Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2023-24

Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6EN301
Course Name	Digital Signal Processing
Desired Requisites:	Signals and Systems

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

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.

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 Transformof 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.	8
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	4
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	8
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	8
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	8
VI	**Introduction to Wavelet Transform** STFT, Wavelets representation, Haar Wavelet, Daubachis Wavelet, Filter BankRepresentation	4

SKP, 25/08/2023

25/8/23

Textbooks	
1	Sanjit K. Mitra, "Digital Signal Processing: A Computer Based Approach",4th Edition, Tata McGraw-Hill Publication.
2	Oppenheim & Schafer, "Discrete Time Signal Processing", ,2nd Edition, Pearson education.
3	
4	
References	
1	J. G. Proakis, "Digital Signal Processing", 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
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

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

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AY 2023-24

Course Information	
Programme	B. Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem. V
Course Code	6EN302
Course Name	Embedded System Design
Desired Requisites:	Microcontroller Peripherals and Interfacing theory and lab

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

Course Objectives	
1	To illustrate the features of ARM architecture.
2	To provide the knowledge of different hardware peripherals and programming of different peripherals of ARM7 based controller. Ex. LPC2148 / LPC1768
3	To empower the students for the design and development of embedded system.
4	To encourage students to provide solution for real world problems using embedded systems .

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 ARM microcontroller	Apply
CO2	**write** assembly and C program to configure and use internal peripherals ARM microcontroller	Apply
CO3	**analyse** program and find operating parameters of peripheral in ARM microcontroller	Analyze
CO4	**design** and **develop** small embedded system using embedded C programming and ARM microcontroller.	Create

Module	**Module Contents**	**Hours**
I	**Architecture** ARM7 / ARM Cortex M3 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 ARM with 8051	6
II	**Embedded C Programming** Introduction to ARM7 / ARM Cortex M3 programming example, Software documentation method, Development Tools, ARM C Programming, Startup code, microcontroller pin layout, PLL configuration, Pin Connect block, I/O programming, boot-loader, In Application Programming. External Peripheral Interfaces like led, switch, LCD, Motor, Seven Segment Display etc.	8
III	**Interrupt Structure of ARM Microcontroller** Interrupt system in ARM7 / ARM Cortex M3, Interrupt Controller, FIQ, IRQ, Non-vectored interrupt, Software interrupt, Interrupt latency, Nested interrupts, External interrupts, Interrupt configuration and Programming examples.	6
IV	**Peripherals of ARM Microcontroller** Block diagram of Timers, role of prescaler, Capture and Match facility of timer and configuration 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.	8

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.	7
VI	**Application Development** Finite state machine in designing Embedded Systems, Design considerations for embedded system design, Design of a simple general purpose ARM kit, Case studies of ARM based applications.	4

Textbooks	
1	Andrew Sloss, ARM System Developer's Guide, Elsevier India, 2005
2	Joseph Yiu, "The Definitive Guide to ARM® Cortex®-M3 and Cortex®-M4 Processors", Newnes; 3rd edition
3	"Textbook of EMBEDDED SYSTEM", NA. VIKRAMAN
4	"Introduction to Microprocessor Based Systems Using the ARM Processor" by Kris Schindler

References	
1	ARM inc, ARM Reference Manual, ARM, inc., NA, 2011
2	Technical references, data sheets and user manuals of respective controller
3	Yifeng Zhu, "Embedded Systems with Arm Cortex-M Microcontrollers in Assembly Language and C", E-Man Press LLC
4	Frank Vahid and Tony Givargis, "Embedded System Design", Wiley

Useful Links	
1	https://nptel.ac.in/
2	https://in.coursera.org/
3	https://www.nxp.com/
4	https://www.arm.com/

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											2

1: Low, 2: Medium, 3: High

Assessment

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

Walchand College of Engineering, Sangli

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AY 2023-24

Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6EN303
Course Name	Digital Communication Engineering
Desired Requisites:	Analog Communication Engineering

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

Course Objectives

1	To equip the students with the advanced knowledge of digital communication.
2	To estimate the performance of modern digital communication in presence of noise

