 2012.

CO-PO-PSO Mapping

COs	**POs**											**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**
CO1	3											2	
CO2	3	2										2	
CO3	3		3	3								3	
CO4	3	3	3	3								3	
CO5		3				3					2	2	
CO6			3					3	3				3
Average	**3**	**2.6**	**3**	**3**		**3**		**3**	**3**		**2**	**2.4**	**3**

COURSE CODE	COURSE TITLE	L	T	P	TW & SL	C
UCS3361	OBJECT ORIENTED PROGRAMMING	30	0	60	30	4

OBJECTIVES

- To learn the basics of Object-Oriented Programming.
- To know the principles of inheritance and polymorphism.
- To learn the concepts of exception handling and packages.
- To learn the concepts of generic methods and generic collections.
- To demonstrate multitasking through multithreading and Unit testing.

UNIT I INTRODUCTION 6

Object oriented programming: features, Basics of Java programming: Data types, Variables, Operators, Control structures, Java methods, Overloading, Math class, Arrays in Java, Objects and Classes: Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, this reference, static members

UNIT II INHERITANCE AND POLYMORPHISM 6

Inheritance, Super and sub class, Types of inheritance: Single - Multilevel - Multiple - Hierarchical; Subclass constructors; Overriding, Polymorphism, Dynamic binding, Abstract class, Interface in java.

UNIT III EXCEPTION HANDLING AND PACKAGES 6

Exception Handling: Benefits of exception handling - Exception hierarchy - Checked exceptions and unchecked exceptions - Usage of try, catch, throw, throws and finally, rethrowing exceptions - Built in exceptions - Creating own exception sub classes; Packages: Built in packages, creating and accessing a user-defined package – Files – Operations - File streams.

UNIT IV GENERICS CLASS AND COLLECTIONS 6

Generic classes and generic methods - Generic types - Restrictions and limitations, Introduction to collections: Collection Classes and Interfaces: List, Set, Queue, Array list, Linked list, Trees; Iterators for collections - Map class.

UNIT V MULTITHREADING AND JUNIT 6

Thread life cycle and methods, Runnable interface, Thread synchronization, Lambda expressions, filter, functional interface, var-args, Benefits of Unit Testing, JUnit Introduction, JUnit Life Cycle API, Developing an Application with JUnit 5, Dependency Injection, Mocking, Testing Traits, and Grouping Tests.

SUGGESTED EXPERIMENTS

1. Micro project on real time applications. (Eg.: Library Management System, Ticket Booking System, Finance Management System)
2. Programs using class, methods, and objects with method overloading. (Eg.: Electricity bill generation)
3. Program using inheritance and method overriding. (Eg.: Payroll application)
4. Programs using interfaces and abstract class. (Eg.: Stack, Queue)
5. Program to demonstrate Packages. (Eg.: Currency converter)
6. Program to demonstrate Exception Handling. (Eg.: Bank Account manipulation)
7. Programs using Collections. (Eg.: ArrayList, LinkedList)
8. Program to demonstrate Multithreading. (Eg.: Chat application)
9. Test the programs in JUnit 5. (Validate the Java applications)

Lecture hours (L)	**: 30 Periods**
Practical hours (P)	**: 60 Periods**
Term work & Self-Learning hours (TW + SL)	**: 30 Periods**
Total hours (TH)	**: 120 Periods**

COURSE OUTCOMES

On successful completion of this course, the student will be able to:

CO1 Explain the fundamental concepts of object-oriented programming and the basic features of Java (K2)

CO2 Use the concepts of inheritance and polymorphism in an application to demonstrate substitutability and extensibility. (K3)

CO3 Develop user-defined packages with exception handling mechanisms to use modular approach (K3)

CO4 Choose suitable collection frameworks for efficient data manipulation and type-safe operations. (K4)

CO5 Apply unit testing methods to validate the correctness and performance of Java applications (K3)

CO6 Design object-oriented solutions for real-world problems through collaborative teamwork and demonstrate the application. (K5)

TEXTBOOKS

1. Herbert Schildt, "Java: The Complete Reference", 12th Edition, McGraw Hill Education, 2022. (Unit I-V)
2. Shekhar Gulati Rahul Sharma, "Java Unit Testing with JUnit 5", APress, 2017 (Unit V)

