Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Digital Signal Processing
Desired Requisites:	Signals and Systems

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives	
1	To illustrate the fundamental concepts of Signal Processing.
2	To explain the different techniques for design of filters and multirate systems.
3	To enable the students for the design and development of DSP systems.
4	

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Solve Discrete Fourier Transform in efficient manner	Apply
CO2	Analyze the structures for Discrete Time systems	Analyze
CO3	Design the FIR, IIR Digital Filters for given specifications	Create
CO4	Describe the fundamentals of Multirate DSP and Wavelet Transform	Evaluate

Module	Module Contents	Hours
I	**Discrete Fourier Transform and its Computation** Introduction, The Discrete Fourier Series and its Properties, The Fourier Transform of Periodic signals, Sampling of the Fourier Transform, The Discrete Fourier Transform and its Properties, Efficient Computation of the Discrete Fourier Transform, Decimation-in-Time FFT Algorithms, Decimation-in-Frequency FFT Algorithms, Implementation of FFT Algorithms for IIR Systems.	6
II	**Structures for Discrete-Time Systems** Introduction, Block Diagram Representation of Difference Equations, Signal Flow Graph Representation of Difference Equations, Basic Structures of FIR Systems, Basic Network structures	3
III	**Filter Design Techniques-FIR Filters** Introduction, Design of FIR Filter by Windowing, Properties of commonly used windows, Linear Phase property of FIR Filter, Kaiser Window Filter design, Discrete Time Differentiator	6
IV	**Filter Design Techniques-IIR Filters** Introduction, Design of Discrete-time IIR Filters from Continuous-time Filters, Filter Design by Impulse Invariance, Filter Design by Bilinear Transformation, Frequency Transformations of Low pass IIR Filters	5
V	**Multirate Digital Signal Processing** Introduction, Decimation and interpolation, Sampling rate conversion, Multistage Implementation of Sampling rate conversion, Sampling rate conversion for Bandpass signals, Sampling rate conversion by arbitrary factor, Applications of Multirate DSP	3
VI	**Introduction to Wavelet Transform** STFT, Wavelets representation, Haar Wavelet, Daubachis Wavelet, Filter Bank Representation	3

Text Books	
1	"Digital Signal Processing: A Computer Based Approach", Sanjit K. Mitra, 4th Edition, Tata McGraw-Hill Publication.
2	"Discrete Time Signal Processing", Oppenheim & Schafer,2nd Edition, Pearson education.
3	
4	
References	
1	"Digital Signal Processing", J. G. Proakis, Prentice Hall India
2	
3	
4	
Useful Links	
1	www.nptel.ac.in
2	
3	
4	

CO PO Mapping

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

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand				
Apply	10		15	25
Analyze	10	10	10	30
Evaluate		10	15	25
Create			20	20
Total	**20**	**20**	**60**	100

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Embedded System Design
Desired Requisites:	Microcontroller, Peripherals and Interfacing

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives	
1	To illustrate the features of ARM7 architecture.
2	To provide the knowledge of different hardware peripherals and programming of different peripherals of ARM7 based controller, LPC2148.
3	To empower the students for the design and development of embedded system.
4	

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	**illustrate** architecture and operation of internal peripherals of ARM7 LPC2148 microcontroller.	Apply
CO2	**write** assembly and C program to configure and use internal peripherals of LPC2148 microcontroller.	Apply
CO3	**analyze** program and find operating parameters of peripheral in LPC2148 microcontroller.	Analyze
CO4	**design** and **develop** small embedded system using embedded C programming and LPC2148 microcontroller.	Create

Module	**Module Contents**	**Hours**
I	**ARM7 Architecture** ARM7 Architecture, Memory organization, Programmers model, Pipelining, Memory, Register Structure, Current Program Status Register, Exception Modes, System buses and peripherals, Memory Accelerator module, Compare features / architecture of ARM7 with 8051.	5
II	**Embedded C language programming** Introduction to ARM7 programming example, Software documentation method, Development Tools, ARM C Programming, Startup code, LPC2148 pin layout, PLL configuration, Pin Connect block, I/O programming, boot-loader, In Application Programming.	4
III	**Interrupt Structure of ARM7 LPC2148** Interrupt system in ARM7, VIC, FIQ, IRQ, Non-vectored interrupt, Software interrupt, Interrupt latency, Nested interrupts, External interrupts, Interrupt configuration and Programming examples.	4
IV	**Peripherals of ARM7 LPC2148** Block diagram of Timers, role of prescaler, Capture and Match facility of timer and confirmation of it using registers, Pulse Width Modulator, RTC operation and Programming, Watch dog timer, Analog to digital converter, Digital to analog converter and their programming.	7

V	**Communication Protocols** On chip serial ports, Serial port programming, Setting baud rate, Using UART buffer, printf for serial data transfer, interrupt based serial port handling, I2C protocol, Using I2C for interfacing external EEPROM, SPI protocol and programming.	4
VI	**Application Development** Finite state machine in designing Embedded Systems, Design considerations for embedded system design, Design of a simple general purpose ARM7 kit, Case studies of some ARM based applications. Introduction to ARM cortex core	2

Text Books	
1	NXP, LPC 2148 data sheet, NXP inc., NA, 2011
2	NXP, LPC 2148 user manual, NXP inc., NA, 2012

References	
1	ARM inc, ARM Reference Manual, ARM, inc., NA, 2011
2	Andrew Sloss, ARM System Developer's Guide, Elsevier India, 2005
3	Computer Organization and Design, ARM Edition, Elsevier, 2010
4	ARM Architecture Reference Manualby Dave Jagger

Useful Links	
1	https://nptel.ac.in
2	https://www.coursera.org/in
3	https://www.tutorialspoint.com/
4	https://www.keil.com/
5	http://vlabs.iitb.ac.in/vlab/

CO PO Mapping

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

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3,4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	T1	T2	ESE	Total
Remember				
Understand				
Apply	10		20	**30**
Analyze	10	10	20	**40**
Evaluate				
Create		10	20	**30**
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2021-22					
Course Information					
Programme	B.Tech. (Electronics Engineering)				
Class, Semester	Third Year B. Tech., Sem V				
Course Code					
Course Name	Digital Signal Processing Lab				
Desired Requisites:	Signals and Systems				

Teaching Scheme (Hrs)		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 hrs/week				
Interaction	-	**Credits: 1**			

Course Objectives	
1	The objective of the course is to work out for the convolution.
2	Correlation, DFT, IDFT, Block convolution.
3	Signal smoothing, filtering of long duration signals.
4	Spectral analysis of signals using MATLAB simulation.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Illustrate the basic operations of Signal processing	Apply
CO2	Analyze the spectral parameter of window functions	Understand
CO3	Create IIR, and FIR filters for band pass, band stop, low pass and high pass filters	Create
CO4	Demonstrate multirate DSP and wavelet transform	Evaluate

List of Experiments / Lab Activities

List of Experiments:

1. Generation of different signals using MATLAB.
2. Calculation of DFT and plot Magnitude,Phase response for the same.
3. Calculation of IDFT and plot Magnitude response for the same.
4. Implementation of Median Filter.
5. Implementation of Moving Average Filter.
6. Find Circular Convolution of given sequences.
7. Illustration of Overlap-Add Method.
8. Design of simple filter.
9. Design of FIR filter using different window functions.
10. Design of FIR filter using Kaiser window.
11. To plot frequency response of low pass filter using Kaiser window for different tuning parameters.
12. Illustration of Up sampling of signal.
13. Illustration of Down sampling of signal.
14. Illustration of Effect of window length.
15. Illustration of Effect of Up sampling in Frequency Domain.

Text Books	
1	"Digital Signal Processing", Sanjit K. Mitra ,4th Edition,Tata McGraw-Hill Publication
2	"Discrete Time Signal Processing", Oppenheim & Schafer, 2nd Edition, Pearson education.
3	
4	
References	
1	"Digital Signal Processing", J. G. Proakis, Prentice Hall India.
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Useful Links	
1	www.nptel.ac.in
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CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3													2
CO2		3												2
CO3				2										2
CO4	2													2

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)

Bloom's Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember				
Understand	10	10	10	**30**
Apply	10		10	**20**
Analyze				
Evaluate		10	10	**20**
Create	10	10	10	**30**
Total	**30**	**30**	**40**	**100**

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AY 2021-22

Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Embedded System Design Lab
Desired Requisites:	Microcontroller, Peripherals and Interfacing theory and lab

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

Course Objectives	
1	Write, simulate and debug assembly and C programs for LPC2148 microcontroller
2	Write, simulate, download and test C programs for LPC2148 microcontroller in LPC2146 kit
3	Develop C program for implementing given or required system operation.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	**apply** programming skills to integrate hardware peripherals of ARM7 based controller, LPC2148.	Apply
CO2	**test** and **debug** programs for LPC2148 microcontroller	Analyze
CO3	**develop** and **demonstrate** small embedded systems using ARM C programming and hardware peripherals for ARM7 based processor, LPC2148	Create

List of Experiments / Lab Activities

List of Experiments:

1. Experiment 1 : Introduction of the development tools and kit
2. Experiment 2 : Simple assembly language, embedded C program and study of startup.s file
3. Experiment 3 : GPIO Programming
4. Experiment 4 : PLL Programming
5. Experiment 5 : Interrupt programming (IRQ and NV-IRQ)
6. Experiment 6 : FIQ programming and comparison of FIQ with VIRQ and NVIRQ
7. Experiment 7 : Programming Timer as Timer and Timer as Counter
8. Experiment 8 : Programming Timer to perform capture operation and match facility of timer
9. Experiment 9 : Programming PWM and application of it
10. Experiment 10 : Programming ADC and DAC
11. Experiment 11 : Programming UART
12. Experiment 12 : Programming RTC and WDT
13. Experiment 13 : Study of power saving modes
14. Mini-Projects Demo