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Understand relevance of probability theory in digital communication	Understand
CO2	Apply channel, source and error control coding techniques effectively	Apply
CO3	Analyze the performance of digital communication system with different environment	Apply

Module	Module Contents	Hours
I	**Random variable and random Processes** Review of Probability concept, Types of Random variable, Uniform, exponential, Poisson, Gaussian Random variable, Expectation, variance, movement generation function, Central limit theorem , Classification of Random Processes, Stationary; Time average; Ergodic Process; Wide sense stationary Process	7
II	**Spread Spectrum Signals for Digital Communication:** Model of spread spectrum digital communication system, Direct sequence spread spectrum signals, Frequency hopped spread spectrum signals, CDMA, Time hopping SS, Synchronization of SS systems.	4
III	**Digital Communication through Fading Multipath Channels:** Characterization of fading multipath channels, The effect of signal characteristics on the choice of a channel model, Frequency nonselective, Slowly fading channel, Diversity techniques for fading multipath channels, Digital signals over a frequency selective, Slowly fading channel.	5
IV	**Communication Link Analysis** What the System Link Budget, the Channel, Received Signal Power and Noise Power, Link Budget Analysis, Noise Figure, Noise Temperature, and System Temperature, Sample Link Analysis	8
V	**Information Theory** Measure of Information, Classification of Source Codes, Source Coding Theorem, Lossless Data Compression, Discrete Memoryless Channels, Channel Coding Theorem, Gaussian Channel Capacity Theorem	8

VI	**Error-Control Coding** Errors, Error-Detection Methods, Automatic Repeat Request (ARQ), Block Codes, Convolutional Codes, Compound Codes	7

Textbooks	
1	T.L. Singal, "Analog and Digital Communication",6th Edition, Mc Graw Hill, 2012
2	Roy Blake , "Electronic Communication System", Thomson Publications, 2nd Edition,2002

References	
1	Simon Hykin, "Communication System", 4th Edition, John Wiley & Sons, 2000
2	B P Lathi, "Modern Digital and Analog Communication System", 4th Edition, Oxford University Press, 2017

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	2													2
CO2		1												
CO3			1										2	
CO4			2										2	

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

Assessment

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

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AY 2022-23

Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem I
Course Code	6EN351
Course Name	Digital Signal Processing Lab
Desired Requisites:	Signals and Systems

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

List of Lab Activities:

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 differenttuning 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.

Textbooks

1	Sanjit K. Mitra, "Digital Signal Processing: A Computer Based Approach",4th Edition, Tata McGraw-Hill Publication.
2	Oppenheim & Schafer, "Discrete Time Signal Processing", ,2nd Edition, Pearson education.
3	
4	

References

1	J. G. Proakis, "Digital Signal Processing", Prentice Hall India
2	

3	
4	

Useful Links	
1	www.nptel.ac.in
2	
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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

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

Assessment

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

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

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

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AY 2023-24

Course Information	
Programme	B. Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem. V
Course Code	6EN352
Course Name	Embedded System Design LAB
Desired Requisites:	Microcontroller Peripherals and Interfacing theory and lab

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

Course Objectives	
1	Write, simulate and debug assembly and C programs for LPC2148 / LPC1768 microcontroller
2	Write, simulate, download and test C programs for microcontroller using development board
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 ARM microcontroller.	Apply
CO2	**Test** and **debug** programs for ARM microcontroller.	Analyze
CO3	**Develop** and **demonstrate** small embedded systems using ARM C programming and hardware peripherals for ARM microcontroller.	Create

List of Experiments / Lab Activities/Topics

List of 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 complex algorithm implementation for application development
14. Mini-Project

Textbooks	
1	NXP, LPC 2148 / 1768 data sheet, NXP inc.,
2	NXP, LPC 2148 / 1768 user manual, NXP inc.,
3	Development board / Kit reference manual

References	
1	Sloss Andrew N, Symes Dominic, Wright Chris, "ARM System Developer's Guide: Designing and Optimizing", Morgan Kaufman Publication
2	Joseph Yiu, "The Definitive Guide to ARM® Cortex®-M3 and Cortex®-M4 Processors", Newnes; 3rd edition
3	Technical references and user manuals of respective controller