REFERENCE BOOKS

1. Cay S Horstmann, Gary Cornell, "Core Java Volume – I Fundamentals", 10th Edition, Prentice Hall, 2016.
2. Edward Lavieri, "Mastering Java 11" - Second Edition, Packt Publishing, 2018.
3. Steven Holzner, "Java 2 Black book", Dream tech press, 2018.
4. Danny Poo, Derek Kiong, Swarnalatha Ashok, "Object-Oriented Programming and Java",2nd Edition, Springer Publication, 2008.
5. C Thomas Wu, "An introduction to Object-oriented programming with Java", 5th Edition, Tata McGraw-Hill Publishing company Ltd., 2009.

CO-PO-PSO Mapping

COs	**POs**											**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**
CO1	3											2	
CO2	3	3										2	2
CO3	3	2										3	2
CO4	3	2	3									3	2
CO5	3	2			2							3	
CO6			3					3	3	2		3	2
Average	3	2.3	3	3	2			3	3	2		2.7	2

COURSE CODE	COURSE TITLE	L	T	P	TW & SL	C
UCS3303	OPERATING SYSTEMS	45	0	0	45	3

OBJECTIVES

- To understand the structure and functions of OS
- To learn about Processes and Scheduling algorithms
- To understand the principles of synchronization and inter process communication
- To learn various memory management schemes
- To study and work with real time operating systems

UNIT I INTRODUCTION 9

Introduction: System software, operating system operations, operating systems generations, Types of operating systems, operating system structures, Process concepts: process control block, process state, operations on process, System calls for process management

UNIT II PROCESS MANAGEMENT AND IPC 9

Process Management: scheduling queues, schedulers, dispatcher, CPU Scheduling: Scheduling Criteria, Scheduling Algorithms, Real-Time CPU Scheduling, Inter Process Communication: Cooperating process, independent process, Communications using Shared memory, Pipe and Message passing, System calls for IPC

UNIT III SYNCHRONIZATION AND DEADLOCK 9

Concurrency And Synchronization: Process synchronization, critical section problem, Peterson's solution, synchronization hardware, semaphores, classic problems of synchronization: producer and consumer problem, reader and writers problem. System calls for process synchronization, Deadlock: Characteristics, Prevention, Avoidance, Detection and Recovery

UNIT IV MEMORY MANAGEMENT 9

Main Memory Management: Swapping, contiguous memory allocation, fragmentation, compaction, paging, segmentation, Virtual Memory: demand paging, page-replacement algorithms, Files and Directories, file system implementation, Systems calls for file operations

UNIT V REAL TIME OPERATING SYSTEMS 9

Real time systems, Types of RTOS, Working with RTOS IDEs, Debugging tools for real time systems, Application: FreeRTOS scheduler, Synchronizing tasks, Intertask communications.

Lecture hours (L) : 45 Periods
Term work & Self-Learning hours (TW + SL) : 45 Periods
Total hours (TH) : 90 Periods

COURSE OUTCOMES

On successful completion of this course, the students will be able to:

CO1: Demonstrate a comprehensive understanding of fundamental concepts of operating system structure and system calls. (K2)
CO2: Apply appropriate process scheduling and inter process communication techniques for an application. (K3)
CO3: Analyse concurrency issues in process synchronization and resource allocation and develop solutions (K4)
CO4: Identify suitable memory management techniques for main memory management and secondary memory management. (K3)
CO5: Experiment with various features of real-time operating systems such as task scheduling, synchronization, and inter-task communication. (K3)
CO6: Evaluate existing research on system-level challenges in operating systems and recommend potential solutions based on contemporary methods. (K5)

TEXTBOOKS

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, "Operating System Concepts", 10th Edition, John Wiley and Sons Inc, 2021
2. W. Richard Stevens Stephen A. Rago, "Advanced Programming in the UNIX ® Environment", Third Edition, Pearson Education, Inc., 2013
3. Brian Amos , "Hands-On RTOS with Microcontrollers", Packt Publishing Ltd, 2020

REFERENCE BOOKS

1. William Stallings, "Operating Systems, Internals and Design Principles", 9th edition, Pearson Education, India, 2018.
2. Harvey M. Deitel, David R. Choffnes and Paul J. Deitel, "Operating systems", 3rd edition, Pearson Education, India, 2008.
3. Sunil K Joseph, Surabhi Kurian, "Mastering Linux: A Comprehensive Guide to the Operating System", Notion Press, 2023
4. Andrew S. Tanenbaum, Herbert Bos, "Modern Operating Systems", 5th edition, Pearson Education, India, 2023.