Text Books	
1	NXP, LPC 2148 data sheet, NXP inc., NA, 2011
2	NXP, LPC 2148 user manual, NXP inc., NA, 2012
3	Development board / Kit reference manual

References	
1	ARM inc, ARM Reference Manual, ARM, inc., NA, 2011
2	Andrew Sloss, ARM System Developer's Guide, Elsevier India, 2005
3	ARM Architecture Reference Manualby Dave Jagger
4	Internet resources related to this topic for mini-project
Useful Links	
1	https://nptel.ac.in
2	https://www.coursera.org/in
3	https://www.tutorialspoint.com/
4	https://www.keil.com/
5	http://vlabs.iitb.ac.in/vlab/

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

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)

Bloom's Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember				
Understand				
Apply	15	10	10	**35**
Analyze	15	10	10	**35**
Evaluate				
Create		10	20	**30**
Total Marks	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Mini Project -1
Desired Requisites:	ECAD I, ECAD II

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

Course Objectives

1	To provide students hands on experience on, troubleshooting, maintenance, fabrication, innovation, record keeping, documentation etc thereby enhancing the skill and competency part of technical education
2	To create an Industrial environment and culture within the institution
3	To inculcate innovative thinking and practice based learning and thereby preparing students for their final year project
4	To set up self-maintenance cell within departments to ensure optimal usage of infrastructure facilities

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Choose, Initiate and manage a minor project.	Understand
CO2	Propose research problem and present it in a clear and distinct manner through different oral, written and design techniques.	Apply
CO3	Construct the circuit using hardware and/or software	Create
CO4	Execute the project and comment upon the results of it	Analyze

List of Experiments / Lab Activities

Mini Project Description

A project group shall consist of *normally 3 students* per group. The mini project will involve the design, construction, and debugging of an electronic system approved by the department. Each student should conceive, design and develop the idea leading to a project/product. **The theme of the project should be based on courses studied in SY using any discrete components up to operational amplifier.**

Each student must keep a project notebook/logbook. The project notebooks will be checked periodically throughout the semester, as part of in-semester-evaluation. The student should submit a soft bound report at the end of the semester. The final product as a result of mini project should be demonstrated at the time of examination.

Text Books

1	

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References	
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Useful Links	
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CO-PO Mapping

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

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)

Bloom's Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember				
Understand	15	5		**20**
Apply	10	15	5	**30**
Analyze	5	10	15	**30**
Evaluate				
Create			20	**20**
Total	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2021-22					
Course Information					
Programme	B.Tech. (Electronics Engineering)				
Class, Semester	Third Year B. Tech., Sem V				
Course Code					
Course Name	Mini Project 2				
Desired Requisites:	Microcontroller Interfacing and Peripherals, ECAD II				

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

Course Objectives	
1	To provide students hands on experience on, troubleshooting, maintenance, fabrication, innovation, record keeping, documentation etc thereby enhancing the skill and competency part of technical education
2	To create an Industrial environment and culture within the institution
3	To inculcate innovative thinking and practice based learning and thereby preparing students for their final year project
4	To set up self-maintenance cell within departments to ensure optimal usage of infrastructure facilities

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Choose, Initiate and manage a minor project.	Understand
CO2	Propose research problem and present it in a clear and distinct manner through different oral, written and design techniques.	Apply
CO3	Construct the circuit using hardware and/or software	Create
CO4	Execute the project and comment upon the results of it	Analyze

List of Experiments / Lab Activities

Mini Project Description

A project group shall consist of normally 3 students per group. The mini project will involve the design, construction, and debugging of an electronic system approved by the department. Each student should conceive, design and develop the idea leading to a project/product. **The theme of the project should be based on courses studied in SY using microcontroller/Arduino/Raspberry Pi etc.**

Each student must keep a project notebook/logbook. The project notebooks will be checked periodically throughout the semester, as part of in-semester-evaluation. The student should submit a soft bound report at the end of the semester. The final product as a result of mini project should be demonstrated at the time of examination.

Text Books	
1	
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References	
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Useful Links	
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3	
4	

CO-PO Mapping

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

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.

Assessment Plan based on Bloom’s Taxonomy Level (Marks) (For lab Courses)

Bloom’s Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember				
Understand	15	5		**20**
Apply	10	15	5	**30**
Analyze	5	10	15	**30**
Evaluate				
Create			20	**20**
Total	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2021-22					
Course Information					
Programme	B.Tech. (Electronics Engineering)				
Class, Semester	Third Year B. Tech., Sem V				
Course Code					
Course Name	Professional Elective 1-Biomedical Instrumentation				
Desired Requisites:	Electronics Measurement and Instrumentation				

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	1 Hrs/week	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To explain the basics body cell structure and different types of transducers
2	To explain the different types of patient monitoring system
3	Understand the design concept of different Medical instruments
4	To demonstrate different medical instruments

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Understand CNS-PNS and Cardio pulmonary system	Understand
CO2	Apply proper sensors for sensing biomedical signals to biomedical instrumentation setup	Apply
CO3	Design ECG,EEG and EMG amplifier	Create
CO4	Explain block diagram of patient monitoring systems, X-ray machine, CT scan and Ultrasonography machine.	Understand

Module	**Module Contents**	**Hours**
I	**Fundamentals of Medical Instrumentation** Physiological Systems of the body, Sources of Biomedical signals, Basic Medical Instrumentation system, Micro-Electro-Mechanical System (Mems), Wireless Connectivity in Medical Instruments, General Constraints in design of Medical Instrumentation Systems	5
II	**The Origin of Bio potentials, Bio potential Electrodes & Biosensors** Electrical activity of Excitable Cells, Functional Organization of the Peripheral NervousSystem,Electrocardiogram(ECG),Electromogram(EMG), Electroencephalogram(EEG), Electroretinogram(ERG) and their recording system, Biomedical signal Analysis and Processing Techniques.	3
III	**Patient Monitoring Systems** System Concepts, Cardiac Monitor, Bedside patient Monitoring Systems, Central Monitors, Measurement of Heart rate, Measurement of Temperature, Measurement of respiration Rate, Biomedical Telemetry Systems	5
IV	**Modern Imaging Systems** X-ray machines And Digital Radiography, X-ray Computed Tomography, Nuclear Medical Imaging Systems, Magnetic Resonance Imaging Systems, Ultrasonic Imaging Systems and Thermal Imaging Systems.	5

V	**Assisting and Therapeutic Equipment's** Cardiac Pacemakers, Defibrillators, Diathermy, Hemodialysis Machines, Ventilators	4
VI	**Laser Application in Biomedical Field** The Laser, Types of Lasers, Laser Application, Laser Safety	4

Text Books	
1	"Medical Instrumentation", John. G. Webster , John Wiley, 2009
2	"Principles of Applied Biomedical Instrumentation", Goddes& Baker, John Wiley, 2008
3	"Biomedical Instrumentation & Measurement", Carr & Brown, Pearson, 2004
4	

References	
1	Hand book of Medical instruments by R.S. Khandpur –TMH, New Delhi, 1987.
2	Medical Electronics and Instrumentation by Sanjay Guha – University Publication, 200.
3	Introduction to Biomedical electronics by Edwand J. Bukstein –sane and Co. Inc, 1973

Useful Links	
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CO PO Mapping

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

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3,4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	10		20	**30**
Apply	10	10	20	**40**
Analyze				
Evaluate				
Create		10	20	**30**
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem. V
Course Code	
Course Name	Professional Elective 1-Microelectronics
Desired Requisites:	-

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	1 Hr/week	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To ***provide*** students with a sound understanding of existing semiconductor devices to give meaning to their studies of electronic circuits and systems.
2	To ***explain*** carrier transport phenomena in solids on the basis of energy band theory and Boltzmann transport equation which forms the basis of electrical characteristics of semiconductor devices.
3	To ***develop*** capability in students to learn on their own about the new researched devices as they keep emerging in the market in future and lay the foundation for of their a constant career updating and self education.
4	To ***prepare*** the students for GATE in order to motivate them for higher studies.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	**Explain** the formation of bandgaps in solids, formation of depletion-diffusion layer capacitance in p-n junction diodes and characteristics of illuminated p-n junction, incoherent (LEDs) and coherent light sources (Lasers)	Understand
CO2	**Apply** continuity equation and Poisson's equation to derive time dependence of carrier concentration on electric fields and potentials by considering band diagram of p-n junction in equilibrium.	Apply
CO3	**Model** the operation of bipolar junction transistor in three regions (cut-off, linear and saturation) using Ebers Moll coupled diode model.	Apply
CO4	**Analyze** BJT band diagram and explain current gain, base transport factor, and emitter injection efficiency.	Analyze
CO5	**Interpret** C-V characteristics of MOS capacitor and I-V characteristics of JFET, MOSFET with relevance to their ethical parameters like pinch off voltage, threshold voltage etc.	Evaluate

Module	**Module Contents**	**Hours**
I	**Energy Bands and Charge Carriers in Semiconductors** Bonding forces and energy bands in solids, Charge carriers in semiconductors, Carrier concentration, drift of carriers in electric and magnetic fields, invariance of Fermi level at equilibrium.	3
II	**Excess Carriers in Semiconductors** Diffusion of carriers, Diffusion current, Drift current, Mobility of carriers, Recombination, Continuity equation, Quasi Fermi levels, Gradients in Quasi Fermi levels, resistivity of materials.	4

III	**Junctions** Formation of p-n junctions, Equilibrium conditions, Steady state conditions, Transient and AC conditions, deviations from simple theory, Metal-Semiconductor Junctions.	6
IV	**Field Effect Transistors** JFET (characteristics), MOS capacitor (threshold voltage, C-V characteristics), MOSFET: I-V characteristics, Equivalent circuits for the MOSFET.	5
V	**Bipolar Junction Transistors** Minority carrier distributions and terminal currents, Generalized Biasing: The Coupled-Diode Model, Charge control analysis; switching, drift in base region, base narrowing, avalanche breakdown, thermal effects, Kirk effect.	5
VI	**Optoelectronic Devices** Photodiodes: I-V characteristics in an illuminated junction, Solar Cells, Photodetectors; LEDs, Semiconductor Lasers.	3