Useful Links	
1	https://nptel.ac.in/
2	https://in.coursera.org/
3	https://www.nxp.com/
4	https://www.arm.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									2
CO2		3												2
CO3			3									3		2
1: Low, 2: Medium, 3: High														

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE. LA1 and LA2 shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be through quizzes, assignments, mini project, lab based activity and submission. Also small weightage is also given to attendance.
IMP: Lab ESE is a separate head of passing. (min 40 %), LA1+LA2 should be min 40%

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

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

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AY 2022-23

Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6EN353
Course Name	Digital Communication Engineering Lab
Desired Requisites:	Analog Comunication Engineering

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

Course Objectives	
1	To analyse the significance and different applications of digital communications.
2	
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Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Analyze different Digital Modulation & Demodulation schemes	Analyze
CO2	Evaluate various Source & Channel Coding Techniques	Evaluate
CO3		
CO4		

List of Experiments / Lab Activities/Topics

List of Lab Activities:

1. Introduction to MATLAB
2. To generate uniform and normal random variables, also find the mean and variance of the distribution using MATLAB
3. To generate continuous sine waveform, square waveform, and saw-tooth waveform using MATLAB
4. Generation of Pseudo Noise (PN) random sequence using MATLAB
5. To study Pulse Code Modulation and Demodulation using MATLAB.
6. To study BPSK Modulation and plot BER using MATLAB.
7. To study QPSK/4-QAM Modulation and plot BER using MATLAB.
8. To study the Digital Signal transmission using Quadrature Amplitude Modulation (QAM) using MATLAB.
9. Write a MATLAB based program for encoding and decoding of Huffman code.
10. To generate the line codes for a 10-bit dataset in a MATLAB

Textbooks	
1	T.L. Singal, "Analog and Digital Communication",6th Edition, Mc Graw Hill, 2012
2	Roy Blake , "Electronic Communication System", Thomson Publications, 2nd Edition,2002
3	
4	

References	
1	Simon Hykin, "Communication System", 4th Edition, John Wiley & Sons, 2000
2	Bernard Sklar, "Digital Communications - Fundamentals and Applications", Pearson Publications
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													3
CO2		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, and preferably to only one PO.														

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

Walchand College of Engineering, Sangli

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AY 2023-24

Course Information	
Programme	B. Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem-V
Course Code	6EN341
Course Name	Mini Project-1
Desired Requisites:	ECAD-I, ECAD-II, Microcontroller Interfacing and Peripherals

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

Course Objectives	
1	To 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/ Topics

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 discrete components/ operational amplifier/ 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.

Textbooks

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	A. E. Ward, J.A.S. Angus, "Electronic Product Design", Stanley Thrones (Publishers) Limited, 1996.
2	Paul Horowitz, Winfield Hill, "The Art of Electronics", Cambridge University Press, 1989
3	

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

Assessment

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

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

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

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AY 2023-24

Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6EN311
Course Name	Professional Elective I -Biomedical Instrumentation
Desired Requisites:	Electronics Measurement and Instrumentation

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		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	8
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.	4
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	4
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.	8
V	**Assisting and Therapeutic Equipment's** Cardiac Pacemakers, Defibrillators, Diathermy, Hemodialysis Machines, Ventilators	8
VI	**Laser Application in Biomedical Field** The Laser, Types of Lasers, Laser Application, Laser Safety	7

Textbooks

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

References	
1	R.S. Khandpur, “Hand book of Medical instruments”, TMH, New Delhi, 1987.
2	Sanjay Guha,”Medical Electronics and Instrumentation”, University Publication, 200.
3	Edwand J. Bukstein, “Introduction to Biomedical electronics” , Sane and Co. Inc, 1973
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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												2	
CO2					3	2							2	
CO3			3										2	
CO4									3				2	

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

Assessment

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

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2023-24

Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem. V
Course Code	6EN312
Course Name	Professional Elective-I: Microelectronics
Desired Requisites:	-