CO-PO-PSO Mapping

COs	**POs**											**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**
CO1	3											2	
CO2	3	2										3	
CO3	3	2										3	2
CO4	3	2										3	
CO5	3				2							3	
CO6				3					3		2	3	
Average	**3**	**2**		**3**	**2**				**3**		**2**	**2.8**	**2**

COURSE CODE	COURSE TITLE	L	T	P	TW & SL	C
UGE3386	DESIGN THINKING, INNOVATION AND ENTREPRENEURSHIP (Common to all B.E./B.Tech. programs)	15	0	60	15	3

OBJECTIVES

- Learn to identify problems, frame challenges, and apply human-centered design methodologies for creative problem-solving.
- Utilize brainstorming techniques, rapid prototyping, and user feedback to refine and test ideas effectively.
- Understand business model frameworks, customer segmentation, and strategies to create scalable and sustainable startups.
- Learn startup funding options, financial planning, pricing strategies, and revenue models to support business expansion.
- Explore different types of innovation, emerging technologies, and industry trends to drive competitive advantage. Offer hands-on experience in prototyping

UNIT I FUNDAMENTALS OF DESIGN THINKING 9

A primer on design thinking – Design thinking vs Traditional Approach - Human centered design approach - Five Stage of Design thinking process – Identifying and defining clear and actionable problem statement.

SL: Case Study on application of design thinking on product development by leading companies. Use "How Might We" (HMW) questions to explore solutions by redefining problems

Activity hands-on: Conduct user interviews and create empathy maps, Product design challenge in short sprint covering all phases of Design thinking principles.

UNIT II DESIGN THINKING PROCESS AND PROTOTYPING 9

Principles of Divergent and Convergent thinking - Ideation Techniques – Rapid prototyping and Wireframing - Low fidelity – Mid fidelity and High-Fidelity Prototypes - Google design Sprint Method - User Testing and Feedback

SL & Activity hands-on: Develop a low fidelity prototype with respect to your domain, develop of physical prototype for a product, Work in teams in a 3-day design sprint, Submit Video Diary summarizing Sprint learnings, Conduct User testing, document feedback and propose three design changes

UNIT III FOUNDATIONS OF ENTERPRENURSHIP 9

Characteristics of Entrepreneur - Types of Entrepreneurships - Entrepreneurial Mindset – Business Model – Business Model Canvas - Types of Startup Business Models - Unique Selling Proposition

SL: Elements of Pitch Deck – Registering a business – Risk Assessment and Decision Making - Art of Leadership, Minimum Viable Product

Activity hands-on: Develop and Submit a 1-minute elevator pitch, develop a business canvas model for a product, Submit a case study on assessing the characteristics of an entrepreneur.

UNIT IV ENTREPRENEURIAL FINANCE 9

Source of Funding for Startups, bootstrapping vs. Debt Financing, Profit & Loss Statement, Balance sheet, Managing Burn rate and Runway - Business Expansion Models – Scaling
SL: Break even analysis - Pricing Strategy & Revenue Models – Revenue Projections
Activity hands-on: Prepare a Basic Finance plan for an imaginary product, Prepare a presentation compare and analyzing pricing model of a product , Simulate a Mock Investment Pitch

UNIT V INNOVATION MANAGEMENT AND FUTURE TRENDS IN INNOVATION 9

Difference between Innovation, Invention and Improvement - Types of Innovation – Disruptive Vs Incremental Innovation - Emerging Technologies & Their Impact on Entrepreneurship

SL: Technology Driven Business Models, Emerging start up Trends – Green Innovation
Activity Session: Analyze a disruptive innovation case study, develop an innovation roadmap for a chosen industry, Record a One Minute Story on a product in the promising emerging markets, Identify a company that failed due to lack of innovation and analyze the reasons.

