ET3051: Biomedical Instrumentation (Professional Elective)	
Teaching Scheme **Lectures : 3 Hrs/week** **Total credits : 03**	**Examination Scheme** **Test 1 : 15 Marks** **Test 2 : 15 Marks** **Teachers' Assessments : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Knowledge of Instrumentation and Measurement

Course description: The course is designed to give the basic concepts of Instrumentation involved in medical field and human physiology. Biomedical Instrumentation is application of technology for Medical field. During the course, students will explore Electro-physiological measurements, medical imaging etc. The course will make the students understand the devices used in diagnosing the diseases.

Course objectives: The course has the following objectives:

- To introduce an fundamentals of transducers as applicable to physiology
- To explore the human body parameter measurements setups
- To make the students understand the basic concepts of forensic techniques.
- To give basic ideas about how multimedia evidences are useful in crime investigation.

Course Outcomes: After completing the course, the students will able to:

CO1	Understand the physiology of biomedical system	K2
CO2	Measure biomedical and physiological information	K2
CO3	Discuss the application of Electronics in diagnostics and therapeutic area	K2

Detailed Syllabus:

Unit	Content
Unit-I	**Physiology and transducers** Cell and its structure, Resting and Action Potential, Nervous system: Functional organization of the nervous system, Structure of nervous system, neurons, synapse, transmitters and neural communication, Cardiovascular system, respiratory system, Basic components of a biomedical system, Transducers, selection criteria, Piezo-electric, ultrasonic transducers, Temperature, measurements - Fiber optic temperature sensors.
Unit-II	**Electro – Physiological measurements** Electrodes: Limb electrodes, floating electrodes, pre-gelled disposable electrodes, Micro, needle and surface electrodes, Amplifiers: Preamplifiers, differential amplifiers, chopper amplifiers, Isolation amplifier. ECG, EEG, EMG, ERG, Lead systems and recording methods, Typical waveforms. Electrical safety in medical environment: shock hazards, leakage current-Instruments for checking safety parameters of biomedical equipment
Unit-III	**Non-electrical parameter measurements** Measurement of blood pressure, Cardiac output, Heart rate, Heart sound Pulmonary function measurements, spirometer, Photo Plethysmography, Body Plethysmography, Blood Gas analyzers : pH of blood, measurement of blood pCO2, pO2, finger-tip oximeter, ESR, GSR, measurements, Standard HL7
Unit-IV	**Medical Imaging** Radiographic and fluoroscopic techniques, X rays, Computer tomography, Mammography, MRI, fMRI, Ultrasonography, Endoscopy, Thermography, Different types of biotelemetry systems and patient monitoring

Unit-V	**Assisting and therapeutic equipments** Pacemakers, Defibrillators, Ventilators, Nerve and muscle stimulators, Diathermy, Heart Lung machine, Audio meters, Dialyzers, Lithotripsy

Text and Reference Books

1. R.S.Khandpur, 'Hand Book of Bio-Medical instrumentation', Tata McGraw Hill Publishing Co Ltd., 2003.
2. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, 'Bio-Medical Instrumentation and Measurements', II edition, Pearson Education, 2002 / PHI.
3. J.Webster, 'Medical Instrumentation', John Wiley & Sons, 1995.
4. L.A. Geddes and L.E.Baker, 'Principles of Applied Bio-Medical Instrumentation', John Wiley & Sons, 1975.

Mapping of course outcome with program outcomes:

Program outcome / Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**1**										
CO2	**1**					**2**					**2**	
CO3						**2**					**2**	

1-High 2-Medium 3-Low

Teachers' Assessment: Teachers Assessments of 10 marks is based on one of the/or combination of few of the following

1. Simulation
2. Presentation of case studies
3. Question and Answer/Numerical solution
4. Study of processes in Industry/Hospital and its presentation

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test 1	Test 2	Teachers' Assessment/ Assignment	End Semester Examination
K1	Remember	05	05	00	10
K2	Understand	10	10	10	50
K3	Apply	00	00	00	00
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks (100)		15	15	10	60

Assessment Table

Assessment Tool	K2	K2	K2
	CO1	CO2	CO3
Class Test 1 (15 marks)	07	08	00
Class Test 2 (15 marks)	00	07	08
Teachers' Assessment (10 marks)	00	05	05
ESE Assessment (60 marks)	10	20	30

ET3052: Lab Biomedical Instrumentation	
Teaching Scheme **Practical: 2 Hrs/Week** **Total credits : 01**	**Examination Scheme** **Term Work : 25 Marks**

Laboratory Course Outcomes

As an outcome of completing the Laboratory course, students will able to:

CO1	Study various transducers
CO2	Get exposure to human body parameter measurement
CO3	Develop understanding of patient monitoring systems

List of Experiments

Perform any eight experiments from the following list or similar experiments based on the theory syllabus can be performed.

Sr. No.	Details
1	Perform the measurements based on transducers and plot the characteristics
2	Compare performance of variety of electrodes
3	Measurement of Blood Pressure
4	Measurement of pH
5	Analyze Instrumentation amplifier for biomedical signals
6	Learn pulse oximeter/Diathermy
7	Simulate the real time ECG monitoring and ECG wave analysis
8	Simulate the real time EEG monitoring and EEG wave analysis
9	Observe the real time patient monitoring system (Visit to Hospital)
10	Observe of pacemakers/ defibrillators / Ventilators/MRI/X-ray(Visit to Hospital)

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				1	3			1				
CO2				3	3							
CO3				3	3			1	2			

1 – High 2 – Medium 3 - Low

Assessment Pattern

Preparation (S1)	04
Conduct of Experiment (S2)	04
Observation and Analysis of Results (S3)	08
Record (S2)	03
Mini-Project / Presentation/ Viva-Voce (S3)	06
Total	**25**

ET3053: Mobile Communication(Professional Elective)	
Teaching Scheme **Lectures: 3 Hrs/Week** **Total Credits:3**	**Examination Scheme** **Test I : 15 Marks** **Test II : 15 Marks** **Teachers' Assessments : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Basic knowledge of Analog communication theory and Digital communication.

Course Description:
To expose the students to the most recent technological developments in Mobile communication systems.

Course Objectives:

- To deal with the fundamental cellular radio concepts
- To accustom with various multiple access Techniques.
- To know about mobile technologies like GSM and CDMA.
- To get familiar with the higher generation cellular standards and latest Development in mobile applications.

Course Outcomes
After completing the course, students will be able to:

CO1	Describe the basic cellular concepts in mobile communication.
CO2	Explore the characteristics of different types of Multiple Access Technologies.
CO3	Understand GSM and CDMA Cellular technologies.
CO4	Learn emerging technologies required for future generation mobile systems.
CO5	Develop small smart phone Applications

Detailed Syllabus:

Unit 1	**Cellular Communication Fundamentals**: Frequency reuse, channel assignment strategies,handoff Strategies, Interference and System Capacity, Co-channel Interference (CCI), Adjacent Channel Interference (ACI) , interference reduction techniques, improving coverage and capacity in cellular system, Call Setup Processes. Diversity techniques
Unit 2	**Multiple Access Technologies:** Narrowband Systems, Wideband Systems, Frequency Division Multiple Access, Time Division Multiple Access, Code Division Multiple Access, Spread Spectrum Multiple Access, Space Division Multiple Access.
Unit 3	**GSM & CDMA Overview:** GSM architecture, GSM identifiers, localization and calling, GSM security, Introduction to CDMA, CDMA forward& reverse link,
Unit 4	**Higher Generation cellular Standards:** Ultra wideband technology, Wi-max, 3G ,4G, 5G systems. WCDMA , LTE ,MIMO, software defined radio(SDR)
Unit 5	**Mobile Applications:** Smart phone technology, Internet of Things (IoT) Communication protocols in IoT, Voice over Internet Protocol (VoIP),Android OS. PhoneGap technology.

