Walchand College of Engineering, Sangli
(Government Aided Autonomous Institute)

AY 2026-27 onwards

Course Information

Programme	VLSI Design and Embedded Systems(Integrated Programme)
Class, Semester	First Year B.Tech, Semester I
Course Code	1BS101
Course Name	Linear Algebra and Calculus (VLSI)
Desired Requisites:	Mathematics course at Higher Secondary Level

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	1 Hrs/week	30	20	50	100

Credits: 03

Course Objectives

1	To introduce the fundamental concepts of linear algebra and differential calculus.
2	To develop problem-solving skills using integral calculus and multiple integrals.
3	To study vector differentiation and vector integration in engineering applications.
4	To apply mathematical techniques for modelling and solving engineering problems.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statements**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Descriptor**
CO1	**Understand** the concepts of matrices, eigenvalues, eigenvectors and differential calculus.	II	Understanding
CO2	**Understand** the principles of improper integral and multiple integrals.	II	Understanding
CO3	**Apply** matrix methods and vector differential calculus techniques to solve engineering problems.	III	Applying
CO4	**Apply** multiple integration and vector integral techniques to solve the engineering problems.	III	Applying

Module	**Module Contents**	**Hours**
I	**Linear Algebra** Matrices and Rank, system of Linear equations, Gauss elimination method, Eigen value and Eigen vector, Cayley Hamilton Theorem.	5
II	**Differential Calculus** Partial derivative, error and approximations, maxima and minima, Mean value theorems.	4
III	**Vector Differentiation** Velocity and acceleration, directional derivative, gradient, divergence, Curl of vector function.	4
IV	**Integral Calculus** Introduction, Improper integral, Gamma function and its properties, Beta function and its properties.	5

V	**Vector Integration** Double Integration, Triple Integration, change order of Double Integration, Change Cartesian to Polar coordinates, Work done, Line integral, surface integral, Green's theorem, Stoke's theorem.	5
VI	**Applications to VLSI and Embedded Systems** Application of linear algebra to circuit node network and power grid analysis, application to system stability in feedback circuits, application of maxima and minima to power dissipation function optimization, application of integral calculus to component reliability and decay models, application of vector calculus to inductance and magnetic flux calculations.	5

Textbooks	
1	B. V. Ramana, Higher Engineering Mathematics, The McGraw Hill companies, 2006.
2	H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., 1st Edition, 2014.
3	Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition

References	
1	Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, Inc., 10th Edition, 2015.
2	R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing House, 5th Edition, 2016.
3	George B. Thomas, Maurice D. Weir, and Joel Hass, Thomas' Calculus, Pearson Education, 14th Edition, 2018.
4	Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, 5th Edition, 2018.

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc20_ma37/preview
2	https://onlinecourses.nptel.ac.in/noc22_ma75/preview

CO-PO Mapping

CO	**Programme Outcomes (PO)**											**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	3	2	—	—	—	—	—	—	—	—	—	—	—
CO2	3	3	—	—	—	—	—	—	—	—	—	—	—
CO3	3	3	—	—	—	—	—	—	—	—	—	—	—
CO4	3	3	—	—	—	—	—	—	—	—	—	—	—

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing).

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AY 2026-27

Course Information

Programme	VLSI Design and Embedded Systems(Integrated Programme)
Class, Semester	First Year B.Tech, Semester I
Course Code	1BS102
Course Name	**Materials Science**
Desired Requisites:	Students are expected to know the basic concept in Chemistry.

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ESE**	**Lab**	**Total**
Practical	2 Hrs/week	20	50	30	100
		Credits: 3			

Desired Knowledge

Basic knowledge of chemistry concepts studied at higher secondary level (10+2), Fundamental understanding of chemistry and mathematics concepts, elementary laboratory skills and scientific understanding.

Course Objectives

1	To develop an understanding of engineering materials and their applications in engineering practice.
2	To provide knowledge of material characterization and chemical analysis for engineering applications.
3	To **impart understanding of PCB materials, chemical etching, corrosion mechanisms, and protection techniques.**
4	To **familiarize students with phase equilibria, renewable energy materials, and emerging technologies for sustainable engineering solutions.**

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	**Understand principles of chemical analysis and instrumental techniques** for the characterization of materials.	II	Understand
CO2	U**nderstand concepts related to corrosion science, renewable energy materials, and phase equilibria.**	II	Understand
CO3	A**pply knowledge of engineering materials and energy systems,** including conducting, semiconducting, dielectric, and magnetic.	III	Apply
CO4	Demonstrate chemical analysis experiments, interpret experimental data, and prepare technical laboratory reports. (Lab).	III	Apply

Module	**Module Contents**	**Hours**

I	**Chemical analysis and Characterization of Materials:** Introduction to chemical analysis, Qualitative vs Quantitative methods, Gravimetric analysis-principles & examples, Volumetric (titrimetric) analysis, Spectroscopic techniques (UV-Vis, IR)-basic concepts, Introduction to SEM& TEM for material characterization, Application examples: alloy composition, quality evaluation.	8
II	**Energy Storage Systems and Materials:** Fundamentals of electrochemical energy storage, Battery technologies (Li-ion, Lead-acid, Solid-state – basics), Supercapacitors, Fuel cells – working principle, Materials challenges in energy storage.	3
III	**Printed Circuit Boards (PCBs) and Chemical Etching Process**: Introduction to Chemistry of Substrate Material, Copper Properties, What is Etching, Etching Chemicals, Chemical Reactions (Ferric Chloride Etching), Oxidation–Reduction Concept, Factors Affecting Etching Rate, Methods of Pattern Transfer, Surface Preparation, Environmental and Safety Aspects, Defects in Etching, **Sustainability and Life Cycle Management:** Basics of Sustainable PCB Manufacturing, Reduction of Material and Chemical Waste, Safe Handling and Recycling of PCBs, E-Waste Management, and Introduction to the Life Cycle of Electronic Products.	5
IV	**Corrosion Science:** Fundamentals of corrosion, Electrochemical corrosion mechanisms, Factors affecting corrosion, Types of corrosion (uniform, pitting, crevice, galvanic), Corrosion monitoring & control, Corrosion prevention methods (coatings, cathodic protection).	5
V	**Phase Rule**: Gibbs phase rule, Explanation of the terms Phase, Component, Degree of freedom, Phase reactions, types of equilibrium, equilibrium conditions. One component system-Water system, Sulphur system, Application of Eutectic system, Merit and Demerits of Phase rule.	3
VI	**Renewable Energy Materials and Systems:** Solar photovoltaic materials (Si, Thin film – basics), Wind energy materials (composites in blades), Materials for hydrogen production, Power electronics material requirements.	2
List of Experiments/ Lab Activities (Any 10)		
1	Estimation of hardness of water by EDTA method (Complexometric titration).	
2	Estimation of alkalinity of water (Neutralization titration).	
3	Estimation of dissolved oxygen in water (Iodometric titration).	
4	Estimation of chloride content in water (Argentometry).	
5	Demonstration of pH meter and pH metric titration.	
6	Determination of strength of acid/base conductometrically.	
7	Colorimetric estimation of copper.	
8	Estimation of copper from bronze (Iodometric titration).	
9	Estimation of Zn from brass (Displacement titration).	
10	Determination of purity of iron (Redox titration).	
11	Determination of viscosity using Ostwald viscometer.	
12	Determination of corrosion rate by weight loss method.	
13	Gravimetric estimation of Ba from $BaSO_4$ as BaO.	
14	Preparation of resin.	
15	To prepare a single-layer PCB using the chemical etching method and understand the redox reaction involved.	
16	V-lab (Virtual Lab) IIT Bombay	
17	Open Lab	
Textbooks		

