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(Accredited by NAAC)

GU/Acad –PG/BoS -NEP/2024/542 Date: 24.09.2024

CIRCULAR

Ref. No.: GU/Acad –PG/BoS -NEP/2024/517 dated 18.09.2024

In supersession to the above referred Circular the updated Syllabus of Semesters I and II of the **Bachelor of Engineering in Electronics Engineering (VLSI Design & Technology)** Programme approved by the Standing Committee of the Academic Council in its meeting held on 06th, 07th and 21st March 2024 is attached with following changes:

- Course VAC-157 "Indian Knowledge System: Case Studies" shall now be read as "Indian Knowledge System Lab", the course content for the same is given in the syllabus below.
- Course Code for Courses "Basics of Computing using Python" and Basics of Computing using Python Lab" shall be ITH-111 and ITH-112 respectively.

The Dean, Faculty of Engineering and Principals of affiliated Colleges offering the **Bachelor of Engineering in Electronics Engineering (VLSI Design & Technology)** Programme are requested to take note of the above and bring the contents of the Circular to the notice of all concerned.

ASHWIN VYAS LAWANDE
Digitally signed by ASHWIN VYAS LAWANDE
Date: 2024.09.24 17:19:20 +05'30'

(Ashwin V. Lawande)
Deputy Registrar – Academic

To,
1. The Dean, Faculty of Engineering, Goa University.
2. The Principals of affiliated Engineering Colleges.

Copy to,
1. The Director, Directorate of Technical Education, Govt. of Goa
2. The Chairperson, BoS in Electronics & Telecommunication Engineering.
3. The Controller of Examinations, Goa University.
4. The Assistant Registrar, Prof. Examinations, Goa University.
5. Directorate of Internal Quality Assurance, Goa University for uploading the Syllabus on the University website.

ELECTRONICS ENGINEERING (VLSI DESIGN & TECHNOLOGY) (AY 2024-25)

SEMESTER - I							
Sr. No	**Course Category**	**Course Code**	**Title of the Course**	**L**	**T**	**P**	**Credits**
1.	**Major**	**ETC-100**	Elements of Electrical and Electronics Engineering	**3**	**0**	**0**	**3**
		ETC-101	Elements of Electrical and Electronics Engineering Lab	**0**	**0**	**1**	**1**
2.	**Minor**	**MCV-111**	Basics of Mechanical and Civil Engineering	**3**	**0**	**0**	**3**
		MCV-112	Basics of Mechanical and Civil Engineering Lab	**0**	**0**	**1**	**1**
		OR					
		SHM-111	Biology for Engineers	**3**	**0**	**0**	**3**
		SHM-112	Biology for Engineers Lab	**0**	**0**	**1**	**1**
3.	**MC**	**SHM-131**	Engineering Mathematics - I	**2**	**1**	**0**	**3**
4.	**AEC**	**AEC-151**	Creative Thinking and Innovation	**2**	**0**	**0**	**2**
		AEC-152	Creative Thinking and Innovation Lab	**0**	**0**	**1**	**1**
5.	**VAC**	**VAC-156**	Indian Knowledge System	**2**	**0**	**0**	**2**
		VAC-157	Indian Knowledge System Lab	**0**	**0**	**1**	**1**
6.	**SEC**	**SEC-144**	Electronics and Mechanical Workshop	**0**	**0**	**3**	**3**
			Total	**12**	**1**	**7**	**20**

SEMESTER - II							
Sr. No.	**Course Category**	**Course Code**	**Title of the Course**	**L**	**T**	**P**	**Credits**
1.	**Major**	**VLI-100**	Fundamentals of VLSI	**3**	**0**	**0**	**3**
		VLI-101	Fundamentals of VLSI Lab	**0**	**0**	**1**	**1**
2.	**Minor**	**ITH-111**	Basics of Computing using Python	**3**	**0**	**0**	**3**
		ITH-112	Basics of Computing using Python Lab	**0**	**0**	**1**	**1**
		OR					
		SHM-113	Engineering Chemistry	**3**	**0**	**0**	**3**
		SHM-114	Engineering Chemistry Lab	**0**	**0**	**1**	**1**
3.	**MC**	**SHM-132**	Applied Physics	**2**	**0**	**0**	**2**
		SHM-133	Applied Physics Lab	**0**	**0**	**1**	**1**
4.	**AEC**	**AEC-153**	Communication and Technical Writing	**2**	**1**	**0**	**3**
5.	**VAC**	**VAC-158**	Environmental Science and Sustainability	**2**	**0**	**0**	**2**
		VAC-159	Environmental Science and Sustainability Lab	**0**	**0**	**1**	**1**
6.	**SEC**	**SEC-143**	Engineering Graphics and Design with UI/UX	**0**	**0**	**3**	**3**
			Total	**12**	**1**	**7**	**20**

Issued on: 24/09/2024

SEMESTER I

Name of the Programme : Electronics Engineering (VLSI Design & Technology)
Course Code : ETC-100
Title of the Course : Elements of Electrical and Electronics Engineering
Number of Credits : 3
Effective from AY : 2024-25

Pre-requisites for the Course:	NIL	
Course Objectives:	The course will enable the students to 1. Understand basic electrical components and electronic devices. 2. Interpret the working of basic electrical and electronic circuits. 3. Solve problems related to basic electrical and electronic circuits. 4. Analyze simple applications of electrical and electronic circuits.	
Content:		**No of hours**
Unit 1	**DC Circuit Analysis:** Kirchhoff's Laws, Mesh Analysis, Nodal Analysis. Network Theorem: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem. **Batteries:** Series and parallel connection of Batteries, Battery specifications.	**10**
Unit 2	**AC Fundamentals:** Representation of AC quantity (Mathematical, Phasor, Waveform). Important Terms and definitions: Frequency, Time Period, Average value, RMS Value, Amplitude, Phase and Phase difference (lead, lag, in-phase concept). Addition of Alternating Quantities. **Series R-L-C circuits (includes Series R-L & Series R-C):** Power factor, Phase angle. **Single Phase Transformer:** Operating Principle, Construction, EMF Equation. Turns Ratio/ Voltage transformation Ratio, Ideal Transformer.	**12**
Unit 3	**Diodes and Circuits:** Construction and V-I Characteristics: P-N Junction diode, Zener Diode and Light Emitting Diode**.** Breakdown mechanisms in diodes. **Diode Applications:** Operation and Analysis of Half /Full wave Rectifier and Bridge rectifier (DC output voltage/ current, RMS output voltage/ current, PIV, Ripple factor). **Voltage regulation using Zener diode:** Line regulation and Load regulation.	**12**
Unit 4	**Bipolar Junction Transistor:** Construction, Operation, Configurations (CB, CE, CC), relations between transistor current gain. Transistor Amplifying Action, Limits of operation.	**11**

	DC Biasing: Operating Point, Fixed-Bias Circuit, Emitter Stabilized Bias Circuit, Voltage Divider Bias Circuit.	
Pedagogy:	Inquiry based learning, Integrative and Reflective learning	
References/ Readings:	**Text Books:** 1. Theraja, B. L.; "Fundamentals of Electrical Engineering and Electronics". S. Chand Publishing. ISBN: 9788121926607. 2. Bhargava N.N., Kulshreshtha D.C., Gupta S.C., "Basic Electronics and Linear Circuits"; McGraw Hill Education. 2nd Edition - 1 July 2017; ISBN-13: 978-1259006463 ISBN-10 1259006468.	
	Reference Books: 1. Del Toro, V.; "Electrical Engineering Fundamentals", Pearson Education. 2nd Edition - 1 January 2015; ISBN-13: 978-9332551763 ISBN-10: 9332551766 2. Boylestad R. & Nashelsky L.; "Electronic Devices and Circuit Theory"; Pearson Education Limited.11th edition; ISBN 9789332542600.	
Course Outcomes:	After taking this course, student will be able to: 1. Recall the basic terminologies associated with DC and AC circuits, transformers, various electrical and electronic devices 2. Explain the operating principles and applications of Diodes and Bipolar Junction Transistor. 3. Solve problems related to DC Circuits and BJT biasing circuits 4. Examine basic circuits like regulators and rectifiers	

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Name of the Programme : Electronics Engineering (VLSI Design & Technology)
Course Code : ETC-101
Title of the Course : Elements of Electrical and Electronics Engineering Lab
Number of Credits : 1
Effective from AY : 2024-25

Pre-requisites for the Course:	Nil	
Course Objectives:	The course will enable the students to 1. Identify electrical and electronic components and understand electrical wiring. 2. Use appropriate test and measurement equipment in a lab setup. 3. Measure electrical parameters and characterize components such as diodes and transistors. 4. Assemble and test electrical and electronic circuits on a breadboard.	
Content:	**List of Experiments**	**No. of hours**
	1. Identification of different passive and active components (e.g. resistors, capacitors, inductors, diodes, transistor and ICs) 2. Familiarization with basic electronic instruments (e.g. Power Supply, Digital Multimeter, Function Generator, and Digital Storage Oscilloscope -DSO). Measurement of AC & DC voltage, current & resistance using digital multimeter. Connection, display & measurement of various types of periodic signals (Sine, Square & Triangular) using function generator and DSO. 3. Study of single-phase domestic wiring system 4. Verifying Kirchhoff's Laws 5. Verifying Mesh Analysis / Nodal Analysis 6. Verifying Superposition theorem 7. Verifying Thevenin's theorem/ Norton's theorem 8. Verifying Maximum Power Transfer theorem 9. Study of Transformers 10. Study of static V-I characteristics of PN Junction Diode and Zener Diode 11. Verification of Half Wave Rectifier circuit parameters 12. Verification of Full Wave Rectifier circuit parameters 13. Line and Load Regulation using Zener diode 14. Input and Output Characteristics of BJT in CE/CB/CC configuration 15. BJT amplifier with voltage divider bias	**30**
Pedagogy:	Inquiry based Learning, Constructive and Collaborative Learning.	
Instructions:	Minimum **Ten** experiments need to be conducted and documented.	