Text and Reference Books

1. Andrea Goldsmith, Wireless Communications, Cambridge University Press.
2. Simon Haykin, Modern Wireless Communications, Pearson Edition.
3. Theodore Rappaport, Wireless Communications: Principles and Practice,Prentice Hall.
4. John Schiller, Mobile Communications, Pearson Education
5. William C.Y.Lee, Mobile Cellular Telecommunications Analog and Digital Systems, II Ed.

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						1		3				2
CO2					3	1						
CO3			2	2	2	1						3
CO4				1	2	1						
CO5			1	2	1	1		1				2

1 – High 2 – Medium 3 - Low

Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Simulation
2) Application development
3) Presentation of case studies
4) Question & answer / Numerical solution
5) Study of Industry processes and its presentation

Recommended Assessment Pattern

Assessment Pattern Level No.	**Knowledge Level**	**Test 1**	**Test 2**	**Teachers Assessment/ Assignment**	**End Semester Examination**
K1	Remember	05	00	00	12
K2	Understand	10	05	05	26
K3	Apply	00	10	05	22
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	**K1**	**K2**	**K3**	**K3**	**K2**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Class Test 1	08	07	00	00	00
Class Test 2	00	08	07	00	00
Teachers Assessment (10 Marks)	00	05	05	00	00
ESE Assessment (60 Marks)	12	10	10	12	16

ET3054 Lab- Mobile Communication

Teaching Scheme	Examination Scheme
Practical: 2 Hrs/Week	**Term Work : 25 Marks**
Total Credits:01	

Laboratory Course Outcomes

As an outcome of completing the Laboratory course, students will able to:

CO1	Acquire knowledge of GSM AT commands for different applications
CO2	Understand the characteristics and limitations of mobile hardware devices.
CO3	To get familiar with future generation mobile systems.
CO4	Use contemporary development environment and languages (java, Android etc.) to develop mobile applications.

List of Experiments

Sr. No.	Details
1	Generation of following waveform using Matlab code. • Direct sequence spread spectrum (DSSS) modulation & demodulation • TDM modulation and demodulation.
2	Understanding GSM handset for various signaling and fault insertion techniques
3	Working with various GSM- AT Commands.
4	Demonstration of DS-SS modulation/Demodulation Process on CDMA trainer.
5	To get familiar with front panel of 3G mobile phone trainer and To observe test point voltages of 3G mobile phone trainer.
6	Understanding smart phone technology.
7	Development of any one android based application.
8	Learn and develop concept of software radio.

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				1	2							
CO2				2	2							
CO3				1	1	2						
CO4				1	1	2	1					2

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	S2	S2	S3	S2
	CO1	CO2	CO3	CO4
Term Work (25 Marks)				

Recommended Assessment Pattern

Assessment Pattern Level No.	Skill Level	Term Work
S1	Imitation	04
S2	Manipulation	07
S3	Precision	14
S4	Articulation	00
S5	Naturalization	00

ET3055: Information Theory & Coding

(Professional Elective)	
Teaching Scheme **Lectures: 3 Hrs/Week** **Credits: 03**	**Examination Scheme** **Test I :15 Marks** **Test II :15 Marks** **Teachers Assessment : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: NIL

Course description: This course describes Information theory, entropy, channels. It also covers various types of codes like linear block codes, cyclic codes, BCH, convolution codes. The subject deals with Information and channels in details.

Course Objectives:

- To give exposure to students about concepts of information, entropy ,coding efficiency
- To explain need of data compression
- To give mathematical foundation of compression, error control and security of information.
- To give exposure to students about various source coding and channel coding

Course Outcomes

After completing the course, students will able to:

CO1	Describe fundamentals concepts of Information theory and source coding	K2
CO2	Explain the need of Source coding and Channel coding	K2
CO3	Describe various types of Source coding and Channel coding and decoding	K2
CO4	Apply theoretical concepts to derive various codes for real world signal	K3

Detailed Syllabus:

Unit 1	Information Theory, Entropy, Source coding theorem, Channel models, capacity and coding, Information capacity theorem, Shannon's Limit
Unit 2	Linear Block Coding/Decoding , Matrix description of Linear block codes, Hamming codes, optimal linear codes, Maximum Distance Separable codes
Unit 3	Cyclic Codes, Polynomials, Generation of Cyclic codes, matrix description of cyclic codes, Burst Error Correction, Fire Codes, Golay Codes, Cyclic Redundancy Check
Unit 4	BCH Coding /Decoding , Primitive elements, Minimal Polynomials, Generator Polynomials, Reed Solomon codes, Nested Codes
Unit 5	Convolutional Code, Tree Codes and trellis codes, Polynomial description of Convolutional Codes, Distance Notion, Generating function, Matrix description, Viterbi coding, Distance Bound, Performance bound, Turbo Coding/Decoding. Block chain

Text and Reference Books

1. Ranjan Bose, "Information Theory coding and Cryptography", McGraw-Hill Publication, 2nd Edition
2. R. Avudaiammal, "Information Coding Techniques" Second Edition. Tata McGraw Hill
3. J C Moreira, P G Farrell, "Essentials of Error-Control Coding", Wiley Student Edition.
4. Simon Haykin, "Communication Systems", John Wiley & Sons, Fourth Edition.

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2									3		
CO2		2										
CO3	1	2	3				2					
CO4	1	2	3									

1 – High 2 – Medium 3 – Low

Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following:

1) Simulation
2) Presentation
4) Question & answer / Numerical solution
5) Case study of real world application of 1-D and 2-D signal

Assessment Pattern

Assessment Pattern Level No.	**Knowledge Level**	**Test I**	**Test II**	**Teachers Assessment/ Assignment**	**End Semester Examination**
K1	Remember	05	00	00	10
K2	Understand	10	15	05	50
K3	Apply	00	00	05	00
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	**K1**	**K2**	**K3**	**K4**
	CO1	**CO2**	**CO3**	**CO4**
Class Test I (15 Marks)	05	10	00	00
Class Test II (15 Marks)	00	10	05	00
Teachers Assessment (10 Marks)	00	00	05	05
ESE Assessment (60 Marks)	06	12	30	12

ET3056 Lab –Information Theory and Coding	
Teaching Scheme **Practical: 2Hrs/Week** **Credits: 01**	**Examination Scheme** **Term Work : 25 Marks**

Laboratory Course Outcomes

As an outcome of completing the Laboratory course, students will able to:

CO1	Recognize /calculate entropy, mutual information of given signal
CO2	Implement programs to generate various codes
CO3	Apply modern tools to code the real world signal
CO4	Demonstrate to compare the performance of coded with un-coded signals

List of Experiments

Sr. No.	Details
1.	Write & Execute programs to find out, entropies and mutual information of given signals for given channel. Test various types of channel such as a) Noise free channel b) Error free channel c) Binary symmetric channel d) Noisy channel Compare channel capacity of above channels
2.	Write & Execute programs for generation and evaluation of source coding a) Shannon – Fano coding and decoding b) Huffman Coding and decoding c) Lempel Ziv Coding and decoding
3.	Write& Execute Programs for coding & decoding of Linear block codes.
4	Write & Execute Programs for coding & decoding of Cyclic codes.
5.	Write & Execute programs for coding and decoding of BCH and RS codes.
6.	Write & Execute programs for coding and decoding of convolutional codes
7.	Write & Execute programs to study performance of a coded and un-coded communication
8.	Implement any one type of coding technique for real world 1-D or 2-D signals

