Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2021-22

Course Information

Programme	B. Tech. (Electronics Engineering)
Class, Semester	Final Year B. Tech., Sem. VII
Course Code	
Course Name	Power Electronics and Drives
Desired Requisites:	Basic Electrical Engineering, Circuit Theory

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

Course Objectives

1	**Explain** the working of modern power semiconductor devices and their applications.
2	**Explain** the working of power converter circuits like controlled rectifier, inverter, AC voltage controller and chopper and provide the knowledge of performance parameters of converters in the analysis of their performance.
3	**Explain** the use of different power control techniques like converters, choppers, inverters and cycloconverters to control the speed of DC motors and Induction motors.
4	**Illustrate** to choose an appropriate power electronic circuit and a power semiconductor device while designing an electrical power control system.

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 power semiconductor devices such as SCR, GTO, Power MOSFET and IGBT.	Understand
CO2	**Analyze** the performance of controlled rectifiers, DC to DC converters, Inverters, AC to AC converter.	Analyze
CO3	**Evaluate the** performance parameters of controlled rectifier, DC to DC converter, DC to AC converter and AC to AC converter.	Evaluate
CO4	**Analyze** the speed control techniques/ methods for AC and DC motors.	Analyze

Module	**Module Contents**	**Hours**
I	**Power Semiconductor Devices** SCR (Silicon Controlled Rectifier): two transistor model, protection circuits, series and parallel operation of SCR, triggering and commutation circuits; GTO, TRIAC, DIAC, Power Diode, Power BJT, Power MOSFET, IGBT.	7
II	**Phase Controlled Rectifiers** Single phase half and full wave controlled rectifier with R and RL load, Single phase half controlled (semiconverter) and fully controlled bridge rectifier. Three phase half wave controlled rectifier with resistive load, three phase half controlled and fully controlled bridge rectifier with R and RL load; Calculation of performance parameters of line commutated converters: Fourier analysis; effect of source impedance on the performance of controlled rectifiers.	9
III	**Inverters and AC voltage Controllers** Single phase half and full bridge inverter using transistor/MOSFET/IGBT, performance parameters, Fourier analysis of inverter output voltage; Three phase bridge inverter- 120^0 and 180^0 conduction mode; PWM inverters; Series and Parallel resonant inverter. AC voltage controllers: single phase and three phase AC voltage controllers; Cycloconverters: single phase to single phase, three phase to single phase, three phase to three phase cycloconverter.	8
IV	**DC to DC converters** Choppers: principles of operation, control strategies: TRC, current limit control; types of chopper, step up chopper, multiphase chopper; SMPS.	4

V	**D.C. Motor Control** Equivalent circuit, speed torque characteristics (separately excited and series motor), operating modes, single phase and three phase controlled rectifier fed drives; four quadrant drive-single phase and three phase dual converter; Chopper-fed DC drive.	6
VI	**A.C. Motor Control** Equivalent circuit, speed torque characteristics, speed control methods-stator voltage control, rotor voltage control, frequency control, stator voltage and frequency control (V/F); Vector Control.	6

Text Books	
1	M. D. Singh & K. B. Khanchandani, "*Power Electronics*", Second Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2007.
2	M.H. Rashid, "*Power Electronics: Circuits, Devices & Applications*", Third Edition, PHI, New Delhi, 2008.
3	P. S. Bimbhra, "*Power Electronics*", Third Edition, Khanna Publishers, 2004.
4	

References	
1	P. C. Sen, "*Power Electronics*", First Edition, Tata McGraw Hill Publishing Company Ltd, 2008.
2	V. R. Moorthi, "*Power Electronics-Devices, Circuits and Industrial Applications*", Oxford University Press, 2010.
3	Ned Mohan, T. M. Undeland, W. P. Robbins, "*Power electronics-Converters, Applications and Design*", Third Edition, John Wiley and Sons Inc., 2003.

Useful Links	
1	https://nptel.ac.in/courses/108/105/108105066/#
2	https://nptel.ac.in/courses/108/108/108108077/
3	https://nptel.ac.in/courses/108/102/108102145/

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	3	1											2
CO3	2	3												
CO4		2	2											2

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

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	15
Apply				
Analyze	10	10	30	50
Evaluate		10	25	35
Create				
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	Final Year B. Tech., Sem VII
Course Code	
Course Name	Real Time Operating System
Desired Requisites:	Courses with C programming, Microcontroller, Peripherals and interfacing, Embedded system design

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

Course Objectives	
1	To explain/illustrate/demonstrate need of RTOS and services provided by it.
2	To explain/illustrate/demonstrate services provided by RTOS
3	To explain/illustrate/demonstrate case studies of applications with task management
4	To explain/illustrate/demonstrate case studies of applications simple inter-task communication

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	**Apply** the knowledge of RTOS to decide whether a given system is suitable for RTOS based implementation.	Apply
CO2	**Apply** the theory and implementation of task, time event management.	Apply
CO3	**Analyze** the given problem/situation related to task, time management	Analyze
CO4	**Analyze** the given program/situation related to inter-task communication.	Analyze

Module	**Module Contents**	**Hours**
I	**Module 1: Real-time Systems Concepts-1** Foreground/Background Systems, Multitasking, Kernels,	6
II	**Module 2: Task management in uCOS-II** uCOSII initialization, creating and deleting a task	4
III	**Module 3: Time management in uCOS-II** Clock tick, delaying a task, resuming the delayed task, getting system time	4
IV	**Module 4: Case study of Task and Time Management** Case study of application based on task and time management	4
V	**Module 5: Intertask Communication in uCOS-II** Need of Intertask communication, Semaphore, Mailbox, Queues in RTOS	4
VI	**Module 6: Case study of inter-task Communication** Case study of application based on inter-task communication	4

Text Books	
1	*"MicroC OS II: The Real Time Kernel"* Jean J. Labrosse, CMP books publication ISBN: 978-1578201037
2	*"Real-Time Concepts for Embedded Systems"*, Qing Li, CarolineYao Elsevier ISBN: 978-1578201242

3	*"Simple Real-time Operating System: A Kernel",* Chowdary Venkateswara Amazon, ISBN: 978-1425117825
4	

References	
1	www.micrium.com for uCOS-II related documents, tutorials, downloads.
2	www.nxp.com for processor specific documents.
3	www.wikipedia.org for general OS related basic literature.
4	www.NPTEL.org for OS and RTOS related video courses.