Lecture hours (L)	**: 15 Periods**
Practical hours (P)	**: 30 Periods**
Term work & Self-Learning hours (TW + SL)	**: 45 Periods**
Total hours (TH)	**: 90 Periods**

COURSE OUTCOMES:

On successful completion of this course, the students will be able to:

- CO1 – Understand and implement design thinking methodologies to identify user needs, frame challenges, and develop innovative solutions.
- CO2 – Utilize brainstorming, rapid prototyping, and user testing to refine ideas and create viable product concepts.
- CO3 – Develop a business model canvas, identify revenue streams, and validate the feasibility of an idea using lean startup principles.
- CO4 – Develop a financial plan, analyze different pricing models, and participate in a mock investment pitch to refine startup strategy and fundraising skills
- CO5 – Identify the difference between invention, innovation, and improvement, analyze types of innovation, and explore how emerging technologies impact startups and business growth

TEXTBOOKS

1. Tim Brown, How design thinking transforms organizations and inspires innovation change by design, Harper Business, 2013.

2. Ries, Eric. The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation to Create Radically Successful Businesses. Crown Business, New York, 2011. ISBN: 978-0-307-88789-4.
3. Christensen, Clayton M. The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail. Harvard Business Review Press, Boston, 1997. ISBN: 978-1-63369-178-0.

REFERENCES

1. IDEO, Human Centered Design Tool Kit, 2nd edition (July 1, 2011) Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
2. J. Berengueres, The brown book of design thinking, UAE university College, Al Ain, First edition, November 16, 2013, ISBN 978-1-63041-059-9
3. Tom Kelly, The art of innovation - Lessons in Creativity from IDEO, America's Leading Design Firm, Profile Books; Main edition, 2016
4. Reddy, N. Krishniah. Innovation Management: Strategies, Concepts, and Tools for Growth and Profit. Tata McGraw-Hill, New Delhi, 2009. ISBN: 978-0-070-15084-3.
5. Thiel, Peter, and Masters, Blake. Zero to One: Notes on Startups, or How to Build the Future. Crown Business, New York, 2014. ISBN: 978-0-8041-3929-8.
6. Osterwalder, Alexander, Pigneur, Yves. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers. Wiley, New Jersey, 2010. ISBN: 978-0-470-87641-1.

CO-PO-PSO Mapping

COs	**POs**											**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**
CO1		2	3										
CO2		2	3										
CO3			2							3			
CO4										3			
CO5		1	2							3	2		
Average		**2**	**3**							**3**	**2**		

COURSE CODE	COURSE TITLE	L	T	P	TW & SL	C
UCS3311	DATA STRUCTURES LABORATORY	0	0	30	15	1.5

OBJECTIVES

- Implement the operations on linear and non-linear data structures
- Use suitable linear and nonlinear data structures for a given problem statement.

SUGGESTED EXPERIMENTS

1. Applications of Array (e.g. Finding pairs in an array with the given constraints)
2. Applications of Linked List (e.g. Polynomial manipulations)
3. Applications of Doubly Linked List (e.g. Simulation of a music player)
4. Applications of Stack (e.g. Simulation of Undo & Redo operations in a text editor)
5. Applications of Queue (e.g. Simulating printer jobs)
6. Implementation of Expression Tree (e.g. Elimination of common subexpression)
7. Applications of Binary Search Tree (e.g. Finding kth-largest and kth smallest element)
8. Applications of Graph Traversal Techniques (e.g. Simulation of network routing protocols)
9. Implementation of Shortest path algorithms (e.g. Finding the shortest route to connect one city to another)
10. Implementation of Hash Table (e.g. Symbol tables in Compilers)
11. Applications of Disjoint Set (e.g. Finding connected components and cycles)
12. Micro Project - Solving classical data structures problems referring to competitive programming websites

Laboratory Requirement for Batch of 30 Students

Hardware

PC - 30 Nos

Software

GCC compiler

Practical hours (P) : 30 Periods
Term work & Self-Learning hours (TW + SL) : 15 Periods
Total hours (TH) : 45 Periods