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	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.	6
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.	6
III	**Junctions** Formation of p-n junctions, Equilibrium conditions, Steady state conditions, Transient and AC conditions, deviations from simple theory, Metal-Semiconductor Junctions.	8
IV	**Field Effect Transistors** JFET (characteristics), MOS capacitor (threshold voltage, C-V characteristics), MOSFET: I-V characteristics, Equivalent circuits for the MOSFET.	7

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.	7
VI	**Optoelectronic Devices** Photodiodes: I-V characteristics in an illuminated junction, Solar Cells, Photodetectors; LEDs, Semiconductor Lasers.	6

Text Books	
1	B.G. Streetman, S. K. Banerjee, " Solid State Electronic Devices ", 7th edition, Pearson India Education Service Pvt. Ltd., 2017.
2	
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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
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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													1
CO2	3													1
CO3	3	2												
CO4	3	2												
CO5	2	2												1

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

Assessment

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

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2023-24

Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6EN313
Course Name	Professional Elective 1 - Linear Algebra
Desired Requisites:	Applied Mathematics I & II

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		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 matrixoperations, the inverse of a matrix, characterization of invertible matrix, partitioned matrix, matrix factorization	4
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	8
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	8
IV	**Linear Transformations** The Idea of a Linear Transformation, The Matrix of a Linear Transformation, Diagonalization and the Pseudo-inverse	8
V	**Eigen values and Eigen vectors** Eigen values and eigen vectors, characteristic equations, linear transformations,digonilzations, Applications to differential equations, complex Eigen values, orthgonality	7

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

Textbooks	
1	Gilbert Strang, Wellesley-Cambridge, "Introduction to Linear Algebra"5th edition, Press, 2016
2	Jim Defranza and Daniel Gagliardi,"Introduction to Linear Algebra with Applications" McGraw Hill Education (India) Edition 2012
3	Stephen Boyd and Lieven Vandenberghe, "Introduction to Applied Linear Algebra", CambridgeUniversity Press, 2018
4	
References	
1	Ward Cheney and David Kincaid, Jones, "Linear Algebra Theory and Applications and Bartlett", Publishers, Indian Edition 2010
2	David C. Lay, Steven R. Lay, and Judi J., "Linear Algebra and its Applications" McDonald, Pearson, 5 edition, 2015
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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												1
CO2	3	3												1
CO3	3													1
CO4														

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

Assessment

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

Walchand College of Engineering, Sangli

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AY 2023-24

Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6EN314
Course Name	Automotive Electronics
Desired Requisites:	

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

Course Objectives	
1	To learn the basic control system and sensor required Engine control
2	To learn basic of signal conversion circuit in Automotive system
3	To enhance skill of communication in automotive vehicle
4	

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Use various sensor system to control engine and its devices	Understand
CO2	Apply knowledge of communication to device for controlling devices	Apply
CO3	Analyse a problem and identify the computing requirements for engine control instrumentation	Analyze

Module	**Module Contents**	**Hours**
I	**The Basics of Electronic Engine Control:** Motivation for Electronic Engine Control. Exhaust Emissions, Fuel Economy, Federal Government Test Procedures, Concept of an Electronic Engine Control System, Definition of Engine Performance Terms, Exhaust Catalytic Converters, Electronic Fuel Control System, Analysis of Intake Manifold Pressure, Idle Speed Control, Electronic Ignition	8
II	**Sensors and Actuators** Automotive Control System Applications of Sensors and Actuators, Throttle Angle Sensor, Temperature Sensors, Typical Coolant Sensor, Sensors for Feedback Control, Knock Sensors, Angular Rate Sensor, LIDAR, Digital Video Camera, Flex-Fuel Sensor, Automotive Engine Control Actuators, Variable Valve Timing, Electric Motor Actuators, Stepper Motors, Ignition System	8
III	**Digital Powertrain Control Systems** Digital Engine Control, Control Modes for Fuel Control, Discrete Time Idle Speed Control, EGR Control, Variable Valve Timing Control, Turbocharging, Direct Fuel Injection, Flex Fuel, Electronic Ignition Control, Integrated Engine Control System, Summary of Control Modes	7