Useful Links	
1	www.micrium.com for uCOS-II related documents, tutorials, downloads.
2	www.nxp.com for processor specific documents.
3	www.wikipedia.org for general OS related basic literature.
4	www.NPTEL.org for OS and RTOS related video courses.

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	2													2
CO3		1												1
CO4			1											1

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

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	10		20	30
3	Apply	10	10	20	40
4	Analyze		10	20	30
5	Evaluate				
6	Create				
Total		**20**	**20**	**60**	**100**

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AY 2021-22

Course Information

Programme	B. Tech. (Electronics Engineering)
Class, Semester	Final Year B. Tech., Sem. VII
Course Code	
Course Name	Power Electronics and Drives Lab
Desired Requisites:	Basic Electrical Engineering, Circuit Theory

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	**Explain** the V-I characteristics of power semiconductor devices and their use as a switch.
2	**Demonstrate** the operating and handling procedure (i.e. safety measures) of power electronic experimental set ups.
3	**Explain** the need of isolating power circuit ground and control circuit ground (use of Powerscope or isolation transformer) during observation of waveforms and measurement of input and output voltage of a power electronic circuit i.e. controlled rectifier, inverter and chopper.
4	**Demonstrate** the use of simulation software (PSIM, MATLAB, PSPICE) in the analysis and design of power electronic circuits /systems.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	**Experiment with** power semiconductor devices and plot its V-I characteristics.	Understand
CO2	**Build** and **test** power electronic circuits (controlled rectifiers, inverters, choppers)	Apply
CO3	**Analyze** the performance power electronic circuits (controlled rectifiers, inverters, choppers)	Analyze
CO4	**Examine** and **compare** speed control techniques/ methods for AC and DC motors.	Analyze

List of Experiments / Lab Activities

The primary objective of this laboratory is to impart the practical knowledge of power electronic circuits for the conversion and control of electrical energy. This laboratory course develops a basic foundation for analysis, design, test, and control of power electronics converters by experimentation and simulation.

List of Experiments: (Minimum 8 experiments)

1. Study of power semiconductor devices: SCR, Power MOSFET, IGBT.
2. SCR triggering circuits: R, RC, and UJT
3. Single phase half controlled bridge rectifier.
4. Single phase fully controlled bridge rectifier.
5. Single phase transistorized inverter.
6. Single phase to Single phase Cycloconverter.
7. Design and implementation of a Type-A chopper (Power MOSFET based) circuit.
8. Single/ Three phase controlled rectifier fed DC drive.
9. Chopper fed DC drive.
10. Three phase induction motor drive.
11. Four quadrant DC drive (Dual converter).
12. Speed control of brushless DC motor.
13. Simulation of Controlled Rectifier and Three Phase Inverter Circuit using MATLAB/ PSIM.

Text Books

1	M.H. Rashid, "*Power Electronics: Circuits, Devices & Applications*", Third Edition, PHI, New Delhi, 2008.

2	M. D. Singh & K. B. Khanchandani, "*Power Electronics*", Second Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2007.
3	V. R. Moorthi, "*Power Electronics: Devices, Circuits and Industrial Applications*", Oxford University Press, 2010.
4	

References	
1	D. R. Grafham, J. C. Hey, "*SCR Manual*", Fifth Edition, General Electric, New York, 1972.
2	https://www.powersimtech.com/wp-content/uploads/2021/01/PSIM-User-Manual.pdf
3	
4	

Useful Links	
1	https://powersimtech.com/products/psim/capabilities-applications/
2	https://in.mathworks.com/solutions/power-electronics-control/power-electronics-simulation.html
3	https://www.plexim.com/products/plecs
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				3	3									2
CO3		1		3	3									2
CO4	1			3	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	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			15
Apply	15	15	15	45
Analyze		15	25	40
Evaluate				
Create				
Total	**30**	**30**	**40**	**100**

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AY 2021-22

Course Information

Programme	B.Tech. (Electronics Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Real Time Operating System Lab
Desired Requisites:	Theory/Lab Courses with C programming, Microcontroller Peripherals and Interfacing, 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 facilitate students to gain practical experience of RTOS and services provided by it.
2	To help students to co-relate the RTOS theory with the RTOS implementation.
3	To provide exposure to industry applications and facilitate for writing applications using RTOS.
4	To help students to acquire skills of using modern tools to develop and test RTOS based project.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	**Apply** the theoretical knowledge and demonstrate the basics of RTOS and the acquired skills of managing uCOS-II based project. (Practical Experience, Modern Tools)	Apply
CO2	**Prove/Verify** the RTOS fundamentals, practically, through illustrative programs and **demonstrate** usage of task, time and event management, Intertask communication using a simulator. (Programming skill, Modern Tools)	Apply
CO3	**Analyze** given RTOS based problem by applying the theoretical knowledge acquired. (Problem Solving, Modern Tools)	Analyze
CO4	**Implement** a given logic as an RTOS based application. Create document of the same and demonstrate using simulation tools. (Programming skill, Independent and team work, Modern Tools)	Create

List of Experiments / Lab Activities

List of Experiments:

1. Demonstration of RTOS based application for creating desired signals on digital I/O.
2. Writing of RTOS based application for creating given signals on digital I/O.
3. Proving that uCOS-II is a pre-emptive RTOS
4. Semaphore for managing shared resource and task synchronization
5. Assigning Mini-project problems. Demonstration of Clock tick and its effect of event timing in RTOS based systems.
6. Semaphore for event synchronization
7. Using mail box facility in RTOS
8. Using queue facility in RTOS
9. Avoiding dead-lock in RTOS
10. Building a small embedded application using an RTOS (Mini-Project) (Solving given problem by writing relevant program, Simulation, documentation, Demonstration, Period is around 3 weeks as a part of Lab ESE)