References/ Readings:	**Reference Books** 1. Chandra S. Poorna, Sasikala B., Electronics Laboratory Primer. S Chand & Company. Reprint of 1998 A H Wheeler edn Edition - 1 March 2005 ISBN-13: 978-8121924597 ISBN-10: 8121924596 2. Massimo Mitolo, Peter Basis, Fabio Freschi, Manual for Introduction to Electronics, Pearson Education Limited.Lab Manual Edition - 8 August 2013; ISBN-13: 978-0132954785 ISBN-10: 0132954788. 3. Paul Zbar, Albert Malvino, Michael Miller, Basic Electronics: A Text Lab Manual, Mcgraw Hill Education. 7th Edition - 3 October 2001; ISBN-13: 978-0074624982 ISBN-10: 9780074624982 4. R. Boylestad & L. Nashelsky; Electronic Devices and Circuit Theory; Pearson Education Limited. 11th edition; ISBN 9789332542600.
Course Outcomes:	**After taking this course, student will be able to:** 1. Identify electrical and electronic components 2. Determine component values and their specifications 3. Assemble and test electrical and electronic circuits 4. Analyze readings and waveforms and interpret results from measurements

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Name of the Programme : **Electronics Engineering (VLSI Design & Technology)**
Course Code : **MCV-111**
Title of the Course : **Basics of Mechanical and Civil Engineering**
Number of Credits : **3**
Effective from AY : **2024-25**

Pre-requisites for the Course:	Nil	
Course Objectives:	The course will enable the students to 1. Learn the principles of thermodynamics, heat engine, refrigeration, structures and their foundations and concepts of green buildings and net zero energy buildings. 2. Analyze the working of heat engines, simple refrigeration systems, building structures and foundations. 3. Evaluate the heat – work, COP of refrigeration systems, requirements of green building and net zero energy buildings.	
Content:		**No. of Hours**
Unit -1	**Basic concepts of thermodynamics:** System, surroundings, property, process, heat and work (concepts only); First law, Non-Flow Energy equation (no proof) with the concept of internal energy and enthalpy; Reversible process constant volume, constant pressure, isothermal and adiabatic only (restricted to basic calculations of heat and work transfer); First law applied to boiler, turbine, condenser and pump; Second law and degradation of energy, absolute temperature scale (concepts only)	**12**
Unit -2	**Heat Engines and Refrigeration:** Internal Combustion (I.C) Engines: Basics, definition, taxonomy – Spark Ignition & Compression Ignition with two stroke and four stroke operating principles with basic parts, Systems: fuel, ignition, lubrication and cooling (elementary description with schematic sketches only), basic calculations of brake power and specific fuel consumption, introduction to Multi-Point Fuel Injection (MPFI) and Common Rail Direct Injection System (CRDI) **Refrigeration:** Basics refrigerants, working principle of Vapour Compression cycle using schematic diagram, domestic refrigerator, Definition of tonne of refrigeration, Coefficient of performance (preliminary treatment without numerical)	**11**
Unit -3	**Building Materials:** Materials and uses: Stones, bricks, mortars, sand, Construction Chemicals; Structural Steel, High Tensile Steel, Cement and different types and properties. Building Construction: Plain cement concrete, Reinforced &	**11**

	Prestressed Concrete constructions, Components of building, load bearing and framed structures. Brick masonry and Stone masonry works- types of masonry constructions. **Types of foundations –** shallow and deep, selection of types of foundation and bearing capacity of soil/rock.	
Unit- 4	**Types of Civil Engineering Structures: Buildings, Bridges, Tunnels, Roads and highways, Railways,** Port & Harbour, Airport, Dams, Water supply systems, Water tanks. Typical uses and importance of each structure. **Introduction to irrigation and water power engineering,** Concepts of green building and net zero energy buildings – definition and basic requirements.	**11**
Pedagogy:	Inquiry based learning, Integrative, Reflective Learning, Constructive learning and Collaborative learning	
References/ Readings:	**Text Books:** 1. Gopi, S., "Basic Civil Engineering", Pearson, 1st Edition, ISBN-13:978-8131729885. ISBN: 978-81-7409-256-4. 2. Jain, A. K., "The Idea of Green Building", Khanna Publishers, New Delhi, 3. Nag, P. K., "Engineering Thermodynamics", McGraw Hill Education, 2017, 978-93-52606-42-9. 4. Punmia, B. C., Jain, A. K., Jain, A. K., "Basic Civil Engineering", Laxmi Publications (P) Ltd., New Delhi, Jan 2004. **Reference Books:** 1. Bhavikatti, S. S., "Elements of Civil Engineering", New Age International Private Limited, 2010. 2. Birdie, G. S., Ahuja, T. D., "Building Construction and Construction Material", Dhanpat Rai Publishing Company, 2012. 3. Iyer, G. H., "Green Building Fundamentals", Notion Press, Chennai, ISBN-13 :979-8886416091.	
Course Outcomes:	After taking this course, student will be able to: 1. Understand the Laws of thermodynamics, principles of Heat Engines and Refrigeration and basics of building materials and construction of structures. 2. Comprehend the Laws of thermodynamics, principles of Heat Engines and Refrigeration and concepts of green building and net zero energy buildings. 3. Analyze the Laws of thermodynamics, principles of Heat Engines and 4. Refrigeration, and requirements of construction procedure of structures and their foundations. 5. Evaluate the heat and work for different thermodynamic processes, and	

	basic parameters in Heat Engines and Refrigeration and requirements for green building and net zero energy buildings.

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Name of the Programme : Electronics Engineering (VLSI Design & Technology)
Course Code : MCV-112
Title of the Course : Basics of Mechanical and Civil Engineering Lab
Number of Credits : 1
Effective From AY : 2024-25

Pre-requisites for the Course:	Nil	
Course Objectives:	The course will enable the students to 1. Study the principles of thermodynamics, heat engine, refrigeration and analyze the working of heat engines, simple refrigeration systems. 2. Evaluate the heat – work, COP of refrigeration systems. 3. Evaluate the physical and strength properties of civil engineering materials	
Content:		**No of Hours**
	List of Practical: 1. To investigate the First Law of Thermodynamics using IC engines 2. To investigate the second Law of Thermodynamics using IC Engines 3. To investigate the second Law of Thermodynamics using refrigeration/AC systems 4. To verify the zeroth law of thermodynamics 5. To determine COP of a domestic refrigerator 6. To determine COP of a window air conditioner 7. To determine the compression strength of building materials 8. To determine the tensile strength of steel 9. To verify physical properties viz. size, density, weight, water absorption, etc. 10. Traversing of simple building using Tape/Chain/Theodolite 11. Sieve analysis of sand cement and aggregates. 12. To determine hardness of building materials using BHN	**30**
Pedagogy	Inquiry based learning, Integrative, Reflective Learning, Constructive learning and Collaborative learning.	
Instructions	Minimum 8 experiments to be performed	
References/ Readings:	**Text Books** 1. B. C. Punmia, A. K Jain, and A. K Jain, “Basic Civil Engineering”, Laxmi Publications (P) Ltd., New Delhi, Jan 2004. 2. Gopi S., “Basic Civil Engineering”, Pearson, 1st Edition, ISBN-13:978-8131729885 3. Nag P. K., “Engineering Thermodynamics”, McGraw Hill Education, 2017,	

	978-93-52606-42-9 **Reference Books** 1. Birdie G. S. and Ahuja T. D., "Building Construction and Construction Material", Publisher, Dhanpat Rai Publishing Company, 2012. 2. S S Bhavikatti, "Elements of Civil Engineering", New Age International Private Limited, 2010.
Course Outcomes:	**After taking this course, student will be able to:** 1. Understand the Laws of thermodynamics, principles of Heat Engines and Refrigeration 2. Understand the physical properties of the building materials 3. Analyze the Laws of thermodynamics, principles of Heat Engines and Refrigeration 4. Evaluate the heat and work for different thermodynamic processes, and basic parameters in Heat Engines and Refrigeration and hardness properties of materials

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Name of the Programme : Electronics Engineering (VLSI Design & Technology)
Course Code : SHM-111
Title of the Course : Biology for Engineers
Number of Credits : 3
Effective from AY : 2024-25

Pre-requisites for the Course:	Nil	
Course Objectives	The students shall be able to: 1. Learn about enzymes and compare different mechanisms of enzyme action. 2. Study DNA as a genetic material in the molecular basis of information transfer. 3. Understand classification of biological processes at the reductionistic level. 4. Study and use thermodynamic principles to biological systems.	
Contents		**No. of Hours**
Unit - 1	**Classification based on Cellular Structure:** Biomolecules and biopolymers: Structure and Function Organic and inorganic molecules; Unique Properties of water, Vitamins and Minerals, Carbohydrates, Lipids, Amino Acids and proteins, Nucleic Acids (DNA and RNA) Cell as a basic unit of life, prokaryotic and eukaryotic cells, microbes, plant and animal cells; Cell organelles – structure and function; Cell membrane Levels of organization: cells, tissues, organs, systems & organism.	**10**
Unit - 2	Energy transformations in Chloroplast: Photosynthesis (photochemical & biochemical phase) and ATP generation, Aerobic and anaerobic systems Energy transformations in Mitochondria: Cellular respiration (glycolysis and Kreb cycle) and ATP generation **Bioenergetics:** Thermodynamic principles applied to biology, negative entropy changes in biological systems, Free Energy, Chemical Equilibrium. Expression and Transmission of Genetic Information: DNA replication, Enzyme driven process of DNA cloning, Protein synthesis- Transcription & translation Techniques for optimization: a. At molecular level: Recombinant DNA Technology, DNA hybridization, PCR, DNA microarray	**12**

Unit - 3	**Transport Phenomena in Biological Systems:** Membrane channels and ion channels; Fluid flow and mass transfer (nutrients & ions); In plants: Xylem and Phloem; In animals: Blood and Lymph Transport of gases: Oxygen and Carbon dioxide Heat Transport - Body temperature regulation. **Communication:** Cell junctions, Cell-cell communications – cell signaling, Hormones, Pheromones and cell behavior Defense mechanisms: In plants: Herbivory, secondary metabolites In animals: Innate and Adaptive immune systems Engineering perspectives of biological sciences: Biology and engineering crosstalk – At cell level: Hybridoma technology At tissue level: Plant Tissue Culture, Animal Tissue Culture; Tissue Engineering: Principles, methods and applications Introduction to Biomimetics and Biomimicry, nanobiotechnology	**11**
Unit - 4	**Human Organ Systems and Bio Designs** Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease). Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye). Heart as a pump system (architecture, electrical signaling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators)**.**	**12**
Pedagogy:	Inquiry based learning, Integrative approach to multidimensional understanding, Reflective thinking leading to right understanding	
References/ Readings:	**Text Books:** 1. Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022 2. Lehninger, A. L., Nelson, D. L., & Cox, M. M. (2000). Lehninger principles of biochemistry. New York: Worth Publishers. 3. Lodish H, Berk A, Zipursky SL, et al. (2000) Molecular Cell Biology. W. H. Freeman. 4. Stent, G. S.; and Calender, R.W.H. "Molecular Genetics (Second edition)", Freeman and company, CBS Publisher, ISBN 978-0716710288 **Reference Books** 1. Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press. 2. Nelson, D. L., Cox M.W.H, "Principles of Biochemistry", (V Edition), Freeman and Company CBS Publication, ISBN 978-13192280002	

Course Outcomes:	**After going through this course, the student will be able to:** 1. Understand enzymes and distinguish between different mechanisms of enzyme action. 2. Explain DNA as a genetic material in the molecular basis of information transfer. 3. Classify biological processes at the reductionistic level 4. Apply thermodynamic principles to biological systems.