IV	**Vehicle Motion Controls** Representative Cruise Control System, Cruise Control Electronics, Antilock Braking System, Electronic Suspension System, Electronic Suspension Control System, Four-Wheel Steering CAR	4
V	**Automotive Instrumentation** Modern Automotive Instrumentation, Input and Output Signal Conversion, Display Devices, Fuel Quantity Measurement, Coolant Temperature Measurement, Oil Pressure Measurement, Vehicle Speed Measurement,	4
VI	**Vehicle Communications** IVN, CAN, Local Interconnect Network (LIN), FlexRay IVN, MOST IVN, Vehicle to Infrastructure Communication, Vehicle-to-Cellular Infrastructure, Short-Range Wireless Communications, Satellite Vehicle Communication, GPS Navigation, Safety Aspects of Vehicle-to-Infrastructure Communication	8

Textbooks	
1	William Ribbens, "Understanding Automotive Electronics An Engineering Perspective" Elsevier
2	Bosch Automotive, Robert Bosch GmbH "Electrics and Automotive Electronics: Systems and Components, Networking and Hybrid Drive", Springer Science & Business Media, 2013
3	
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References	
1	Najamuz Zaman, "Automotive Electronics Design Fundamentals", Springer Cham, October 2016
2	Ronald K. Jurgen ,"Automotive Electronics Handbook", McGraw Hill Professional, 1999
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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										
CO2				3										
CO3				3										
CO4														

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

Assessment

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

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AY 2023-24

Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6EN315
Course Name	Professional Elective II - Object Oriented Programming
Desired Requisites:	C Programming

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	1 Hr/week	30	20	50	100
		Credits: 3			

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 headerfiles, Revision of C type constructs in CPP	5
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, defaultconstructor, copy constructor, scope resolution, UML diagram of class	4
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	5
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.	4

Textbooks

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	
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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	
CO2			2											2
CO3		3											3	
CO4			3											3

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

Assessment

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

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2023-24

Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Final Year B. Tech., Sem-V
Course Code	6EN316
Course Name	Data Analytics
Desired Requisites:	Probability and Statistics

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

Course Objectives	
1	Develop in depth understanding of the key technologies in data science and business analytics:
2	Use quantitative modeling and data analysis techniques to the solution of real world business problems, communicate findings, and effectively present results using data visualization techniques
3	
4	

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Describe various concepts of data analytics pipeline	
CO2	Apply classification, regression, mining techniques on streaming data	
CO3	Compare different clustering and frequent pattern mining algorithms	
CO4	Describe the concept of R programming and implement analytics on Big data using R	

Module	**Module Contents**	**Hours**
I	**Introduction to Data Analytics**: Sources and nature of data, classification of data (structured, semi-structured, unstructured), characteristics of data, introduction to Big Data platform, need of data analytics, evolution of analytic scalability, analytic process and tools, analysis vs reporting, modern data analytic tools, applications of data analytics. **Data Analytics Lifecycle**: Need, key roles for successful analytic projects, various phases of data analytics lifecycle – discovery, data preparation, model planning, model building, communicating results, operationalization.	5
II	**Data Analysis** Regression modeling, multivariate analysis, Bayesian modeling, inference and Bayesian networks, support vector and kernel methods, analysis of time series: linear systems analysis & nonlinear dynamics, rule induction, neural networks: learning and generalisation, competitive learning, principal component analysis and neural networks, fuzzy logic: extracting fuzzy models from data, fuzzy decision trees, stochastic search methods.	8
III	**Mining Data Streams** Introduction to streams concepts, stream data model and architecture, stream computing, sampling data in a stream, filtering streams, counting distinct elements in a stream, estimating moments, counting oneness in a window, decaying window, Real-time Analytics Platform (RTAP) applications, Case studies – real time sentiment analysis, stock market predictions	8