1	A. I. Vogel, *A Textbook of Quantitative Chemical Analysis*, 5th ed. London, U.K.: Longman Scientific & Technical, 1989.
2	B. K. Sharma, *Engineering Chemistry*. Meerut, India: Krishna Prakashan Media Pvt. Ltd., 2014.
3	C. Baird and M. Cann, *Environmental Chemistry*, 5th ed. New York, NY, USA: W. H. Freeman and Company, 2012.
4	J. R. Mihelcic and J. B. Zimmerman, *Environmental Engineering: Fundamentals, Sustainability, Design*, 2nd ed. Hoboken, NJ, USA: John Wiley & Sons, 2014.
5	S. Rani, *Laboratory Manual on Engineering Chemistry*. New Delhi, India: Dhanpat Rai Publishing Co., 2018.
References	
1	J. Mendham, R. C. Denney, J. D. Barnes, and M. Thomas, *Vogel's Textbook of Quantitative Chemical Analysis*, 6th ed. Harlow, U.K.: Pearson Education, 2000.
2	S. S. Dara and S. S. Umare, *A Textbook of Engineering Chemistry*. New Delhi, India: S. Chand Publishing, 2015.
3	A. K. De, *Environmental Chemistry*, 8th ed. New Delhi, India: New Age International Publishers, 2017.
4	S. S. Dara and S. S. Umare, *Practical Engineering Chemistry*. New Delhi, India: S. Chand Publishing, 2014.
5	S. Sahay, *Quantitative Chemical Analysis*. New Delhi, India: Tata McGraw-Hill Education, 2012.
Useful Links	
1	https://nptel.ac.in/courses/113105101
2	https://nptel.ac.in/courses/113105102
3	https://nptel.ac.in/courses/113106062
4	https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_ee163

CO-PO Mapping (Theory)

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1	-	-	-	-	-	-	-				
CO2	2	2	2	-	-	-	-	-	-	-				
CO3	3	3	2	-	-	-	-	-	-	-				
CO4	3	3	-	3	3	-	-	2	3	3	1			

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment (Theory)

The assessment is based on MSE and ESE.
MSE shall be typically on modules 1 to 3.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Assessment (Lab)				
The lab assessment will be conducted as mentioned below. IMP: Lab ESE is a separate head of passing (min 40 %).				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
Lab ESE	Lab Activities/ Journal/ Performance/ Presentations/ Oral/ Mini Project	Lab Course Faculty and External Examiner as applicable	During Week 1 to Week 13. Marks Submission at the end of Week 13.	30
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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Course Information

Programme	VLSI Design and Embedded Systems(Integrated Programme)
Class, Semester	First Year B.Tech, Semester I
Course Code	8ES151
Course Name	Engineering Exploration
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**LA1**	**LA2**	**ESE**	**Total**
Interaction	-				
Tutorial	-	30	30	40	100
Practical	4 Hr /week	**Credits: 4**			

Course Objectives

1. To instil an understanding of the engineering profession
2. To impart a structured engineering design methodology
3. To build foundational skills in system modelling and analysis
4. To introduce physical computing and platform-based development
5. To foster professional ethics and sustainable engineering practices

Course Outcomes (CO)

CO	**Description**	**Blooms Taxonomy**	
		Descriptor	**Level**
CO1	Discuss the scope of Engineering and its study.	Understand	II
CO2	Solve real world challenges using multidisciplinary engineering skills	Apply	III
CO3	Demonstrate effective teamwork and communication skill during engineering project execution.	Apply	III
CO4	Analyse alternative design concepts using engineering criteria such as functionality, sustainability.	Analyse	IV
CO5	Develop engineering solutions using the engineering design process while considering sustainability and ethical constraints.	Create	VI

CO – PO mapping

	Programme Outcomes (PO)										
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**
CO1	1	-	-	-	-	1	-	-	-	-	-
CO2	2	2	-	-	2	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-	-	3	2	-
CO4	-	2	2	-	-	-	3	-	-	-	-
CO5	-	-	3	-	-	-	1	3	-	-	-

Module	**Module Contents**	**Hours**
I	**Module 1: Introduction to Engineering and Engineering Study**	03 + 04

	Requirements and expectations of Engineering, disciplines of engineering, Expectation of modern engineer and Graduate Attributes Significance of teamwork, Significance of Agile practices, Significance of documentation	
II	**Module 2: Sustainability and Ethics in Engineering** Introduction to sustainability, Sustainability leadership matrix, Life cycle assessment, carbon footprint, embodied energy calculation, alternative material selection and justification Identifying Engineering as a Profession, Significance of Professional Ethics, Code of Conduct for Engineers, Identifying Ethical Dilemmas in different tasks of engineering, Applying Moral Theories and codes of conduct for resolution of Ethical Dilemmas.	03 + 04
III	**Module 3: Engineering Design** Engineering Design Process, Problem definition formulation process, Concept generation- Function tree, Morphological chart, and Concept selection- Pugh Chart, Material selection based on density, carbon foot-print and embodied energy, Product Architecture.	06 + 12
IV	**Module 4: Virtual Implementation** Virtual Implementation, Introduction to Engineering Drawing, Introduction to 3D modelling software, Part modelling & assembly. Circuit Diagram, Flowchart	06 + 14
V	**Module 5: Mechanisms, Motor Sizing and Battery Sizing (MSBS)** Types of mechanisms, degree of freedom, linkages, four bar linkage mechanism, actuators & its types, torque, governing equations, FOS, motor sizing, motor selection, mass identification using software, power adapters, types of adapters, power calculations & adapter selection	06 + 12
VI	**Module 6: Platform Based Development** Introduction to various platform-based development (Arduino) programming and its essentials, Introduction to sensors, transducers and actuators and its interfacing with Arduino	06 + 14
		Total Hrs: 30+60

Course Project

Physical Implementation: Prototyping planning/Prototyping Sprint Reviews 18 Hrs

Each faculty will provide a need statement to students and mentor the group of students. Each group will come up with their own solution to the need statement. Number of need statements should be equal to number faculty teaching this course.

Sample need statements

1. To automate floor cleaning and reduce human effort.
2. To automate a selected industrial processing operation.
3. To automate Waste Segregation and Recycling.
4. To digitally capture the shape and dimensions of physical objects.
5. To reduce time and effort required for fruit peeling.
6. To automate corn shelling and improve agricultural productivity.
7. To detect driver fatigue and help prevent road accidents.
8. To automate the stacking of objects for improved productivity and safety.

Expected Deliverables

1) Problem Statement
2) Objectives
3) Literature Review
4) Methodology

5) Sustainability Analysis

6) Ethical Considerations

7) Prototype/Model/Survey/Simulation

8) Results and Discussion

9) Conclusion and Future Scope

10) Presentation and Final Report

Course Assessment Plan (*for total 90 learning hours)*

Assessment No.		Formative Assessment type	Brief Description	Marks	Notional Learning hours	Week
LA1	**1**	Engineering Exploration Quiz & Reflection (individual)	Quiz or Individual reflection report on engineering disciplines, graduate attributes, ethics, sustainability and teamwork, Agile practices.	**10**	5 (1)	1–3
	2	Sustainability & Ethics Studio Activity (individual or team)	Life Cycle Assessment and carbon footprint & embodied energy calculation exercise or ethical dilemma case study analysis	**10**	5 (1)	4–7
	3	Concept Generation & Design Review (team submission)	Problem definition & formulation, concept generation (function tree, morphological chart), concept selection (Pugh chart), material selection justification	**10**	6 (1)	8-15
LA2	**4**	Virtual Implementation (individual or team)	CAD part modelling & assembly, engineering drawing.	**10**	12 (2)	1–3
	5	Motor and Battery Sizing (individual or team)	circuit diagram/flowchart, mechanism selection, motor & battery sizing calculations	**10**	10 (2)	4–7
	6	Platform-Based Development (individual or team)	Arduino programming fundamentals, sensor/transducer/actuator interfacing	**10**	10 (2)	8-15
ESE	**7**	Prototyping Sprint Review 1	Problem Statement, Objectives, Literature Review, Methodology (Project deliverables 1–4)	**15**	4 (7)	1–3
	8	Prototyping Sprint Review 2	Sustainability Analysis, Ethical Considerations, working Prototype/Model/Survey/Simulation (Project deliverables 5–7)	**15**	4 (7)	4–7
	9	Final Presentation & Report	Results and Discussion, Conclusion and Future Scope, final report + presentation (Project deliverables 8–10)	**10**	4 (7)	8-15
Total				**100**	**60** (Contact hrs) **+ 30** (Self Learning) **=90 hrs**	

Note: The Course Faculty will finalize the assessment plan (including the distribution of internal evaluations, practical rubrics, and continuous assessments) at the start of the semester in accordance with institute regulations. Any modifications will be communicated to the students in advance.