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Name of the Programme : Electronics Engineering (VLSI Design & Technology)
Course Code : SHM-112
Title of the Course : Biology for Engineers Lab
Number of Credits : 1
Effective from AY : 2024-25

Pre-requisites for the Course:	Nil	
Course Objectives:	The students shall be able to: 1. Remember the structure of unicellular and multicellular cells 2. Learn the Chromosome map and Mendel's law 3. learn the Lipids and Carbohydrates and DNA from Cauliflower 4. Carry out experiments to determine activity of enzymes and photosynthesis.	
Contents	**List of Experiments**	**No. of hours**
	1. Study of Prokaryotic cells using Gram's staining technique 2. Study of Eukaryotic Cell using suitable staining technique- (Buccal epithelial Cells/yeast cells) 3. Study of ultrastructure of prokaryotes or eukaryotes 4. Demonstrate segregation and independent assortment using simple genetic traits like flower color in pea plants or coat color in mice using Punnett squares. 5. Determine the genotype and phenotype ratios of the offspring and discuss the concepts of dominance and recessiveness. 6. Study of activity of salivary amylase under optimum conditions (Conversion of starch to glucose). 7. Qualitative tests to identify proteins and lipids in the given solution 8. Numerical problems on calculations of Standard Free Energy Change and Equilibrium constant 9. Numerical problems on calculations of Standard Free Energy Change and Equilibrium constant 10. Staining of photosynthetic bacteria from pond water 11. Determination of total chlorophyll in shade and sun plants.	**30**
Pedagogy	Inquiry based learning Constructive planning of experiments Collaborative approach in performing experiments	
Instructions	**Minimum 8 experiments to be performed**	
References	**Text Books:** 1. Stent, G. S.; and Calender, R.W.H. "Molecular Genetics (Second edition)", Freeman and company, CBS Publisher, ISBN 978-0716710288	

	2. Uma Devi Koduru, “General Biology”, Khanna Book Publishing Company, ISBN 9789-3915-05028, January 2022
	Reference Books 1. Nelson, D. L., Cox M.W.H, “Principles of Biochemistry”, (V Edition), Freeman and Company CBS Publication, ISBN 978-13192280002
Course Outcomes	After going through this course, the student will be able to: 1. Understand the structure and ultrastructure of prokaryotic and eukaryotic cell. 2. Students will be able to analyze the problems related to genetic transfers. 3. Students will be able to Apply the techniques involved in biochemical methods for analysis of biomolecules 4. Students will be able to apply the laws of thermodynamics techniques to understand the physiology of living organisms.

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Multidisciplinary Courses
Name of the Programme : Electronics Engineering (VLSI Design & Technology)
Course Code : SHM-131
Title of the Course : Engineering Mathematics - I
Number of Credits : 3 (2L+1T)
Effective from AY : 2024-25

Pre-requisites for the Course:	Nil	
Course Objectives:	The course will enable the students to 1. Gain knowledge of series and their convergence. 2. Understand the significance of Taylor's series expansion, familiarity with functions of several variables and their analytic properties. 3. Understand matrix operations and concepts such as rank, inverse, determinant and linear independence. 4. Equip them with skills to deal with linear systems and eigenvalue problems.	
Content:		**No of Hours**
Unit 1	**Infinite Series, Alternating Series and Power Series.** **Convergence of sequence and series-tests for convergence:** Integral Test, Comparison test, D'Alembert's Ratio test, Cauchy root test, Leibnitz test for alternate series. **Power series:** Radius of convergence and Interval of convergence.	**07**
Unit 2	**Differential Calculus** Higher order derivatives, Leibnitz theorem, and Taylor's series expansion in one variable. Partial derivatives, maxima, minima, and saddle points; method of Lagrange multipliers. Gradient, directional derivative, linear approximation.	**08**
Unit 3	**Matrix Operations, Special Matrices, Determinant, Rank and Independence** Types of matrices, Determinant, Adjoint of a Matrix, Inverse of matrix, Elementary transformations, Elementary matrices, Rank of matrix, Row Reduced Form, Row Reduced Echelon Form, Rank using elementary transformation, Reduction to normal form. Linear independence, and dependence of vectors	**08**
Unit 4	**Linear Systems, Eigenvalues and Eigenvectors, Cayley-Hamilton Theorem and Diagonalization.** Systems of the form AX = 0, and AX = B, and their solutions. Eigen values, Eigen vectors with properties, Cayley-Hamilton theorem with its applications, minimal polynomial, diagonalization.	**07**
Pedagogy:	Inquiry based learning, Constructive, Integrative and Reflective learning.	

	One or more assignments to be carried out on topics covered in each unit above- Total time allotted 15 hours
References/ Readings:	**Text Books** 1. Grewal, B. S., "Higher Engineering Mathematics", Khanna Publishers, India 2014. **Reference Books** 1. Kreyszig, Erwin, "Advanced Engineering Mathematics", United Kingdom, Wiley, 2020.
Course outcomes:	**After taking this course, student will be able to:** 1. Test the convergence of an infinite series and determine the interval of convergence of a power series. 2. Express a function of one variable in the form of a power series, compute directional derivative, and understand partial differentiation and its applications. 3. Carry out matrix operations including computing rank, inverse, and determinant, and also demonstrate an understanding of linear independence. 4. Solve systems of linear equations, compute Eigenvalues and Eigenvectors, and diagonalize matrices.

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Ability Enhancement Courses

Name of the Programme : Electronics Engineering (VLSI Design & Technology)
Course code : AEC-151
Title of the course : Creative Thinking and Innovation
Number of credits : 2
Effective from AY : 2024-25

Pre-requisites for the Course:	Nil	
Course Objectives:	The students shall be able to: 1. Explain the steps involved in the creative thinking process 2. Apply the various techniques for stimulating creativity and innovation thinking 3. Analyze the techniques to design and develop new products 4. Synthesize the creative design with analysis to develop new products.	
Contents:		**No. of Hours**
Unit 1	**Introduction:** Creative thinking, blocks to creativity, factors that influence creative design, engineering design and creative design, influence of society, technology and business on creativity, force field analysis, market pull & technology push, attribute of a creative person, thinking in groups. **Emotional design:** Emotional Design – Three levels of Design – Viceral, Behavioral and Reflective design; designs with personality – machines that senses emotions and induce emotions- Robots, personality products, products for games, fun, people and places; Simulation – dimensional or mathematical, virtual simulation, physical simulation, scale down models.	**8**
Unit 2	**Generation Of Ideas:** Need or identification of a problem, market survey, data collection, review & analysis, problem definition, Kipling method, challenge statement, problem statement initial specifications, Brain storming, analogy technique or synectics, check list, trigger words, morphological method, interaction matrix method, analysis of interconnected decision making, record-discuss-clarify-verify.	**8**
Unit 3	**Theory Of Inventive Problem Solving (Triz):** Common features of good solutions – resolve contradiction, use available resource, increase the ideality, trade-off, inherent contradiction, 30 key TRIZ principles – multifunction, preliminary action, compensation, nested doll, blessing in disguise, segmentation, separation, regional influences, symmetry change, opaque & porous, inflate and deflate, colour, recycle & recover, phase transformation, energy, imaging,	**8**

	environment, composition, economical, surface response, equipotential, static & dynamic, continuous & intermittent, servo systems, smart systems, dimensions.	
Unit 4	**Product Design & Intellectual Property Rights (IPR)** Recording of ideas, evaluation of ideas, detail design, prototyping, patent act, patent laws, drafting patent applications, product deployment, useful life assessment and recycling and sustainability.	**6**
Pedagogy:	Inquiry based learning, Integrative approach to multidimensional understanding, Reflective thinking leading to right understanding.	
References/ Readings:	**Text Books:** 1. Chakrabarti, Amaresh, "Creative Engineering Design Synthesis", Springer, 2002. 2. Floyd Hurt, "Rousing Creativity: Think New Now", Crisp Publ Inc. 1999, ISBN 1560525479. **Reference Books:** 1. Adair John, 'The Art of Creative Thinking', Kogan Page Publication, 2011, ISBN 978-0-7494-5483-8. 2. Norman, Donald A., "Emotional Design", Perseus Books Group New York, 2004, ISBN 123-1-118-027-6. 3. Rantanen, Kalevi, Domb Ellen, 'Simplified TRIZ' – II edn., Auerbach Publications, Taylor & Francis Group, 2010, ISBN: 978-142-0062-748.	
Course Outcomes:	After going through this course, the student will be able to: 1. Explain the steps involved in the creative thinking process. 2. Apply the various techniques for stimulating creativity and innovation thinking. 3. Analyze the techniques to design and develop new products. 4. Synthesize the creative design with analysis to develop new products.	