IV	**Frequent Itemsets and Clustering** Mining frequent itemsets, market based modelling, Apriori algorithm, handling large data sets in main memory, limited pass algorithm, counting frequent itemsets in a stream, clustering techniques: hierarchical, K-means, clustering high dimensional data, CLIQUE and ProCLUS, frequent pattern based clustering methods, clustering in non-euclidean space, clustering for streams and parallelism.	7
V	**Frame Works and Visualization** MapReduce, Hadoop, Pig, Hive, HBase, MapR, Sharding, NoSQL Databases, S3, Hadoop Distributed File Systems, Visualization: visual data analysis techniques, interaction techniques, systems and applications	7
VI	**Introduction to R** R graphical user interfaces, data import and export, attribute and data types, descriptive statistics, exploratory data analysis, visualization before analysis, analytics for unstructured data	5

Textbooks	
1	Rechard Dosey, "Data Analytics: Become A Master In Data Analytics Paperback"
2	Mark Gardner, "Beginning R: The Statistical Programming Language", Wrox Publication
3	
4	

References	
1	David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big Data Analytics", EMC Education Series, John Wiley
2	Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer
3	Anand Rajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press
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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											
CO2														
CO3				3										3
CO4	3				3									

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

Assessment

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

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2023-24

Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6EN317
Course Name	Optical Communication
Desired Requisites:	Communication Engg

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

Course Objectives	
1	Understand the basics of signal propagation through optical fibers, fiber impairments, components and devices.
2	Classify the various sources and detector for Optical link budget
3	Interpret various types of amplifier used in the optical link.
4	Understand the system performance for long link communication.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Demonstrate the basic elements of optical fiber transmission link, fiber modes configurations and structures.	II
CO2	Identify 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	III
CO3	Classify fiber slicing and connectors, noise effects on system performance, operational principles WDM and solutions	IV
CO4	Choose the various optical source materials, LED structures, quantum efficiency, Laser diodes and different fiber amplifiers, optical receivers such as PIN APD diodes, noise performance in photo detector, receiver operation and configuration	V

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.	7
II	**Transmission Characteristics of Optical Fibres** Attenuation, Material absorption losses in silica glass fibers, Linear and Nonl inear 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	7

III	**Sources and Detectors** 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. 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	7
IV	**Coupling and Receiver operation** Power Launching and Coupling: Source to fiber power launching, Lensing schemes, fiber-to-fiber joints, LED coupling to single mode fibers, fiber splicing, Optical fiber connectors. Optical Receiver Operation : Receiver operation, Preamplifier types, receiver performance and sensitivity, Eye diagrams, Coherent detection, Specification of receivers	6
V	**Optical Transmission System** Transmission Systems : Point –to-point link –system considerations, Link power budget and rise time budget methods for design of optical link, BER calculation Optical Amplifiers : Semiconductor optical Amplifier, EDFA, Raman Amplifier, Wideband Optical Amplifiers	6
VI	**Measurements and Advances in Optical Fiber Systems** Fiber Attenuation measurements- Dispersion measurements – Fiber Refractive index profile measurements – Fiber cut- off Wave length Measurements – Fiber Numerical Aperture Measurements – Fiber diameter measurements Principles of WDM, DWDM, Telecommunications & broadband application, SONET/SDH, MUX, Analog & Digital broadband, optical switching	6

Textbooks	
1	Keiser, G, “Optical Fiber Communications”, ISBN - 9780071164689, by McGraw-Hill, 5th Edition, 2000.
2	John M. Senior, M. Yousif Jamro, “Optical Fiber Communications: Principles and Practice”, ISBN - 9780130326812, Prentice Hall Internacional series in optoelectronics, 2009
3	
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References	
1	Singal, T.L, “Optical Fiber Communications: Principles and Applications”. ISBN - 9781316870532, 2017, Cambridge University Press
2	Rogers, A.J, “Understanding Optical Fiber Communications”, ISBN - 9780890064788, Artech House optoelectronics library, 2001
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Useful Links	
1	https://archive.nptel.ac.in/courses/108/106/108106167/
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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													

CO2				3										
CO3				3										
CO4				3										
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

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

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2023-24

Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6OE357
Course Name	Introduction to Electronic Systems
Desired Requisites:	Basic Electronics Engineering

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

Course Objectives	
1	To illustrate the concept behind electronics systems and its application.
2	
3	
4	