Text Books	
1	Introduction to Engineering, Paul H. Wright, Carl T. F. Ross, Wiley India, 2008
2	Engineering Design: A Project-Based Introduction. 4th ed., by Clive L. Dym and Patrick Little, John Wiley & Sons, 2013.
References	
1	Systems Engineering Principles and Practice, Alexander Kossiakoff, William N. Sweet, Samuel J. Seymour, Steven M. Biemer, Wiley, 2020
2	Engineering Ethics: Concepts and Cases, Charles E. Harris Jr., Michael S. Pritchard, Michael J. Rabins, Cengage Learning, 2018
3	Norman, D. A., The Design of Everyday Things, Revised and Expanded Edition, Basic Books, 2013.
4	Ulrich, K. T., & Eppinger, S. D., Product Design and Development, 7th Edition, McGraw-Hill, 2024.
5	Ashby, M. F., Materials Selection in Mechanical Design, 5th Edition, Elsevier, 2016.
6	Budynas, R. G., & Nisbett, J. K., Shigley's Mechanical Engineering Design, 11th Edition, McGraw-Hill, 2019.
7	White, E., Making Embedded Systems, 2nd Edition, O'Reilly Media, 2024.
Useful Links	
1	https://youtube.com/playlist?list=PL2935W76vRNEE_NNWlpUar20iUdkFQ1z2&si=-MaDgeRnw2uTllTw
2	https://onlinecourses.nptel.ac.in/e-learning/preview/noc22_mg54
3	https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_mg63
4	https://www.youtube.com/playlist?list=PLGxa5y5etMwAY238yKu1orXTnzD9h5nL_
5	https://docs.arduino.cc/

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AY 2026-27

Course Information

Programme	VLSI Design and Embedded Systems(Integrated Programme)
Class, Semester	First Year B.Tech, Semester I
Course Code	1ES101
Course Name	Network Analysis
Desired Requisites:	Basic knowledge of Mathematics and Physics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
Lab	-	**Credits: 3**			

Course Objectives

1	Develop a strong foundation in electrical network fundamentals and circuit analysis techniques applicable to electronic and embedded systems.
2	Apply network theorems, transient analysis and steady-state analysis to solve practical electrical and electronic circuits.
3	Analyze two-port networks that form the basis for analog electronics, signal processing, communication and VLSI circuits.
4	Prepare students with analytical and mathematical skills required for advanced courses such as Analog Electronics, Signals & Systems, CMOS VLSI Design and Embedded Systems.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain the fundamental laws, network theorems and basic principles of electrical circuits.	L2	Understand
CO2	Apply network analysis techniques, Laplace transforms and phasor methods for solving DC and AC circuits.	L3	Apply
CO3	Analyze transient response, resonance characteristics and two-port networks using appropriate mathematical models.	L4	Analyze
CO4	Evaluate the performance of electrical networks and filters using network analysis principles.	L5	Evaluate

Module	**Module Contents**	**Hours**
I	**Network Analysis**: Review Of R-L-C Electrical Circuit Elements, KCL And KVL, Star-Delta Conversion, Voltage and Current Sources, Graphs and Trees, Node and Mesh Analysis, Source Transformation, Network Theorems: Superposition, Millman, Norton, Thevenin, Maximum Power Transfer, Practical Applications and Case Studies of Network Theorems.	7
II	**Transient Response of Circuits:** RL and RC Circuits, Switching Conditions, RLC Circuits, Review of Laplace Transform, Important Theorems and Properties, Application Analysis of Circuits in Time Domain, Transfer Function.	7
III	**Sinusoidal Steady State Analysis:** The Sinusoidal Forcing Function, Phasor Concept, Average and Effective values of Voltage and Current, Instantaneous and Average Power, RMS Voltage, Complex Power, Steady State Analysis using Mesh and Nodal Analysis, Application of Network Theorems to AC Circuits.	7
IV	**Resonance And Magnetically Coupled Circuits:**	7

	Series Resonance, Impedance and Phase Angle of Series Resonant Circuit, Voltage and Current in Series Resonant Circuit, Effect of Resistance on Frequency Response Curve, Bandwidth, Selectivity and Quality Factor. Parallel Resonance, Resonant Frequency for Tank Circuit, And Variation of Impedance with Frequency Factor of Parallel Resonant Circuit, Reactance Curves.	
V	**Filters:** Filter fundamentals, classification of filters, Filter Characteristics & Parameters, Filter Networks, Constant K Low Pass and High Pass Filter.	4
VI	**Two Port Networks:** Open And Short Circuit Parameters, Transmission Parameters, Hybrid Parameters, Matrix Form of Input Output Relations, Interaction of Two Four Terminal Networks, Unsymmetrical Networks, Propagation Functions, Lattice Networks, Bisection Theorem.	7

Module wise Measurable Students Learning Outcomes:

After the completion of the course the student should be able to:

1. Apply fundamental circuit laws and network theorems to analyze DC electrical networks.
2. Analyze the transient response of first- and second-order circuits using Laplace transform techniques.
3. Analyze sinusoidal steady-state AC circuits using phasor concepts and power calculations.
4. Evaluate the performance of resonant and magnetically coupled circuits under different operating conditions.
5. Analyze the characteristics and frequency response of constant-k low-pass and high-pass filters using filter parameters and network theory.
6. Analyze two-port networks using various parameter representations for interconnected circuits.

Text Books	
1	Sudhakar and Shyam Mohan Palli, “Circuits and Networks; Analysis and Synthesis”, 3rd. Edition, Tata McGraw Hill, 2008.
2	Hayt W. H, Jack Kemmerly, Steven Durbin, “Engineering Circuit Analysis”, Tata McGraw Hill, 8th Illustrated Edition, 2011.
3	Van Valkenburg, “Network Analysis”, PHI publication, 3rd Edition, 1983.
References	
1	Ravish R Singh “Circuit Theory and Networks Analysis and Synthesis”,2nd Edition, McGraw Hill Education (India) Private Limited,2019.
2	L.P. Huelsman, “Basic Circuit Theory”, PHI Publication, 3rd Edition, 2009.
3	C. K. Alexander, M. N. O. Sadiku, “Electrical Circuits”, Tata McGraw-Hill, 2008.
Useful Links	
1	https://nptel.ac.in/courses/108102001
2	https://nptel.ac.in/courses/108105159

CO-PO Mapping

	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11		1	2	
CO1	3	2											2		
CO2	3	3	2										3		
CO3	3	3		2									3		
CO4	2	3	2	2									2	1	

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High

Assessment

The assessment is based on MSE, ISE/LA and ESE.
MSE shall be typically on modules 1 to 3.
ISE/LA shall be taken throughout the semester in the form of teacher’s assessment. Mode of assessment can be lab work, assignment, orals etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE/LA+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2026-27

Course Information

Programme	VLSI Design and Embedded Systems(Integrated Programme)
Class, Semester	First Year B.Tech, Semester I
Course Code	1VL101
Course Name	Digital Electronics
Desired Requisites:	Engineering Physics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	Introduce the fundamental concepts of number systems, digital codes, Boolean algebra, and logic gates used in digital systems.
2	Develop the ability to simplify Boolean expressions and implement basic digital logic circuits using combinational logic techniques.
3	Develop an understanding of sequential circuits, including flip-flops, counters, registers, and finite state machines.
4	Introduce the fundamental principles of Analog-to-Digital Conversion (ADC) and Digital-to-Analog Conversion (DAC) and their applications in digital systems.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Solve number systems, binary arithmetic, coding schemes, and perform arithmetic operations in different number systems.	Understand
CO2	Apply Boolean algebra and K-map techniques to simplify and realize digital logic circuits.	Apply
CO3	Design and analyze combinational and sequential circuits	Analyze
CO4	Analyze and apply finite state machines and basic ADC/DAC techniques for digital system applications.	Analyze

Module	**Module Contents**	**Hours**
I	**Module 1: Introduction to Number Systems** Introduction to number system. Binary, Hex BCD, Gray code, Arithmetic operations, Addition, Subtraction on binary, Hex, BCD numbers.	4
II	**Module 2: Logic Gates** Review of logic gates, NAND/NOR as universal gates, tri-state logic, algebraic minimization (min-terms, max- terms), K-map minimization, Realization using gates, converting AOI to NAND/NOR	6
III	**Module 3: Combinational Circuits** Design of comparator, Adder/subtractor, Code converters, Introduction to MUX / DEMUX	8
IV	**Module 4: Module 4 Sequential Circuit** Introduction to sequential circuits, Latches and flip-flops: SR, JK, D and T flip-flops, asynchronous counters. Mod N Counters, BCD counters, Shift Register	8
V	**Module 5: State Diagram** Introduction to finite state machines: Mealy Machine & Moore Machine, State diagram, State assignment, State Reduction. Merger Char methods	7
VI	**Module 6: Introduction to ADC and DAC** Introduction to data converters, need for ADC and DAC, basic concept and working of ADC and DAC, sampling and quantization, resolution and step size, types of ADC, types of DAC, applications of ADC and DAC.	4

Textbooks	
1	John F. Wakerly, *"Digital Design",* Pearson Education Publication, 4th edition, 2008.
2	Anand Kumar, "*Fundamentals of Digital Circuits*", PHI, 2ndEdition, 2009.
3	MandalS.K , "*Digital Electronics*" 1stEdiction.Mc-Graw-Hill, 2009.