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2			3								
CO2		2	3									
CO3					2		3		3			
CO4			2	2						2		

1– High 2 – Medium 3 - Low

Assessment Pattern

Preparation (S1)	04
Conduct of Experiment (S2)	04
Observation and Analysis of Results (S3)	08
Record (S2)	03
Mini-Project / Presentation/ Viva-Voce (S3)	06
Total	**25**

ET3057: Digital System Design (Professional Elective)	
Teaching Scheme **Lectures : 3 Hrs/week** **Total credits : 03**	**Examination Scheme** **Test 1 : 15 Marks** **Test 2 : 15 Marks** **Teachers' Assessments : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Basic knowledge of Digital Electronics

Course description: This course introduces the concept of hardware design and implementation using Hardware Description Languages like VHDL. Students also learn about the architectures of different Programmable Logic Devices like PAL, PLA, CPLD, FPGA etc. Students will be able to simulate and test hardware and optimize their designs. They will learn about the use of FPGAs in digital design and the full FPGA design flow.

Course objectives: The course has the following objectives:

- To introduce the fundamental principles of VLSI circuit design
- To obtain comprehensive knowledge about VHDL language to implement digital systems.
- To expose the students to write test bench, synthesize and simulate programs
- To acquaint them with integrated circuit designing using CAD tools and Hardware Description Languages
- To explain architectures of different programmable devices.

Course Outcomes: After completing the course, the students will able to:

CO1	Identify the different process steps in HDL design flow, basics of VHDL and architectures.	**K1**
CO2	Implement combinational and sequential digital circuits using different styles of modeling and Finite State machines	**K2**
CO3	Develop and design digital systems to meet a given set of specifications using VHDL or finite state machines.	**K3**
CO4	Understand simulation, synthesis process and architectures of programmable devices	**K2**

Detailed Syllabus:

Unit	Content
Unit I	**Fundamentals of VHDL and Modeling Styles** Introduction to HDL, HDL design flow, VHDL, Features of VHDL, Levels of Abstraction, Language Constructs, Entity, Architecture, Data types, constants, Signals and variables, Libraries and Packages, Functions and Procedures Dataflow modelling: concurrent statements Behavioral Modeling: Process statement, Inertial and Transport Delay Models, Signal Drivers, Sequential statements, IF, CASE, NULL, Loop, Wait, Exit, Next statements, Assertion and Report statements, block statement Structural Modeling: Component declaration, component instantiation, Generics
Unit II	**Combinational Logic Design Using VHDL**

	VHDL modeling of basic gates, half and full adder, subtractor, multiplexers, multiplier, ALU, decoders, parity checker, Comparator, priority encoder, (Dataflow, behavioral and structural modeling). Introduction to Verilog
Unit III	**Sequential Logic Design Using VHDL** VHDL modeling of D, T, JK, Shift Registers, Counters, Implementation of Moore and Mealy Machines, Asynchronous Sequential Machines, Applications like Traffic light controller, lift controller or any other
Unit IV	**VHDL Simulation and Synthesis** Writing a Test Bench, Simple examples of Test Benches, Compilation and Simulation of VHDL code, Simulation deltas, Synthesis Process, RTL Description, Translation, Boolean Optimization, Mapping to Gates
Unit V	**Introduction to FPGA** Architecture of PAL, PLA, CPLD and FPGA. Case Studies: Xilinx XC9500 CPLD series, Review of SPARTAN,VIRTEX, SoCs and MPSoCsFPGA Series

Text and Reference Books

1. Charles Roth, “Digital Design with VHDL”, Thomson Learning, India Edition
2. John Wakerly, “Digital Design: Principal and Practices”, Pearson Education
3. Douglus Perry, “VHDL Programming by example”, TMH, fourth edition
4. J. Bhasker, “VHDL Primer”, PHI
5. J. Bhasker, “A VHDL synthesis Primer”, BSP, New Delhi
6. Wayne Wolf, "FPGA-Based System Design," Prentice Hall

Mapping of course outcome with program outcomes:

Program outcome / Course outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3				3						
CO2			2		3				2		2	
CO3			1		1				1		2	2
CO4		2			2							

1-High 2-Medium 3-Low

Teachers’ Assessment: Teachers Assessments of 10 marks is based on one of the/or combination of few of the following

1. Simulation
2. Presentation of case studies
3. Question and Answer/Numerical solution
4. On Board Application Development

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test 1	Test 2	Teachers' Assessment/ Assignment (10)	End Semester Examination
K1	Remember	05	00	00	06
K2	Understand	10	10	05	42
K3	Apply	00	05	05	12
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks (100)		15	15	10	60

Assessment Table

Assessment Tool	K1	K2	K3	K2
	CO1	**CO2**	**CO3**	**CO4**
Class Test 1 (15 marks)	05	10	--	--
Class Test 2 (15 marks)	--	10	05	--
Teachers' Assessment (10 marks)	--	05	05	--
ESE Assessment (60 marks)	06	24	12	18

ET3058: Lab Digital System Design	
Teaching Scheme **Practical: 2Hrs/Week** **Total Credits:1**	**Examination Scheme** **Term Work : 25 Marks**

Term Work: Term work will consist of record of experiments/assignments based on the syllabus. The experiments will comprise of Modeling, Simulation and Synthesis and Hardware verification using programmable logic Target boards
• Xilinx ISE/Aldec / Vivado

Course Outcomes
As an outcome of completing the Laboratory course, students will be able to:

CO1	Demonstrate HDL design flow with the help of CAD design tools
CO2	Execute programs using VHDL with different modeling techniques and finite state machines
CO3	Synthesize, simulate and download programs on FPGA platforms

List of Experiments: (Minimum eight)

Sr. No.	Name of the experiment
1	Demonstrate and practice to use CAD design tools to model digital circuits.
2	Implement simple circuits using data flow modeling: Gate, half adder, MUX, function
3	Write simple VHDL programs to use different operators of VHDL: relational, logical, data types
4	Implement combinational circuits using data flow modeling (conditional statement): MUX, Decoder, Prime number. Write test bench to generate waveforms and hardware.
5	Implement combinational digital circuits using behavioral modeling: Priority Encoder, full adder, parity generator/checker. Write test bench to generate waveforms and hardware.
6	Implement sequential digital circuits using behavioral modeling: D,JKflipflops, 3-bit counter, up/down counter, ring counter. Write test bench to generate waveforms and hardware.
7	Implement digital circuits using structural modeling: 4-bit adder using half and full adder, 8-bit inverter using 1-bit inverter, 8:1MUX using 2:1 MUX. Write test bench to generate waveforms.
8	Implement types of counter with 1 Hz frequency to download on FPGA platform: 4-bit counter, decade counter, ring counter. Write test bench to generate waveforms and hardware.
9	Implement FSMs using VHDL: Mealy and Moore Machines
10	Write simple Verilog programs. (Any four programs).
11	Design and develop Lift/Traffic controller on FPGA.