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Name of the Programme : Electronics Engineering (VLSI Design & Technology)
Course code : AEC-152
Title of the course : Creative Thinking and Innovation Lab
Number of credits : 1
Effective from AY : 2024-25

Prerequisites for the Course:	NIL	
Course Objectives:	The students shall be able to: 1. Identify the problem or limitations of existing devices, processes and systems. 2. Explain the need for improved/ development of new devices, process or system 3. Analyze creative and innovative techniques / solutions 4. Develop designs, drawings, models of devices, processes and systems	
Contents:		**No. of hours**
	• Groups of three or four students will be made, • Each group shall choose any one of the following topics, in consultation with the faculty • Identify a problem statement and come up with creative ideas and innovative solutions. (a) Renewable Energy; (b) Agriculture, Aqua Culture, Food Processing; (c) Waste Processing; (d) Technologies for Healthcare; (e) Technologies for law enforcement; (f) Application of Robots (g) Technologies for Mobility	**30**
Pedagogy:	Inquiry based learning, Constructive planning of experiments, Collaborative approach in performing experiments	
References/ Readings:	**Text Books:** 1. Chakrabarti, A., "Creative Engineering Design Synthesis", Springer, 2002. 2. Hurt, F., "Rousing Creativity: Think New Now", Crisp Publishers Inc., 1999, ISBN 1560525479. **Reference Books:** 1. Adair, J., "The Art of Creative Thinking", Kogan Page Publication, 2011, ISBN 978-0-7494-5483-8. 2. Norman, D. A. "Emotional Design", Perseus Books Group New York, 2004, ISBN 123-1-118-027-6. 3. Rantanen, K., Domb, E., "Simplified TRIZ", 2nd Edn., Auerbach Publications, Taylor & Francis Group, 2010, ISBN: 978-142-0062-748.	

Course Outcomes:	After going through this course, the student will be able to: 1. Identify the problem or limitations of existing devices, processes and systems. 2. Explain the need for improved/ development of new devices, process or system 3. Analyze creative and innovative techniques / solutions 4. Develop designs, drawings, models of devices, processes and systems.

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Value Added Courses
Name of the Programme : Electronics Engineering (VLSI Design & Technology)
Course code : VAC-156
Title of the course : Indian Knowledge System
Number of credits : 2
Effective from AY : 2024-25

Prerequisites for the Course:	Nil	
Course Objectives:	The students shall be able to: 1. Remember the contributions made by ancient Indian civilization 2. Understand the importance of Indian Knowledge System 3. Explain the relevance of Indian Knowledge System in Today's context 4. Apply the Indian Knowledge System in Daily Practices.	
Contents:		**No. of Hours**
Unit 1	**Historical Perspective of Indian Civilization :3**000 BCE to 2000 CE, Education System in Ancient India - Universities-Takshashila, Nalanda, Vikramashila; Knowledge of Materials and Processes; Mathematics; Astronomy; Indian Calendar, Public Administration and Governance; Economics and Trade; Relevance in today's context.	**07**
Unit 2	**Town Planning;** Architecture & Sculpture; Vastu Shastra; Jyothishya, Vedas-Rig, Yajur, Sama, Athrva; Brahmana, Aranyaka, Upanishad, Vedangas, Vedanta, Jainism, Buddhism; Universal Human Values-Dharma, Artha, Kama, Moksha; Character: Sattva, Rajas, Tamas; Relevance in today's context in terms of content and values	**08**
Unit 3	**Ayurveda-**mind-body relation, five koshas, vatta-pitta-kapha, dravya-guna-karma, Medicinal values of fruits, vegetables, spices; disease prevention and cure; Health & Wellness – Ashtanga Yoga – Yama, Niyama, Asana, Pranayama, Pratyahara, Dharana, Dhyana, Samadhi; Relevance in today's context in terms of content and value.	**07**
Unit 4	**Linguistics;** Music and Musical Instruments – Dhvani Siddhanta; Traditional Dance Forms – Bharata Natyashastra, Navarasa; Mudras; Dress Materials /Textiles, weaving, dyeing of cotton and silk fabric. Relevance in today's context in terms of content and values.	**08**
Pedagogy:	Inquiry based learning, Integrative approach to multidimensional understanding Reflective thinking leading to right understanding.	
References/ Readings:	**Text Books:** 1. Iyengar B. K. S., "Light On Yoga", Aquarian-Thorsons Publication, 1991, ISBN:978-18-55381-16-67. 2. Mahadevan B., Bhat, V., Pavana, N., "Introduction to Indian Knowledge Systems", PHI-EEE, 2022, ISBN:978-93-91818-20-3.	

	Reference Books: 1. Chidatmananda Swami, 'Ancient Indian Society', Chinmaya Mission. 2. Gaur R. R., Asthana R., Bagaria G. P. "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1. 3. Prajnanananda Swami, "History of Indian Music", Advaita Ashram, Kolkata.
Course Outcomes:	After going through this course, the student will be able to: 1. Remember the contributions made by Ancient Indians to Global Knowledge. 2. Understand the importance of the Indian Knowledge System in the Global Context. 3. Explain the relevance of Indian Knowledge System to Today's Context 4. Apply the Knowledge into Daily Practices.

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Name of the Programme : B.E. Mechanical Engineering
Course Code : VAC-157
Title of the Course : Indian Knowledge System Lab
Number of Credits : 1
Effective from AY : 2024-25

Pre-requisites for the Course:	Nil	
Course Objectives:	The students shall be able to: 1. Study the various features of Indian Knowledge System. 2. Learn specific characteristics of Indian Knowledge System. 3. Observe and examine various knowledge aspects in practice in Today's world. 4. Examine the application of IKS to certain practices in Today's world.	
Contents:		**No. of Hours**
	Four Member Student groups shall be formed and they shall be given two topics to conduct a detailed study on the contributions of Indian, give periodic presentation, submit a final report 1. Astronomy and Calendar 2. Mathematics 3. Architecture & Town Planning 4. Public Administration and Governance 5. Painting, 6. Dance 7. Music and musical instruments 8. Vedas & Other Texts 9. Ayurveda 10. Yoga	**30**
Pedagogy:	Inquiry based learning, Constructive planning of experiments Collaborative approach in performing experiments	
References/ Readings:	**Text Books:** 1. BKS Iyengar, 'Light On Yoga', Aquarian-Thorsons Publication, 1991, ISBN:978-18-55381-16-67. 2. Mahadevan, B., Bhat, V., Pavana, N., "Introduction to Indian Knowledge Systems", PHI-EEE2022, ISBN:978-93-91818-20-3. **Reference Books:** 1. Gaur, R. R., Asthana, R., Bagaria, G. P., "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1. 2. Swami Chidatmananda, "Ancient Indian Society", Chinmaya Mission. 3. Swami Prajnanananda, "History of Indian Music", Advaita Ashram, Kolkata.	
Course	**After going through this course, the student will be able to:**	

Outcomes:	1. Understand the various features of Indian Knowledge System. 2. Explain specific characteristics of Indian Knowledge System. 3. Examine certain aspects in practice in today's world. 4. Investigate application of IKS to certain practices in Today's world.

Name of the Programme : Electronics Engineering (VLSI Design & Technology)
Course Code : SEC-144
Title of the Course : Electronics and Mechanical Workshop
Number of Credits : 3
Effective from AY : 2024-2025

Pre-requisites for the Course:	Nil	
Course Objectives:	The students shall be able to: 1. Understand the transformation of raw material to finished product and an understanding of the printed circuit board manufacturing procedure. 2. Identify the tools, machines and effort required to complete the job and an ability to perform basic tasks involved in the in-house manufacturing of a printed circuit board. 3. Demonstrate the skills required for Turning/Machining and Sheet Metal Work job and the skill to manufacture printed circuit board in-house, for a given circuit design. 4. Execute the skills in Turning/Machining and Sheet Metal Work to process the specified jobs using safe practices and the capability to design and manufacture printed circuit boards in-house, for complex applications.	
Contents:		**No. of Hours**
Unit 1	**Turning and Machining:** 1. Demonstration of lathes, drilling machines, Execute the skills in Turning/Machining 2. Processing the specified jobs using grinding machines, milling machines and shaper tools and equipment using safe practices 3. Performing practical experiments with at least one job on lathe covering operations such as facing, centre drilling, plain turning, step turning, taper turning and chamfering	**21**
Unit 2	**Sheet Metal Work:** 1. Demonstration of various tools used in Sheet Metal Work 2. Preparing the layout/ development of the surfaces for producing the specified job viz. prismatic box or a conical job 3. Preparing a paper model of the specified prismatic box or a conical job 4. Producing the specified prismatic box or a conical job using sheet metal	**24**
Unit 3	**PCB Design using Electronic Design Automation (EDA) Software e.g. KiCad:** 1. Generation of the schematic layout of the circuit 2. Footprint selection of symbols using datasheets and design considerations. 3. Generation of PCB layout of the circuit	**21**

	4. Performing circuit simulation to verify the electrical functionality. 5. Creation of a custom symbol and corresponding custom footprint	
Unit 4	**Development of a Printed Circuit Board:** 1. Etching/ milling, drilling and edge-cutting of a copper-clad board 2. Soldering through-hole and/ or surface-mount components. 3. Testing and recording the results of each implemented circuit for its intended performance. **Mini Project**	**24**
Pedagogy:	Constructive, collaborative and Inquiry based learning	
Reference/ Readings:	**Reference Books** 1. Khanna R. S., "Basic Workshop Practice", S. Chand & Co. ISBN: 9788121939171 2. Veerana D. K. "Workshop / Manufacturing Practices (with Lab Manual) (English)", Khanna Publishing ISBN: 978-93-91505-332 3. John K C, "Mechanical Workshop Practice", PHI Learning, ISBN : 978-81-20341661 4. Narvekar Shekhar R, "Automobile Garage Equipment & Vehicle Testing" First Ed., 2018, Rajhans Publishers. 5. Kicad documentation (https://docs.kicad.org/) 6. Khandpur, Singh Raghbir , "Printed Circuit Boards: Design, Fabrication, Assembly and Testing", McGraw-Hill, 2006. 2nd edition, ISBN: 9780071464208, 0071464204	
Course Outcomes:	**After taking this course, the student will be able to:** 1. Describe each step involved in the transformation of raw material to finished product for Turning/Machining, Sheet Metal Work and in-house manufacturing of a printed circuit board 2. Identify the tools, machines and effort required to complete the specified tasks and jobs for Turning/Machining, Sheet Metal Work and in-house manufacturing of a printed circuit board 3. Demonstrate the skills required for Turning/Machining, Sheet Metal Work and in-house manufacturing of a printed circuit board, under supervision. 4. Perform tasks of considerable difficulty, required for Turning/Machining, Sheet Metal Work and in-house manufacturing of a printed circuit board, using safe practices.	