References	
1	R..P.Jain, "*Modern Digital Design",* Mc-Graw-Hill, 4th edition, 2010.
2	Morris Manno, "Digital Logic and Computer Design", Prentice-Hall India, 4th edition, 2014

Useful Links	
1	http://learn-aboutelectronics.com

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2													
CO2		2												
CO3														
CO4			2											2
CO5		2												

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli
(Government Aided Autonomous Institute)

AY 2022-23

Course Information

Programme	VLSI Design and Embedded Systems(Integrated Programme)
Class, Semester	First Year B.Tech, Semester I
Course Code	1VL151
Course Name	Digital Electronics Lab
Desired Requisites:	Physics

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction		30	30	40	100
		Credits: 1			

Course Objectives

1	To familiarize students with digital electronic components, ICs, and laboratory instruments.
2	To develop practical skills in implementing and testing combinational and sequential logic circuits.
3	To verify the operation of digital circuits using standard logic ICs and simulation tools.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Verify the operation of logic gates, number system conversions, and Boolean logic using digital hardware and simulation tools.	
CO2	Design and implement combinational logic circuits using standard logic gates	
CO3	Implement and analyze sequential circuits using flip-flops, counters.	

List of Experiments / Lab Activities/Topics

List of Lab Activities:

(A minimum of 10 experiments shall be conducted from the above list during the semester.)

1. Familiarization with Digital Electronics Laboratory, Digital Trainer Kit, Breadboard and Digital ICs
2. Verification of basic logic gates and universal gates (NAND and NOR)
3. Realization of basic gates using universal gates (NAND and NOR)
4. Design and implementation of Half Adder, Full Adder, Half Subtractor, and Full Subtractor
5. Design and implementation of 1-bit magnitude comparator.
6. Design and implementation of Code Converters (Binary to Gray and Gray to Binary)
7. Study and implementation of Multiplexer and Demultiplexer circuits
8. Verification of SR, JK, D, and T Flip-Flops
9. Design and implementation of Asynchronous Mod-N Counter
10. Design and implementation of BCD Counter.
11. Mini Project(Open Lab)

Textbooks

1	John F. Wakerly, *"Digital Design",* Pearson Education Publication, 5th edition, 2018.
2	Anand Kumar, "*Fundamentals of Digital Circuits*", PHI, 2ndEdition, 2009.
3	MandalS.K , "*Digital Electronics*" Mc-Graw-Hill, 1stEdiction., 2009

References

1	R..P.Jain, "*Modern Digital Design",* Mc-Graw-Hill, 4th edition, 2010.
2	Morris Manno, "Digital Logic and Computer Design", Prentice-Hall India, 1st edition 1979.

Useful Links	
1	https://www.allaboutelectronics.org

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11		1	2
CO1	3				2						2		1	
CO2	3	2	2		2						2		1	
CO3	3	3	2	2	2						2		1	

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

Walchand College of Engineering, Sangli
(Government Aided Autonomous Institute)

Course Information	
Programme	VLSI Design and Embedded Systems(Integrated Programme)
Class | Semester	First Year B.Tech, Semester I
Course Code	1VS151
Course Name	Digital Manufacturing
Desired Requisites:	Basic Computer Knowledge

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction		30	30	40	100
		Credits: 1			

Course Objectives

1	To introduce students to the fundamentals of additive manufacturing and 3D printing technologies.
2	To develop skills in creating CAD models and preparing digital files for additive manufacturing.
3	To familiarize students with additive manufacturing materials, processes, and equipment for engineering applications.
4	To provide hands-on experience in fabricating, inspecting, and evaluating products using additive manufacturing techniques.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain fundamentals of CAD models for 3D printing.	II	Understand
CO2	Perform CAD data exchange and prepare digital models for 3D printing.	III	Apply
CO3	Select suitable materials and additive manufacturing processes for simple engineering applications.	III	Apply
CO4	Fabricate, inspect, and evaluate products using additive manufacturing techniques.	IV	Analyse

List of Experiments / Lab Activities/Topics

List of Experiments:

(A minimum of 10 experiments shall be conducted from the above list during the semester.)

1. Introduction to Digital Manufacturing and Industry 4.0.
2. 3D modelling of a simple component.
3. Assembly of CAD-modelled components.
4. CAD data exchange and different CAD file formats.
5. Generation of STL files.
6. Slicing of STL files and printer setup.
7. Selection of product and preparation of AM process plan.
8. Fabrication using a 3D printer.
9. Post-processing techniques.
10. Inspection and defect analysis.
11. Comparison with conventional manufacturing.
12. Mini Project: Design and fabricate a simple engineering product.

This list serves as a guideline, It may be changed or enhanced by the instructor as needed.

Textbooks

1	AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual), Khanna Book Publishing Co.
2	Lan Gibson, David W. Rosen and Brent Stucker, "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2010.
3	Andreas Gebhardt, "Understanding Additive Manufacturing: Rapid Prototyping, Rapid Tooling, Rapid Manufacturing", Hanser Publisher, 2011.
References	
1	Sabrie Soloman, "3D Printing and Design", Khanna Publishing House, Delhi.
2	CK Chua, Kah Fai Leong, "3D Printing and Rapid Prototyping- Principles and Applications", World Scientific, 2017.
3	J.D. Majumdar and I. Manna, "Laser-Assisted Fabrication of Materials", Springer Series in Material Science, 2013.
Useful Links	
1	https://www.tinkercad.com/
2	https://ultimaker.com/software/ultimaker-cura

CO-PO Mapping

	Programme Outcomes (PO)											PSO	
	1	2	3	4	5	6	7	8	9	10	11	1	
CO1	2	2			2						1	1	
CO2	2	2	2		3						1	1	
CO3	2	3	2	2	2							2	1
CO4	2	3	3	2	3				1	1	1	2	1

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, Submission	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, Submission	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities/ submission/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*						
AY 2026-27						
Course Information						
Programme		VLSI Design and Embedded Systems(Integrated Programme)				
Class, Semester		First Year (Electronics), Semester I				
Course Code		8AE151				
Course Name		Professional Communication				
Desired Requisites:		10+2 level English				
Teaching Scheme		**Examination Scheme (Marks)**				
Lecture	1 Hrs/week	**LA1**	**LA2**	**ESE**	**Total**	
Interaction	1 Hrs/week	30	30	40	100	
		Credits: 2				

Course Objectives	
1	Enable clear, confident, and context-aware communication (verbal, non-verbal, written, digital).
2	Prepare students to understand and apply effective listening, feedback and professional writing skills required for academic and career contexts.
3	Develop oral communication skills including public speaking, group discussion, debate and persuasion skills
4	Inculcate understanding of teamwork, collaboration, and digital communication, and equip students with personal branding and career communication skills.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Communicate clearly, confidently, and competently in diverse real-world scenarios	III	Apply
CO2	Demonstrate adequate proficiency in language.	III	Apply
CO3	Demonstrate communication skills (LSRW) in personal and professional settings.	III	Apply
CO4	Work effectively in teams and apply communication and interpersonal skills for career readiness.	III	Apply

Module	Module Contents	Hours
I	**Foundations of Communication** Communication -Nature, Types, and Principles. Barriers to Effective Communication and overcoming them. Developing Effective Listening Skills: Types, listening and note-making.	2
II	**Language Skills & Communicative Grammar** Vocabulary precision, clarity. Modal verbs, passives, phrasal verbs. Common errors & editing Communicative Grammar: modal verbs, question tags, misplaced modifiers, passives Reading comprehension	2
III	**Non-Verbal Communication & Vocalics** Understanding Non-Verbal Communication — Scope and Significance, Codes of non-verbal communication. Vocalics —Understanding Pronunciation, Intonation, and Voice modulation, eliminating fillers Developing Non-verbal skills for professional settings	3

IV	**Formal Oral Communication Skills** Presentation Skills — Structure, Delivery and Confidence. Techniques for public speaking, Group Discussion: Types, Dynamics, and Techniques, Introduction to Debate: Structured Arguments and Rebuttal Techniques.	2
V	**Professional Writing & Business Communication** Introduction to academic writing. Principles of Professional Writing: Brevity, Clarity and Pragmatic writing, Cover letter writing. Résumé Writing: Formats, ATS Compatibility	2
VI	**Interpersonal, Teamwork & Career Communication Skills** Interpersonal skills- Significance, Emotional Intelligence (EQ) —Cores of Emotional Intelligence, Team Building: Definition, Hierarchy and Team Dynamics, Personal Branding in the Digital Age — LinkedIn and Social Media Strategy, Interview Skills: Types, STAR Method, Mock Interview Preparation	3