Text Books	
1	B.G. Streetman, S. K. Banerjee, " Solid State Electronic Devices ", 7th edition, Pearson India Education Service Pvt. Ltd., 2017.
2	
References	
1	S. M. Sze, "Physics of Semiconductor Devices", 2nd Edition, PHI, 2005.
2	Donald. A. Neamen, "Semiconductor Physics and Devices: Basic Principles", 3rd Edition, McGraw Hill Higher Education, 2003.
Useful Links	
1	https://nptel.ac.in/courses/108/107/108107142/
2	https://www.youtube.com/playlist?list=PLF178600D851B098F
3	https://www.youtube.com/playlist?list=PLgMDNELGJ1CaNcuuQv9xN07ZWkXE-wCGP

CO- PO Mapping

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

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	T1	T2	ESE	Total
Remember				
Understand	**10**	**5**	**10**	**25**
Apply	**10**	**15**	**20**	**45**
Analyze			**15**	**15**
Evaluate			**15**	**15**
Create				
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Professional Elective 1 -Linear Algebra
Desired Requisites:	Applied Mathematics I & II

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	1 Hr/week	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives	
1	To provide the students understanding of Linear transformations, Matrix algebra, Vector space, Inner product of vector space..
2	To prepare students to solve systems of linear equations and counting problems,
3	To illustrate applications of Linear Algebra in Electrical networks, Control systems and computer graphics.
4	

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	**Describe** vector and matrix algebra rules, vector space, inner product space, Eigen values and Eigen vectors.	Understand
CO2	**Solve** systems of linear equations, inner product space problems, problems of Eigen values and Eigen vectors.	Apply
CO3	**Examine** linear algebra techniques to electrical and electronics circuits and data smoothing, Linear Transformations to Computer Graphics.	Apply
CO4		

Module	**Module Contents**	**Hours**
I	**Systems of Linear Equations** Vectors and Linear combinations, Solving systems of linear equations, Echelon and reduced echelon form, Matrices, Elimination using matrices, rules for matrix operations, the inverse of a matrix, characterization of invertible matrix, partitioned matrix, matrix factorization	5
II	**Vector Spaces** Vector spaces and subspaces, null space, Column and row spaces, Dual space, transformations, linearly independent sets, bases and dimension, coordinate systems, applications to Electrical circuits and data smoothing	5
III	**Inner product of Vector Spaces** Length and dot product in R^n, Inner product Spaces Orthonormal Bases: Gram-Schmidt Process, Mathematical models and Least squares analysis, Applications of Inner product spaces	4
IV	**Linear Transformations** The Idea of a Linear Transformation, The Matrix of a Linear Transformation, Diagonalization and the Pseudo-inverse	4
V	**Eigen values and Eigen vectors** Eigen values and eigen vectors, characteristic equations, linear transformations, digonilzations, Applications to differential equations, complex Eigen values, orthgonality	4

VI	**Applications** Matrices in engineering, ,single value decomposition, Computer Graphics, Least squares approximation.	4

Text Books	
1	Introduction to Linear Algebra: 5th edition, Gilbert Strang, Wellesley-Cambridge Press, 2016
2	Introduction to Linear Algebra with Applications: Jim Defranza and Daniel Gagliardi McGraw Hill Education (India) Edition 2012
3	Introduction to Applied Linear Algebra: Stephen Boyd and Lieven Vandenberghe, Cambridge University Press, 2018
4	

References	
1	Linear Algebra Theory and Applications: Ward Cheney and David Kincaid, Jones and Bartlett publishers, Indian Edition 2010
2	Linear Algebra and its Applications: David C. Lay, Steven R. Lay and Judi J. McDonald, Pearson, 5 edition, 2015
3	

Useful Links	
1	
2	
3	
4	

CO PO Mapping

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

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	10	10	30	50
Apply	10	10	30	50
Analyze				
Evaluate				
Create				
Total	**20**	**20**	**60**	100

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Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Professional Elective 2- Information Theory and Coding
Desired Requisites:	Probability Theory , Digital Communication

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives	
1	To illustrate the concepts of error control coding, encoding and decoding of digital data streams.
2	Be familiar with the methods for the generation of these codes and their decoding techniques.
3	Understand the compression and decompression techniques
4	

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Derive equations for entropy, mutual information and channel capacity for channels	Understand
CO2	Illustrate various methods of generating and detecting different types of error correcting codes	Analyze
CO3	Use compression and decompression techniques	Apply
CO4	Explain audio video image data coding techniques	Analyze

Module	**Module Contents**	**Hours**
I	**Information Theory:** Entropy, Information rate, classification of codes, Kraft McMillan inequality, Source coding theorem, Shannon-Fano coding, Huffman coding, Extended Huffman coding - Joint and conditional entropies, Mutual information - Discrete memoryless channels – BSC, BEC – Channel capacity, Shannon limit.	5
II	**Error Control Coding: Block Codes:** Definitions and Principles: Hamming weight, Hamming distance, Minimum distance decoding - Single parity codes, Hamming codes, Repetition codes - Linear block codes, Cyclic codes - Syndrome calculation, Encoder and decoder - CRC	5
III	**Error control coding: convolutional codes:** Connection representation, State representation, Tree Diagram, Trellis Diagram, Convolutional decoding – Maximum likelihood decoding, Algorithms such as Viterbi, Sequential, Feedback, Viterbi decoder implementation, Distance properties, Minimum free distance, Error Correction capacity, Systematic and Nonsystematic codes	4
IV	**Source Coding Image, Text and Audio** Audio: Perceptual coding, Masking techniques, Psychoacoustic model, MEG Audio layers I,II,III, Dolby AC3 - Speech: Channel Vocoder, Linear Predictive Coding	4
V	**Compression techniques I** : Principles – Text compression – Static Huffman Coding – Dynamic Huffman coding – Arithmetic coding – Image Compression – Graphics Interchange format – Tagged Image File Format – Digitized documents – Introduction to JPEG standards.	4

VI	**Compression Techniques -II** Video Compression: Principles-I,B,P frames, Motion estimation, Motion compensation, H.261, MPEG standard	4

Text Books	
1	R Bose, "Information Theory, Coding and Cryptography", TMH 2007
2	Fred Halsall, "Multimdedia Communications: Applications, Networks, Protocols and Standards", Perason Education Asia, 2002
3	
4	

References	
1	K Sayood, "Introduction to Data Compression" 3/e, Elsevier 2006
2	S Gravano, "Introduction to Error Control Codes", Oxford University Press 2007
3	Amitabha Bhattacharya, "Digital Communication", TMH 2006
4	

Useful Links	
1	
2	
3	
4	

CO-PO Mapping

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

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	T1	T2	ESE	Total
Remember				
Understand	10	10	20	**40**
Apply	10		30	**40**
Analyze		10	10	**20**
Evaluate				
Create				
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Professional Elective 2- Object Oriented Programming
Desired Requisites:	C Programming

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives	
1	To introduce the students the concepts of object oriented programming
2	To explain and illustrate the fundamental concepts of classes, objects, facilities in OOP etc.
3	To explain and illustrate the concepts of operator overloading, pointers etc.
4	To explain and illustrate the concepts of inheritance and polymorphism etc.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Apply the understanding (of OOP) to identify how the problem can be solved using OOP approach (for a given situation).	Apply
CO2	Apply the knowledge of OOP to illustrate the functioning of OOP facilities through related programs.	Apply
CO3	Analyze the given OOP program and identify the functionality.	Analyze
CO4	Evaluate a OOP based library for electronic peripherals	Evaluate

Module	**Module Contents**	**Hours**
I	**OOP Programming Fundamentals** Need of Object oriented programming, Differences between procedural and OOP approach, input output, directives, data types, type conversion, library and header files, Revision of C type constructs in CPP	4
II	**Objects and Classes** Need of class, real life examples of class, class and objects, class and data types, access specifiers, objects as function arguments, constructor, destructor, default constructor, copy constructor, scope resolution, UML diagram of class	5
III	**Operator Overloading** Need of Operator overloading, Overloading unary operators, Overloading binary operators, data conversion between objects and basic types, Pitfalls of operator overloading and conversion	4
IV	**Inheritance and Polymorphism** Base class and derived class, derived class constructor, overriding member functions, abstract base class, class hierarchy, public and private inheritance, avoiding ambiguity of multiple inheritance, polymorphism	4
V	**Pointers and Virtual Functions** Address and pointers, Pointers and arrays, pointers and functions, strings, memory management using new and delete, applications of pointers, Virtual functions, friend functions, static functions, this pointer,	4
VI	**Using OOP for embedded electronic systems** Using OOP for Arduino library. Need of OOP for electronic systems, Developing a library for electronic peripherals.	5

Text Books

1	Robert Lafore, "*Object Oriented Programming in C++*", SAMS publishing, Fourth Edition, ISBN: 0-672-32308-7. (If needed the relevant language book will be referred)
2	Arduino Library related Internet resources
3	
4	

References	
1	Bjorne Stroustrup, "*The C++ programming language*", 4th Edition, Addison-Wesley Professional, ISBN: 978-0321563842
2	Web tutorials C++ and Object Oriented Programming
3	NPTEL lectures, Object-Oriented Programming by IITBx (free audit course)
4	Arduino Library related Internet resources

Useful Links	
1	https://www.learncpp.com/
2	https://en.wikipedia.org/wiki/Object-oriented_programming
3	https://www.visual-paradigm.com/guide/uml-unified-modeling-language/what-is-class-diagram/
4	https://www.toptal.com/c/the-ultimate-list-of-resources-to-learn-c-and-c-plus-plus

CO-PO Mapping

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

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.