Text Books

1	*"MicroC OS II: The Real Time Kernel"* Jean J. Labrosse, CMP books publication ISBN: 978-1578201037
2	*RTOS Lab Manual*
3	
4	

References	
1	www.micrium.com for uCOS-II related documents, tutorials, downloads.
2	www.nxp.com for processor specific documents.
3	https://www.freertos.org/Documentation/RTOS_book.html
4	Everything You Need to Know about RTOS (pdf book) by Silabs

Useful Links	
1	www.highintegritysystems.com/rtos for RTOS tutorials
2	https://www.youtube.com/watch?v=ECEvUEkSSLg for videos by Renesas Inc.
3	University of Waterloo lecture material on RTOS
4	Micrium µC/OS-II Documentation (Documentation of RTOS company)

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												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	10			**10**
Analyze	20	10		**30**
Evaluate		20	10	**30**
Create			20	**20**
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	Final Year B. Tech. sem VII
Course Code	
Course Name	Project 1 and Seminar
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	6 Hrs/Week				
Interaction	-	**Credits: 3**			

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 thereby preparing students for main 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.	Apply
CO2	Propose research problem and present them in a clear and distinct manner through different oral, written and design techniques.	Evaluate
CO3	Construct, Comment and Evaluate Mini Projects' undertaken/ implemented by students.	Create
CO4	Deliver the seminar on project work completed	Analyze

List of Experiments / Lab Activities

Project Description:

A project group shall consist of not more than 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 develop and realize an electronic product. The electronic part of the product should be an application of the analog & digital systems covered up to the 7th semester. The schematic and PCB design should be done using any of the standard schematic capture & PCB design software. . The realization of the product should include design and fabrication of PCB.

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 project should be demonstrated at the time of examination.

The Projects may be from the following areas/domains, but not limited to:

- Embedded Systems
- Electronic Control Systems
- Electronic Communication Systems
- Biomedical Electronics
- Power Electronics
- Robotics and Mechatronic Systems
- Electric Vehicles
- Artificial Intelligence and Machine Learning
- Applications of Electronics to Agriculture

ASSESSMENT

A demonstration and oral examination on the mini project shall be conducted at the end of the semester.

The examination will consist of demonstration and viva voce on the project.	
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
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
Useful Links	
1	
2	

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											2
CO4						3								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 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			**20**
Analyze	10	10		**20**
Evaluate		20	20	**40**
Create			20	**20**
Total Marks	**30**	**30**	**40**	**100**

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AY 2021-22

Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Final Year B. Tech., Sem VII
Course Code	
Course Name	Professional Elective 5 : Microwave Engineering
Desired Requisites:	Communication Engineering

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

Course Objectives	
1	To understand the theoretical principles underlying microwave devices and networks
2	To introduce the various types of transmission lines and to discuss the losses associated
3	To instil knowledge on the properties of various microwave components
4	To deal with the microwave generation and microwave measurement techniques

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Classify the microwave frequencies and the waveguides that are used application	Understand
CO2	Categories the propagation of signals through antenna	Analyze
CO3	Examine the active & passive microwave devices & components used in Microwave communication systems	Apply
CO4	Analyse the operation and working of the various tubes or sources for the transmission of the microwave frequencies	Analyse

Module	**Module Contents**	**Hours**
I	**Microwave Fundamentals and Electromagnetic field Theory** Microwave regions and band designations, microwave devices, applications of microwaves, Interaction between electrons and fields, electron motion in electric, magnetic and electromagnetic field, electromagnetic plane waves	5
II	**Microwave Waveguide and Components** Rectangular and circular waveguide, TE and TM modes, power transmission and power losses in waveguide, excitation modes in waveguide, microwave cavities, Microwave passive components—Tee junctions, magic tee, couplers, circulators, attenuators, phase shifters, bends, twists, corners, irises, windows. Scattering Matrix Parameters of microwave networks, S-matrix for E-plane Tee junction, S-matrix for H-plane Tee junctions, S-matrix for directional coupler.	7

III	**Microwave Tubes** Limitations of conventional tubes, O and M type classification of microwave tubes, reentrant cavity, velocity modulation. **O type tubes** **Two cavity Klystron**: Construction and principle of operation, velocity modulation and bunching process Applegate diagram. **Reflex Klystron**: Construction and principle of operation, velocity modulation and bunching process, Applegate diagram, Oscillating modes, o/p characteristics, efficiency, electronic & mechanical tuning. **M-type tubes** **Magnetron**: Construction and Principle of operation of 8 cavity cylindrical travelling wave magnetron, hull cutoff condition, modes of resonance, PI mode operation, o/p characteristics, Applications. **Slow wave devices** Advantages of slow wave devices, **Helix TWT**: Construction and principle of operation, Applications.	8
IV	**Microwave Solid State Devices** Tunnel diode, PIN diode, Gunn diode, LSA diode, Read diode, IMPATT diode, TRAPATT diode, BARITT DIODE, Varactor Diode, solid state ruby laser, semiconductor laser.	8
V	**Microwave Measurements** Measurement devices: Slotted line, Tunable detector, VSWR meter, Power Meter, S-parameter measurement, frequency measurements, Power measurement, Attenuation measurement, Phase shift measurement, VSWR measurement, Impedance measurement, Q of cavity resonator measurement	6
VI	**Microwave Strip Lines and Antenna** Micro-strip line, Slot line, Parallel strip line, advantages, Horn antenna, Dish Antenna, Micro-strip antenna	5

Text Books	
1	*"Microwave Devices and Circuits", Samuel* Y. Liao, PHI.
2	
3	
4	

References	
1	*Microwave Engineering",* D. M. Pozar, John Wiley.
2	
3	
4	

Useful Links	
1	http://nptel.ac.in/downloads/117105077
2	http://www.nptelvideos.in/2012/12/digital-communication.html
3	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-450-principles-of-digital-communications-i-fall-2006/video-lectures/
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		3												2
CO3			3											2
CO4							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	10	5	20	35
3	Apply	10	10	20	40
4	Analyze		5	20	25
5	Evaluate				
6	Create				
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	Final Year B. Tech., Sem VII
Course Code	
Course Name	Professional Elective 5-Adaptive Signal processing
Desired Requisites:	Probability theory, Digital Signal Processing, Linear algebra.