Textbooks	
1	Adler, R.B. & Rodman, G. — Understanding Human Communication, Oxford University Press
2	Sanjay Kumar & Pushpalata — Communication Skills, Oxford University Press, First Edition, 2012
3	Cialdini, R. — Influence: The Psychology of Persuasion, Harper Business
References	
1	Ashraf Rizvi, Effective Technical Communication, Tata McGraw Hills publishing Company 2006
2	William Sanborn Pfeiffer, T.V.S. Padmaja, Technical Communication: A Practical Approach, Pearson, Sixth Edition 2012
3	Reynolds, G. — Presentation Zen: Simple Ideas on Presentation Design and Delivery, New Riders
4	Exercises in Spoken English, Parts I and II, CIEFL, Hyderabad, Oxford University Press
Useful Links	
1	www.ted.com/talks — TED Talks on Communication

Course Assessment Plan — Notional Learning Hours

Professional Communication | First Year B Tech | Sem I & II | Credits: 2 | Total NLH: 60

Sl. No.	Assessment Type	Brief Description	Marks	Notional Learning Hours (NLH)	A T*	CO Mapped	Bloom's Taxonomy Level
1	Tutorial Exercise	Structured exercises based on Module I & II topics	20	8	LA1	CO2	Apply (L3)
2	Listening + Note-Making Task	Audio-visual listening exercise with note-making and summary writing from Module I	10	8	LA1	CO1, CO2	Apply (L3)

Sl. No.	Assessment Type	Brief Description	Marks	Notional Learning Hours (NLH)	A T*	CO Mapped	Bloom's Taxonomy Level
3	Oral Presentation	Individual 10-minute structured presentation evaluated via rubric (Module IV)	10	10	LA2	CO1, CO3	Apply (L3)
4	Group Discussion / Debate	Mock GD / Debate on current affairs or case-based topics (Module IV)	10	10	LA2	CO3, CO4	Apply (L3)
5	Professional Writing Task	Email makeover + Résumé peer review using ATS simulation (Module V)	10	8	LA2	CO1, CO4	Apply (L3)
6	End-Semester Examination	Oral exam covering all 6 modules (30–40% weightage on Modules 1–3; 60–70% on Modules 4–6)	40	16	ESE	CO1–CO4	Apply (L3)
		Total	**100**	**60**	—		

Notes: | **AT**= Assessment Type. NLH **= Notional Learning Hours** includes lecture contact hours, tutorial hours, self-study, and assessment preparation. | Total NLH = 60 (as per 2-credit course norm: 1 credit = 30 NLH).

Notional Learning Hours breakup as per component.

Component	Hours	Basis
Lecture contact hours (1 hr/week × 14 teaching weeks)	14	Teaching scheme
Tutorial / Lab contact hours (1 hr/week × 14 teaching weeks)	14	Teaching scheme
Self-study, reading & comprehension practice	12	Home preparation
Assessment preparation (LA1 + LA2 + ESE)	12	Assessment plan
Co-curricular / Activity-based learning tasks	8	Activity sessions
Total Notional Learning Hours	**60**	1 Credit = 30 NLH × 2 Credits

CO-PO Mapping

	Programme Outcomes (PO)											PSO		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1									3		2			
CO2									3		2			
CO3							2		2		2			
CO4								3	2		2			

The strength of mapping is to be written as 1,2,3; Where, 1: Low, 2: Medium, 3: High

Each CO of the course must map to at least one PO.

Walchand College of Engineering, Sangli
(Government Aided Autonomous Institute)

AY 2026-27 onwards

Course Information

Programme	VLSI Design and Embedded Systems(Integrated Programme)
Class, Semester	First Year B.Tech, Semester II
Course Code	1BS103
Course Name	Transforms and Complex Analysis
Desired Requisites:	Mathematics course at Higher Secondary Level

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	1 Hrs/week	30	20	50	100

Credits: 03

Course Objectives

1	To introduce the fundamental concepts of transform techniques, probability, statistics, and complex analysis.
2	To develop the ability to analyse engineering problems using Laplace and Fourier transform methods.
3	To develop an understanding of statistical and probabilistic techniques used in engineering applications.
4	To apply concepts of complex analysis in solving mathematical and engineering problems.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statements**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Descriptor**
CO1	**Explain** the concepts and properties of Laplace transforms, Fourier series, and Fourier transforms.	II	Understanding
CO2	**Explain** the fundamental concepts of probability, statistics, and complex analysis.	II	Understanding
CO3	**Apply** transform techniques to solve engineering and mathematical problems.	III	Applying
CO4	**Apply** statistical, probabilistic, and complex analysis techniques to analyse engineering problems.	III	Applying

Module	**Module Contents**	**Hours**
I	**Laplace Transform** Definition and standard Laplace transform, Properties of Laplace transform, inverse Laplace transform, Applications.	**5**
II	**Fourier Series** Definition and Euler formulae, even and odd functions, Fourier series for arbitrary period, Fourier sine and cosine series.	**4**

III	**Fourier Transform** Fourier integral, Fourier transform, Fourier Sine and Cosine transform, Properties of Fourier transform, Parseval's identities.	**5**
IV	**Statistics** Mean and variance of the data, correlation, Regression, curve fitting.	**5**
V	**Probability** Continuous and discrete random variable, probability mass function, probability density function, Binomial distribution Poisson distribution, Gaussian Distribution, Exponential distribution.	**5**
VI	**Complex Analysis** Analytic function, Cauchy Riemann equation, Taylor's series, Maclaurin's series, Laurent's series, Residue Theorem.	**4**

Textbooks	
1	B. V. Ramana, Higher Engineering Mathematics, The McGraw Hill companies, 2006.
2	H. K. Dass, Advanced Engineering Mathematics, S. Chand & Company Ltd., 1st Edition, 2014.
3	Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition

References	
1	Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, Inc., 10th Edition, 2015.
2	R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, Narosa Publishing House, 5th Edition, 2016.
3	George B. Thomas, Maurice D. Weir, and Joel Hass, Thomas' Calculus, Pearson Education, 14th Edition, 2018.
4	Sheldon M. Ross, Introduction to Probability and Statistics for Engineers and Scientists, Academic Press, 6th Edition, 2020.
5	Glyn James, Advanced Modern Engineering Mathematics, Pearson Education, 5th Edition, 2018.

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc23_ma43/preview
2	https://onlinecourses.nptel.ac.in/noc21_ma74/preview
3	https://onlinecourses.nptel.ac.in/noc20_ma50/preview

CO-PO Mapping

CO	**Programme Outcomes (PO)**											**PSO**	
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PSO1**	**PSO2**
CO1	2	2	—	—	—	—	—	—	—	—	—	—	—
CO2	3	2	—	—	—	—	—	—	—	—	—	—	—
CO3	3	3	—	—	—	—	—	—	—	—	—	—	—
CO4	3	3	—	—	—	—	—	—	—	—	—	—	—

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing).

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2026-27					
Course Information					
Programme		VLSI Design and Embedded Systems(Integrated Programme)			
Class, Semester		First Year B.Tech, Semester II			
Course Code		1BS104			
Course Name		Semiconductor Physics			
Desired Requisites:		Basic concepts of 10+2 level Physics.			
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ESE**	**Lab**	**Total**
Practical	2 Hrs/week	20	50	30	100
		Credits: 3			

Course Objectives	
1	To provide fundamental scientific concepts for solving engineering and technical problems.
2	To develop analytical and critical thinking skills required for engineering studies.
3	To enhance the understanding of modern engineering and technological developments.
4	To develop experimental skills and the ability to analyze and interpret engineering data.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Exhibit memory of previously learned information by recalling facts, terms, and basic concepts in Physics.	I	Remember
CO2	Demonstrate understanding of facts and ideas by recalling, comparing, interpreting the terms in Physics.	II	Understand
CO3	Solve problems to new situations by applying acquired knowledge, facts, techniques and rules for various concepts in Physics.	III	Apply
CO4	Analyze engineering systems for solving problems.	IV	Analyze