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SEMESTER II

Name of the Programme : Electronics Engineering (VLSI Design & Technology)
Course Code : VLI-100
Title of the Course : Fundamentals of VLSI
Number of Credits : 3
Effective from AY : 2024-25

Pre-requisites for the Course:	Nil	
Course Objectives:	**The course will enable students to:** 1. Understand basic concepts of digital design, VLSI design, MOSFET and IC fabrication. 2. Demonstrate knowledge of Boolean Laws, MOSFET operation, CMOS logic and IC fabrication. 3. Apply the concepts to design basic MOSFET based digital circuits. 4. Analyze Boolean expressions, basic MOS and CMOS-based circuits.	
Content:		**No of hours**
Unit - 1	**Fundamentals of Digital Logic:** Number system: Binary and Decimal. Conversion between binary and decimal. Logic gates-AND, OR, NAND, NOR, XOR, XNOR, NOT. NAND and NOR as universal gates. Boolean Algebra and De Morgan 's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 4 variables. Half Adder, Full Adder, Half subtractor and Full Subtractor circuits.	**12**
Unit - 2	**Introduction to Semiconductors:** Metals, insulators and semiconductors, Band gap, Intrinsic Semiconductors, Extrinsic semiconductors, Fermi level, Thermal Equilibrium, Law of mass action, mobility, generation and recombination. **Introduction to MOS:** NMOS, PMOS. Working of NMOS and PMOS. Basic Electrical Properties of MOSFET: Cutoff, Linear and Saturation regions. Threshold Voltage, ID - VDS relationship.	**12**
Unit - 3	**Overview of VLSI Design:** Introduction to CMOS, CMOS Inverter Working and VTC, NAND and NOR gates using CMOS. Boolean Function implementation using CMOS Logic. **SPICE Modeling for basic MOSFET circuits:** NMOS, CMOS inverter VTC, NAND and NOR gates, Boolean functions. VLSI design flow. Brief overview of FPGA and ASIC.	**11**
Unit - 4	**Introduction to IC Fabrication:** Si Crystal Growth. Clean room and Wafer Processing, Overview of Oxidation, Lithography, Diffusion, Ion Implantation, Deposition, Etching and Metallization.	**10**
Pedagogy:	Inquiry based learning, Integrative and Reflective learning	

References/ Readings:	**Text Books:** 1. Anand Kumar, Fundamentals of Digital Circuits, PHI ISBN-978-81-203-3679-7, Second Edition. 2. N.H.E. Weste and Kamran Eshraghian, Principles of CMOS VLSI design: A Systems Perspective, Second Edition, ISBN 81-7808-222-5, Pearson Education India. **Reference Books:** 1. Donald A Neamen"Semiconductor Physics and Devices", Fourth edition, ISBN 978-0-07-352958-5, McGraw-Hill Education. 2. Sung-Mo Kang, Yusuf Leblebici “CMOS Digital integrated circuits, Third Edition, ISBN 0-07-053077-7, Tata McGraw Hill.
Course Outcomes:	**After taking this course, student will be able to:** 1. State the basic terminology associated with Digital Logic, Semiconductors, VLSI Design and IC Fabrication. 2. Explain the fundamental concepts of Digital Logic, MOSFET working, VLSI Design and IC Fabrication. 3. Solve basic problems related to Digital Logic circuits, MOSFET and VLSI Design. 4. Examine basic MOSFET based digital circuits using SPICE modeling.

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Name of the Programme : **Electronics Engineering (VLSI Design & Technology)**
Course Code : **VLI-101**
Title of the Course : **Fundamentals of VLSI LAB**
Number of Credits : **1**
Effective from AY :**2024-25**

Pre-requisites For the Course:	Nil	
Course Objectives:	The course will enable the students to 1. Understand digital ICs and MOSFET based circuits. 2. Understand the concepts, working and characteristics of basic digital circuits. 3. Assemble and test Digital ICs. 4. Design and verify CMOS circuits using SPICE.	
Content:	**LIST OF EXPERIMENTS**	**No of hours**
	1. Verifying the truth tables of Logic gates using Digital ICs 2. Boolean function implementation using Logic Gates. 3. De Morgans theorem using Digital ICs 4. Half Adders using Digital ICs 5. Full Adders using Digital ICs 6. Half Subtractor using ICs. 7. Full Subtractor using ICs. 8. Logic implementation of NMOS using SPICE 9. Logic implementation of CMOS inverter using SPICE 10. DC Analysis of CMOS inverter using SPICE 11. Logic implementation of NAND gate in SPICE 12. Logic implementation of NOR gate in SPICE 13. Boolean function implementation using SPICE	**30**
Pedagogy:	Inquiry based Learning, Constructive and Collaborative Learning.	
Instructions:	Any Ten experiments from the list need to be conducted and documented in the laboratory report.	
References/ Readings:	**TEXT BOOKS:** 1. Texas Instruments, TTL Logic, Data Book, 1988.ISBN -10 -0895120968 2. SPICE, Gordon W. Roberts , Adel S. Sedra, second edition, ISBN-0-19-510842-6, Oxford University press. **REFERENCE BOOKS:** 1. Anand Kumar, Fundamentals of Digital Circuits, PHI ISBN-978-81-203-3679-7, Second Edition. 2. M Morris Mano, Digital Logic and Computer Design, ISBN -81-203-0417-9, 21st Indian Reprint, PHI	

Course Outcomes:	**After taking this course, student will be able to:** 1. Design the circuits with basic ICs, LEDs, measuring instruments & power supplies that serves many practical purposes 2. Construct, analyze and troubleshoot the designed circuits 3. Measure and record the experimental data, analyze the results, and prepare a formal laboratory report. 4. Verify the working of different CMOS logic circuits using SPICE tool.

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Name of the Programme : Electronics Engineering (VLSI Design & Technology)
Course Code : ITH-111
Title of the Course : Basics of Computing Using Python
Number of Credits : 3
Effective from AY : 2024-25

Pre-requisites for the Course:	Nil	
Course Objectives:	The course will enable students to 1. Understand the fundamental concepts of computers and Python programming. 2. Illustrate competency in Python programming by effectively utilizing basic programming constructs 3. Apply expertise in Python programming by utilizing functions and a various data structures in different contexts. 4. Develop Python programs to address practical, real-world challenges.	
Content:		**No. of hours**
Unit 1	**Introduction to Computers:** Importance of computers, characteristics of computers, classification of computers, uses of computers. **Anatomy of Digital Computer:** parts of computer, CPU: Control Unit and ALU. secondary storage devices, keyboards, mouse, scanners, readers, digital cameras, monitors, and printers. **Operating Systems:** Introduction, functions of an operating system, classification of operating systems. **Introduction to Computer Problem Solving:** Introduction, problem-solving aspect, top-down design.	**10**
Unit 2	**Introduction:** Features of Python, execution of Python programs, Python virtual machines, memory management, garbage collection, comparison between C and Python. **Data Types:** Comments, docstrings, built-in data types, strings, sets, literals, user-defined data types, constants, identifiers, reserved words and naming conventions in python. **Operators:** Arithmetic, assignment, unary, relational, logical, Boolean, bitwise, membership, identity operators, operator precedence and associativity. **Control statements:** if, if-else, if-elif else, while, for, nested loops, break, continue, pass, assert and return statements	**12**
Unit - 3	**Array in Python:** Advantages of arrays, creating, importing, indexing and slicing, processing of array, types of array, working	**12**

	with single and multi-dimensional arrays using numpy, creating array using array() functions, mathematical operations on array like: addition and multiplication **Strings and Characters:** Creating, length, indexing, slicing, repeating, concatenation, comparing of strings, checking membership, removing spaces, finding substring, counting substring, changing case.	
Unit 4	**Functions:** Difference between function and method, defining, calling, returning result, returning multiple values from functions, formal and actual parameters, positional, keyword and default arguments, variable length arguments, local and global variables, passing a group of elements to a function. **List and Tuples:** Creating lists using range () function, updating concatenating, repetition of lists, methods to process lists, finding the biggest and smallest element in a list, sorting the list elements, tuples, creating, accessing tuples, basic operations on tuples.	**11**
Pedagogy:	Inquiry-Based Learning, Reflective, Integrative Learning	
References/ Readings:	**Text Books** 1. Alexis Leon and Mathews Leon, "Fundamentals of Information Technology", Vikas Publication, Second edition, 2009. 2. Dr. R. Nageswara Rao; "Core Python Programming", Dreamtech press, Third edition, 2018. 3. Taneja Sheetal & Kumar Naveen, Python Programming a modular approach, Pearson Education, First edition, 2017 **Reference Books** 1. R.G. Dromey, "How to Solve it by Computers", Pearson Education. 2. Kenneth. A. Lambert, Cengage, "Fundamentals of Python First Programs", Cengage publisher, ISBN 978-93-5350-289-8 3. Vamsi Kurama, "Python Programming: A Modern Approach", Pearson India, 2017. 4. Martin C. Brown, Python: The Complete reference, McGraw Hill Education ,4th Edition,2018.	
Course Outcomes:	After taking this course, student will be able to: 1. Describe the fundamental aspects of computers and Python programming. 2. Illustrate the concepts of the Python programming such as data types, control statements, operators. 3. Demonstrate proficiency in Python programming by developing code that incorporates arrays, functions, lists, and tuples. 4. Create Python programs to provide solutions for real-life challenges.	