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

Course Objectives

1	To develop a mathematical theory of linear adaptive filters
2	To provide a comprehensive treatment of mathematical signal processing algorithms
3	
4	

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Demonstrate key theory and applications of adaptive signal processing	Understand
CO2	Analyse LMS algorithm	Analyse
CO3	Apply adaptive modelling	Apply
CO4	Explain Adaptive Control Systems	Evaluate

Module	**Module Contents**	**Hours**
I	**Adaptive Systems:** Definitions and characteristics - applications – properties, examples - adaptive linear combiner- input signal and weight vectors , Desired response and error-performance function-gradient and minimum mean square error , Normal form of the input co relation matrix, eigenvalues and eigenvectors of the input correlation matrix	8
II	**Searching performance surface-stability and rate of convergence:** Methods of searching the performance surface, Basic ideas of Gradient search Methods, A simple gradient search algorithm and its solution, stability and rate of convergence, The learning curve, Gradient search by Newton's method, Gradient search by the method of Steepest Descent Algorithm	6
III	**The LMS algorithm** Derivation of the LMS algorithm, Convergence of the weight vector, An example of Convergence, Learning Curve, Noise in Weight vector solution, Misadjustment, The performance advantage of LMS algorithm	6
IV	**Adaptive Modelling and System identification:** General description, Adaptive modelling of multipath communication channel, Adaptive modelling in Geophysical Exploration, Adaptive Modelling in FIR Synthesis	6
V	**Inverse Adaptive Modelling:** General description of Inverse modelling, Some theoretical Examples, Adaptive equalization of Telephone Channels, Adaptive Poles and zeros for IIR Digital filter synthesis	7
VI	**Adaptive Control Systems:** Adaptive Model Control, Adaptive Inverse Control, Example of Adaptive Inverse Control	7

Text Books	
1	Bernard Widrow and Samuel D. Stearns, ―Adaptive Signal Processing‖, Person Education, 1985
2	
3	
4	
References	
1	Simon Haykin, ―Adaptive Filter Theory‖, Pearson Education, 2003.
2	John R. Treichler, C. Richard Johnson, Michael G. Larimore, ―Theory and Design of Adaptive Filters‖, Prentice-Hall of India, 2002.
3	
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Useful Links	
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	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		1												1
CO2	1													1
CO3	1													2
CO4		2												1

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	10	5	20	35
3	Apply	10	10	20	40
4	Analyze		5	15	20
5	Evaluate			5	5
6	Create				
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	Final Year B. Tech., Sem. VII
Course Code	
Course Name	Professional Elective 5- Analog CMOS IC Design
Desired Requisites:	Digital Electronics, Digital CMOS IC Design

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

Course Objectives

1	To **explain** the analog circuit concepts based on MOS devices in such a way to develop in students the insight and intuition towards MOS circuits.
2	To **organize** guest lectures and practical sessions with the help of industry persons.
3	To **deliver** the tips (or thumb rules) related with design of analog circuits throughout the course.
4	To **motivate** the students to develop lifelong/ self-learning attitude.

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	**Analyze** MOS device circuits to derive the dependence of various electrical parameters analytically and graphically. (M1)	Analyze
CO2	**Develop** large signal and small signal models for single stage amplifiers and differential amplifiers using MOS transistors and derive the gain relationships. (M2, M3)	Apply
CO3	**Design** common source, common gate, common drain amplifier for given specifications. Further recognize their application under various typical situations. (M2, M3)	Design
CO4	**Analyze** large signal and small signal behaviour of differential amplifiers and compute the differential gain, common mode gain and CMRR. (M3)	Analyze
CO5	**Analyze** active current mirrors and explain the properties of differential pairs using such circuits as loads. (M5)	Analyze
CO6	**Design** 2-stage Op-Amp for given specifications. **Compute** the poles and zeros in the frequency response of the single stage amplifiers using time-constant method (M6)	Design

Module	**Module Contents**	**Hours**
I	**MOS Device Physics** MOS IV Characteristics, Second Order Effects, MOS device models (MOS device capacitance, MOS small signal model) MOS model parameters	8
II	**Single Stage Amplifier** Part I CS stage with resistance load, diode connected load, current source load, , CS stage with source, degeneration,	6
III	**Single Stage Amplifier** Part II source follower, common-gate stage, Cascode stage, folded cascade, choice of device models.	6
IV	**Differential Amplifiers** Basic difference pair, differential mode response, common mode response, Differential pair with MOS loads	6
V	**Passive and Active Current mirrors** Basic current mirrors, Cascode mirrors, active current mirrors.	7
VI	**Frequency Response** CS stage, Source follower, Common gate stage, Cascode stage and Difference pair. Design of 2-stage operational amplifier	7

Text Books	
1	Behzad Razavi, "*Design of Analog CMOS Integrated Circuits"*, Second Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2017.
2	
3	
4	
References	
1	R. Jacob Baker, "*CMOS: Circuit Design, Layout and Simulation*", Wiley-Inter- science, (2008)
2	Allen, P.E. and Holberg, D.R., "*CMOS Analog Circuit Design*", Oxford University Press (2002)
3	
4	
Useful Links	
1	www.vlsi-expert.com,
2	www.testbench.in
3	www.asic-world.com
4	https://nptel.ac.in/courses/117/101/117101105/

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3												3
CO2	2	3												3
CO3			3											3
CO4	2	3												3
CO5	2	3												3
CO6		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.														