Module	Module Contents	Hours
I	**Band Theory of Solids:** Introduction to Semiconductor Physics, Formation of Energy Bands, Classification of Solids on Basis of Band Theory, Number of Energy Levels in a Band, Density of States.	5
II	**Carrier Statistics and Transport Phenomena:** Introduction, Fermi-Dirac Statistics, Fermi Level, Variation of Fermi Level with Temperature, Electrical Conductivity of Metal and Semiconductor, Hall Effect.	4
III	**Semiconductor Devices:** Formation of P-N Junction, V-I Characteristics of Forward and Reverse Bias of P-N, Rectifier, Clipper & Clamper, Zener Diode, Applications of Diodes.	5
IV	**Transistors:** Introduction to transistors, including the construction, symbol, working principle, types, basic characteristics, and applications of Bipolar Junction Transistors (BJT) and Field Effect Transistors (FET).	4
V	**Fundamentals of Microchip Technology:** Introduction, Classification of Integrated Circuits (ICs), Silicon Crystal Growth, Oxidation, Photolithography, Diffusion, Ion Implantation, Etching, Metallization, Packaging of Integrated Circuits, and Applications of Microchips.	4
VI	**Nanoscience and Nanotechnology:** Introduction to Nanoscience and Nanotechnology, Nanoscale and Nanomaterials, Classification and Properties of Nanomaterials, Synthesis of Nanomaterials: Top-Down and Bottom-Up Approaches, Graphene and Carbon Nanotubes, Applications of Nanotechnology.	4

List of Experiments/ Lab Activities (Any 8-10)	
1	study of electrical conductivity of a given metal specimen and Verification of Ohm's Law.
2	Study of variation of resistivity/conductivity of a semiconductor with temperature (thermistor-based experiment).
3	Determination of energy band gap of a semiconductor by four-probe method.
4	Study of Hall effect: determination of Hall coefficient and carrier concentration.
5	Study the I-V characteristic of P-N junction diode in forward and reverse bias conditions.
6	Study of I-V characteristics of Zener diode.
7	Design and study of clipper circuits.
8	Design and study of clamper circuits.
9	Study of half-wave and full-wave rectifier circuits.
10	Transistor characteristics (CE configuration) and determination of current gain (β).
11	Study of transistor as a switch and as an amplifier.
12	Synthesis of nanomaterials by a simple bottom-up method.
13	Synthesis of nanomaterials by a simple top-down method.
14	Virtual lab: Characteristics of an NPN/PNP Transistor in Common Emitter Mode https://ep2-iitb.vlabs.ac.in/exp/transistor-emitter-mode/
15	Open lab

Textbooks	
1	M. N. Avadhanulu and P. G. Kshirsagar, "A Text book of Engineering Physics", S.Chand Pub.
2	Bhattacharya & Nag, Engineering Physics
3	Harnam Singh, *Advanced Practical Physics for Students*, S. Chand & Company Ltd., Revised Edition, 2011, Volumes I & II.

References	
1	Beiser, Arthur, Concepts of Modern Physics, McGraw-Hill Education, 7th Edition, 2015**.**
2	Streetman, Ben G. and Banerjee, Sanjay Kumar, Solid State Electronic Devices, Pearson Education, 7th Edition, 2015**.**
3	Campbell, S. A. *The Science and Engineering of Microelectronic Fabrication*. 2nd Edition, Oxford University Press, 2001.

Useful Links	
1	https://nptel.ac.in/courses/108106181
2	https://nptel.ac.in/courses/113106093
3	https://vlabs.ac.in

CO-PO Mapping

	Programme Outcomes (PO)											PSO	
	1	2	3	4	5	6	7	8	9	10	11	1	2
CO1	3	1									1		
CO2	3	2		1							1		
CO3	3	3	2	2							1		
CO4	3	3	2	3							1		

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

A student shall be declared to have passed if the student secures a minimum of 40% marks in aggregate (LA + MSE + ESE) and a minimum of 40% marks in the End-Semester Examination (ESE) separately.

LA	Continuous Learning Assessment based upon performance in the Laboratory sessions, Lab reports and Viva.	30 Marks	
MSE	Written / Online Test based upon approximately 50% of the theory course content.	20 Marks	
ESE	Written Examination based upon 100% of the theory course content giving 70% weightage on post mid-sem portion.	50 Marks	

Walchand College of Engineering, Sangli
(Government Aided Autonomous Institute)

AY 2026-27

Course Information

Programme	VLSI Design and Embedded Systems(Integrated Programme)
Class, Semester	First Year B.Tech, Semester II
Course Code	1ES102
Course Name	Engineering Graphics
Desired Requisites:	Basic Knowledge of Different Types of Curves, Line and Planes.

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
Lab	2 Hrs/week	**Credits: 3**			

Course Objectives

1	To develop fundamental engineering drawing and visualization skills required for electrical and electronics engineering applications.
2	To impart knowledge of engineering graphics principles including projections, sections, and development of surfaces.
3	To familiarize students with standard electrical symbols, schematic diagrams, wiring layouts, and electrical drafting practices.
4	To introduce CAD-based drafting techniques for preparation of professional electrical engineering drawings and layouts.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Draw and interpret engineering graphics using standard BIS conventions and drafting practices.	I	Demonstrating
CO2	Explain principles of projections, sections, and graphical representation of engineering objects.	II	Understanding
CO3	Apply engineering graphics principles to prepare electrical diagrams, layouts, and installation drawings.	III	Applying
CO4	Create CAD-based electrical engineering drawings, panel layouts, and wiring schematics following industry standards.	IV	Analysing

Module	**Module Contents**	**Hours**
I	**Introduction to Engineering Graphics and Curves**: Importance of engineering graphics in engineering communication; drawing instruments and BIS conventions; lettering and dimensioning; scales (plain, diagonal, and vernier scales); construction of conic sections (ellipse, parabola, hyperbola); engineering curves such as cycloid, epicycloid, hypocycloid, and involute	4
II	**Projection of Points, Lines and Planes:** Principles of orthographic projection; projection of points in different quadrants; projection of lines inclined to one or both reference planes; determination of true length and true inclinations; projection of plane surfaces inclined to HP and VP; auxiliary views and true shape determination.	5
III	**Projection of Solids:** Projection of prisms, pyramids, cylinders, and cones in various positions; solids inclined to one or both reference planes; visible and hidden edges; applications of projections in engineering visualization.	4

IV	**Sections and Development of Solids:** Sectioning of prisms, pyramids, cylinders, and cones; true shape of sections; development of surfaces of prisms, pyramids, cylinders, and cones; applications in electrical enclosures, ducts, cable trays, and fabrication works.	5
V	**Electrical Engineering Drawings and Layouts:** Standard electrical symbols as per BIS/IEC standards; circuit diagrams and schematic representation; single-line diagrams; domestic wiring diagrams; staircase and godown wiring; electrical installation layouts; distribution boards; earthing layouts; electrical panel layouts; switchgear representation; transformer and motor installation drawings; introduction to substation single-line diagrams.	5
VI	**CAD Applications in Electrical Engineering:** Introduction to CAD and AutoCAD; drawing setup, coordinate systems, layers, and drawing aids; preparation of electrical symbols and libraries; schematic diagrams, wiring diagrams, panel layouts, cable routing drawings, and substation layouts using CAD; dimensioning, annotation, plotting, and printing of drawings.	4

Module wise Measurable Students Learning Outcomes :

After the completion of the course the student should be able to:

[1] Draw engineering curves, scales, and geometrical constructions using BIS standards and drafting practices.

[2] Prepare orthographic projections of points, lines, and planes and determine their true dimensions using projection techniques.

[3] Construct projections of engineering solids in various orientations with respect to reference planes.

[4] Generate sectional views and developments of engineering solids for practical engineering applications.

[6] Prepare and interpret electrical symbols, schematic diagrams, single-line diagrams, wiring layouts, and electrical installation drawings.

[7] Create professional CAD-based electrical engineering drawings including schematics, panel layouts, and installation drawings using AutoCAD.