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course

Bloom's Taxonomy Level		T1	T2	ESE	Total
1	Remember				
2	Understand				
3	Apply	10		10	20
4	Analyze	10	10	30	50
5	Evaluate		10	20	30
6	Create				
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Professional Elective 2 Lab-Computer Organization and Architecture
Desired Requisites:	Digital Electronics, Microcontroller peripheral and Interfacing

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	T1	T2	ESE	Total
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	Credits: 1			

Course Objectives	
1	To explain the designs of building blocks of digital system viz. data path design, control unit design, memory units to finally design the microprocessor.
2	To unfold the architectures of DACs and ADCs using various approaches motivating students to compare their performance.
3	To assign medium complexity digital system design related problems in batches as a self-study exercise.
4	To illustrate HDL implementation of digital designs in FPGA.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Apply FSM approach to develop sequential digital circuits, and floating point and fixed point arithmetic to develop architectures of floating/fixed point data-path blocks.	Apply
CO2	Analyze digital circuits and their architectures for functionality, and memory units for timing performance using timing diagrams.	Analyze
CO3	Analyze the bus arbitration, coprocessor, system map	Analyze
CO4	Develop architectures of digital blocks (Data-path, Control units) with knowledge of functionality extending further to 4-bit/8-bit microprocessor with defined set of instructions.	Create

Module	**Module Contents**	**Hours**
I	CPU Architecture: Instruction format, control signals in CPU, micro program control unit and hardwired control unit, ALU & sequencer, look ahead carry generator, MIPS ISA	5
II	Arithmetic: Integer Arithmetic-multiplication, Booth"s Algorithm, division algorithm; Floating point number representation, and floating point arithmetic	5
III	Memory: Dynamic RAM organization, CACHE memory & it"s mapping, cache coherence & MESI protocol, virtual memory, secondary storage, MBR and GPT hard disks, RAID, File system FAT	4

IV	System and memory map: Closely coupled and loosely coupled multiprocessor systems, bus arbitration, co-processor, lower 1MB memory map	5
V	Instruction Pipelining: Basic concepts and issues, Introduction to the basic features & architecture of RISC & CISC processors, super scalar processor, MIPS pipeline	3
VI	Multiprocessor: Introduction to Multicores, Multiprocessors and Clusters. Introduction to GPGPU	4

Text Books	
1	Hayes, “Computer Architecture and Organization”, McGraw Hill, 3rd Edition, 2012
2	William Stallings, Computer Organization and Architecture, Prentice Hall
3	John Wakerley, “Digital Design , Principles and Practices”, PHI, 2005
4	D. Paterson, J. Hennesy, “Computer Organization and Design: The Hardware Software Interface”, 5th Edition

References	
1	Frank Vahid “Digital Electronics” Wiley Publication. 2012
2	Enoch O. Hwang, “Digital Logic and Microprocessoor Design with VHDL”, Thomson Publication, 2007 Reprint
3	
4	

Useful Links	
1	www.xilinx.com,
2	www.altera.com
3	
4	

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

Assessment (for Theory Course)
The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom’s Taxonomy Level (Marks) For Theory Course					
Bloom’s Taxonomy Level		**T1**	**T2**	**ESE**	**Total**
1	Remember				
2	Understand				
3	Apply				
4	Analyze	10	10	15	35
5	Evaluate	5	5	25	35
6	Create	5	5	20	30
Total		**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Professional Elective 2 Lab-Information Theory and Coding Lab
Desired Requisites:	Digital Communication, Probability and Statistics

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

Course Objectives	
1	To learn the principles and applications of information theory in communication systems
2	To Understand the current state of the art for both data compression and channel coding

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Apply different source and error control coding techniques to improve performance of digital communication system in presence of noise.	Apply
CO2	Design various coding schemes for text, speech and audio.	Create

List of Experiments / Lab Activities

List of Experiments:

1. To find information and entropy of a given source.
2. Determination of various entropies and mutual information of the Binary Symmetric Channel.
3. Implementation of Shannon fanno source coding algorithm
4. Implementation of Huffmann source coding algorithm
5. Coding and decoding of Linear block codes
6. Coding and decoding Convolutional codes
7. Case study example : Application of algorithm on text, speech and audio

Text Books	
1	B. P. Lathi and Jeff Kennedy, "*Modern Digital and Analog Communication Systems*", Third edition, Oxford University Press, 1998, ISBN: 12345678
2	Straus, Joseph Nathan, "*Elements of Communication*", Third edition, Prentice Hall, 2011, ISBN: 12345678
3	
4	

References	
1	B. P. Lathi and Jeff Kennedy, "*Modern Digital and Analog Communication Systems*", Third edition, Oxford University press, 1998, ISBN: 12345678
2	
3	
4	

Useful Links	
1	
2	
3	

4	

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

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)

Bloom's Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember				
Understand				
Apply	30	30	20	**80**
Analyze				
Evaluate				
Create			20	20
Total	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli

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Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	
Course Name	Professional Elective 2 Lab - Object Oriented Programming Lab
Desired Requisites:	C Programming

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

Course Objectives	
1	To explain and illustrate practically the fundamentals of OOP, Classes and facilities in OOP.
2	To explain and illustrate practical aspects of programming, debugging and testing
3	To illustrate/explain the UML diagrams for OOP program architecture.
4	To provide experiential learning for solving practical problems using OOP.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Demonstrate use of at least one IDE for OOP program development and awareness of various other IDEs. Demonstrate use of helper utilities.	Apply
CO2	Analyze (Debug) programs to illustrate the functioning of OOP facilities and demonstrate the working of programs.	Analyze
CO3	Evaluate give program to identify the structure and functionality	Evaluate
CO4	Implement a mini-project based on given problem for developing OOP based library for electronic hardware	Create

List of Experiments / Lab Activities

List of Experiments:

1. Revision of Procedural language-1 (based on language constructs, operators, argument passing and returning)
2. Revision of Procedural language-2 (based on Header files, Library, Array, string etc. facilities)
3. Example OOP based programs. Program/s based on class, objects, member access specifiers etc.
4. Programs based on Constructor, Destructor, UML diagram components.
5. Program for illustration of operator overloading, operators
6. Program for operator overloading and data conversion, UML diagram for simple applications.
7. Program for base and derived classes, overriding member functions.
8. Program for public and private inheritance, addressing ambiguity of multiple inheritance.
9. Programming related pointer, arrays, new and delete operators.
10. Programs for pointer to objects, Linked list or related programs, Pointer to pointer.
11. Program for implementing Virtual functions, friend functions, static functions, this pointer.
12. Program to implement file I/O, multi-file programs, Templates, UML for OOP based software architecture.
13. A mini project that uses all facilities in OOP. The problem statement is preferred to be relevant to industry needs.

Text Books	
1	Robert Lafore, "*Object Oriented Programming in C++*", SAMS Publishing, Fourth Edition, ISBN: 0-672-32308-7 (If needed the relevant language book will be referred)
2	Arduino Library development related Internet resources
3	
4	

References	
1	Bjorne Stroustrup, "*The C++ programming language*", 4th Edition, Addison-Wesley Professional, ISBN: 978-0321563842
2	Web tutorials C++ and Object Oriented Programming
3	NPTEL lectures, Object-Oriented Programming by IITBx (free audit course)
4	Arduino Library development related Internet resources

Useful Links	
1	https://www.learncpp.com/
2	https://en.wikipedia.org/wiki/Object-oriented_programming
3	https://www.visual-paradigm.com/guide/uml-unified-modeling-language/what-is-class-diagram/
4	https://www.toptal.com/c/the-ultimate-list-of-resources-to-learn-c-and-c-plus-plus

CO-PO Mapping

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

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.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)

Bloom's Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember				
Understand				
Apply	20			**10**
Analyze	10	10		**20**
Evaluate		20	20	**40**
Create			20	**20**
Total Marks	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2021-22					
Course Information					
Programme	B.Tech. (Electronics Engineering)				
Class, Semester	Third Year B. Tech., Sem V				
Course Code					
Course Name	Professional Elective 2 Lab - Computer Organization and Architecture Lab				
Desired Requisites:	Digital Electronics, Microcontroller peripheral and Interfacing				

Teaching Scheme (Hrs)		Examination Scheme (Marks)			
Lecture	-	LA1	LA2	ESE	Total
Tutorial	-	30	30	40	100
Practical	2 Hrs/week				
Interaction	-	Credits: 1			

Course Objectives	
1	To know the HDL language for Digital Design
2	To understand the difference in HDL and other high level programming language
3	To understand the concept in simulation and synthesis

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Develop error free HDL code for the components of the system and then for the main design entity by integrating the tested components.	Apply
CO2	Demonstrate the complete flow of Xilinx tools from HDL design entry to functional simulation, synthesis, and implementation with final download in chosen FPGA device.	Analyze
CO3	Justify the superiority of structural architecture over Datapath architecture and behavioral architecture with few examples	Evaluate

	List of Experiments / Lab Activities	
	1. HDL (Verilog) introduction 2. Basic digital logic base programming with HDL 3. 8-bit Addition, Multiplication, Division 4. 8-bit Register design 5. Memory unit design and perform memory operatons. 6. 8-bit simple ALU design 7. 8-bit simple CPU design 8. Interfacing of CPU and Memory	

Text Books	
1	Hayes, "Computer Architecture and Organization", McGraw Hill, 3rd Edition, 2012
2	FPGA Based Digital Design: Wayne Wolf, Pentice Hall, 2012
3	John Wakerley, "Digital Design , Principles and Practices", PHI, 2005
4	
References	
1	Frank Vahid "Digital Electronics" Wiley Publication. 2012
2	Enoch O. Hwang, "Digital Logic and Microprocessoor Design with VHDL", Thomson Publication, 2007 Reprint
3	
Useful Links	
1	www.xilinx.com,
2	www.altera.com
3	

CO-PO Mapping

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

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)

Bloom's Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember				
Understand				
Apply	10	5	10	25
Analyze	10	10	15	35
Evaluate	10	15	15	40
Create				
Total Marks	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli