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	20
Analyze	10	10	25	45
Evaluate				
Create		10	25	35
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 VII
Course Code	
Course Name	Professional Elective 6 : Optical Communication
Desired Requisites:	Communication Engineering

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

Course Objectives	
1	To understand transmission characteristics of optical fibers.
2	To understand factors affecting signal distortion in optical fiber communication
3	
4	

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	Calculate the attenuation and signal degradation due to intermodal and intramodal distortion	Analyze
CO3	Calculate power coupling losses due to connectors, splices, source output pattern and fiber numerical aperture	Analyze
CO4	Compute 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.	9
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	**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.	6

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	**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	7
VI	**Measurements and Advances in Optical Fiber Systems :** Fiber Attenuation measurements- Dispersion measurements – Fiber efractive 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	7

Text Books	
1	Optical Fiber Communications by Gerd Keiser, 4th Edition (Mc Graw Hill)
2	Optical Fiber Communication by John M. Senior (PHI/Pearson)
3	
4	

References	
1	Fiber optical communication Technology by Djafar Mymbaev & Lowell L, Scheiner. (Pearson)
2	Fiber optic Communication Systems by G. Agrawal (John Wiley and sons)
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 (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	10		20	30
2	Understand				
3	Apply	10	10	20	40
4	Analyze		10	20	30
5	Evaluate				
6	Create				
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	Final Year B. Tech., Sem VII
Course Code	
Course Name	Professional Elective 6:Advanced Control System
Desired Requisites:	Control System

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

Course Objectives	
1	To introduce state space state variable approach for linear time invariant systems in both the continuous and discrete time systems.
2	To explain about developing the describing function for the nonlinearity present to assess the stability of the system.
3	To explain stability analysis of linear and nonlinear systems
4	To explain design techniques of pole assignment and state observer using state feedback.

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Develop state models for linear continuous time and discrete time systems.	Apply
CO2	Develop the describing function for the nonlinearity present to assess the stability of the system.	Apply
CO3	Illustrate Lyapunov function for the stability analysis of nonlinear systems.	Apply
CO4	Design pole assignment and state observer using state feedback.	Analyze

Module	**Module Contents**	**Hours**
I	**State Space Analysis :** Multivariable systems, State Space Representation of systems, Solution of State Equation, State Transition Matrix, Transfer function from state variable model, Eigenvalues and Eigenvectors, Concepts of controllability and observability, Tests for controllability and observability for continuous time systems – Time varying case, minimum energy control, time invariant case, Principle of Duality, Controllability and observability form Jordan canonical form and other canonical forms.	8
II	**Describing Function Analysis:** Definition, limitations, use of describing function for stability analysis, Introduction to nonlinear systems, Types of nonlinearities, describing function analysis of nonlinear control systems, describing function of ideal relay, relay with hysteresis & dead zone, saturation/coulomb friction & backlash.	6
III	**Stability Analysis:** Stability in the sense of Lyapunov., Lyapunov's stability and Lypanov's instability theorems. Direct method of Lypanov for the Linear and Nonlinear continuous time autonomous systems.	6

IV	**Digital Control Introduction:** Why Use Digital Control, Configuration of the Basic Digital Control Scheme, Principles of Signal Conversion, Basic Discrete – Time signals, Time – Domain models for discrete – time systems, Transfer function models, Stability on the Z-plane and the Jury stability criterion, Sampling as Impulse Modulation, Sampled Spectra and Aliasing, Filtering Practical Aspects of the choice of sampling rate, Principle of discretization, The Routh stability criterion on the r- plane.	7
V	**Digital Control Devices And Systems And Algorithms:** Introduction, z-Domain description of sampled continuous – time plants, z-Domain description of systems with Dead – Time, Implementation of Digital Controllers, Digital temperature control system, Digital position control system, Stepping motors and their control. z- plane specifications of control system design, Digital compensator Design using frequency response plots, Digital compensator Design using root Locus plots, z- plane Synthesis.	7
VI	**Pole-placement Design and State observers:** Introduction, Stability improvement by state feedback, Necessary and sufficient conditions of arbitrary pole-placement, State regulator design, Design of State Observers, Compensator Design by the separation principle, Servo design: Introduction of the reference input by feed forward control, State Feedback with Integral Control, Digital Control systems with state feedback, Deadbeat control by state feedback and Dead beat observers.	7

Text Books	
1	Modern Control System Theory – by M. Gopal, New Age International Publishers, 2nd edition, 1996
2	Digital Control and State Variable Methods: Conventional and Intelligent Control Systems M.Gopal McGraw Hill 3 rdEdition, 2008
3	Modern Control Engineering, Ogata, Fifth edition, Prentice Hall of India, 2009.
4	

References	
1	"Modern Control Engineering" – by K. Ogata, Prentice Hall of India, 3rd edition, 1998
2	2. "Control Systems Engineering" by I.J. Nagarath and M.Gopal, New Age International (P) Ltd.
3	Digital Control and State Variable Methods" – by M. Gopal, Tata Mc Graw-Hill Companies, 1997
4	Systems and Control by Stainslaw" H. Zak , Oxford Press, 2003

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		2		1									1
CO2	2		1											1
CO3	2		1											1
CO4	1	1	2		1									1

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

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	30	50
4	Analyze	10	10	30	50
5	Evaluate				
6	Create				
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	Final Year B. Tech., Sem VII
Course Code	
Course Name	Professional Elective 6-TCP/IP and Industrial Protocols
Desired Requisites:	

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

Course Objectives

1	To develop an understanding of computer networking basics
2	be exposed to the TCP/IP protocol suite
3	To develop an understanding of different components of computer networks, various protocols, modern technologies and their applications.
4	To gain conceptual understanding of Software Defined Networks (SDN)

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Design a small TCP/IP Network	Apply
CO2	Identify security issues and suggest suitable solution	Analyze
CO3	Explain concept of cloud and its models.	Understand
CO4	Explain OpenFlow, challenges in SDN, and developments in SDN	Understand

Module	**Module Contents**	**Hours**
I	**Internet Protocol : IPv4 :** IP Datagram Formats - Data and Fragmentation - Address Masks- Prefixes- and Subnetworks - Network Address Translation (NAT) - IP Switching and Routing - Local Delivery and Loopbacks - Address Resolution Protocol ICMP.	8
II	**Transport layer protocols** UDP and TCP segments, comparison, TCP flow control, congestion control, error control.	6
III	**Application layer protocols:** Audio video streaming over IP(RTP,RTCP, SCTP), Application layer protocols, HTTP, SMTP, SNMP, FTP.	6
IV	**Security:** The Need of Security, Security Approaches, Principal of Security, Types of Attacks. Network Security: Brief Introduction to Firewalls, IP Security, Virtual Private Networks (VPN)	7
V	**Fundamental Cloud Computing :** Business Drivers - Technology Innovations - Basic Concepts and Terminology - Roles and Boundaries - Cloud Characteristics - Cloud Delivery Models - Cloud Deployment Models. Cloud-Enabling Technology	7
VI	**Software Defined Networking(SDN)**: basics and Open flow, SDN Controller, SDN challenges, SDN and virtualization.	6