Text Books	
1	Bhatt N.D., Panchal V.M. and Ingle P.R., Engineering Drawing, Charotar Publishing House, 2014.
2	Surjit Singh, *Electrical Engineering Drawing*, Dhanpat Rai Publications, New Delhi.
3	K. V. Natarajan, *A Textbook of Electrical Engineering Drawing*, Dhanpat Rai & Co.
References	
1	Narayana, K.L. and P Kannaiah, Text book on Engineering Drawing, Scitech Publishers, 2008.
2	Fredderock E. Giesecke, Alva Mitchell and Others, *Principles of Engineering Graphics*, Maxwell McMillan Publishing, 2010.
3	Uppal S. L. and Rao S., *Electrical Wiring, Estimating and Costing*, Khanna Publishers.
Useful Links	
1	https://nptel.ac.in/courses/112/103/112103019/
2	https://nptel.ac.in/courses/105/104/105104148/
3	https://www.youtube.com/watch?v=xXdpkQXDuMw&list=PL9RcWoqXmzaJT-fliqTSwUjWU4zCX_H2A

CO-PO Mapping For Electrical Engineering Department															
	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11		1	2	
CO1	3				2					1			2		
CO2			2										1		
CO3					3					1			2		
CO4											3		1		

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High

CO-PO Mapping For Electronics Engineering Department															
	Programme Outcomes (PO)												PSO		
	1	2	3	4	5	6	7	8	9	10	11		1	2	
CO1	3				2					1			2		
CO2			2										1		
CO3					3					1			2		
CO4											3		1		
The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High															

Assessment
The assessment is based on MSE, ISE/LA and ESE. MSE shall be typically on modules 1 to 3. ISE/LA shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be lab work, assignment, orals etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE/LA+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli
(Government Aided Autonomous Institute)

Course Information					
Programme	VLSI Design and Embedded Systems(Integrated Programme)				
Class | Semester	First Year B.Tech, Semester II				
Course Code	1ES151				
Course Name	C Programming and Data Structures				
Desired Requisites:	Basic computer knowledge				

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	4 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Lecture	1 Hrs/ Week	30	30	40	100
		Credits: 3			

Course Objectives	
1	To develop problem-solving skills using algorithms and the C programming language.
2	To familiarize students with programming constructs such as functions, arrays, pointers, structures, and file handling.
3	To introduce fundamental linear and non-linear data structures and their implementation using C.
4	To enable students to analyze and apply searching, sorting, and basic data structures for solving engineering problems.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Develop C programs using programming constructs such as control statements, functions, arrays, pointers, structures, and file handling.	III	Apply
CO2	Analyze and implement searching and sorting algorithms for efficient data processing	IV	Analyse
CO3	Implement linear data structures such as linked lists, stacks, and queues using C.	III	Apply
CO4	Explain and implement basic non-linear data structures such as trees and graphs for solving simple computational problems.	III	Apply

List of Experiments / Lab Activities/Topics

List of Topics (Applicable for Interaction Mode):

1. Problem Solving and C Programming Fundamentals: Introduction to problem solving, algorithms, flowcharts, pseudocode, programming languages, features and structure of C, variables, constants, data types, operators, expressions, input/output functions, **C program compilation process, different stages of compilation and intermediate files generated, code size measurement, and basic memory organization of a C program.**

2. Control Statements and Functions: Decision-making statements (if, if-else, nested if, switch), looping statements (while, do-while, for), break and continue, functions, recursion, parameter passing, scope, **storage classes and their memory implications.**

3.**Arrays, Strings and Pointers:** One-dimensional and two-dimensional arrays, strings and string handling functions, introduction to pointers, pointer arithmetic, arrays and pointers, dynamic memory allocation, **C memory map, memory organization of variables and data.**

4. Structures, File Handling and Introduction to Data Structures: Structures, arrays of structures, unions, file handling, overview of data structures, classification of linear and non-linear data structures, asymptotic notation (Big-O concept), searching (Linear and Binary Search) and sorting (Bubble, Selection and Insertion Sort).

5.Linear Data Structures: Arrays as data structures, linked lists (singly linked list), stacks and queues, implementation using arrays and linked lists, applications.

6.Introduction to Non-Linear Data Structures: Trees: terminology, binary tree, binary search tree (concept and basic operations), Graphs: terminology, graph representations (adjacency matrix and adjacency list), applications of trees and graphs.

List of Experiments:

(A minimum of 10 experiments shall be conducted from the above list during the semester.)

C programming-

1. Perform basic input/output operations, arithmetic operations, and mathematical computations using C.
2. Implement decision-making and iterative control statements.
3. Develop programs using user-defined functions, parameter passing, and recursion.
4. Perform operations on one-dimensional and two-dimensional arrays.
5. Apply string handling techniques using standard library functions.
6. Illustrate the use of pointers, pointer arithmetic, and dynamic memory allocation.
7. Implement applications using structures and unions.
8. Perform file handling operations using text and binary files.
9. Develop programs integrating arrays, functions, and pointers.
10. Apply structures with functions and arrays to solve simple engineering problems.
11. Practice modular programming concepts using C.
12. Develop a mini application using C programming concepts.
13. Develop and compare efficient C programs by optimizing a given program—for example, rewriting a program using fewer loops or reduced operations—and compare the number of iterations, execution time, and code size.

DSA programming-

(A minimum of 10 experiments shall be conducted from the above list during the semester.)

1. Implement searching techniques on arrays.
2. Implement and analyze sorting techniques for data organization.
3. Implement stack operations using arrays.
4. Implement queue operations using arrays.
5. Implement circular queue operations.
6. Develop singly linked list operations.
7. Implement stack using linked lists.
8. Implement queue using linked lists.
9. Construct and traverse binary trees.
10. Implement basic operations on binary search trees.
11. Represent and explore graphs using adjacency matrix and adjacency list.
12. Develop a mini application using appropriate data structures.

This list serves as a guideline, It may be changed or enhanced by the instructor as needed.

Textbooks	
1	Reema Thareja, Programming in C, 2nd Edition, Oxford University Press.
2	Ellis Horowitz, Sartaj Sahni, and Susan Anderson-Freed, Fundamentals of Data Structures in C, Universities Press.
References	
1	E. Balagurusamy, Programming in ANSI C, 8th Edition, McGraw-Hill Education.
2	Yashavant Kanetkar, Let Us C, 17th Edition, BPB Publications.
3	Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson.
4	Seymour Lipschutz, Data Structures with C, Schaum's Outline Series, McGraw-Hill.
Useful Links	
1	https://www.programiz.com/c-programming
2	https://www.w3schools.com/c/c_intro.php
3	https://www.geeksforgeeks.org/

CO-PO Mapping													
	Programme Outcomes (PO)											PSO	
	1	2	3	4	5	6	7	8	9	10	11	1	2
CO1	3	2	1		2							1	
CO2	3	3	2		3							1	
CO3	3	3	2	1	3							2	1
CO4	3	3	3	2	3				1	1	1	2	1
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.													

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, Submission	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, Submission	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities/ submission/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

Walchand College of Engineering, Sangli
(Government Aided Autonomous Institute)

AY 2026-27

Course Information

Programme	Integrated B. Tech. & M. Tech. (VLSI Design and Embedded Systems)
Class, Semester	First Year, Sem. II
Course Code	1VL102
Course Name	Analog Electronics
Desired Requisites:	12th Physics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To introduce the construction, operation, characteristics, and biasing techniques of BJT, JFET, and MOSFET.
2	To explain the operation and performance of transistor amplifiers and power amplifiers.
3	To familiarize students with feedback, oscillators, and wave shaping circuits.
4	To introduce regulated DC power supplies and voltage regulator circuits for electronic applications.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain the operation, characteristics, and biasing techniques of BJT, JFET, and MOSFET devices.	II	Understand
CO2	Analyze the performance of transistorized amplifiers and the op-amp based circuits and applications of IC55 timer.	IV	Analyze
CO3	Explain the working principles of feedback amplifiers, oscillators, multivibrators.	II	Understand
CO4	Analyze regulated DC power supply circuits and voltage regulators for the basic electronic applications.	IV	Analyze

Module	**Module Contents**	**Hours**
I	**Transistors and Biasing Techniques:** Revision of BJT, JFET and MOSFET: construction, working principle, characteristics and operating regions. Comparison of BJT, JFET and MOSFET. Need for biasing, operating point (Q-point), Biasing Methods for BJT, JFET and MOSFET, DC and AC load line analysis.	7
II	**Transistorized Amplifiers:** Amplifier fundamentals, small signal amplifiers: common emitter amplifier, common collector amplifier; JFET/MOSFET common source/ common drain amplifier, cascade and cascode amplifier, frequency response of amplifiers.	7
III	**Power Amplifiers:** Classification of power amplifiers: class A, B (push-pull) and class AB.	5
IV	**Oscillator and Multivibrator Circuits:** Concept of positive and negative feedback, amplifiers with negative feedback, effects of negative feedback, Barkhausen criterion for oscillation, RC and LC oscillators; astable, monostable and bistable multivibrator circuits, Schmitt trigger circuit.	8
V	**Operational Amplifier:** Basic op-amp configuration, feedback in op-amp circuits, ideal op-amp circuit analysis, inverting, non-inverting amplifier, summing amplifier, difference amplifier, unity gain buffer, voltage comparator, monolithic timer IC555.	7

VI	**Regulated DC Power Supply:** Block diagram of regulated dc power supply, Zener diode voltage regulator, series and shunt regulator, introduction to IC voltage regulators (78XX and 79XX series)	5

Textbooks	
1	Sedra, A. S., & Smith, K. C. (2014). *Microelectronic Circuits* (7th ed.). Oxford University Press.
2	Boylestad, R. L., & Nashelsky, L., Electronic Devices and Circuit Theory, Pearson.