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Explain the working of components used in the electronic systems.	Understand
CO2	Develop a digital circuit for a given logic and build circuit for given specifications.	Apply
CO3	Analyze the performance of Data Acquisition System and Power Electronics Circuits.	Analyze
CO4	Test embedded system applications using Arduino board.	Apply

Module	**Module Contents**	**Hours**
I	**Electronic System Components** Transducers-Types, Classification, Characteristics: Signal Conditioning of inputs, Instrumentation Amplifiers, Capacitive type, Inductive type sensors, Limit switches, Temperature sensors:RTD, thermistor, Thermocouple, semiconductor diode sensor, piezoelectric transducer photovoltaic cell, LDR, Speed measurement using magnetic photoelectric pickup. Distance measurement: LVDT, capacitive transducers, Resistive, Glass scales, Magnetic scales. Concept of Quadrature output and index pulse.PH Sensors, ProximitySensors, Motion Sensors.	7
II	**Operational Amplifier** Differential amplifier, Basic op-Amp configuration, Ideal op-amp analysis, Op-amp characteristics, Inverting and Non inverting amplifiers, Adder, Subtractor, voltage to current converters, current to voltage converters, instrumentation amplifiers, Active filters. Voltage comparator, Comparator application, waveform generators: multivibrators, oscillators.	8
III	**Digital Systems** Flip-flops, Counters, Up-counters, Down Counters, Mod-N counters, State diagram.	5
IV	**Data Acquisitions System** Digital to Analog Converter (DAC), Analog to Digital converter (ADC), Data Acquisition System (DAS): introduction, objectives of DAS, single and multichannel, data conversion, sample and hold circuit, elements of DAS, interfacing of transducers-multiplexing.	7
V	**Power Semiconductor Devices and its Applications** SCR, TRIAC, DIAC, UJT, AC voltage regulator, Controlled rectifiers, Inverters, Speed control of AC and DC motors, SMPS,UPS, Electronics lamp ballast.	5

VI	**Embedded Systems** Introduction to microcontroller based system: Arduino board, Arduino based systems, Simple Arduino program, interfacing display board to Arduino, Speed control of DC motor, motor driver IC: L293D.	8

Textbooks	
1	R. Boylestad and L. Nashelsky, “Electronics Devices and Circuits”, 8th Edition, Prentice Hall International, 2005.
2	Anand Kumar, "Fundamentals of Digital circuits", 2nd Edition, PHI, 2009.
3	A. K. Sawhney, “Measurements and Instrumentation”, Dhanpat Rai and Sons, 2013
4	
References	
1	R. P. Jain, "Modern Digital Design", Mc-Graw-Hill, 2008
2	Ramakant Gaikwad, “Op-amps and Linear Integrated Circuits”, Pearson Education, 2011.
3	M.D. Singh and KB Khanchandani, “Power Electronics”, 2nd Edition, McGraw-Hill, 2007.
4	
Useful Links	
1	www.spoken-tutorial.org ---IIT Bombay.
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											2
CO3		3												3
CO4	3		2											3

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

Assessment

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

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AY 2023-24

Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem V
Course Code	6OE358
Course Name	Open Elective – Signals and Systems
Desired Requisites:	-

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

Course Objectives	
1	Develop the mathematical skills to solve problems involving signals and systems in various areas of appllications
2	To Understand signals and systems in terms of both the time and transform domains with , complementary insights into tools for analysis
3	
4	

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Classify the different signals and systems	Understand
CO2	Characterize LTI systems in the time domain and frequency domain	Apply
CO3	Use MATLAB software to implement the signal processing and system analysis for different applications	Apply

Module	**Module Contents**	**Hours**
I	**Classification of Signals and Systems:** Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids, Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals, Classification of systems- CT systems and DT systems, Linear & Nonlinear, Time-variant & Time-invariant, Causal & Noncausal, Stable & Unstable.	6
II	**Analysis of CT and DT signals** Fourier series for periodic signals - Fourier Transform – properties- Laplace Transforms and properties.	8
III	**Analysis of DT signals** Baseband signal Sampling – Fourier Transform of discrete time signals (DTFT) – Properties of DTFT - Z Transform & Properties	6
IV	**Linear Time Invariant DT Systems** Impulse response – Difference equations-Convolution sum- Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems- DT systems connected in series and parallel.	8
V	**Application areas of Signals and Systems** Overview of applications of Signals and Systems in the fields of Speech and audio processing.Multimedia processing (image and video),Underwater acoustic, Biological signal analysis, Biometrics, control applications	7
VI	**Analysis of Signals and Systems using Simulation Tools** Introduction to MATLAB, Use MATLAB software to implement the signal processing and system analysis.	4