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AY 2021-22

Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem. VI
Course Code	
Course Name	Electromagnetic Engineering
Desired Requisites:	Basic Electrical Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	1 Hr/week	20	20	60	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To **understand** the electric fields, electric energy and potential.
2	To **understand** the magnetic flux and forces, energy stored in magnetic field.
3	To **develop** in-depth understanding of time-varying fields and electromagnetic waves.
4	To **study** the electromagnetic wave transmission methods like transmission lines, antennas and waveguides.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	**Explain** the principles of static and time-varying electric and magnetic fields.	Understand
CO2	**Compare** the behaviour of electromagnetic waves in free space and guided medium like two-wire transmission line.	Understand
CO3	**Solve** the problems on static and time-varying electromagnetic fields.	Apply
CO4	**Analyze** the effects of electromagnetic radiation and electromagnetic interference.	Analyze

Module	Module Contents	Hours
I	**Electrostatics** Review of vector analysis and coordinate systems. Coulomb's Law, electric field intensity, field due to line charge, sheet charge; electric flux density, Gauss's Law and it's applications, divergence theorem; energy and potential, potential gradient, electric dipole; energy density in electrostatic field	5
II	**Conductors, Dielectrics and Capacitance** Current and current density, continuity of current, conductor properties and boundary conditions; boundary conditions for perfect dielectric materials, Poisson's and Laplace's equations; Capacitance.	3
III	**Steady Magnetic Field** Magnetic field intensity, Biot-Savart Law, Ampere's circuital Law, Stokes' theorem, magnetic flux and magnetic flux density; scalar and vector magnetic potential; Force on a moving charge, force between differential current elements, properties of magnetic materials, energy stored in magnetic field, forces on magnetic materials, inductance, magnetic boundary conditions.	5
IV	**Time Varying Fields and Maxwell's Equations** Faraday's Law, displacement current, Maxwell's equations in point (differential) form and integral form, time varying potentials, time-harmonic fields	3
V	**Uniform Plane Electromagnetic Waves** Wave propagation in free space and dielectrics, Power flow in uniform plane wave, Poynting's theorem, wave propagation in conductors: skin depth, reflection of plane waves, standing wave ratio, polarization of uniform plane waves.	5

VI	**Transmission Lines** Types of two-conductor transmission lines, equivalent circuit, transmission line parameters, transmission line equations, lossless propagation, wave reflection, standing waves and voltage standing wave ratio, reflection coefficient, Smith Chart.	5

Text Books	
1	William H. Hayt and John A. Buck, "Engineering Electromagnetics", 7th Edition, Tata McGraw-Hill, 2007.
2	Matthew N. O. Sadiku, "Elements of Electromagnetics", 3rd Edition, Oxford University Press, 2007.
3	S. C. Mahapatra and Sudipta Mahapatra, "Principles of Electromagnetics", Tata McGraw-Hill, 2011.
4	

References	
1	E. C. Jordan & K. Balman, "Electromagnetic Waves and Radiating Systems", 2nd Edition, PHI, 2007.
2	David K. Cheng, "Field and Wave Electromagnetics", Pearson Education, 2015.
3	
4	

Useful Links	
1	https://nptel.ac.in/courses/108/106/108106073/
2	https://nptel.ac.in/courses/108/104/108104087/
3	
4	

CO-PO Mapping

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

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	T1	T2	ESE	Total
Remember				
Understand	**10**		**15**	**25**
Apply	**10**	**15**	**25**	**50**
Analyze		**5**	**20**	**25**
Evaluate				
Create				
Total	**20**	**20**	**60**	**100**

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AY 2021-22

Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	
Course Name	FPGA Based System Design
Desired Requisites:	Digital Design , Microcontroller

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	T1	T2	ESE	Total
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives	
1	To expose the students to the various FPGA fabrics in terms of FPGA architectures,
2	To explain how combinational logic is modeled using hardware description language.
3	To illustrate with example combinational network delays.
4	To illustrate the difference between behavioral simulation, post-synthesis simulation and post-implementation simulation.
5	To demonstrate sequential machine design process using register transfer models and finite state machine,
6	To explain the design of a microprocessor using memory unit, control unit and data path blocks.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Compare various types of FPGA architectures with justification	Apply
CO2	Model combinational and sequential components by developing synthesizable and optimized (for delay) HDL code.	Apply
CO3	Analyze the given HDL code to generate synthesized RTL	Analyze
CO4	Design a sequential block using state table and register transfer model for the implementation in FPGA.	Evaluate
CO5	Design a n-bit processor by developing its instruction set and various hardware blocks viz. I/O unit, ALU, memory and control unit .	Evaluate

Module	**Module Contents**	**Hours**
I	FPGA Architectures, SRAM based FPGAs, Permanently programmed FPGAs (Anti-fuse type), Chip I/O,FPGA fabric, Interconnect architectures,	4
II	Modelling combinational logic with HDL, combinational network delays, Gate and wire delays, Fanout, path delay, power optimization	4
III	Sequential Machines, Sequential Machine Design process, Sequential Machine Design Styles, Rules for clocking, Clock skew	5
IV	Fast arithmetic logic blocks (Adders, Multipliers, ALUs), Data path controller architecture, Scheduling and Allocation, Pipelining,	4
V	Memory units, ROM, SRAM, DRAM, Virtual Memory,Cache memories, Paging, Memory organization	5
VI	Design of a n-bit processor by developing its instruction set and integrating memory units, ALU, control unit .	4

Text Books	
1	FPGA Based Digital Design : Wayne Wolf, Pentice Hall, 2012
2	Hayes, "Computer Architecture and Organization", McGraw Hill, 3rd Edition, 2012
3	

4	

References	
1	Digital System Design using VHDL, Charles H. Roth, PWS Publishing, a branch of Thomson Learning
2	FPGA product catalog from Xilinx and Altera,
3	
4	

Useful Links	
1	www.nptel.ac.in/courses/117/108/117108040
2	www.xilinx.com/products/devices/fpga.html
3	
4	

CO-PO Mapping

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

Assessment (for Theory Course)

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course

Bloom's Taxonomy Level		T1	T2	ESE	Total
1	Remember				
2	Understand				
3	Apply	5	5	10	20
4	Analyze	10	5	20	35
5	Evaluate	5	10	30	45
6	Create				
Total		**20**	**20**	**60**	**100**

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Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	
Course Name	FPGA Based System Design Lab
Desired Requisites:	Digital Design

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

Course Objectives

1	Demonstrate the flow of Xilinx EDA tools for designing and simulating FPGA based digital systems by modelling the components in HDL.
2	Explain the terms functional simulation, timing simulation, synthesis, translate and technology mapping,
3	Demonstrate how to write and use constraint files.
4	Demonstrate how to download the bit streams of the designs in FPGAs and test by inputting the data and observing the outputs.
5	Prepare the students for good documentation discipline.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Develop error free HDL code for the components of the system and then for the main design entity by integrating the tested components	Apply
CO2	Demonstrate the complete flow of Xilinx tools from HDL design entry to functional simulation, synthesis, and implementation with final download in chosen FPGA device..	Understand
CO3	Justify the superiority of structural architecture over Datapath architecture and behavioral architecture with few examples	Evaluate
CO4	Apply the user constraints for speed, power, group of ports etc by defining user constraint files.	Apply
CO5	Design systems by developing the codes as well as calling the available IP cores from Xilinx sites and evaluate those	Apply
CO6	Exhibit following technical and professional skills. i. Hands on skills of using modern EDA tools ii. Communication Skills iii. Collaborative work spirit iv. Research Skills v. Lifelong learning attitude vi. Ethical behavior	Related with psychomotor and affective domain and assessed thr' rubric on a scale of 1 to 5

List of Experiments / Lab Activities

1. Study of FPGA based development board

2. Writing code for 8-bit/16bit adder using different style of modelling and simulating on simulator

3. Writing code for mux / demux based adder/subtrator and simulating on simulator

3. Writing code for LED blinking and demonstrating on kit

4. Writing code for interfacing LED display to FPGA

5. Writing code for interfacing LCD display to FPGA

6. Writing code for interfacing thumb wheel to FPGA

7. Writing code for interfacing temperature sensor to FPGA.

8. Writing code for interfacing IR sensor to FPGA

9. Writing code for interfacing temperature sensor to FPGA

Text Books	
1	FPGA Based Digital Design: Wayne Wolf, Pentice Hall, 2012
2	
3	
4	

References	
1	Digital System Design using VHDL, Charles H. Roth, PWS Publishing, a branch of Thomson Learning, 2008
2	FPGA product catalog from Xilinx and Altera,
3	
4	

Useful Links	
1	www.nptel.ac.in/courses/106/105/106105165
2	www.xilinx.com/products/silicon-devices/fpga.html
3	
4	

CO-PO Mapping

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

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.

Assessment Plan based on Bloom's Taxonomy Level (Marks) (For lab Courses)				
Bloom's Taxonomy Level	**LA1**	**LA2**	**Lab ESE**	**Total**
Remember				
Understand	15	15	5	**35**
Apply	15	15	10	**40**
Analyze			10	**10**
Evaluate			15	**15**
Create				
Total Marks	**30**	**30**	**40**	**100**

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Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	
Course Name	Mini Project 3
Desired Requisites:	Digital Signal Processing, Embedded System Design

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

Course Objectives

1	To provide students hands on experience on, troubleshooting, maintenance, fabrication, innovation, record keeping, documentation etc thereby enhancing the skill and competency part of technical education
2	To create an Industrial environment and culture within the institution
3	To inculcate innovative thinking and practice based learning and thereby preparing students for their final year project
4	To set up self-maintenance cell within departments to ensure optimal usage of infrastructure facilities.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Choose, Initiate and manage a minor project.	Understand
CO2	Propose research problem and present it in a clear and distinct manner through different oral, written and design techniques.	Apply
CO3	Construct the circuit using hardware and/or software	Create
CO4	Execute the project and comment upon the results of it	Analyze

List of Experiments / Lab Activities

Mini Project Description

A project group shall consist of normally 3 students per group. The mini project will involve the design, construction, and debugging of an electronic system approved by the department. Each student should conceive, design and develop the idea leading to a project/product. **The theme of the project should be syllabus covered in the 5th semester like Embedded System Design, Digital Signal Processing etc.**

Each student must keep a project notebook/logbook. The project notebooks will be checked periodically throughout the semester, as part of in-semester-evaluation. The student should submit a soft bound report at the end of the semester. The final product as a result of mini project should be demonstrated at the time of examination.