References	
1	Millman, J., & Halkias, C., Integrated Electronics, McGraw-Hill.
2	Neamen, D. A., Electronic Circuit Analysis and Design, McGraw-Hill.
3	Floyd, T. L., Electronic Devices, Pearson.

Useful Links	
1	https://nptel.ac.in/courses/117101106
2	https://nptel.ac.in/courses/108101091

CO-PO Mapping

	Programme Outcomes (PO)											**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	1	2
CO1	3	2			2						2		1
CO2	3	3	2	2	1						2		2
CO3	3	2	2		2						1		1
CO4	3	3	2	2	2						2		2

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment (Theory)

The assessment is based on MSE and ESE.
MSE shall be typically on modules 1 to 3.
ESE covers all modules, with 30% weightage for Modules 1–3 and 70% for Modules 4–6.
For passing a theory course, Min. 40% marks in (MSE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli
(Government Aided Autonomous Institute)

Course Information	
Programme	Integrated B. Tech. & M. Tech. (VLSI Design and Embedded Systems)
Class | Semester	First Year, Sem. II
Course Code	1VL152
Course Name	Analog Electronics Lab
Desired Requisites:	12th Physics

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	To familiarize students with electronic components, laboratory instruments, and safety practices.
2	To verify the characteristics and operation of transistor-based analog circuits.
3	To develop practical skills in implementing amplifiers, oscillators, and regulated power supply circuits.
4	To analyze the performance of analog electronic circuits through experimentation.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Identify and use electronic components and laboratory instruments for analog circuit implementation.	III	Apply
CO2	Perform experiments to verify the characteristics and performance of transistorized amplifiers and wave shaping circuits.	III	Apply
CO3	Analyze the performance of oscillators, multivibrators, and regulated power supply circuits using experimental observations.	IV	Analyze
CO4	Build, test, and troubleshoot basic analog electronic circuits using standard laboratory practices.	III	Apply

List of Experiments / Lab Activities/Topics

List of Experiments:

(A minimum of 10 experiments shall be conducted from the above list during the semester.)

1. Biasing Techniques for BJT/JFET/MOSFET.
2. Common Emitter/ Common Source amplifier.
3. Common Collector/ Common Drain amplifier.
4. Frequency response of transistor amplifier.
5. Class-A/ class-AB power amplifier.
6. RC Phase Shift Oscillator.
7. Astable Multivibrator.
8. Study of inverting and non-inverting amplifier using op-amp.
9. Implementation of op-amp based applications (adder / subtractor).
10. Build and test multivibrator/ timer circuits using IC 555.
11. Zener diode voltage regulator.
12. IC Voltage Regulator (78xx series).

This list serves as a guideline, it may be changed or enhanced by the instructor as needed.

Textbooks

1	Sedra, A. S., & Smith, K. C. (2014). Microelectronic Circuits (7th ed.). Oxford University Press.

2	Boylestad, R. L., & Nashelsky, L. (2019). Electronic Devices and Circuit Theory (12th ed.). Pearson.
References	
1	D. A. Neamen, “Electronic Circuit Design and Analysis”, 3 rd Edition, McGraw Hill Education (India) Private Limited, New Delhi, 2007.
2	Allen Mottershed , “Electronic Devices and Circuits”, 2 nd Edition, PHI, 1979.
3	Gerald E. Williams, “Practical Transistor Circuit Design and Analysis”, 1st Edition, Tata McGraw Hill, New Delhi, 1973.
1	https://nptel.ac.in/courses/117101106
2	https://nptel.ac.in/courses/108101091

CO-PO Mapping

	Programme Outcomes (PO)											PSO	
	1	2	3	4	5	6	7	8	9	10	11	1	2
CO1	3	2			3						2		1
CO2	2	3	2	2	2						2		2
CO3	2	2	2	3	3						2		1
CO4	2	2	3	2	3			2			2		2

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, Submission	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, Submission	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities/ submission/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

Walchand College of Engineering, Sangli
(Government Aided Autonomous Institute)

Course Information	
Programme	VLSI Design and Embedded Systems(Integrated Programme)
Class | Semester	First Year B.Tech, Semester II
Course Code	1VS152
Course Name	Linux and Scripting
Desired Requisites:	Basic computer knowledge

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction		30	30	40	100
		Credits: 1			

Course Objectives

1	To introduce students to the Linux operating system and basic command-line operations.
2	To develop basic shell scripting and Python programming skills for simple automation tasks.
3	To familiarize students with the fundamentals of TCL scripting.
4	To enable students to apply Linux and scripting concepts to solve basic engineering problems.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Use Linux commands for file management and basic system operations.	II	Understand
CO2	Develop simple shell and Python programs for basic automation tasks.	III	Apply
CO3	Write basic TCL scripts using programming constructs.	IV	Analyse
CO4	Develop simple scripting solutions using Linux, Python, and TCL.	III	Solve

List of Experiments / Lab Activities/Topics

List of Topics (Applicable for Interaction Mode):

Module I: Linux Environment for EDA

Introduction to Linux operating system, Linux distributions, Linux file system, terminal basics, file and directory commands, file permissions, help commands.

Module II: Linux Command-Line Processing and Shell Scripting

Shell and command interpreter; command syntax; wildcards; pipes; input/output redirection; filters; command substitution; variables; aliases; basic text processing using grep, sed, awk, cut, sort, head, tail, wc; process and job control.

Module III: Shell Scripting for EDA Automation

Shell basics, variables, input/output, operators, conditional statements, loops, simple shell scripts and execution.

Module IV: Python for EDA Automation

Python syntax and variables; strings, lists and dictionaries; conditions and loops; functions; file handling; command-line arguments; basic text processing

Module V: TCL for EDA Tool Automation

Introduction to TCL, variables, operators, input/output, conditional statements, loops, procedures, simple TCL programs.

Module VI: Integrated Scripting and Version-Controlled Workflow

Version-control concepts; repository, commit, branch and merge; .gitignore; basic Git workflow; organizing an automated EDA project

List of Experiments:

1. Linux-Based VLSI Workspace Setup.
2. Linux Command-Line Processing of VLSI Files.
3. Basic Shell Script for VLSI Project Initialization.
4. Shell Script for EDA Flow Automation.
5. Python-Based VLSI File and Report Processing.
6. Python Automation of Linux/EDA Commands.
7. TCL Fundamentals for EDA.
8. TCL-Based EDA Tool Automation.
9. Git-Based Version Control of an EDA Project.
10. Integrated Linux–Bash–Python–TCL VLSI Automation Project.

This list serves as a guideline, it may be changed or enhanced by the instructor as needed.

Textbooks	
1	Richard Blum, *Linux Command Line and Shell Scripting Bible*, Wiley.
2	Eric Matthes, *Python Crash Course*, No Starch Press.
3	John K. Ousterhout, *Tcl and the Tk Toolkit*, Addison-Wesley.
References	
1	William Shotts, *The Linux Command Line*, No Starch Press.
2	Mark Lutz, *Learning Python*, O'Reilly.
3	Brent Welch, *Practical Programming in Tcl and Tk*, Prentice Hall.
4	Samir Palnitkar, *Verilog HDL*, Pearson (for EDA scripting context).
5	Stephen Brown and Zvonko Vranesic, *Fundamentals of Digital Logic with Verilog Design*, McGraw-Hill.
Useful Links	
1	https://nptel.ac.in/courses/117106113
2	https://www.youtube.com/playlist?list=PLbMVogVj5nJRa3VKt_eyZdJ_DitCz1cvQ
3	https://www.classcentral.com/classroom/youtube-electronics-linux-programming-scripting-47539

CO-PO Mapping													
	Programme Outcomes (PO)											PSO	
	1	2	3	4	5	6	7	8	9	10	11	1	
CO1	3	2			2							1	
CO2	3	3	2		3							1	
CO3	2	2	2		3							2	1
CO4	3	2	3	2	3				1	1	1	2	1
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.													

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, Submission	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, Submission	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities/ submission/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates the starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				