Name of the Programme : Electronics Engineering (VLSI Design & Technology)
Course Code : ITH-112
Title of the Course : Basics of Computing Using Python Lab
Number of Credits : 1
Effective from AY : 2024-25

Pre-requisites for the Course:	Nil	
Course Objectives:	The course will enable students to: 1. Understand basic Python programming concepts. 2. Illustrate the knowledge of syntax and semantics of Python programming language. 3. Design and implement Python programs using basic concepts, arrays, strings, functions. 4. Evaluate and modify any given Python program as per the requirement.	
Content:	**List of Programs/Experiments**	**No. of Hours**
	1. Python program to demonstrate basics, data types, and base conversion. 2. Python program to demonstrate usage of operators, and control statements. 3. Python program to demonstrate usage of control statements and loops. 4. Python program to demonstrate creation and manipulation of one-dimensional numpy array. 5. Python program to demonstrate creation and manipulation of two-dimensional numpy array. 6. Python program to demonstrate slicing, and indexing operations on strings. 7. Python program to demonstrate, repetition operations on strings 8. Python program to demonstrate inbuilt functions on strings. 9. Python program to demonstrate functions. 10. Python program to demonstrate basic operations on the list data structure. 11. Python program to demonstrate basic operations on the tuple data structure. 12. Python program to demonstrate applications of lists and tuples.	**30**
Pedagogy:	Inquiry-based Learning, Constructive and Collaborative Learning.	
Instructions:	**Minimum 10 Experiments to be performed.**	

References/ Readings:	**Text Books** 1. Leon Alexis and LeonMathews, "Fundamentals of Information Technology", Vikas Publication, Second edition, 2009. 2. Rao R. Nageswara, "Core Python Programming", Dreamtech press, Third edition, 2018. **Reference Books** 1. Dromey R.G., "How to Solve it by Computers", Pearson Education. 2. LambertKenneth. A., Cengage, "Fundamentals of Python First Programs, Course Technology Ptr", Second edition,2019. 3. Kurama Vamsi, "Python Programming: A Modern Approach", Pearson India, 2017.
Course Outcomes:	1. Illustrate Python language features, encompassing data types, operators, control statements, lists, and tuples. 2. Demonstrate Python language concepts in a development environment. 3. Develop Python programs to solve real life problems. 4. Analyze the syntax and semantics of given data types, data structures, and Python code.

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Name of the Programme : Electronics Engineering (VLSI Design & Technology)
Course code : SHM-113
Title of the course : Engineering Chemistry
Number of Credits : 3
Effective from AY : 2024-25

Pre-requisites of the course:	Nil	
Course Objectives:	The students shall be able to: 1. Deal with industrial technologies and applications related to chemistry. 2. Meet the basic needs of an individual, the society and the environment	
Contents:		**No of Hours**
Unit 1	**Electrochemical Energy Systems:** Single electrode potential: concept, sign convention, Determination of standard electrode potential, Nernst equation and related numerical. Electrochemical cells: Galvanic and Concentration cells- Construction, Representation, Determination of EMF, Role of Electrochemical series and numerical. Electrodes: Reference Electrodes –Calomel and Silver/Silver chloride electrodes; Ion Selective electrodes, glass electrode; Construction, representation, pH determination using the electrodes. **Batteries**: Basic concepts, Characteristics, classification. Construction, working and applications of Zn-Air Battery and Li-ion polymer battery. **Fuel Cells:** Basic construction and working with reference to Hydrogen–Oxygen Fuel cell with KOH as electrolyte. **Fuels:** Definition, Classification with reference to combustible fuels; Important Terms-Calorific value, GCV, NCV. Crude oil- Mining and purification, grading of Gasoline and Diesel. Blending of gasoline with ethanol. **Non-Conventional Sources of Energy**: Solar and Biogas- working principles and constructions involved therein	**12**
Unit 2	**Corrosion:** Definition and Mechanism of corrosion- Direct chemical corrosion and Electrochemical corrosion. Types of Corrosion: Galvanic corrosion, differential aeration corrosion (with reference to waterline and Pitting corrosion), Inter-granular and stress corrosion. Factors Influencing corrosion: Nature of metal and Environment; Corrosion Control Measures: Proper design, Purity and alloying, Cathodic protection, Modifying environment, Metal cladding, Inorganic coatings (phosphate and anodized) and Protective Metal coatings e.g. (Hot metal coatings (Galvanization & Tinning),	**11**

	Electroless (PCB preparation) and Electroplating (Chromium Plating). **Green Chemistry:** Objectives and significance of Green Chemistry; Basic components of green chemistry: Alternative feedstocks (adipic acid preparation), reagents (methylation by use of DMC), reaction conditions (Use of aqueous solvent) and final products (Synthesis of acetyl acetate esters); Concept of atom Economy. Industrial application of Green Chemistry (with reference to Products from natural materials, Green Solvents and Green fuels).	
Unit 3	**Polymers:** Definition, Classification-based on source of availability, structure, number of monomers and their arrangement, type of polymerization and response to heat, Basic concepts- monomers, Degree of polymerization, Functionality. Methods of Polymerization- Bulk, Suspension, Emulsion and solution. Structure-Property relationships in Polymers- chemical, Electrical (conducting polymer e.g., polyacetylene), optical, Mechanical and Crystallinity in Polymers (Tg and Tm). Degradation of Polymers Oxidation, weathering, Environmental stress cracking and thermal. Compounding of polymers to yield plastics: ingredients involved. Elastomers: Processing of natural rubber, comparison between natural and synthetic rubber. I**nstrumental Techniques: covering Principles**, working and applications of UVvisible, Gas Chromatography and Differential Scanning Calorimeter (DSC).	**11**
Unit 4	**Water Technology:** Impurities in water, water analysis-Determination of pH, Turbidity, Dissolved solids, Hardness, Alkalinity, BOD and COD including numericals. Specifications for drinking water; BIS and WHO standards. Municipal treatment for large scale production of potable water. Large scale production of potable water using saline water- Flash Evaporation, Electrodialysis and reverse Osmosis method. Sewage treatment. **Composites:** Definition, constituents of composites, Types of composites-Fibre, particulate and layered. Applications of composites.	**11**
Pedagogy	Inquiry based learning, Integrative approach to multidimensional understanding, Reflective thinking leading to right understanding	
References/ Readings:	**Text Books** 1. Jain and Jain; Engineering Chemistry; Dhanpat Rai Publishing Co.; 2013. 2. S. S. Dara; Engineering Chemistry; Chand & Co.; 2011. 3. Shashi Chawla; A Text Book of Engineering Chemistry; Dhanpat Rai Publishing Co.; 2011. **Reference Books**	

	1. M.G. Fontana; Corrosion Engineering; McGraw Hill Publication. 2. M.M. Uppal; Engineering Chemistry; Khanna Publication.
Course Outcomes:	After going through this course, the student will be able to: 1. Understand basic concepts relevant to electrochemical systems, corrosion, polymer and water technology 2. Identify types of fuels cells, types of corrosion, polymeric unit, and contaminants in water. 3. Analyze suitability of chemical materials for engineering applications 4. Apply the concepts of electrochemical energy system, corrosion, polymers and water technology to solve real life problems

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Name of the Programme : Electronics Engineering (VLSI Design & Technology)
Course Code : SHM-114
Title of the Course : Engineering Chemistry Lab
Number Of Credits : 1
Effective From AY : 2024-25

Prerequisites for the Course:	Nil	
Course Objectives:	The students shall be able to: 1. Deal with industrial technologies and applications related to chemistry. 2. Meet the basic needs of an individual, the society and the environment.	
Contents:		**No of hours**
	1. Introduction to the Chemistry laboratory session: Discussion on basic aspects like calculation of normality & Molarity, preparations of solutions, Acquaintance with glassware and other laboratory facilities 2. Determination of Standard Electrode potential and verification of Nernst Equation 3. Study of corrosion activity of Aluminum metal in Acid and Base Solution 4. Study of deposition of Ni metal on Aluminium by Electroless plating 5. Determination of Viscosity by using Ostwald Viscometer 6. Elemental analysis using Colorimeter 7. Determination of pH, Turbidity and Dissolved solid content of water 8. Determination of Hardness of a given water sample 9. Determination of Alkalinity of a given water sample 10. Determination of Dissolved oxygen content in water 11. Determination of COD of a water sample 12. Determination of molecular weight of polymer using Ostwald viscometer 13. Analysis of an ore using titrimetric method of analysis 14. Separation of miscible liquids using Fractional distillation method 15. Titrimetric analysis involving use of Conductometer 16. Synthesis of Polymer	**30**
Pedagogy:	Inquiry based learning, Constructive planning of experiments, Collaborative approach in performing experiments	
Instructions:	**Minimum 10 experiments to be performed**	

References/ Readings	1. J. Mendham, R.C. Denney, J.D. Barnes, M.J.K. Thomas, "Vogels Textbook of Quantitative Chemical Analysis", Pearson Education. India, 2006, ISBN: 9788177581805 2. Rattan, S. "Experiments in Applied Chemistry: For Engineering Students". Kataria Publishers, India, 2012.
Course Outcomes:	**After going through this course, the student will be able to** 1. Understand basic concepts relevant to electrochemical systems, corrosion, polymer and water technology 2. Identify types of fuels cells, types of corrosion, polymeric unit, and contaminants in water 3. Analyze suitability of chemical materials for engineering applications 4. Apply the concepts of electrochemical energy system, corrosion, polymers and water technology to solve real life problems.