COURSE OUTCOMES

On successful completion of this course, the student will be able to:

CO1 Solve the applications using array, list, stack and queue data structures. (K3)
CO2 Use trees, graphs, hash tables and disjoint set data structures to solve real-world applications. (K3)
CO3 Select suitable data structure for real-world problems and work in teams applying best practices for problem solving and demonstrating its working with a good documentation (K5)

CO-PO-PSO Mapping

COs	POs											PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**
CO1	3		3									3	2
CO2	3		3									3	2
CO3	3	3	3		2		2		2		3	3	2
Average	3	3	3	3	2		2		2		3	3	2

COURSE CODE	COURSE TITLE	L	T	P	TW & SL	C
UCS3312	OPERATING SYSTEMS LABORATORY	0	0	30	15	1.5

OBJECTIVES

- To learn and implement basic Unix commands using system calls
- To implement various CPU Scheduling Algorithms, Inter Process Communication and Synchronization algorithms
- To implement Page Replacement Algorithms
- To explore RTOS and its operations

SUGGESTED EXPERIMENTS

1. Install virtual machine or windows subsystem and develop programs for process management using system calls. (Eg.: fork, wait, waitpid, exec, system, read, write, sleep, getpid, getppid, abort, kill)
2. Implement UNIX commands using system calls and include it as a part of the system commands in Linux operating system. (Eg.: ls, grep, cp using system calls like open, creat, read, write, close, lseek, dup, fctnl, ioctl, stat, umask, chmod, link, unlink, mkdir, chdir, opendir, closedir, readdir, getcwd, etc.)
3. Simulate the CPU scheduling algorithm (FIFO, Preemptive Priority). (Eg.: Printer job scheduling, scheduling jobs in automated boiler plant)
4. Develop inter-process communication mechanisms using shared memory and pipes for parent-child communication and client-server communication. (Eg.: Chat application, File transfer using system calls like pipe, popen, pclose, mkfifo, shmget, shmat, shmdt, shmctl, etc.)
5. Implement synchronization between processes using semaphores. (Eg.: Log File Synchronization using system calls like semget, semctl, semop, sem_wait, sem_open, sem_close, sem_post, sem_init, sem_destroy, sem_getval etc.)
6. Apply a deadlock avoidance algorithm to ensure safe resource allocation and prevent deadlocks. (Eg.: Cloud resource allocation for multiple users, Computer resource allocation)
7. Simulate the memory allocation using page replacement algorithms (LRU, Optimal). (Eg.: Multiprogramming in RAM)
8. Implement file allocation techniques for secondary memory management (Linked, Indexed). (Eg.: FAT storage structure)
9. Install RTOS and execute scheduler to run the jobs.
10. Apply synchronization techniques for inter task communication in RTOS.

Practical hours (P)	**: 30 Periods**
Term work & Self-Learning hours (TW + SL)	**: 15 Periods**
Total hours (TH)	**: 45 Periods**

LABORATORY REQUIREMENT FOR BATCH

Hardware: 1. Standalone Desktops with Linux OS - 38 Nos
Software: 1. C Compiler

COURSE OUTCOMES

On successful completion of this course, the student will be able to:

CO1: Examine the use of system calls, IPC mechanisms, and synchronization methods in operating systems. (K4)
CO2: Use relevant algorithms to build solutions for managing processes, allocating resources, and handling memory efficiently. (K3)
CO3: Assess the core features of real-time operating systems focusing on meeting time constraints in scheduling and synchronization. (K5)

CO-PO-PSO Mapping

COs	POs											PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**
CO1	3	2	3									3	2
CO2	3	2					2					3	2
CO3	3				3				2	2	2	3	2
Average	3	2	3		3		2		2	2	2	3	2

COURSE CODE	COURSE TITLE	L	T	P	TW & SL	C
UCSV303	SKILL DEVELOPMENT LABORATORY – I	0	0	30	15	1

Course Objectives

- Introduce fundamentals of prompt engineering for interacting with Large Language Models (LLMs).
- Develop skills in crafting effective prompts for text, coding, and specialized tasks.
- Explore advanced techniques like prompt chaining and API integration.
- Understand LLMs' capabilities, limitations, and ethical implications.
- Apply prompt engineering in a practical project combining basic and advanced methods.