Text Books

1	Electronics Projects For Dummies, by by Earl Boysen and Nancy Muir, Published by Wiley Publishing, Inc., 2006
2	Make: Electronics, by Charles Platt, Published by Maker Media, 2015
3	
4	

References

1	
2	

3	
4	

Useful Links	
1	
2	
3	
4	

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

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember				
Understand	15	5		**20**
Apply	10	15	5	**30**
Analyze	5	10	15	**30**
Evaluate				
Create			20	**20**
Total	**30**	**30**	**40**	**100**

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Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	
Course Name	Mini Project 4
Desired Requisites:	ECAD I, II, Microcontroller and Peripherals, Digital Signal Processing, Embedded System Design

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

Course Objectives	
1	To provide students hands on experience on, troubleshooting, maintenance, fabrication, innovation, record keeping, documentation etc thereby enhancing the skill and competency part of technical education
2	To create an Industrial environment and culture within the institution
3	To inculcate innovative thinking and practice based learning and thereby preparing students for their final year project
4	To apply the knowledge gained to solve real life societal problems.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Choose, Initiate and manage a minor project.	Understand
CO2	Propose research problem and present it in a clear and distinct manner through different oral, written and design techniques.	Apply
CO3	Construct the circuit using hardware and/or software	Create
CO4	Execute the project and comment upon the results of it	Analyze

List of Experiments / Lab Activities

Mini Project Description

A project group shall consist of normally 3 students per group. The mini project will involve the design, construction, and debugging of an electronic system approved by the department. Each student should conceive, design and develop the idea leading to a project/product. **The theme of the project should be related to electronics engineering discipline to be decided by the students based on the societal needs after an exhaustive survey.**

Each student must keep a project notebook/logbook. The project notebooks will be checked periodically throughout the semester, as part of in-semester-evaluation. The student should submit a soft bound report at the end of the semester. The final product as a result of mini project should be demonstrated at the time of examination.

Text Books	
1	
2	
3	
4	

References	
1	
2	

3	
4	

Useful Links	
1	
2	
3	
4	

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

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember				
Understand	15	5		**20**
Apply	10	15	5	**30**
Analyze	5	10	15	**30**
Evaluate				
Create			20	**20**
Total	**30**	**30**	**40**	**100**

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Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	
Course Name	Professional Elective 3-Introduction to Machine Learning
Desired Requisites:	Probability & Statistics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	Familiarize some basic learning algorithms and techniques and their applications.
2	Analysing and handling large data sets.
3	
4	

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Understand computing and mathematics to machine learning problems, models and algorithms	Understand
CO2	Analyse a problem and identify the computing requirements appropriate for its solution	Analyze
CO3	Design, implement, and evaluate an algorithm to meet desired needs	Apply

Module	**Module Contents**	**Hours**
I	**Machine Learning** Introduction, Supervised Learning, Learning a Class from Examples, Learning Multiple Classes, Regression, Dimensions of a Supervised Machine Learning Algorithm	4
II	**Parametric, Multivariate and Nonparametric Methods** Maximum Likelihood Estimation, Evaluating an Estimator: Bias and Variance, The Bayes' Estimator, Parametric Classification, Multivariate Data, Multivariate Normal Distribution.	4
III	**Dimensionality Reduction, Clustering and Decision Trees** Principal Components Analysis, Factor Analysis, Linear Discriminant Analysis, Mixture Densities, k-Means Clustering, Expectation-Maximization Algorithm.	5
IV	**Linear Discrimination and Multilayer Perceptrons** Generalizing the Linear Model, Geometry of the Linear Discriminant, Parametric Discrimination Revisited, Gradient Descent, Logistic Discrimination, Discrimination by Regression, The Perceptron, Training a Perceptron, Learning Boolean Functions,	4
V	**Kernel Machines and Bayesian Estimation** Optimal Separating Hyperplane, The Nonseparable Case: Soft Margin Hyperplane, ν-SVM, Kernel Trick, Vectorial Kernels, Multiple Kernel Learning, Multiclass Kernel Machines, Kernel Machines for Regression, Estimating the Parameter of a Distribution,	4

VI	**Hidden Markov Models and Graphical Models** Discrete Markov Processes, Hidden Markov Models, Three Basic Problems of HMMs, Evaluation Problem, Finding the State Sequence, Learning Model Parameters.	5

Text Books	
1	Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997.
2	Introduction to machine learning by Ethem Alpaydin., 2nd edition, The MIT Press, 2004

References	
1	Introduction to Machine Learning by Alex Smola and S.V.N. Vishwanathan, Cambridge University Press 2008.
2	Pattern Recognition and Machine Learning by Christopher Bishop, Springer, 2006.
3	
4	

CO-PO Mapping

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

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level (Marks) For Theory Course

Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	10	5	20	35
Apply	10	10	30	50
Analyze		5	10	15
Evaluate				
Create				
Total	**20**	**20**	**60**	100

Walchand College of Engineering, Sangli

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AY 2021-22

Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	
Course Name	**Professional Elective 3 : Optical Communication**
Desired Requisites:	Communication Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives	
1	To understand the different kind of losses, signal distortion in optical wave guides and other signal Degradation factors. Design optimization of SM fibers, RI profile and cut-off wave length.
2	To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes and different fiber amplifiers.
3	To learn the fiber optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration.
4	To learn fiber slicing and connectors, noise effects on system performance, operational principles WDM and solutions

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Relate light waves into small optical components with high precision	Remember
CO2	Determine the attenuation and signal degradation due to intermodal and intramodal distortion	Evaluate
CO3	Determine power coupling losses due to connectors, splices, source output pattern and fiber numerical aperture	Evaluate
CO4	Identify the modes in step index fiber and graded index fiber	Apply

Module	**Module Contents**	**Hours**
I	**Introduction** Introduction**,** Ray theory transmission, Total internal reflection, Acceptance angle, Numerical aperture, Skew rays, Electromagnetic mode theory of optical propagation, EM waves, modes in Planar guide, phase and group velocity, cylindrical fibers, SM fibers.	6
II	**Transmission characteristics of optical fibers:** Attenuation, Material absorption losses in silica glass fibers, Linear and Non linear Scattering losses, Fiber Bend losses, Midband and farband infra red transmission, Intra and inter Modal Dispersion, Over all Fiber Dispersion, Polarization, non linear Phenomena. Optical fiber connectors**,** Fiber alignment and Joint Losses, Fiber Splices, Fiber connectors, Expanded Beam Connectors	6

III	**Optical Sources :** Semiconductor Physics background, Light emitting diode (LEDs)- structures, materials, Figure of merits, characteristics & Modulation. Laser Diodes -Modes & threshold conditions, Diode Rate equations, resonant frequencies, structures, characteristics and figure of merits, single mode lasers, Modulation of laser diodes, Spectral width , temperature effects, and Light source linearity.	4
IV	**Optical Detectors**: PIN Photo detectors, Avalanche photo diodes, construction, characteristics and properties, Comparison of performance, Photo detector noise -Noise sources , Signal to Noise ratio , Detector response time	4
V	**Transmission Systems :** Point –to-point link –system considerations, Link power budget and rise time budget methods for design of optical link, BER calculation.	3
VI	**Optical Receiver Operation :** Receiver operation, Preamplifier types, receiver performance and sensitivity, Eye diagrams, Coherent detection, Specification of receivers	3

Text Books

1	Gerd Keiser, "Optical Fiber Communications", 4th Edition , Tata Mc Graw Hill , 2013, ISBN: 9781259006876
2	Jamro, M. Yousif, and Senior, John M.. Optical Fiber Communications: Principles and Practice. United Kingdom, Financial Times/Prentice Hall, 2009, ISBN: 9780130326812
3	
4	

References

1	Singal, T. L.. "Optical Fiber Communications: Principles and Applications", India, Cambridge University Press, 2016, ISBN: 9781316610046
2	Agrawal, Govind P.. Fiber-Optic Communication Systems. Germany, Wiley, 2012, ISBN: 9780470922828,
3	
4	

Useful Links

1	http://nptel.ac.in/
2	
3	
4	

CO-PO Mapping

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

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.