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Multidisciplinary Courses
Name of the Programme : Electronics Engineering (VLSI Design & Technology)
Course Code : SHM-132
Title of the Course : Applied Physics
Number of Credits : 2
Effective from AY : 2024-25

Pre-requisites for the Course:	Nil	
Course Objectives:	The course will enable the students to 1. Understand the interference of light & its applications 2. Explain the transport phenomenon is semiconductors. 3. Describe the working, types & applications of Lasers 4. Analyze the optical properties & applications of optical fibers.	
Content:		**No. of Hours**
Unit 1	**Interference of light:** Geometric and optical path, Phase change at reflection (only statement), Interference based on division of amplitude, Interference in thin parallel films due to reflected & transmitted light, Interference in wedge shaped film (due to reflected light), Newton's rings for reflected light. **Applications of Newton's rings:** Determination of radius of curvature of Plano-convex lens, wavelength of light used and refractive index of liquid.	**8**
Unit 2	**Semiconductors:** Band theory of solids-Energy Gap, Classification of solids, Mobility, Drift velocity, Conductivity of charge carriers. Hall effect-derivation of Hall coefficient, Applications of Hall effect - carrier concentration and mobility**.** **Introduction to Nanomaterials:** Definition of nanomaterials, Properties, Examples of nanomaterials, Applications.	**7**
Unit 3	**Lasers:** Laser characteristics, Stimulated emission of radiation, Active medium, Metastable state, Condition for light amplification, Population inversion (qualitative), Pumping Mechanism, Optical resonator. Einstein's coefficients; **Types of lasers:** Ruby laser, He-Ne laser, Semiconductor laser, Nd:YAG laser, CO2 laser, Dye laser. applications of lasers in science, engineering and medicine.	**8**
Unit 4	**Optics and Optical Fibers**: Refraction of light, Snell's law, Critical angle, Total internal reflection. Propagation of light in optical fiber, Structure of an optical fiber, Acceptance angle and cone, Numerical aperture & Fractional index change, Modes of propagation, Types of optical fibers: single, multimode, GRIN fibers, V-Number Number of modes. Losses in optical fibers, Applications.	**7**

Pedagogy:	Inquiry based learning, Integrative approach to multidimensional understanding, Reflective thinking leading to right understanding
References/ Readings:	1. A.S. Vasudeva, "Modern Engineering Physics", S. Chand & Company Pvt. Ltd. Revised Edition. 2015 2. M. N. Avadhanulu and P. G. Kshirsagar; "A textbook of Engineering Physics", S. Chand & company Pvt. Ltd. Revised edition 2015. 3. R. K. Gaur & S. L. Gupta; "Engineering Physics", DhanpatRai Publications Pvt. Ltd. Reprint 2013. 4. Uma Mukherji, "Engineering Physics", Narosa Publications. 2012
Course Outcomes:	After taking this course, student will be able to: 1. Understand the concepts of interference of light, lasers, optical fibers and semiconductors. 2. Explain thin film interference, types of lasers, optics of fibers and transport phenomenon in semiconductors. 3. Relate the concepts logically & derive the necessary formulae. 4. Calculate various physical parameters based on thin film interference, lasers, optical fibers and semiconductors.

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Name of the Programme : Electronics Engineering (VLSI Design & Technology)
Course Code : SHM-133
Title of the Course : Applied Physics Lab
Number of Credits : 1
Effective from AY : 2024-25

Pre-requisites for the Course:	Nil	
Course Objectives:	The course will enable students to: 1. To collect & record data neatly by performing the experiments related to thin film interference, semiconductors, lasers & fibre optics. 2. To understand the underlying concepts & principles of the experiments performed. 3. To calculate various physical parameters by applying necessary formulae. 4. To draw meaningful conclusions through proper analysis of data.	
Content	**List of Experiments**	**No. of Hours**
	1. Radius of curvature of a plano-convex lens using Newton's rings. 2. R.I of a liquid using Newton's rings. 3. Determination of thickness of thin object by Air wedge. 4. Determination Wavelength of laser. 5. Determination of particle size. 6. Determination of divergence of laser. 7. NA & acceptance angle of an optical fibre. 8. Photo diode characteristics & power response. 9. Determination of critical angle for a given pair of media. 10. Communication system using optical fibre. 11. Energy gap of a semiconductor. 12. Hall Effect 13. Photoelectric effect - Determination of Planck's constant using LED/photo diode 14. Thermistor characteristics 15. Dielectric constant – charging & discharging of capacitor.	**30**
Pedagogy:	Inquiry based learning, Constructive planning of experiments Collaborative approach in performing experiments	
Instructions	Total 10 experiments to be conducted including 2 demonstrations	
References/ Readings:	**Text Books:** 1. Arora C.L. "Practical Physics", S Chand & Co., ISBN: 9788121909099, 8121909090.	

	2. Avadhanulu M. N., Kshirsagar P. G., "A text book of Engineering Physics"; S. Chand & company Pvt. Ltd., Revised edition 2015. **Reference Books:** 1. Vasudeva A. S., "Modern Engineering Physics", S. Chand & Company Pvt. Ltd., Revised Edition, 2015.
Course Outcomes:	After going through this course, the student will be able to: 1. Record the readings carefully, and show them neatly on a lab record book. 2. Demonstrate the various principles and basic phenomenon involved in the experiments by following proper procedure. 3. Calculate the various physical parameters involved in the experiments by using formulae derived in the theory. 4. Draw conclusions from the results obtained by organizing the data in a proper manner to justify the aim of the experiment.

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Ability Enhancement Courses

Name of the Programme : Electronics Engineering (VLSI Design & Technology)
Course Code : AEC-153
Title of the Course : Communication and Technical Writing
Number of Credits : 3 (2L+1T)
Effective from AY : 2024-25

Pre-requisites for the Course	Nil	
Course Objectives	The students will be able to: 1. Imbibe precise language skills with suitable vocabulary, apt style 2. Acquire the skills and techniques of writing in professional life 3. Appreciate importance of interpersonal skills to progress professionally 4. Demonstrate effective presentation exhibiting verbal and non-verbal skills	
Contents:		**No. of Hours**
Unit 1	**Communication:** Stages of Communication, Channels of Communication, Verbal Communication, Non-verbal Communication, Barriers to Effective Communication, Critical thinking in Communication, Global Communication, Social Media Communication, Cross Cultural Communication. **Listening:** Hearing and listening, Active listening, Empathetic Listening, Critical Listening, Appreciative Listening, Barriers to listening. Exercises on listening comprehension. **Reading:** Skimming and Scanning, Reading Different Kinds of Texts, Note Making Techniques, Topicalising, Methods of Sequencing, Summarizing, Paraphrasing an article from any source. **Speaking:** Pitch, Tone, Articulation, Intonation, and Body Language. Public Speaking Skills, Barriers to Effective Speaking and how to overcome them through preparation, practice, and perseverance. Conversation Skills and Situational Dialogues.	**08**
Unit 2	**Inter-Personal Skills:** Developing a professional attitude; self-esteem; and emotional intelligence. **Group Discussion:** Group Discussions, Dos and Don'ts, Traits of a good GD Member. **Presentations:** Effective ways of content delivery and presentation **Interviews:** Interview Process, Characteristics of the Job Interview, Pre-interview preparation techniques. **Company Meetings:** Notice, Agenda, Minutes of the Meeting.	**07**
Unit 3	**Formal Writing:** Formal letter-writing, Structure of a Formal/Business Letter, Complete/Full Block Style Format, Types of Formal Letters	**07**

	(Leave request, Admission request, Queries to higher authorities, Job Application). **Email-writing:** Etiquette in Email writing, Characteristics of Successful Email Messages, Email Format, Standard Email Practices. **Resume Writing:** Format, Structure, Tone, and keyword-usage.	
Unit 4	**Technical Writing:** Concept and definition of technical writing, features of technical writing – style and language, eliminating Common Grammatical Errors. **Report-Writing:** Introduction, Types & Usage. Book format. **Proposals:** Types and Structure of Formal Proposals. **Referencing:** Introduction to Referencing.	**08**
Pedagogy:	**I**nquiry based learning, Integrative approach to multidimensional understanding, Reflective thinking leading to right understanding	
References/ Reading:	**Text Books:** 1. Raman Meenakshi, Sharma Sangeeta, "Technical Communication", Oxford Publication 2004. **Reference Books:** 1. Rizvi Ashraf, "Effective Technical Communication", Mc Graw Hill, 2nd Edition 2. Beer David, McMurrey, "Guide to writing as an Engineer", John Willey, New York, 2004.	
Course Outcomes:	After going through this course, the student will be able to: 1. Remember precise language skills with suitable vocabulary, apt style. 2. Understand the skills and techniques of writing in professional life. 3. Explain importance of interpersonal skills to progress professionally. 4. Demonstrate effective presentation – verbal and non-verbal skills.	

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Value Added Courses
Name of the Programme : Electronics Engineering (VLSI Design & Technology)
Course Code : VAC-158
Title of the Course : Environmental Science and Sustainability
Number of Credits : 2
Effective from AY : 2024-25

Pre-requisites for the Course	Nil	
Course Objectives	The student will be able to: 1. Understand and explore the interconnectedness of ecosystems and the importance of biodiversity for ecological balance 2. Explain various causes for environmental degradation and individuals contribution in the environmental pollution 3. Apply tools and frameworks for reporting and measuring sustainability practices. 4. Analyze effective mechanisms to handle e-waste.	
Contents:		**No. of Hours**
Unit 1	**Environment and Biodiversity:** Definition, scope and importance of environment - need for public awareness. Eco-system and Energy flow - ecological succession. Types of biodiversity: genetic, species and ecosystem diversity - values of biodiversity, India as a mega-diversity nation - hot - spots of biodiversity - threats to biodiversity: habitat loss, poaching of wildlife, man - wildlife conflicts - endangered and endemic species of India - conservation of biodiversity: In-situ and ex-situ.	**07**
Unit 2	**Environmental Pollution:** Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Air Pollution: Types of particulates, Topography, Effects of air pollution on living organisms, plants, materials, stratosphere. Control measures for air pollution, Air quality. **Water pollution:** Point and non-point sources, causes of water pollution, control measures. Soil pollution: Causes of soil degradation, problems with pesticide use. Noise pollution: Effects on noise pollution on physical health, mental health, permitted noise levels, control measures.	**07**
Unit 3	**E-Waste Management** Introduction, Type of contaminants in e-waste, toxic substances and precious metals associated with e-waste and their health impacts, treatment strategies of e-waste: Recycling, landfill disposal, biological treatment, advanced methods, Conclusions.	**08**