Text Books

1	B A Forouzan ," Computer Networks", McGraw Hill Education 2016
2	Software defined Networking, Chuck Black Elsevier 2014
3	

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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			2										2	
CO2		2												1
CO3		1												1
CO4	1	1												1

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

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	10		20	30
3	Apply	10	10	20	40
4	Analyze		10	20	30
5	Evaluate				
6	Create				
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	Final Year B. Tech. sem VIII
Course Code	
Course Name	Project 2
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	6 Hrs/Week				
Interaction	-	**Credits: 3**			

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 thereby preparing students for main 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.	Apply
CO2	Propose research problem and present them in a clear and distinct manner through different oral, written and design techniques.	Evaluate
CO3	Construct, Comment and analyse Projects' undertaken.	Create
CO4	Deliver the seminar on project work completed	Analyze

List of Experiments / Lab Activities

Project Description:

A project group shall consist of 5 students per group. The project will involve the design, construction, and debugging of an electronic system approved by the department. Each student should conceive, design develop and realize an electronic product. The electronic part of the product should be an application of the analog & digital systems covered up to the 7th semester. The schematic and PCB design should be done using any of the standard schematic capture & PCB design software. . The realization of the product should include design and fabrication of PCB.

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 project should be demonstrated at the time of examination.

The Projects may be from the following areas/domains, but not limited to:

- Embedded Systems
- Electronic Control Systems
- Electronic Communication Systems
- Biomedical Electronics
- Power Electronics
- Robotics and Mechatronic Systems
- Electric Vehicles
- Artificial Intelligence and Machine Learning

· Applications of Electronics to Agriculture

ASSESSMENT

A demonstration and oral examination on the mini project shall be conducted at the end of the semester. The examination will consist of demonstration and viva voce on the project.

Text Books	
1	Make: Electronics, by Charles Platt, Published by Maker Media, 2015

References	
1	

Useful Links	
1	
2	

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											2
CO4						3								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	20			**20**
Analyze	10	10		**20**
Evaluate		20	20	**40**
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	Final Year B. Tech. Semester VII
Course Code	
Course Name	Techno Social Activities
Desired Requisites:	

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

Course Objectives

1	To nurture the life skill qualities
2	To engage in independent and lifelong learning
3	
4	

Course Outcomes (CO) with Bloom's Taxonomy Level

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

CO1	Use life skills	Apply
CO2	Select the proper opportunity in corporate life.	Analyze
CO3	Develop communication effectively with the engineering community and with society at large.	Create
CO4	Develop himself/ herself as successful Engineer	Create

Contents

To earn the credit, participation of the students in following activities (More than one activity) will be evaluated.

1. Internship: 15 days internship (Online/ Offline)

2. Co-curricular Activities : Co-Curricular activities include activities by chapters of professional societies like SAE, IEEE, ISTE, IET, Department Associations, Lab Development, Paper Presentation in National/International Conferences, Paper Publication in National/ International Journal, Model Building, Project competition, Entrepreneurship, Patenting, Participation in Dept level/ Institute level Technical (Engineering) club activities.

3. Extra - Curricular Activities: Extra-Curricular Activities include activities such as NSS, Unnat Bharat, Gymkhana Clubs, Cultural Fests (Inside or outside of the college) , Spots Event (Inside or outside of the college), Community Services, Social work, Activities in Alumni Association, Participation in Sports, Various Clubs of Institute, Intra and Inter Collegiate competitions . Participation in Dept level/ Institute level club activities. (Activity conducted by club should be Technical- Ethics, Management, Professionalism/ skill/ Proficiency developments activities)

4. Course (Technical or fine arts) completed through **Continuing Education Program**

5. Any project completed which is helping the Electronics Engineering Department

The performance of a student shall be monitored and evaluated by the Faculty-in-charge

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
CO2							3							2
CO3										3				2
CO4												3		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	15	10	10	**35**
Analyze	15	10	10	**35**
Evaluate			10	**10**
Create		10	10	**20**
Total Marks	**30**	**30**	**40**	**100**

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AY 2021-22

Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Final Year B. Tech. Semester VIII
Course Code	
Course Name	Professional Elective 7-Radar and Navigation
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 learn Radar fundamentals and analysis of the radar signals.
2	To understand various technologies involved in the design of radar transmitters and receivers.
3	To learn various radars like MTI, Doppler and tracking radars and their comparison.
4	

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Demonstrate an understanding of the factors affecting the radar performance using Radar Range Equation	Understand
CO2	Analyze the principle of FM-CW radar	Analyze
CO3	Identify the different types of Radar Displays and their application in real time scenario	Apply
CO4	Demonstrate an understanding of the importance of Matched Filter Receivers in Radars	Understand

Module	**Module Contents**	**Hours**
I	**Basics of Radar**: Introduction, Maximum Unambiguous Range, Simple form of Radar Equation, Radar Block Diagram and Operation, Radar Frequencies and Applications. Prediction of Range Performance, Minimum Detectable Signal, Receiver Noise, Modified Radar Range Equation, Illustrative Problems. **Radar Equation** : SNR, Envelope Detector — False Alarm Time and Probability, Integration of Radar Pulses, Radar Cross Section of Targets (simple targets – sphere, cone-sphere), Transmitter Power, PRF and Range Ambiguities, System Losses (qualitative treatment), Illustrative Problems.	5
II	**CW and Frequency Modulated Radar:** Doppler Effect, CW Radar — Block Diagram, Isolation between Transmitter and Receiver, Non-zero IF Receiver, Receiver Bandwidth Requirements, Applications of CW radar. Illustrative Problems **FM-CW Radar:** Range and Doppler Measurement, Block Diagram and Characteristics, FM-CW altimeter, Multiple Frequency CW Radar	4
III	**MTI and Pulse Doppler Radar:** Introduction, Principle, MTI Radar with – Power Amplifier Transmitter and Power Oscillator Transmitter, Delay Line Cancelers — Filter Characteristics, Blind Speeds, Double Cancellation, Staggered PRFs. Range Gated Doppler Filters. MTI Radar Parameters, Limitations to MTI Performance, MTI versus Pulse Doppler Radar.	4
IV	**Tracking Radar**: Tracking with Radar, Sequential Lobing, Conical Scan, Monopulse Tracking Radar — Amplitude Comparison Monopulse (one- and two-coordinates), Phase Comparison Monopulse, Tracking in Range. Acquisition and Scanning Patterns. Comparison of Trackers.	4