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level				
Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember	10		20	**30**
Understand				
Apply	10	10	20	**40**
Analyze				
Evaluate		10	20	**30**
Create				
Total	**20**	**20**	**60**	**100**

Walchand College of Engineering, Sangli

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AY 2021-22

Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	
Course Name	Professional Elective 3- Design and Analysis of Algorithm
Desired Requisites:	Data Structure and Algorithms

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives	
1	To provide different algorithm approaches like static, dynamic, iterative and recursive techniques.
2	To explain Comparative features of algorithms on the basis of space, time computational complexities,
3	To explain the selection criteria for identifying, formulating and applying a typical algorithm for given problem.
4	

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Interpret different algorithm approaches like static, dynamic, iterative and recursive techniques.	Apply
CO2	Compare the different algorithms on the basis of space, time computational complexities	Analyze
CO3	Identify the optimum algorithm for given problem.	Analyze
CO4		

Module	**Module Contents**	**Hours**
I	**Introduction** Static and dynamic structures, stacks, queues, dynamic memory allocation and pointers, linked stacks and queues, trees and recursion, Hashing:- Sparse-table, hash function, collision resolution with open addressing and collision resolution by chaining	4
II	**Searching and Sorting Algorithms** Sequential search, Binary search, Comparison of trees, Insertion sort, Selection sort (Heap sort), Shell sort. Computational Complexity, lower bound, & comparison of searching and sorting algorithm	4
III	**Divide and Conquer** Merge sort, quick sort (portioning), Matrix multiplication algorithm, Limitation of divide and conquer. Computational complexity of divide and conquer algorithms.	4
IV	**Dynamic Programming & Greedy Approach** Binomial Coefficients, Floyd's algorithm for shortest path, Chain matrix multiplication, optimal binary search trees and the traveling salesperson problem, Dynamic programming approach to 0-1 knapsack problem, Minimum spanning traces algorithms and their Comparison.	5

V	**Back Tracking & Branch and Bound** Back tracking techniques, the n-queens problem, Back tracking algorithm's efficiency using Monte Carlo algorithm. Graph coloring, the Hamiltomnian circuits' problem. Backtracking Algorithm for 0-1 Knapsack problem and its comparison	5
VI	**Theory of NP** The three general categories of problems. The sets P & NP. NP complete problems, NP-Hard, NP-easy, NP – Equivalent problems, NP Hard problems	4

Text Books	
1	*"Fundamentals of Computer Algorithms",* Ellis Horowitz, Sartaj Sahani, Sangutherar Rajasekaran., Galgotia Pubication Ltd, 2010
2	*"Design and Analysis of Algorithms",* I. Chandra Mohan, PHI Publication, 2012.
3	*"Analysis of Computer Algorithms",* Horowitz and Sahni, Galgotia Publishers., 2007
4	

References	
1	*"Foundation of Algorithms",* Richard E. Neapolita & Kumarss Naimipour (Northeastern Illinois University), D.C. Heath and Company, Publication, 1996.
2	*"Data Structures and Program Design in C",* Robert L. Kruse & Brunce P. Leung et. Al, PHI Publication, 1984.
3	*"Introduction to Algorithms" Coremn, Leiserson, Rivest, PHI Publication, 2012.*

CO-PO Mapping

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

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand				
Apply	10	10	40	60
Analyze	10	10	20	40
Evaluate				
Create				
Total	**20**	**20**	**60**	100

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AY 2021-22

Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	
Course Name	Professional Elective 4- Mobile Communication Engineering
Desired Requisites:	Probability Theory and statistics, Digital Communication Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	To introduce the concepts and techniques associated with Wireless Cellular Communication systems.
2	To familiarize with state of art standards used in wireless cellular systems.
3	
4	

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Apply fundamentals of cellular system design to improve performance of cellular network	Apply
CO2	Distinguish between different multiple access technology	Analyze
CO3	Study evolution of mobile communication generation standards	Analyze
CO4	Analyze the different internetworking challenges to provide solutions in wireless mobile networks.	Analyze

Module	**Module Contents**	**Hours**
I	**The Cellular Concept – System Design Fundamentals** Introduction of Cells, Channel Reuse, SIR Calculations, Traffic Handling Capacity: Erlang Performance, Cellular system design, Co channel interference ratio, Co channel interference reduction techniques and methods to improve cell coverage, Frequency management and channel assignment, concepts of cell splitting, handover in cellular system.	5
II	**Multiple Access Technologies** Frequency Division Multiple access (FDMA), Time Division Multiple access (TDMA), Code Division Multiple access (CDMA), spectral efficiency calculations, comparison of T/F/CDMA technologies based on their signal separation techniques, advantages, disadvantages and application areas.	3
III	**GSM Architecture and Interfaces** Introduction to GSM subsystems, GSM Interfaces, GSM architecture, details of following blocks in GSM (Mobile station, Base station systems, Switching subsystems, Home location registers, Visiting location registers, Equipment identity register, Echo canceller), Mapping of GSM layers onto OSI layers, GSM Logical Channels, Data Encryption in GSM, Mobility Management, Call Flows in GSM. Mobile Management: Handoff, Location and Paging, Evolution of mobile technologies 1G to 4G.	5

IV	**Overview of 5G technology** An Overview of 5G requirements, Regulations for 5G, Spectrum Analysis and Sharing for 5G, Channel modeling requirements, Basic requirements of transmission over 5G, Modulation Techniques – Orthogonal frequency division multiplexing (OFDM), generalized frequency division multiplexing (GFDM),	4
V	**Mobile Ad-hoc Network (MANET)** Introduction, properties, applications, architecture, routing in MANET, proactive and reactive routing protocols, hybrid protocol	4
VI	**Mobile Security** Introduction, security in wireless network, information security, security techniques and algorithms, Security protocols.	5

Text Books

1	T.S.Rappaport, *"Wireless Communications Principles and Practice"*, II Ed. PHI, Publications, 1995
2	Prashant Kumar Patra, Sanjit Kumar Dash, "*Mobile Computing*", 2nd Edition, Scitech, 2014
3	V.K.Garg, J.E.Wilkes, "*Principle and Application of GSM*" Pearson Education, 1999.

References

1	William C. Y. Lee, *"Mobile Communication Engineering: Theory and Applications"*,2nd Edition, McGraw Hill Publication, 1997
2	Mischa Schwartz, "*Mobile Wireless Communication*", 1st Edition, Cambridge University Press, 2009.
3	

Useful Links

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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										2	
CO3		2												
CO4			1										2	

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	T1	T2	ESE	Total
Remember				
Understand				
Apply	10	10	40	**60**
Analyze	10	10	20	**40**
Evaluate				
Create				
Total	**20**	**20**	**60**	**100**

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Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem. VI
Course Code	
Course Name	Professional Elective 4- CMOS Digital VLSI Design
Desired Requisites:	Digital Electronics, Electronic Circuits Analysis and Design, Microelectronics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives

1	***Explain*** the long and short channel MOS transistor models with emphasis on unified model.
2	***Explain*** the steps involved in manufacturing process of MOS devices.
3	***Explain*** the considerations in optimizing the physical dimensions of MOS transistors in obtaining the trade-off between area, speed and power requirements of CMOS based systems.
4	***Develop*** the logical and design skills of CMOS combinational and sequential logic circuits.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	**Explain** the basic steps with theoretical principles involved in the process of manufacturing of CMOS devices.	Understand
CO2	**Model** sub-micron, deep submicron MOS transistors and Interconnects.	Apply
CO3	**Analyze** the fundamental principles involved with MOS devices to **design** CMOS inverter to meet the area, speed and power requirements.	Analyze
CO4	**Design** static and dynamic CMOS Combinational Logic circuits and Sequential Logic Circuits by considering the performance parameters like area, speed and power.	Create

Module	**Module Contents**	**Hours**
I	**MOS Transistor Theory** MOS Transistor under Static Conditions, Dynamic Behaviour, Secondary Effects, SPICE Models for MOS Transistor, Technology Scaling.	3
II	**Manufacturing Process for CMOS ICs** Photolithography, Design Rules, Packaging Integrated Circuits, Thermal Considerations in Packaging.	2
III	**CMOS Inverter** Static and Dynamic Behaviour of CMOS Inverter, Power and Energy-Delay, Impact of Technology Scaling on Inverter Metrics.	6
IV	**CMOS Combinational Logic Circuits** Static CMOS Logic Design, Dynamic CMOS Logic Design, Comparison between the two Design Styles.	6
V	**CMOS Sequential Logic Circuits** Static Latches and Registers, Dynamic Latches and Registers, Pulse Registers, Non-Bistable Sequential Circuits: Schmitt Trigger Circuit, Ring Oscillator, Voltage Controlled Oscillator.	5
VI	**Interconnect and Semiconductor Memories** Electrical Models of Wires, Lumped RC Model, Distributed rc line, Transmission Line; Memory Classification, Memory Architectures and Building Blocks, Memory Core: ROM, RAM.	4

Text Books	
1	Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, "Digital Integrated Circuits-A Design Perspective", 2nd Edition, Prentice-Hall India Learning Pvt. Limited/ Pearson Education, 2014.
2	Sung-Mo Kang, Yusuf Leblebici, "CMOS Digital Integrated Circuits: Analysis and Design", 3rd Edition, McGraw-Hill Education (India) Pvt. Ltd., 2015.
3	
4	

References	
1	Neil Weste, Kamran Eshraghian, "Principles of CMOS VLSI Design: Analysis and Design", Addison Wesley/Pearson Education, 2008
2	William Dally and John Poulton, "Digital System Engineering", Cambridge University Press, Reprint 2007.
3	
4	

Useful Links	
1	https://nptel.ac.in/courses/108/107/108107129/
2	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-374-analysis-and-design-of-digital-integrated-circuits-fall-2003/index.htm
3	
4	

CO-PO Mapping

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

Assessment

The assessment is based on 2 in-semester examinations in the form of T1 (Test-1) and T2 (Test-2) of 20 marks each. Also there shall be 1 End-Sem examination (ESE) of 60 marks. T1 shall be typically on modules 1 and 2, T2 based typically on modules 3, 4 and ESE shall be on all modules with nearly 50% weightage on modules 1 to 4 and 50% weightage on modules 5, 6.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	T1	T2	ESE	Total
Remember				
Understand		**5**	**5**	**10**
Apply	**10**	**5**	**10**	**25**
Analyze	**10**	**10**	**20**	**40**
Evaluate				
Create			**25**	**25**
Total	**20**	**20**	**60**	**100**

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Course Information					
Programme	B.Tech. (Electronics Engineering)				
Class, Semester	Third Year B. Tech., Sem VI				
Course Code					
Course Name	Professional Elective 4: Digital Image Processing				
Desired Requisites:	Digital Signal Processing				

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**T1**	**T2**	**ESE**	**Total**
Tutorial	-	20	20	60	100
Practical	-				
Interaction	-	**Credits: 2**			