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					2							
CO2				2	1						2	3
CO3				2	1						2	1

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	**S1**	**S2**	**S2**
	CO1	**CO2**	**CO3**
Term Work (25 Marks)	05	16	04

ET3059: Industrial Automation (Professional Elective)	
Teaching Scheme **Lectures: 3 Hrs/Week** **Total Credits: 3**	**Examination Scheme** **Test 1 : 15 Marks** **Test 2 : 15 Marks** **Teachers' Assessments : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Nil

Course description: After completing this course, students will have a broad and fundamental understanding of industrial automation. Topics range from an overview of common automation industries to an introduction of basic automated system components, such as controllers, I/O, drives, and HMI (Human Machine Interface). In addition, students will learn common automation terminology, tools used in industrial automation, and career options available within this field

Course Objectives:

- To provide a clear view on Programmable Logic Controllers (PLC), SCADA and DCS
- To accustom with various methods involved in automatic control and monitoring
- To impart knowledge about robotics, fuzzy Neuro controllers used in automation
- To familiarize with industrial communication protocols

Course Outcomes

After completing the course, students will able to:

CO1	Develop the PLC program for various timing and sequencing operations.
CO2	Identify the necessity of using DAS, SCADA, DCS &PLC for Complex projects.
CO3	Understand the interfacing methods and industrial communication protocols

Detailed Syllabus:

Unit 1	Signal Conditioning Systems Data Acquisition systems, Data Loggers, Industrial case studies
Unit 2	Programmable logic controllers (PLC), Programming techniques, SCADA, Distributed Control Systems (DCS). Human Machine Interface, Case studies
Unit 3	Introduction to industrial communication protocols- TCP/IP protocol- HART communicator protocol Wireless communication(Ip56, Ip58) LAN – PROFI bus, PROFI Net, Modbus, CAN bus, fieldbus architecture, I/O Link and Industrial Ethernet
Unit 4	Process Control system principles, Basic concepts, Industrial pneumatic and hydraulic systems, case studies, SEAL 2 & 3 systems.
Unit 5	Introduction to Robotics, Computer vision. Fuzzy Neuro Controllers Development of automation systems to industrial processes, IoT, Case studies

Text and Reference Books

1. Bela G. Liptak, Instrumentation Engineer "s Hand Book,CRC Press
2. H. S. Kalsi, Electronic Instrumentation, TMH
3. J.Nagrath&M.Gopal,Control System Engineering, Third edition, New Age International Publication
4. Rangan and Sarma, Instrumentation Systems, TMH
5. Helfric A.D & Cooper W.D, Modern Electronic Instrumentation &Measurement Techniques, Pearson Education
6. Curtis D Johnson, Process Control; Instrumentation Technology, Pearson Education, 2008
7. PLC manuals from Siemens
8. G.C.Goodwin, S.R.Graebe, M.E. Salgado, Control System Design, Pearson Education

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					2			3				1
CO2		3										2
CO3												1

1 – High 2 – Medium 3 – Low

Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Simulation
2) Application development
3) Presentation of case studies
4) Question & answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini projects

Recommended Assessment Pattern

Assessment Pattern Level No.	**Knowledge Level**	**Test-I**	**Test-II**	**Teachers Assessment/ Assignment**	**End Semester Examination**
K1	Remember	05	05	00	10
K2	Understand	10	10	00	25
K3	Apply	00	00	10	25
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	K1	K2	K2
	CO1	CO1,CO2	CO3
Class Test – I (15 Marks)	05	10	00
Class Test – II (15 Marks)	00	05	10
Teachers Assessment (10 Marks)	00	00	10
ESE Assessment (60 Marks)	15	25	20

Special Instructions if any: Nil

ET3060- Lab Industrial Automation	
Teaching Scheme **Practical: 2Hrs/Week** **Total Credits: 01**	**Examination Scheme** **Term Work : 25 Marks**

Laboratory Course Outcomes

As an outcome of completing the Laboratory course, students will able to:

CO1	Explore PLC‟s, SCADA, DCS, controllers, motors, actuators, encoders, sensors, and PID loops in automation systems.
CO2	Develop an understanding of economic issues related to industrial Robotic and automation systems.
CO3	Participate in a group atmosphere for the defining, planning, and execution of an open ended Automation problem.
CO4	Communicate effectively both verbally and in written form through the preparation of journal report and practical presentation.

List of Experiments

Sr. No.	Details
1	Analyze PLC, SCADA and write a PLC program for a defined timing and sequence operation
2	Industrial visitfor study of SCADA/ DCS implementation.
3	Applications of various types of practical sensor and its interfacing with systems.
4	Implementation/ Simulation of application of automation to any manual systems.
5	Design and development of a tiny robotic systems.
6	Development of simple computer vision systems.
7	Analyze various industrial communication protocols.
8	Development of Automation system for industrial process.

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				1	2	3						1
CO2		3		1	1							2
CO3				1							2	3
CO4			2		3					1		

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	S1	S2	S3	S3
	CO1	CO2	CO3	CO4
Term Work (25 Marks)	04	05	10	06

Assessment Pattern Level No.	**Skill Level**	**Term Work**
S1	Imitation	04
S2	Manipulation	07
S3	Precision	14
S4	Articulation	00
S5	Naturalization	00
Total		25

ET3061: Object Oriented Programming (Professional Elective)	
Teaching Scheme **Lectures: 3 Hrs/Week** **Credits: 03**	**Examination Scheme** **Test 1 + Test 2: 15+15 Marks** **Teachers Assessment: 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: NIL

Course description: This course presents the philosophy of Object Oriented Programming using C# Language and .NET Framework. Students will be able to apply Object Oriented Programming to Engineering Problems related to signal processing, multimedia storage and communication, graphics, application and system software development.

Course Objectives:

- To understand the concepts of Object Oriented Programming using console applications
- To understand the concept of Windows Forms and Form Control Components
- To apply the Events and Delegates to Windows Applications
- To understand the fundamentals of Database Management

Course Outcomes

After completing the course, students will be able to:

CO1	Understand concepts of Object Oriented Programming	K1
CO2	Understand concepts of Windows Application Development	K2
CO3	Apply the concepts of programming to Image Processing	K3
CO4	Understand concepts of Events, Delegates and Exceptions	K2

Detailed Syllabus

Unit 1	**Introduction to .NET Framework** Overview of .NET Framework- Mixed language development and portability, .NET Assembly and Common Language Runtime, Common Type System and Common Language Specification, Base Class Libraries, Namespaces. Managed Vs. Unmanaged Code, Garbage Collector, Introduction to Visual Studio, and Anatomy of C #Program.
Unit 2	**C# Programming Basics** Console Application, Data Types as objects, Iteration and branching constructs, Arrays, Value Type and Reference Types, Methods, Classes and Objects, Interfaces, Exception Handling, Events and Delegates, File I/O.
Unit 3	**Windows Forms** Introduction to Windows Forms, Form Controls and Properties, Dialogs, Drawing Basics, Callback functions, Tablet API, Ink as data object, XML objects and schema, Introduction to XAML and use of Windows Presentation Foundation,
Unit 4	**Application Development** Graphic Calculator, Image Processing System, Introduction to Multithreading, Multiple Document Interface (MDI) GUI, EDA Software Architecture, Net-listing,

	Data Visualization, XML archival and retrieval
Unit 5	**Deployment** Installation Package Design, Debug and Release, Compression and Decompression, Reflection and CLI, Obfuscation