V	**Detection of Radar Signals in Noise** : Introduction, Matched Filter Receiver – Response Characteristics and Derivation, Correlation Function and Cross-correlation Receiver, Efficiency of Non-matched Filters, Matched Fitter with Nonwhite Noise. **Radar Receivers** – Noise Figure and Noise Temperature. Displays — types. Duplexers — Branch type and Balanced type. Circulators as Duptexers. Introduction to Phased Array Antennas – Basic Concepts, Radiation Pattern, Beam Steering and Beam Width changes, Applications. Advantages and Limitations.	5
VI	**Radar clutter and basic navigational radar system 9 :** Introduction to Radar Clutter - Types, Surface clutter radar equation, Fundamentals of Navigation aids: Types of Navigation aids, ILS, DME, VOR, TACAN, MLS, LORAN, DECCA, OMEGA,	4

Text Books	
1	Introduction to Radar Systems — Men* I. Skolnik, TMH Special Indian Edition, 2nd Ed.. 2007
2	G S N Raju ,"Radar Engineering and Fundamentals of Navigational Aids" IK International Publishers, 2008

References	
1	Principles of Modem Radar: Basic Principles – Mark A. Rkhards, James A. Scheer, William A. HoIm. Yesdee, Scitech Publication, 2013

Useful Links	
1	www.Nptel.ac.in
2	https://ocw.mit.edu/resources/res-ll-001-introduction-to-radar-systems
3	www.radartutorial.eu/index.en.html

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	
CO2	3		3										2	
CO3	3		3										2	
CO4	3		3											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		5	20	25
Analyze	10	5	20	35
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	Final Year B. Tech. Semester VIII
Course Code	
Course Name	Professional Elective 7-Wavelet and Filter Banks
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 provide a mathematical introduction to the theory and applications of orthogonal wavelets and their use in analysing functions and function spaces.
2	It includes a brief survey of Fourier series representation of functions, Fourier transform and the Fast Fourier Transform (FFT) before proceeding to the Haar wavelet system, multi resolution analysis, decomposition and reconstruction of functions, Daubechies wavelet construction, and other wavelet systems.

Course Outcomes (CO) with Bloom's Taxonomy Level		
CO1	Explain the basic concepts and terminology that are used in the Fourier Techniques, wavelets Transforms and Time frequency analysis.	Understand
CO2	Apply multi-resolution analysis	Apply
CO3	Calculate filter bank coefficients and **Apply** the concepts of CWT, STFT and DWT for signal analysis	Evaluate
CO4	Construct perfect reconstruction wavelet filter banks for a particular application	Analyze

Module	**Module Contents**	**Hours**
I	**Fundamentals of Linear Algebra:** Vector spaces, Bases, Orthogonality, Ortho normality, Projection, Functions and function Spaces, Orthogonal functions, Orthonormal functions, Orthogonal basis functions.	4
II	**Signal Representation in Fourier Domain** Fourier series, Orthogonality, Orth normality and the method of finding the Fourier coefficients Complex Fourier series, Orthogonality of complex exponential bases, Mathematical preliminaries for continuous and discrete Fourier transform, limitations of Fourier domain signal processing, Review of Nyquist theorem, Review of Z transform	5
III	**Short Time Fourier Transform**: Signal representation with continuous and discrete STFT, concept of time-frequency resolution, Resolution problem associated with STFT, Heisenberg's Uncertainty principle and time frequency tiling, why wavelet transform?.	3
IV	**Continuous Wavelet Transform:** Wavelet transform-A first level introduction, Continuous time-frequency representation of signals, Properties of wavelets used in continuous wavelet transform, Continuous versus discrete wavelet transform	3
V	**Discrete Wavelet Transform** Wavelets and other wavelet like transforms, History of wavelet from Morlet to Daubechies via Mallat, Different communities and family of wavelets, Different families of wavelets within wavelet communities, Haar Scaling Functions and Function Spaces, Translation and Scaling, Orthogonality of Translates, Function	7

	Space Vo, Finer Haar Scaling Functions, Nested Spaces Haar Wavelet Function, Scaled Haar Wavelet Functions, Orthogonality of φ(t) and ψ(t), Normalization of Haar Bases at Different Scales, Standardizing the Notations, Refinement Relation with Respect to Normalized Bases, Support of a Wavelet System, Triangle Scaling Function, Daubechies Wavelets.	
VI	**Discrete Wavelet Transform and Relation to Filter Banks** Signal decomposition (Analysis), Relation with filter banks, Frequency response, Signal reconstruction: Synthesis from coarse scale to fine scale, Up sampling and filtering, Perfect reconstruction filters, QMF conditions, Computing initial sj+1 coefficient, Concepts of Multi-Resolution Analysis (MRA) and Multi-rate signal processing, Applications of DWT	4
Text Books		
1	K P Soman, Ramachandran, Resmi, *Insights into wavelets from theory to practice*, Prentice Hall,New Delhi,	
2	A.N. Akansu and R.A. Haddad, "*Multiresolution signal Decomposition: Transforms, Subbands and Wavelets*", Academic Press, Oranld, Florida, 1992.	
3	John G. Proakis, Dimitris G. Manolakis, "*Digital Signal Processing*", Pearson Prentice Hall, 2007.	
References		
1	C. Sidney Burrus, Ramesh A. Gopinath, Haitao Guo, *Introduction to Wavelets and Wavelet Transforms,* A Primer PH International Editions, 1998.	
2	Raghuveer M. Rao, Ajit S. Bopardikar, Wavelet Transforms – *Introduction to Theory and Applications*, Addison Wesley Pearson Education Asia, 2000.	
3	IEEE Transaction Papers.	
Useful Links		
1	https://nptel.ac.in/courses/117/101/117101001/	