Course Objectives	
1	To develop an overview of the field of image processing.
2	To illustrate the fundamental algorithms and their implementation.
3	To apply image processing algorithms for real problems.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Apply digital image enhancement techniques for gray scale images and colour images	Apply
CO2	Analyze various image segmentation techniques	Analyze
CO3	Explain image restoration, de noising and image compression techniques	Evaluate
CO4	Identify image representation and description techniques	Understand

Module	Module Contents	Hours
I	**Introduction to Digital Image Processing** Fundamental steps in digital image processing- Components of Image processing system Image sensing and acquisition - Image sampling and Quantization - relationship between pixels. Image file formats	3
II	**Image Enhancement Techniques** Spatial Domain: Gray level transformation - Histogram processing, Spatial filtering - smoothing filters , sharpening filters ; Frequency Domain: Fourier transform – smoothing frequency domain filters , sharpening filters , Homographic filtering.	4
III	**Image Restoration, Denoising and Image Compression Techniques** Model of Image degradation/ restoration process Types of image blur- Noise models , Classification of Image restoration techniques, Blind de convolution, Image de noising, Median filtering, Inverse filtering, Weiner, least square, Geometric mean filters; Classification of compression techniques, Fundamentals of Information Theory, Shannon Fano coding, Huffman coding, Transform based compression.	5
IV	**Color Image Processing** Color fundamentals, color models, pseudo color image processing, basics of full–color image processing, color transforms, smoothing and sharpening, color segmentation.	4
V	**Image Segmentation** Classification of Image segmentation Techniques, Region approach to Image segmentation, Edge based segmentation, Classification of edges, edge detection , edge linking, Hough Transform, Clustering Techniques, Watershed Transformation.	5
VI	**Representation & Description** Chain codes - Polygonal Approximations – signatures - Boundary segments - Skeletons; Boundary Descriptors - Regional descriptors.	5

	Text Books
1	Digital Image Processing", R.C. Gonzalez and R.E. Woods, 3rd Edition, Prentice-Hall,
2	Pratt, W.K., Digital Image Processing, John Wiley and Sons, New York, 1978.
3	
4	
	References
1	Fundamentals of Digital Image Processing – A.K. Jain
2	M Sonka, V Hlavac and R Boyle, Image Processing, Analysis and Machine Vision, PWS 1999
3	
4	
	Useful Links
1	www.nptel.com

CO-PO Mapping

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

Assessment

The assessment is based on 2 in-semester evaluations (ISE) of 10 marks each, 1 mid-sem examination (MSE) of 30 marks and 1 end-sem examination (ESE) of 50 marks.
MSE is based on the modules taught till MSE (typically Module 1-3) and ESE is based on all modules with 30-40% weightage on modules before MSE and 60-70% weightage on modules after MSE.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	**T1**	**T2**	**ESE**	**Total**
Remember				
Understand	10		15	**25**
Apply	10	10	10	**30**
Analyze		10	15	**25**
Evaluate			20	**20**
Create				
Total	**20**	**20**	**60**	**100**

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Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	
Course Name	Professional Elective 4 Lab- Mobile Communication Engineering Lab
Desired Requisites:	Advanced Digital Communication Engineering

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

Course Objectives	
1	To introduce the concepts and techniques associated with Wireless Cellular Communication systems
2	To familiarize with state of art standards used in wireless cellular systems.
3	
4	

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Analyze the performance of different mobile generation standards in terms of different performance measure	Analyse
CO2	Estimate the performance of different mobile ad-hoc networks and security standards	Evaluate
CO3		
CO4		

List of Experiments / Lab Activities

List of Experiments :

1. Study of GSM system

2. Understanding 3G communication system

3. Understanding 4G/ LTE communication system.

3. Introduction to NetSim

4. Modeling and Simulation of simple network using NetSim

5. Study of GSM network for different performance measure parameters

6. Study how the throughput of LTE network varies as distance between ENB and UB varies.

7. Study how the throughput of LTE network varies as the channel bandwidth changes.

8. Analysis of LTE handover

9. Analyzing the performance of MANET

Text Books	
1	T.S.Rappaport,"Wireless Communications Principles and Practice", II Ed. PHI, Publications, 2010.

2	Prashant Kumar Patra, Sanjit Kumar Dash, “Mobile Computing”, 2nd Edition, Scitech.2013.
3	V.K.Garg, J.E.Wilkes, “Principle and Application of GSM” Pearson Education, 2007
4	
References	
1	William C. Y. Lee, “Mobile Communication Engineering: Theory and Applications”,2nd Edition, McGraw Hill Publication. 2014
2	Mischa Schwartz, “Mobile Wireless Communication”, 1st Edition, Cambridge University Press, 2009.
3	NetSim online resources
4	
Useful Links	
1	
2	
3	
4	

CO-PO Mapping

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

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.

Assessment Plan based on Bloom’s Taxonomy Level

Bloom’s Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember				
Understand				
Apply				
Analyze	30	30	10	70
Evaluate			30	30
Create				
Total	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem. VI
Course Code	
Course Name	Professional Elective 4 Lab- CMOS Digital VLSI Design Laboratory
Desired Requisites:	Digital Electronics, Electronic Circuits Analysis and Design, Microelectronics

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

Course Objectives	
1	Demonstrate the flow of EDA tools (Cadence/ Microwind) for designing CMOS digital circuits. a) Cadence Tools (Schematic entry to simulation) b) Microwind for designing digital circuits (at physical level/ layout of CMOS circuits).
2	
3	
4	

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	**Design** and **Simulate** schematics of CMOS circuits using Cadence/ Microwind tools.	Create
CO2	**Design** and **Simulate** physical layouts with optimum area for CMOS gates, pass-Transistors, Transmission gates, Combinational and Sequential Logic Circuits using Cadence/ Microwind tools.	Create
CO3		
CO4		

List of Experiments / Lab Activities

List of Experiments :

Using Cadence/ Microwind Design Tools:

1. MOS Transistor (NMOS and PMOS) characterization.
2. Implementation of CMOS inverter and its characterization for VTC and power for equal area and equal delay approach.
3. Implementation of 2-input NAND and NOR gate.
4. Implementation of AND gate and OR gate using pass transistors logic and transmission logic.
5. Implementation of Ring Oscillator Circuit and Schmitt Trigger Circuit and.
6. Implementation of 1-bit RAM/ ROM using MOS transistors.

Text Books	
1	Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, "Digital Integrated Circuits- A Design Perspective", 2nd Edition, Prentice-Hall India Learning Pvt. Limited/ Pearson Education, 2014.
2	Sung-Mo Kang, Yusuf Leblebici, "CMOS Digital Integrated Circuits: Analysis and Design", 3rd Edition, McGraw-Hill Education (India) Pvt. Ltd., 2015.
3	
4	

References	
1	Cadence Manual

2	Microwind Manual
3	
4	

Useful Links	
1	https://www.cadence.com/en_US/home.html
2	https://www.microwind.net/
3	https://www.ni2designs.com/microwind.html
4	https://studylib.net/doc/15236608/microwind-user-manual-v1

CO-PO Mapping

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

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.

Assessment Plan based on Bloom’s Taxonomy Level

Bloom’s Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember				
Understand				
Apply				
Analyze				
Evaluate				
Create	**30**	**30**	**40**	**100**
Total	**30**	**30**	**40**	**100**

Walchand College of Engineering, Sangli
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AY 2021-22

Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	
Course Name	Professional Elective 4 Lab: Digital Image Processing Lab
Desired Requisites:	Digital Signal Processing

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

Course Objectives	
1	Ability to learn digital image processing techniques and apply in practical problems using MATLAB/ Python

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Apply image enhancement algorithms for gray scale and colour images	Apply
CO2	Analyze spatial and frequency domain filters	Analyze
CO3	Develop programs and evaluate the same for image restoration	Evaluate
CO4	Write and execute programs for image segmentation	Create

List of Experiments / Lab Activities

List of Experiments:

1. **To study and develop programs for Image Operations in spatial domain using following techniques**
   - Brightness Enhancement
   - Brightness Suppression
   - Contrast Manipulation
   - Histogram Equalization
   - Determination of Image Negative
   - Threshold Operation
   - Gray level slicing without preserving background
   - Gray level slicing with preservation of background
   - Logarithmic Transformation
   - Power Law Transformation
   - Spatial domain Filtering
   - Noise minimization using averaging filter
   - Noise minimization using median Filter
   - Un-sharp masking
   - Bit-plane slicing

2. **To study and develop programs for following Image Operations in Frequency domain**
   - Low pass filter
   - High pass filter
   - Band pass filter
3. **To write programs for implementing the Image Arithmetic for following operations**
   - Addition
   - Subtraction
   - Multiplication

- Division

4. **To study Image Restoration and de noising techniques by developing programs for the following**
   - Create motion blur
   - Inverse filtering
   - Psudo inverse filter
   - Wiener filter
5. **To study various Colour Image Processing concepts by developing programs for following**
   - Extraction of Red Green and Blue Components of colour image
   - Removal of RGB Plane
   - Histogram of a colour image
   - Histogram equalization of a colour image
   - Various types of filtering of a colour image
   - Pseudo-colouring Operation

Text Books	
1	"Digital Image Processing", R.C. Gonzalez and R.E. Woods, 3rd Edition, Prentice-Hall Publications

References	
1	Fundamentals of Digital Image Processing - A.K. Jain

Useful Links	
1	www.nptel.ac.in

CO-PO Mapping

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

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule (for 26-week Sem)	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab activities, attendance, journal	Lab Course Faculty	During Week 15 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates starting week of a semester. The typical schedule of lab assessments is shown, considering a 26-week semester. The actual schedule shall be as per academic calendar. 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.

Assessment Plan based on Bloom's Taxonomy Level

Bloom's Taxonomy Level	LA1	LA2	Lab ESE	Total
Remember				
Understand				
Apply	10		10	**20**
Analyze	10	10	10	**30**
Evaluate		10	10	**20**
Create	10	10	10	**30**
Total	**30**	**30**	**40**	**100**