Text Books

1. Pro C# and the .NET 4.5 Framework, Sixth Edition, Andrew Troelsen, Apress, 2012, ISBN 978-1-4302-4233-8
2. Windows Forms Programming in C#, Chris Sells, Addison Wesley, ISBN 0321116208
3. C# How to Program, Deitel, J. Listfield, T.R. Nieto, C. Yaeger, M. Zlatkina, ISBN 0130622214

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	3										
CO2	2	2										
CO3	1	2										
CO4	1	2	2									2

1 – High 2 – Medium 3 – Low

Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1. Simulation
2. Application development
3. Presentation
4. Question & answer / Numerical solution
5. Mini projects

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Class Test I	Class Test II	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	04	04	00	10
K2	Understand	05	05	03	20
K3	Apply	06	06	05	20
K4	Analyze	00	00	02	10
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	**K1**	**K2**	**K3**	**K2**
	CO1	**CO2**	**CO3**	**CO4**
Class Test 1 (15 Marks)	04	05	06	00
Class Test 1 (15 Marks)	04	05	06	00
Teachers Assessment (10 Marks)	05	05	05	05
ESE Assessment (60 Marks)	10	20	20	10

ET3062 : Lab. Object Oriented Programming	
Teaching Scheme **Practical: 2Hrs/Week** **Credit-01**	**Examination Scheme** **Term Work : 25 Marks**

Lab Objectives

1. Learn Core C# programming Constructs
2. Learn Windows Form and its Controls
3. Learn Software Package Architecture, design and deployment

Laboratory Course Outcomes

As an outcome of completing the Laboratory course, students will be able to:

CO1	Understand .NET Framework, Base Class Libraries, Anatomy of C# programs, core C# constructs	S1
CO2	Design small application packages	S2
CO3	Learn external APIs	S3
CO4	Learn software obfuscation and deployment	S3

List of Experiments

Sr. No.	Details
1	Installation of Object Oriented Platform
2	Write and execute console application to display messages and read inputs from user
3	Write and execute console application to explore branching and iteration
4	Write and execute console application to define a class and instantiate its objects
5	Write and execute console application to demonstrate function and operator overloading
6	Write and execute console application to explore inheritance from class and interface
7	Write and execute windows application to design a calculator
8	Write and execute windows application to read a colored image, display Red, Green and Blue components and plot their histogram
9	Write and execute a program to perform 2D convolution of image with a filter
10	Write and execute a program for Snake and Ladder game
11	Write and execute a program to draw line, circle, polygon, rectangle using mouse
12	Write and execute a program with ink API and convert writing to text

Mapping of Course outcome with Program Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3			1								
CO2				2								
CO3				2								2
CO4	1			1								1

1 – High 2–Medium

3-Low

Assessment Table

Assessment Tool	S1	S2	S3	S3
	CO1	CO2	CO3	CO4
Term Work (25 Marks)	02	09	09	05

Assessment Pattern

Assessment Pattern Level No.	**SkillLevel**	**Term Work**
S1	Imitation	02
S2	Manipulation	18
S3	Precision	05
S4	Articulation	00
S5	Naturalization	00
Total		25

ET4051: Robotics (Professional Elective)	
Teaching Scheme **Lectures : 03 Hrs/week** **Total credits : 03**	**Examination Scheme** **Test 1 : 15 Marks** **Test 2 : 15 Marks** **Teachers' Assessments : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Basic knowledge of Electronics

Course description: The course gives exposure to fundamentals of Robotics. Robotics has become major field or future industries. The course covers the basic understanding of Kinematics and Dynamics and various controls involved in robotics. This also includes exposure to applications of Robotics and Robot vision.

Course objectives: The course has the following objectives:

- To develop understanding Robotics components
- To know the classification of Robots
- To impart knowledge of kinematics and dynamics
- To expose the students to Robot control and applications

Course Outcomes: After completing the course, the students will able to:

CO1	Learn classification and mechanics and controls involved in Robot	**K1**
CO2	Understand Robotics, kinematics and dynamics	**K2**
CO3	Explore role of robotics in modern era	**K3**
CO4	Study Robotic systems and applications	**K2**

Detailed Syllabus:

Unit	Content
Unit-I	**Introduction to Robotics and Components** Automation and Robotics, Definition, Basic Structure of Robots, Classification of Robots based on coordinate system, Present trends and future trends in robotics, Overview of robot subsystems. Manipulator, Controller, Power conversion unit etc., Specifications of robot.
Unit-II	**Kinematics & Dynamics** Rigid body Kinematics, Inverse Kinematics, Rotation matrix, Homogenous transformation matrix, Denavit - Hartenberg convention, Euler angles, RPY representation, Direct and inverse Kinematics for industrial robots, Lagrangian Dynamics, link inertia tensor and manipulator inertia tensor, Newton-Euler Dynamics of Robot
Unit-III	**Robot Control** Control approaches: oscillatory based time varying control law, control law based on vector field orientation approach. Advanced strategies of control: conventional aerial vehicle, Bidirectional X4-flyer.
Unit-IV	**Applications** Applications of Fuzzy Logic and Neural network in Robot Control, Neural controllers, Implementation of Fuzzy controllers: Trajectory tracking controller.

	Applications of Robotic system: complex control system, Human Robot Interaction: Architecture.AI systems
Unit-V	**Robot Vision** Machine Vision system, description, sensing, Digitizing, Image Processing and Analysis and Application of Machine Vision System, Robotic assembly sensors & Intelligent Sensors. Object recognition.

Text and Reference Books

1. Fundamentals of Robotics: Analysis and Control – *Robert J Schilling,* PHI, New Delhi
2. Robotic Engineering – *Klafter, Thomas, Negin,* PHI, New Delhi
3. Robotics, Fu, Gonzales and Lee, , McGraw Hill
4. Introduction to Robotics, J.J, Craig, , Pearson Education
5. Robot Motion and Control (Recent Developments) by M.Thoma& M. Morari
6. Robotics And Automation Handbook, Thomas R. Kurfess, CRC Press, 2004, ISBN 0-8493-1804-1

Mapping of course outcome with program outcomes:

Program outcome / Course outcome	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**											
CO2		**2**							**2**			
CO3						**2**			**1**		**2**	
CO4			**2**		**1**	**1**			**3**			

1-High **2-Medium** **3-Low**

Teachers' Assessment: Teachers Assessments of 10 marks is based on one of the/or combination of few of the following

1. Simulation
2. Presentation of case studies
3. Question and Answer/Numerical solution
4. Survey of actual channels used in practice

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test 1	Test 2	Teachers' Assessment/ Assignment (10)	End Semester Examination
K1	Remember	5	5	00	06
K2	Understand	10	10	00	42
K3	Apply	00	00	10	12
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks (100)		15	15	10	60

Assessment Table

Assessment Tool	K1	K2	K3	K2
	CO1	**CO2**	**CO3**	**CO4**
Class Test 1 (15 marks)	05	10	--	--
Class Test 2 (15 marks)	04	06	--	05
Teachers' Assessment (10 marks)	--	05	05	--
ESE Assessment (60 marks)	06	24	12	18

ET4052- Lab Robotics	
Teaching Scheme **Practical: 2 Hrs/Week** **Total credits : 01**	**Examination Scheme** **Term Work : 25 Marks**

Laboratory Course Outcomes

As an outcome of completing the Laboratory course, students will able to:

CO1	Explore controllers, motors, actuators, encoders, sensors used in robots.
CO2	Develop an understanding of economic issues related to industrial Robotic and automation systems.
CO3	Participate in a group atmosphere for the defining, planning, and execution of an open ended robotic system.