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			2											2
CO2				2										2
CO3				1										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	10	10	10	30
Apply	10	5	20	35
Analyze		5	25	30
Evaluate			5	5
Create				
Total	**20**	**20**	**60**	100

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Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Final Year B. Tech. Semester VIII
Course Code	
Course Name	Professional Elective 8-Satellite communications
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 provide students with solid foundation in orbital mechanics and launches for the satellite communication
2	To train the students with a basic knowledge of link design of satellite with a design examples
3	To provide better understanding of multiple access systems and earth station technology
4	To prepare students with knowledge in satellite navigation and GPS & and satellite packet communications

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Analyze satellite orbit	Analyze
CO2	Analyze the earth segment and space segment	Analyze
CO3	Design various satellite applications	Create

Module	**Module Contents**	**Hours**
I	**Communication Satellite:** Orbit and Description: A Brief history of satellite Communication, Satellite Frequency Bands, Satellite Systems, Applications, Orbital Period and Velocity, effects of Orbital Inclination, Azimuth and Elevation, Coverage angle and slant Range, Eclipse, Orbital Perturbations, Placement of a Satellite in a Geo-Stationary orbit.	5
II	**Satellite Sub-Systems:** Attitude and Orbit Control system, TT &C subsystem, Attitude Control subsystem, Power systems, Communication subsystems, Satellite Antenna Equipment. Satellite Link: Basic Transmission Theory, System Noise Temperature and G/T ratio, Basic Link Analysis, Interference Analysis, Design of satellite Links for a specified C/N, (With and without frequency Re-use), Link Budget.	5
III	**Propagation effects:** Introduction, Atmospheric Absorption, Cloud Attenuation, Tropospheric and lonospeheric Scintillation and Low angle fading, Rain induced attenuation, rain induced cross polarization interference.	4
IV	Multiple Access: Frequency DivisIon Multiple Access (FDMA) – Intermodujation Calculation of C/N, Time Division Multiple Access (TDMA) – Frame Structure, Burst Structure, Satellite Switched TDMA, On-board Processing, Demand Assignment Multiple Access (DAMA) — Types of Demand Assignment, Characteristics, CDMA Spread Spectrum Transmission and Reception.	4
V	Earth Station Technology: Transmitters, Receivers, Antennas, Tracking Systems,	4

	Terrestrial Interface, Power Test Methods, Lower Orbit Considerations.	
VI	**Satellite Navigation and GPS Systems:** Radio and Satellite Navigation, GPS Position Location Principles, GPS Receivers, GPS C/A Code Accuracy, Differential GPS.	4

Text Books	
1	Satellite Communications Dennjs Roddy, 2nd Edition, 1996, McGraw Hill.
2	Satellite Communications —Timothy Pratt, Charles Bostian, Jeremy Allnutt, 2nd Edition, 2003, John Wiley & Sons.
3	
4	
References	
1	Satellite Communications: Design Principles — M. Richcharia, 2nd Ed., BSP, 2003.
2	Fundamentals of Satellite Communications — K. N. Raja Rao, PHI, 2004.
3	
4	
Useful Links	
1	
2	
3	

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	1												3	
CO3	3	3												3
CO4		2												1

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

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				
Analyze	20	10	40	70
Evaluate				
Create		10	20	30
Total	**20**	**20**	**60**	100

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AY 2021-22

Course Information	
Programme	B.Tech. (Electronics Engineering)
Class, Semester	Final Year B. Tech. Semester VIII
Course Code	
Course Name	Professional Elective 8-IoT
Desired Requisites:	

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 understanding of the Internet of Things concepts.
2	To demonstrate various IoT protocols.
3	To expose the student with the latest trends & techniques in the field and expertise him/her considering academic & professional aspect.
4	

Course Outcomes (CO) with Bloom's Taxonomy Level		
At the end of the course, the students will be able to,		
CO1	Explain in a concise manner how Internet of Things work	Understand
CO2	Explain on various connectivity and communication technologies used in IoT.	Understand
CO3	Apply the knowledge for solution building in IoT domain	Apply
CO4		

Module	**Module Contents**	**Hours**
I	Overview of Internet of Things : Introduction of IoT, Network Configuration and addressing, IoT sensors and actuators	4
II	Connectivity and communication technologies for IoT : IEEE 802.15.4, 6LoPAN, RFID, WiFi, Bluetooth, Zigbee, Wireless HART for IoT, MQTT, CoAP, XMPP, AMQP	5
III	Sensor networks :Target tracking, MWSN, UWSN, Stationary and Mobile WSN, UAV Networks	4
IV	Machine to Machine Communication : M2M Features, Node types, Ecosystem, various M2M platforms	4
V	Sensor Cloud : Limitations of WSN, Architecture, workflow, target tracking, virtual sensor, caching in sensor cloud, performance, pricing	5
VI	IoT Applications : Smart cities, Smart Homes, Smart Agriculture, Smart Energy, Smart vehicles	4

Text Books	
1	Introduction to Industrial Internet of Things By Sudip Misra, Chandana Roy, Anandarup Mukherjee 2021
2	Introduction to Industrial Internet of Things and Industry 4.0 By Sudip Misra, Chandana Roy, Anandarup Mukherjee , Cambridge University Press, 2020
3	
4	

References	
1	D.E. Comer “Internetworking with TCP/IP”, Vol. I (4th Edition), II, III (PHI)
2	“Internet of Things Applications and Protocols ”, Wiely publication 2nd Ed.
3	William Stallings “Foundations of Modern Networking : SDN, NFV, QoE, IoT and Cloud” Pearson Education

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc21_cs17/preview
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													3
CO4														

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

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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