Textbooks	
1	B.P. Lathi, “Signals, Systems & Communications”- BS Publications, 2003.
2	A.V. Oppenheim, A.S. Willsky and S.H. Nawab,”Signals and Systems”- PHI, 2nd Edn.
3	
4	
References	
1	Simon Haykin and Van Veen,”Signals & Systems” -,Wiley, 2nd Edition.
2	
3	
4	
Useful Links	
1	NPTEL lectures
2	https://www.mathworks.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	3													
CO2		2												
CO3					3								2	
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

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

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AY 2023-24

Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Third Year B. Tech., Sem-V
Course Code	6EN354
Course Name	Project Management
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	2 Hour/week	30	30	40	100
		Credits: 2			

Course Objectives

1	To prepare the students to manage projects by exploring both technical and managerial challenges and preparing the budget.
2	To make aware the students about leadership and ethical qualities in dealing with real life project
3	To induce qualities for working in interdisciplinary and cross functional teams with effective communication skills, economical and managerial challenges and commercial management.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Grasp and perceive the project activities with respect to resources and constraints of feasibility or completion time	II	Understanding
CO2	Estimate and prepare budget for project completion and commercial management	IV	Analyzing
CO3	Figure out and schedule the project and assess for controlling critical path networks	V	Evaluating

Contents

1	**Introduction to Project Management.** Phases in the life cycle of projects and their significance, characteristics of projects from conventional organizations, objectives of the project and interdependence of cost on schedules	4
2	**Project Cost, Planning, feasibility, risk.** Controlling Schedules, Cost, specifications or quality, Monitoring both the cost and schedule of a project in financial terms, Baseline Cost Curves and their significance in the overall project cost impact	4

3	**Critical Path Networks - Principles of Resource Scheduling.** Numeric Models of Project, Non-Numeric Models of Project, Scoring Models of Project, Project Network and CPM, Gantt Charts, Resource allocation and Controlling phases of a project	4
4	**Executing and Controlling.** Audit schedules and auditing a project and identifying deviations, quality needs in a project, applying relevant quality tools in a project and interpreting the results of the tools to monitor the quality **Commercial Management and various regulations.** Potential risks in a project, Categorizing of project risks, and defining the strategies for managing the project risks	4
5	**Study and use of software related to Project Management System.**	3
6	**Human Values and Professional Ethics** Need, basic guidelines, content & process for value education, understanding harmony in the human being- harmony in myself, understanding harmony in the family & society- harmony in human relationship, understanding harmony in the nature & existence, implications of the above holistic understanding of harmony on professional ethics.	7

Text Books	
1	Dennis Lock ," Project Management ", Gower Publishing Limited, 2013
2	Samuel J. Mantel, Jr., Jack R. Meredith, Scott M. Shafer, Margaret M. Sutton, "Project Management in Practice " JOHN WILEY & SONS, INC., 2011
3	Horald Kerzner, "Project Management: A systems approach to planning, scheduling and controlling", John Wiley & Sons Inc., 2009

References	
1	K. Nagarajan, Project Management, New Age Int., 2nd ed. 2004.
2	B.M.Naik, "Project Management-Scheduling and Monitoring", PERT/CPM, 1984
3	William R Duncan, "A guide to the project management body of knowledge", PMI Publications, 1996
4	The factories act 1948 – Government of India 6. Meri Williams , "The Principles of Project Management ", By – Site point Pvt Ltd., 2008

Useful Links	
1	https://www.apm.org.uk/resources/what-is-project-management/
2	https://www.projectmanager.com/project-management

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1								1					1	1
CO2									2					2
CO3							1						2	
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High														

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

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