List of Experiments

Sr. No.	Details
1	Introduction of Robotic system, various configurations and DOF calculations
2	Basic robot Joints and its simulation using high end computer software
3	Direct kinematics for open/closed loop configurations analytically/simulation/coding
4	Inverse kinematics for open/closed loop configurations analytically/simulation/coding
5	Coding/simulation of direct kinematics for open/closed loop configurations along with work space generation using high end software
6	Formulation of DH parameters of robot configuration and its simulation using open source software
7	Simulation/ performance of a trajectory planning of a robot
8	Application of various robotic sensors along with specifications and their applications area
	OPEN ENDED PROBLEM 1. Design of robot for a given degree of freedom and required pay load capacity 2. Static force analysis of any robot or robotic arm configuration under consideration 3. Trajectory planning for a robot for a given industrial requirement MAJOR EQUIPMENT - Robot kits - MATLAB/ High end Simulation software for mechanisms/robots

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				1	2	3						1
CO2		3		1	1							2
CO3				1							2	3

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	S1	S3	S4	S2
	CO1	CO2	CO3	CO4
Term Work (25 Marks)	05	05	10	05

Recommended Assessment Pattern

Assessment Pattern Level No.	**Skill Level**	**Term Work**
S1	Imitation	05
S2	Manipulation	05
S3	Precision	05
S4	Articulation	10
S5	Naturalization	00
Total		25

ET4053:Automotive Electronics (Professional Elective)	
Teaching Scheme **Lectures: 3Hrs/Week** **Total Credits: 03**	**Examination Scheme** **Test I : 15 Marks** **Test II : 15 Marks** **Teachers Assessment : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Basic knowledge of Electronics devices and Instrumentation,

Course Objectives:

- To understand the concepts of Automotive Electronics and it's evolution and trends
- Automotive systems & subsystems overview.
- To understand sensors and sensor monitoring mechanisms aligned to automotive systems, different signal conditioning techniques, interfacing techniques and actuator mechanisms.
- To understand, design and model various automotive control systems using Model based development technique.
- To understand role of Microcontrollers in ECU design and choice of appropriate Hardware and Software.
- To describe various communication systems, wired and wireless protocols used in vehicle networking.
- To understand Safety standards, advances in towards autonomous vehicles.
- To understand vehicle on board and off board diagnostics.

Course Outcomes

After completing the course, students will able to:

CO1	Obtain an overview of automotive components, subsystems, design cycles, communication protocols and safety systems employed in today's automotive industry.
CO2	Interface automotive sensors and actuators with microcontrollers
CO3	Develop, simulate and integrate control algorithms for ECUs with hardware

Detailed Syllabus:

Unit 1	**Automotive Fundamentals -** The engine-components-Drive train -Starting &charging systems operation- Ignition system- Suspension systems-brakes -ABS - Steering system.
Unit 2	**Automotive Sensors -** Temperature sensor-gas sensor-knock sensor-pressure sensor - flow sensor-torque sensor-crash sensor-Speed sensor and acceleration sensor-micro sensor-smart sensor-operation, types, characteristics, advantages and their applications.
Unit 3	**Smart Sensors -** Basic sensor arrangement – Types of sensors. Oxygen Sensor – Cranking Sensor – Position Sensors – Engine cooling water temperature Sensor – Engine oil pressure Sensor – Fuel metering – Vehicle speed sensor and detonation sensor – Stepper motors – Relays - Microprocessor and Micro Computer applications in automobiles.
Unit 4	**Electronic management -** Electronic management of chassis systems, Vehicle motion control, anti - lock braking system, Tyre pressure monitoring system, Collision avoidance system, Traction control system, Active suspension system Key less entry system and Electronic power steering system. Fault finding and diagnostics system.
Unit 5	**Vehicle Intelligence -** Introduction -basic structure-vision based autonomous road vehicles-architecture for dynamic vision system features-applications- A visual control system using image

	processing and fuzzy theory-An application of mobile robot vision to a vehicle information system.-object detection, collision warning and Avoidance system, Tyre pressure warning system.

TEXT AND REFERENCE BOOKS:

1. Williams. B. Ribbens: "Understanding Automotive Electronics", 6th Edition, Elsevier Science, Newnes Publication, 2003.
2. Robert Bosch: "Automotive Electronics Handbook", John Wiley and Sons, 2004.

Reference books:
1. Ronald K Jurgen: "Automotive Electronics Handbook", 2nd Edition, McGraw-Hill, 1999.
2. James D. Halderman: "Automotive Electricity and Electronics", PHI Publication.
3. Terence Rybak& Mark Stefika: "Automotive Electromagnetic Compatibility (EMC)", Springer, 2004.
4. Allan Bonnick: "Automotive Computer Controlled Systems, Diagnostic Tools and Techniques", Elsevier Science, 2001.
5. UweKieneke and Lars Nielsen: "Automotive Control Systems: Engine, Driveline and Vehicle", 2nd Edition, Springer Verlag, 2005.
6. David Alciatore& Michael Histand: "Introduction to Mechatronics and Measurement Systems (SIE)", TMH, 2007.
7. Iqbal Husain: "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, 2003.
8. Tom Denton: "Advanced Automotive Diagnosis", 2nd Edition, Elsevier, 2006.

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					2			3				1
CO2		3										2
CO3												1

1 – High 2 – Medium 3 – Low

Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Simulation
2) Application development
3) Presentation of case studies
4) Question & answer / Numerical solution
5) Study of Industry processes and its presentation
6) Mini projects

Recommended Assessment Pattern

Assessment Pattern Level No.	**Knowledge Level**	**Test-I**	**Test-II**	**Teachers Assessment/ Assignment**	**End Semester Examination**
K1	Remember	05	05	00	10
K2	Understand	10	10	00	25
K3	Apply	00	00	10	25
K4	Analyze	00	00	00	00

K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	**K1**	**K2**	**K2**
	CO1	**CO1,CO2**	**CO3**
Class Test – I (15 Marks)	05	10	00
Class Test – II (15 Marks)	00	05	10
Teachers Assessment (10 Marks)	00	00	10
ESE Assessment (60 Marks)	15	25	20

Special Instructions if any: Nil

ET4054 : Lab Automotive Electronics	
Teaching Scheme **Practical: 2 Hrs/Week** **Credits:01**	**Examination Scheme** **Term Work : 25 Marks**

Laboratory Course Outcomes

As an outcome of completing the Laboratory course, students will able to:

CO1	Obtain an overview of automotive components, subsystems, design cycles, communication protocols and safety systems employed in today's automotive industry
CO2	Interface automotive sensors and actuators with microcontrollers
CO3	Develop, simulate and integrate control algorithms for ECUs with hardware

List of Experiments

Sr. No.	Details
1	Demonstrate Electronics Ignition system- Suspension systems-brakes -ABS - Steering system.
2	Analysis of brakes -ABS - Steering system.
3	Understanding smart sensor-operation, types, characteristics, advantages and their applications.
4	Applications of Microprocessor and Micro Computer in automobiles
5	Electronic management of chassis systems and tyre pressure monitoring system,
6	Fault identification systems
7	Understanding Collision avoidance system, Traction control system, Active suspension system
8	Study of Key less entry system and Electronic power steering system

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			3									3
CO2			1						2			3
CO3			1				3					1

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	S1	S3	S4
	CO1	CO2	CO3
Term Work (25 Marks)	05	10	10

Recommended Assessment Pattern

Assessment Pattern Level No.	Skill Level	Term Work
S1	Imitation	05
S2	Manipulation	05
S3	Precision	05
S4	Articulation	10
55	Naturalization	00
Total		25

ET4055 : Optical Fiber Communication (Professional Elective)	
Teaching Scheme **Lectures : 3Hrs/week** **Total credits : 03**	**Examination Scheme** **Test I : 15 Marks** **Test II : 15 Marks** **Teachers' Assessments : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Knowledge of Engineering Chemistry and Electromagnetic Engineering

Course description: This course covers basics of light propagation in optical fiber, types and structure of optical fiber. It deals with manufacturing process as well. Signal degradation which includes attenuation and dispersion are discussed in detail. Measurements related to optical fiber are covered. Optical networks are dealt appropriately.