Pre-requisites

Basic programming skills (e.g., Python, C++). No prior LLM knowledge needed.

Unit 1: Foundations of Prompt Engineering and LLMs (3 Hours)

Objective: Understand LLMs and the basics of prompt engineering.

- **Theory (1 Hour)**:
  - Overview of Large Language Models: Transformers, tokens, and context.
  - Role of prompt engineering in AI applications (e.g., chatbots, code assistants).
  - Real-world use cases: Content generation, code completion, and automation.
  - Introduction to model limitations: Context window, hallucinations.
- Real-world examples:
  - **Pizza My Heart's "Jimmy the Surfer" Chatbot:** A California pizza chain employs an AI persona named Jimmy the Surfer to handle orders via text, illustrating how role-based prompting ("You are Jimmy, a laid-back surf expert") guides tone and improves engagement in a real retail setting WIRED.
- **Hands-on (2 Hours)**:
  - Accessing free LLMs (e.g., ChatGPT, Gemini, Grok, or Hugging Face models).
  - Write simple prompts for text generation (e.g., "Describe a futuristic city").
  - Experiment with prompt variations (e.g., tone, specificity) and compare outputs.
- **Learning Outcomes**:
  - Understand how LLMs process prompts.
  - Gain initial experience with LLM interactions.

Unit 2: Crafting Effective Prompts for Text and Coding (3 Hours)

Objective: Design precise prompts for text generation and basic coding tasks.

- **Theory (1 Hour)**:
  - Anatomy of a good prompt: Clarity, specificity, context.
  - Techniques: Zero-shot, few-shot, and chain-of-thought prompting.
  - Prompts for coding: Specifying language, functionality, and constraints.
  - Common pitfalls: Ambiguity, bias, incorrect code logic.
- Real-world examples:
  - **Med-PaLM2 Chain-of-Thought in Clinical QA:** Google's Med-PaLM2 uses multi-step "chain-of-thought" prompts to decompose medical questions into reasoning steps,

achieving over 85 % accuracy on USMLE-style exams—demonstrating few-shot plus CoT prompting in high-stakes domains OpenReview.

- **Hands-on (2 Hours)**:
  - Create prompts for text tasks (e.g., summarize a CS article, write a README).
  - Write prompts for Python code (e.g., generate a sorting algorithm).
  - Debug a code snippet using LLM prompts (e.g., "Fix errors in this loop").
- **Learning Outcomes**:
  - Craft effective prompts for text and coding.
  - Evaluate LLM outputs for accuracy and relevance.

Unit 3: Intermediate Prompt Engineering Techniques (3 Hours)

Objective: Apply iterative and domain-specific prompt engineering.

- **Theory (1 Hour)**:
  - Iterative prompting: Refining outputs through follow-up prompts.
  - Domain-specific prompts: Tailoring for tasks like technical writing or data analysis.
  - Introduction to prompt chaining: Structuring multiple prompts for complex tasks.
  - Collaborative workflows: Using LLMs as a "co-pilot" (e.g., iterative editing).
- Real-world examples:
  - **Frost Bank Call-Summary AI:** Frost Bank's customer-service AI automatically summarizes banking conversations using tailored summarization prompts, reducing agent after-call work by 30 % and ensuring consistent record-keeping San Antonio Express-News.
- **Hands-on (2 Hours)**:
  - Iteratively refine a technical document (e.g., algorithm explanation).
  - Design a domain-specific prompt (e.g., "Explain a binary tree for a beginner").
  - Use prompt chaining to solve a multi-step task (e.g., "Generate, test, and document a function").
- **Learning Outcomes**:
  - Refine prompts iteratively for better results.
  - Apply prompt chaining for structured tasks.

Unit 4: Advanced Prompt Engineering and API Integration (3 Hours)

Objective: Explore advanced techniques and basic LLM API interactions.