	Urban E-waste: Introduction, Driving factors of E-waste, Raw materials in electrical and electronic equipment and their waste, Physical techniques - Dismantling, Crushing, shredding, and milling, Sieving and separation; Chemical techniques - Pyrometallurgy, Hydrometallurgy (Acid/alkaline leaching, Cyanide leaching, Thiourea leaching, Thiosulfate leaching); Biometallurgy - Bioleaching, Biosorption. Organic pollutant types from E-waste - Polycyclic aromatic hydrocarbons/poly nuclear aromatic hydrocarbons; Polychlorinated biphenyls, polybrominated biphenyls, and polybrominated diphenyl ethers, Electrokinetic remediation concept and it use for the removal of organic waste.	
Unit 4	**Sustainability and Management** **Sustainability** – Concept (IAPT equation), needs and challenges – economic, social and Environmental aspects of sustainability. From unsustainability to sustainability - millennium development goals and protocols. Concept of Carbon Credit, Carbon Markets and Carbon Offsets- Basic definitions, creation comparison of carbon credits and Offsets. Zero waste 3R concept and Circular economy concepts. **Material Recovery Facility (MRFs)**- Definition, Importance, Classification- based on technology used and its characteristics: Mixed MRF, Dry MRF, Manual MRF, Semi-automatic MRF, Mechanical MRF/automated MRF; Criteria for Location of MRFs; Constituents in an MRF: Standard Process Flow of MRF; Unit Processes in MRF; Value chain of MRF.	**08**
Pedagogy	Inquiry based learning, Integrative approach to multidimensional understanding Reflective thinking leading to right understanding.	
References/ Reading:	**Text Books:** 1. Benny Joseph, "Environmental Science and Engineering", McGraw Hill Education, ISBN: 978-9387432352 2. Bharucha, Erach, "Textbook of Environmental Studies for Undergraduate Courses", India, Universities Press (India) Pvt. Limited, 2005. 3. Kaushik Anubha, Kaushik C. P., "Perspectives in Environmental Studies", New Age International Publishers, ISBN: 978-9386418630. **Reference Books:** 1. Allen David T., Shonnard David R., "Sustainable Engineering- Concepts, Design and case studies"; Prentice Hall, ISBN: 978-0132756549. 2. Jez Areta A., Alexander Brad D., and Shaikh Ayaz R., "Carbon Credit and Carbon Offset Fundamentals", Mintz. 3. Majeti Narasimha Vara Prasad et.al, "Handbook of Electronic waste management", Elsevier Publication, 2019, ISBN: 978-0128170304.	

	4. Mensah Justice, "Sustainable Development: Meaning, History, Principles, Pillars and implications for Human Action: Literature Review", Cogent Social Sciences. 5. Swachh Bharat Mission Advisory on Material Recovery Facility (MRF) for Municipal Solid Waste.
Course Outcomes:	**After going through this course, the student will be able to:** 1. Understand key environmental concepts and the importance of biodiversity conservation 2. Explain the environment, human health and socio-economic impacts of different types of pollution 3. Assess the health and safety risks associated with e-waste handling and disposal and implement measures to mitigate these risks 4. Apply sustainable practices for utilization of resources.

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Name of the Programme : **Electronics Engineering (VLSI Design & Technology)**
Course Code : **VAC-159**
Title of the Course : **Environmental Science and Sustainability Lab**
Number of Credits : **1**
Effective from AY : **2024-25**

Pre-requisites for the Course	Nil	
Course Objectives	The students shall be able to: 1. Understand the use of Titrimetric analysis as a tool for analysis of Water and Soil quality. 2. Calibrate and operate basic Instruments involved in Water, Soil, Air and Noise pollution. 3. Compute various parameters involved in analysis of Water and Soil quality. 4. Correlate the Parameters measured with applicable standards.	
Contents	**List of Experiments**	**No. of Hours**
	1. Calibration of pH meter, conductivity meter and Nephelometer and determination of pH, conductivity and TDS of a given water sample. 2. To determine the acidity and alkalinity of a given water sample. 3. To determine the hardness of a water sample by measuring the amount of calcium present. 4. To determine the concentration of sulphate of a given water sample and Determination of dissolved oxygen in water sample 5. To determine chloride ion concentration in a water sample and Determination of free CO2 in water sample 6. To determine the BOD of Water sample. 7. To determine the COD of water sample. 8. Determination of Oil and Grease in given wastewater sample. 9. Determination of Organic Carbon, NPK and CEC of a given soil sample. 10. Determination of Total Nitrogen in Soil Sample. 11. To Determine Available Phosphorus in soil sample. 12. Ambient noise monitoring. 13. Soil Electrical Conductivity. 14. Measurement of SPM; RSPM in ambient air by High Volume Sampler. 15. Colorimetric estimation of any element/compound: (Cu, Fe, Sulphate, nitrite, etc).	**30**
Pedagogy	Inquiry based learning, Constructive planning of experiments, Collaborative approach in performing experiments	

References/ Reading:	**Text Books:** 1.Mendham, J., Rc Denney, "Vogels Text Book of Quantitative Chemical Analysis", Pearson Education Limited, 6th edition, 2018. 2.Svehla, G., Sivasankar, B., "Vogels Qualitative Inorganic Analysis", Pearson Education Limited, 7th edition, 2018, ISBN: 978-8126511143**.** **Reference Books:** 1. "Practical Manual Chemical Analysis of Soil and Plant Samples" ICAR-Indian Institute of Pulses Research. 2. Rattan, Sunita, "Experiments in Applied Chemistry", S K Kataria & Sons, 3rd edition 2010.
Course Outcomes:	**After going through this course, the student will be able to:** 1. Understand the use Titrimetric analysis as a tool for analysis of Water and Soil quality. 2. Calibrate and operate basic Instruments involved in Water, Soil, Air and Noise. 3. Compute various parameters involved in analysis of Water and Soil quality. 4. Correlate the Parameters measured with applicable standards.

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Skill Enhancement Courses
Name of the Programme : Electronics Engineering (VLSI Design & Technology)
Course Code : SEC-143
Title of the Course : Engineering Graphics and Design with UI/UX
Number of Credits : 3
Effective from AY : 2024-25

Pre-requisites for the Course:	Nil	
Course Objectives	The course will enable the students to 1. Convert ideas into engineering drawing and understand the concepts of UI/UX design process. 2. Understand the principles of projections in engineering drawing, and Demonstrate proficiency in UI/UX toolkit design. 3. Apply the projection principles for projections of lines, solids and planes, and Integrate advanced UI/UX elements for enhanced user experience. 4. Read the orthographic, isometric drawings, and develop a complete mobile and web application interface using the UI/UX toolkit.	
Content:		**No of Hours**
	PART A	
Unit 1	**Introduction to Engineering Drawing**: Types of Lines, Dimensioning, Scales; Engineering Curves: Conic sections, Ellipse (Focus Directrix Eccentricity method, Concentric circles method), Parabola (Focus Directrix Eccentricity method, Rectangle method) **Projection:** Introduction, Principle of Projection, Method of projection, Planes of projection, Four quadrants, first and third angle projection, Reference line, Symbols of projection **Projection of Point:** Introduction, Point situated in first, second, third & fourth quadrant **Projection of lines:** Introduction, Line parallel to both the planes, Line inclined to one and parallel to other plane, Line inclined to both the planes. **Projection of Planes using first angle:** Introduction, Types of planes, Projection of planes, Projection of planes perpendicular to both the reference planes, Perpendicular to one plane and parallel to other plane, Plane inclined to both planes.	**24**
Unit 2	**Projection of solids using first angle:** Introduction, Type of solids (Cone, cylinder, prism, pyramid), Projections of solids in simple position, Projection of solids with axes inclined to one of the reference planes and parallel to the other, Projections of solids with axes inclined to both reference planes	**21**

Issued on: 24/09/2024

	Isometric Projection using first angle: Introduction, Isometric axes, Isometric scale, Isometric projection and Isometric views **Orthographic Projection using first angle:** 2 Views and 3 Views	
	PART B	
Unit 3	**Getting started with UI/UX tool Fundamental:** Creating a UI/UX tool Account, creating a new design file, mapping the user journey, creation of wireframes. **UI/UX tool Toolkit Essentials:** Frames, fonts, and layouts, creating frames, function of tools, font usage, layout planning. **UI/UX tool Prototyping:** Framing, layering, grouping, creating and editing shapes, images, and masking. **Exploring UI/UX tool toolkit part 1:** Importing icons and other graphics, working with color and styles, and setting up the components. **Exploring UI/UX tool toolkit part 2:** 3D Buttons, gradient graph tricks, forms, buttons, plugins.	**22**
Unit 4	**UI/UX tool Animations:** Animating "Like"buttons, animating a burgerMenu.. **Mobile Application development using UI/UX tool:** Wireframing, brand name page, Signin /Signup page, Menu page, prototyping **Web Application development using UI/UX tool:** Wireframing; brand name page, Signin /Signup page Menu page, Prototyping **Mini-Project.**	**23**
Pedagogy:	Inquiry-based learning, Constructive and Collaborative Learning	
Instructions:	**For Unit 1 and Unit 2** 1. Minimum 6 sheets to be completed. 2. Minimum one Problem each from isometric and orthographic projection to be drafted on computer aided software. **For Unit 3 and Unit 4** Suggested Software (one or more): Figma, Adobe XD, Marvel, InVision Studio, Sketch, Webflow, Optimal Workshop.	
References:	**Text Books** 1. Bhat N.D., "Engineering Drawing", Charotar Publication, 2023, ISBN:978-93-85039-70-6 2. James Cabrera, "Modular Design Frameworks: A Projects-based Guide for UI/UX Designers", APress, 1st edition, 2017. **Reference Books** 1. Apurvo Ghosh, "Mastering UX Design with Effective Prototyping: Turn your ideas into reality with UX prototyping", 1st edition, 2023 2. Fabio Staiano, "Designing and Prototyping Interfaces with Figma: Learn essential UX/UI design principles by creating interactive prototypes for	

	mobile, tablet, and desktop", Packt Publishing Limited (Kindle Edition), 2022. 3. Gopalkrishna K.R., "Engineering Drawing I & II", India Subhas Stores book Corner,2017,978-93-83214-23-5 4. Tom Mulligan, "UX/UI Design 2021-2022 Tutorial for Beginners: The Complete Step by Step Guide to UX/UI Design and Best Practices for designers with no Experience", (Kindle Edition), 2021.
Course Outcome	After taking this course, student will be able to: 1. Demonstrate the imagination skills required in converting idea into drawing and Illustrate UI/UX design process, assess effectiveness of various wireframes. 2. Understand the principles of projection systems in engineering graphics and Build wireframes, frames, layouts, and prototypes utilizing UI/UX toolkit. 3. Apply the projection principles in solving problems in engineering graphics and Civil Engineering drawings and Apply design principles through advanced UI/UX element usage, such as 3D buttons, gradient graphics, forms, and plugins. 4. Analyze and interpret Orthographic Isometric and building drawings and build comprehensive mobile and web interfaces using UI/UX toolkit.

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