Course Objectives:

1. To give exposure to students about components of optical fiber communication link
2. To explain propagation of light through optical fibers
3. To make students understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors
4. To give exposure to students about various optical networks
5. To explain various measurements of optical fiber

Course Outcomes

After completing the course, students will able to:

CO1	Define basic laws related to communication in optical fiber
CO2	Illustrate operation of optical fiber communication components , their integration and related measurements
CO3	Formulate mathematical representation of light signal at various stages in optical fiber communication
CO4	Understand the significance of dispersion and attenuation in optical fiber communications
CO5	Design Optical Fiber link power and time budget considering attenuation and dispersion
CO6	Express operations of and trends in, optical networks

Unit 1	Optical fiber communication link, fiber types and structure, manufacturing technique, fiber connections, signal degradation in optical fiber wave guide : attenuation and dispersion
Unit 2	Optical Sources: Light emitting diode, LASER diode, Optical detectors : PIN diodes, Avalanche photo diode, Optical Amplifiers
Unit 3	Optical Receiver Performance Considerations: Fundamental receiver operation, Receiver noise, Receiver structures, Preamplifiers, High performance amplifiers.
Unit 4	Digital Transmission System: Point to point links, Digital system planning considerations, Analog systems, Distribution Systems, Advanced multiplexing strategies,
Unit 5	Measurements: Test equipment, Attenuation measurements, Dispersion

	measurement, Refractive index profile, Numerical aperture, fiber cut off wavelength measurements, Field measurements OTDR, optical networks, Lifi

Text and Reference Books

- G. Keiser, Optical Fiber Communications (4/e), TMH, 2008.
- Optical Fiber Communications Principles and Practices (4/e) PHI John M. Senior 2010
- J. Gowar, Optical Communication Systems, (2/e), PHI, 2001.
- Ghatak and K. Thygarajan, Introduction to Fiber Optics, Cambridge, 1999.
- G.P. Agrawal, Fiber Optic Communication Systems, (3/e), Wiley, 2002.

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2			2		3							
CO3	1	2										
CO4		2	2									
CO5		2	1								2	
CO6										2	2	

1 – High 2 – Medium 3 - Low

Teacher's Assessment: Teachers Assessment of 20 marks is based on one of the / or combination of few of following

- Question & answer / Numerical solution
- Simulation
- Power point presentation of advanced topics
- Visit to manufacturing processes plants and BSNL
- Mini projects
- Survey

Recommended Assessment Pattern

Assessment Pattern Level No.	**Knowledge Level**	**Test 1**	**Test 2**	**Teachers Assessment/ Assignment**	**End Semester Examination**
K1	Remember	04	04	00	12
K2	Understand	06	06	05	36
K3	Apply	05	05	05	12
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	K1	K2	K3	K2	K2	K2
	CO1	CO2	CO3	CO4	CO5	CO6
Class Test (15 Marks)	04	06	05	00	00	00
Class Test (15 Marks)	04	06	05	00	00	00
Teachers Assessment (20 Marks)	00	00	05	05	00	00
ESE Assessment (60 Marks)	12	12	12	12	06	06

Special Instructions if any: Nil

ET4065: Lab Optical Fiber Communication	
Teaching Scheme **Practical: 2 Hrs/Week**	**Examination Scheme** **Term Work : 25 Marks**

Laboratory Course Outcomes

As an outcome of completing the Laboratory course, students will able to:

CO1	Plot the characteristics of optical devices
CO2	Organize various components of optical fiber communication and establish /set up transmission-reception link
CO3	Use modern tools to perform optical fiber communication related measurements

List of Experiments

1.	Draw the characteristics of optical sources and detectors
2.	Establish an optical fiber communication link
3.	Examine /measure attenuation
4.	Examine /Measure Numerical Apertures
5.	Measure pulse spreading
6.	Measure power using OTDR
7.	Demonstrate use of connectors ,splicers
8.	Measure bit rate

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				2								
CO2			3	3								
CO3					1							

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	S1	S2	S3
	CO1	CO2	CO3
Term Work (25 Marks)	5	10	10

Recommended Assessment Pattern

Assessment Pattern Level No.	**Skill Level**	**Term Work**

S1	Imitation	5
S2	Manipulation	10
S3	Precision	10
S4	Articulation	00
55	Naturalization	00
Total		25

Preparation (S1)	5
Conduct of Experiment (S2)	5
Observation and Analysis of Results (S3)	5
Record (S2)	5
Mini-Project / Presentation/ Viva-Voce (S3)	5
Total	**25**

ET4057: Microwave Engineering(Professional Elective)			
Teaching Scheme		**Examination Scheme**	
Lectures	**3hrs / week**	**Test I**	**15 Marks**
		Test II	**15 Marks**
Total Credits	**3**	**Teacher's Assessment**	**10 Marks**
		End Semester Exam	**60 Marks**

Prerequisites: Knowledge of Electromagnetic Engineering & Network & lines

Course description: The course introduces Electromagnetic Propagation in free space and in transmission line structures, discusses operation and design of passive and active microwave components and circuits, microwave signal source. The course introduces microwave measurement techniques.

Course Objectives:

- To develop conceptual understanding of microwave generation using Solid State devices.
- To analyze microwave components and system behavior in terms of scattering parameters.
- To impart fundamental knowledge of microwave measurements

- To provide hands-on training on open source CAE (qucs)

Course Outcomes

After completing the course, students will be able to:

CO1	Understand microwave propagation in free space and transmission lines	K2
CO2	Understand microwave generation	K2
CO3	Understand microwave measurement and simulation techniques	K2
CO4	Design and Analyze MIC and MMIC circuits	K3

Detailed Syllabus

Unit 1	**Application of Electromagnetics** Maxwell's Equations and their applications, Constitutive relations, Free Space Wave and Guided Wave, Modes of Propagation in Waveguide, Poynting Vector Theorem, Transmission Line Model, Smith Chart construction and usage, Planar Transmission Lines, Rectangular Wave Guide, Coaxial Line, RF Connectors and Transitions
Unit 2	**Microwave Passives** Matching Networks, Microwave Filters, Power Divider/ Combiner, Hybrid, Directional Coupler, Circulator, Even Odd Mode Analysis, BALUN, Attenuators and Phase Shifters
Unit 3	**Microwave Actives** Silicon, GaAs, GaN, SiGe Process, Diodes, HBTs, pHEMTs and HEMTs, Small Signal Amplifiers, Low Noise Amplifiers, Power Amplifiers, Voltage Controlled Oscillators
Unit 4	**Microwave Measurements** Noise Figure, Sources of Noise, Noise Figure Measurements, Phase Noise, Source of Phase Noise, Phase Noise measurement, Power Measurement, Linearity and measurements
Unit 5	**Packaging Technology** Plastic and Ceramic Package Analysis and effects on circuit performance, LTCC Process, LTCC for System-In-Module design