- **Theory (1 Hour)**:
  - Advanced prompt chaining: Automating workflows with sequential prompts.
  - Contextual prompt design: Optimizing for specialized tasks (e.g., generating SQL queries, UI mockups).
  - Introduction to LLM APIs: Basic structure of API calls (e.g., Hugging Face, xAI API).
  - Limitations of advanced techniques: Computational cost, API quotas.
- Real-world examples:
  - **CI/CD-Integrated OpenAI Evals:** Teams at leading AI startups integrate OpenAI Evals into their CI/CD pipelines, running nightly automated pass/fail tests on production prompts to detect performance regressions before release OpenAI Cookbook.
- **Hands-on (2 Hours)**:
  - Create a chained prompt workflow (e.g., "Generate a dataset, analyze it, and visualize results").
  - Design a contextual prompt for a specialized task (e.g., "Write a REST API endpoint in Flask").
  - Make a simple API call to an LLM (e.g., Hugging Face's text generation API using Python).

- **Learning Outcomes**:
    - Implement advanced prompt chaining for complex tasks.
    - Interact with LLMs via APIs at a basic level.

Unit 5: Ethics, Limitations, and Capstone Project (3 Hours)

Objective: Address ethical issues and apply skills in a project combining basic and advanced techniques.

- **Theory (1 Hour)**:
    - Ethical considerations: Bias, misinformation, responsible AI use.
    - Advanced LLM limitations: Hallucinations, scalability, and ethical risks in automation.
    - Future trends: Agentic AI, prompt engineering in production systems.
- Real-world examples:
    - **Consistent Diagnostic Prompts for Medical AI:** A study found that GPT-4-Web with a "ROT" (Requirement-Outcome-Test) declarative prompt achieved the most consistent, reproducible answers on professional medical exam questions, highlighting reproducibility practices PMC.
    - PromptLayer in Fintech Compliance: Fintech firms use PromptLayer to log, evaluate, and version prompts powering KYC and transaction-monitoring workflows—enabling audit trails and automatic rollback when prompt performance drifts blog.promptlayer.com.
    - AWS Bedrock Content Moderation: Banks deploying AWS Bedrock leverage its built-in moderation checks and prompt-sanitization filters to prevent inadvertent exposure of PII in customer-facing AI assistants incubity.ambilio.com.
- **Hands-on (2 Hours)**:
    - Identify and mitigate bias in LLM outputs (e.g., rewrite a biased prompt).
    - Develop a solution using prompt engineering (e.g., a chatbot script, an automated code generator, or a data analysis pipeline). Use basic and advanced techniques (e.g., prompt chaining, API calls). Present a short demo.
- **Learning Outcomes**:
    - Critically assess LLM outputs for ethical concerns.
    - Synthesize prompt engineering skills in a practical project.

References

- OpenAI Prompt Engineering Guide (online).
- Hugging Face tutorials on text generation APIs.
- Blog posts on advanced prompt engineering (e.g., Zapier, DataCamp).

Requirements

- **Tools**: Free access to ChatGPT, Grok, or Hugging Face models. Optional: xAI API for educational use (see https://x.ai/api).
- **Hardware**: Lab computers with internet access; Python installed for API exercises.

Practical hours (P)	**: 30 Periods**
Term work & Self-Learning hours (TW + SL)	**: 15 Periods**
Total hours (TH)	**: 45 Periods**

COURSE OUTCOMES

After the completion of the course, the students should be able to:

CO1: Apply prompt engineering techniques to interact effectively with Large Language Models for diverse tasks such as content generation, summarization, and basic code writing. (K3)

CO2: Implement prompt refinement methods including few-shot learning, chain-of-thought prompting, and iterative feedback to improve output quality in domain-specific scenarios (K3)

CO3: Develop and demonstrate a functional solution using prompt chaining and API integration, showcasing ethical and practical applications of LLMs in real-world projects (K3)

CO-PO-PSO Mapping

COs	**POs**											**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**1**	**2**
CO1	3	2	2		2	3	3	3	2		3	3	2
CO2	3	2	3		2	3	3	3	3		3	3	2
CO3	3	3	3		3	3	3	3	3		3	3	3
Average	3	2.3	2.6		2.3	3	3	3	2.6		3	3	2.3