Text Books

1. Microwave Engineering, Fourth Edition Wiley E-Text Reg Card, David M. Pozar, John Wiley & Sons, Incorporated, 2013, ISBN 1118631439, 9781118631430
2. FOUNDATIONS FOR MICROWAVE ENGINEERING, 2ND ED, Robert E. Collin, John Wiley & Sons, 2007, ISBN 8126515287, 9788126515288

Reference Books

1. Microstrip Lines and Slotlines, Third Edition (Artech House Microwave Library (Hardcover))3rd Edition,Ramesh Garg, InderBahl, Maurizio Bozzi, Artech House, 2013, ISBN 1608075354

Mapping of Course outcome with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	3		3									
CO3	2				2							
CO4			1		1							2

1 – High 2 – Medium 3 – Low

Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Quiz
2) Surprise Test
3) Presentation of advanced topic in detail
4) Question & answer / Numerical solution

Recommended Assessment Pattern

Assessment Pattern Level No.	**Knowledge Level**	**Test 1**	**Test 2**	**Teachers Assessment/ Assignment**	**End Semester Examination**
K1	Remember	05	00	00	10
K2	Understand	10	05	05	30
K3	Apply	00	10	05	20
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	**K2**	**K2**	**K2**	**K3**
	CO1	**CO2**	**CO3**	**CO4**
Class Test 1 (15 Marks)	05	10	00	00
Class Test 2(15 Marks)	00	05	10	00
Teachers Assessment (10 Marks)	00	05	05	00
ESE Assessment (60 Marks)	10	30	12	08

ET4058: Lab Microwave Engineering			
Teaching Scheme		**Examination Scheme**	
Practical	**2hrs / week**	**Term Work**	**25 Marks**
Credits	**01**		

Lab Objectives

1. To design, simulate and implement microwave passives on available 2-layer FR4 substrate
2. To design microwave source using off the shelf ICs, implement them on 2-layer FR-4 substrate and evaluate their performance
3. To design microwave transceiver using of the shelf ICs, implement them on 2-layer FR-4 substrate and evaluate their performance

Laboratory Course Outcomes:

After completing the Laboratory course, students will able to:

CO1	Demonstrate design of various microwave circuits in simulation	S1
CO2	Demonstrate design of various microwave circuits on RF board	S2
CO3	Layout MICs and MMICs	S4
CO4	Demonstrate Power Measurements	S4

List of Experiments

Sr. No.	Details
1	Design, Simulate, Layout and EM Simulate- Microstrip Line, Coplanar Waveguide with Ground, Coaxial Line, Rectangular Waveguide, Plot Current Distribution, E and H Fields
2	Design, Simulate, Layout and EM Simulate- Attenuation Pads, Phase Shifters
3	Design, Simulate, Layout and EM Simulate- Power Dividers, Hybrids, Lange Coupler
4	Design, create 3D geometry of MOSFET, HBT, Simulate and Plot DC characteristics
5	Design and implement RF board for evaluating off-shelf VCO IC, evaluate on power bench
6	Design and implement RF board for transceivers using off-shelf IC, evaluate the link with audio input
7	Study of Vector Signal Generator, Network and Spectrum Analyzers, Noise Figure Measurement Setup and Phase Noise Measurement Techniques
8	Importing 3D files, creating 3D drawings of QFN Plastic Package, Assigning Materials, EM Simulating QFN Packages
9	Study of Ferro LTCC A6S process and design, EM Simulation of Passives
10	Modeling of Inductors, Capacitors and Resonators on LTCC Process
11	Simulation of a Power Amplifier with Wi-Fi IEEE 802.11 a/b/g signal
12	Simulation of Low Noise Amplifier characteristics- Gain, Return Loss, Noise Figure

Mapping of Course outcome with Program Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3			1								
CO2				2								
CO3				2								2
CO4	1			1								1

1 – High 2–Medium 3-

Low

Assessment Tool	S1	S2	S2	S3
	CO1	CO2	CO3	CO4
Term Work (25 Marks)	02	09	09	05

Assessment Table

Assessment Pattern

Assessment Pattern Level No.	**Skill Level**	**Term Work**
S1	Imitation	02
S2	Manipulation	12
S3	Precision	05
S4	Articulation	06
S5	Naturalization	00
Total		25

ET4059: Network Security (Professional Elective)	
Teaching Scheme **Lectures: 3 Hrs/Week** **Total Credits:3**	**Examination Scheme** **Test I : 15 Marks** **Test II : 15 Marks** **Teachers' Assessments : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: NIL

Course Outcomes

As an outcome of completing the course, students will able to:

CO1	Analyze the components of security management
CO2	Evaluate the Operating system security and Application Security.
CO3	Understand Web Application Security and Cryptography
CO4	Critically analyze case studies for security issues and their solution in Internet protocol and Mobile Platform.

Detailed Syllabus:

Unit 1	Security Management, Accreditation, Risk Assessment Operating System Protection Malicious code Security Administration Legal and ethical issues
Unit 2	Foundations of Cryptography, Crypto-Protocol and Network Security, Operating Systems Security, Application Security, Security Evaluation Methodologies
Unit 3	Basic web security model. Web application security. Session Management & User Identification. Overview of cryptography. HTTPS: goals and pitfalls. Content Security Policies (CSP), Web workers, and extensions
Unit 4	Security issues in Internet protocols: TCP, DNS, and routing. Network defense tools: Firewalls, VPNs, Intrusion Detection, and filters. Tools for improving system security. Unwanted traffic: denial of service attacks Case Study
Unit 5	Mobile platform security models: Android and iOS. Understanding Android Security. Mobile threats and malware, Case Study, Security Certificates

Recommended Books:

1. Cryptography and Network Security, William Stalling, Pearson Education,.
2. Cryptography and Network Security, Behrouz A. Forouzan, TMH, Third Edition
3. Cryptography and Network Security, AtulKahate, TMH.

List of Reference Sources for Classes and Assignments:

Resources available on e-learning site http://www.e-gecaect.com

Mapping of Course outcome with Program Outcomes

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO1					2							1
CO2		3										2
CO3												1
CO4	1		2		3						1	

1 – High 2 – Medium 3 – Low

Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Simulation
2) Application development
3) Presentation of case studies
4) Question & answer / Numerical solution
5) Study of Industry processes and its presentation 6) Mini projects

Recommended Assessment Pattern

Assessment Pattern Level No.	**Knowledge Level**	**Test-I**	**Test-II**	**Teachers Assessment/ Assignment**	**End Semester Examination**
K1	Remember	05	05	00	10
K2	Understand	10	10	00	25
K3	Apply	00	00	05	25
K4	Analyze	00	00	05	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	K1	K2	K2	K3
	CO1	CO1,CO2	CO3	CO4
Class Test – I (15 Marks)	05	10	00	00
Class Test – II (15 Marks)	00	00	10	05
Teachers Assessment (10 Marks)	00	00	05	05
ESE Assessment (60 Marks)	10	20	20	10

Special Instructions if any: Nil

ET4060: Lab Network Security	
Teaching Scheme **Practical: 2 Hrs/Week** **Total Credits: 01**	**Examination Scheme** **Term Work : 25 Marks**

Laboratory Course Outcomes

As an outcome of completing the Laboratory course, students will able to:

CO1	Perform Security Management of an organization
CO2	Provide protection to desktop and mobile operating system
CO3	Use various network protection tools
CO4	Analyze practical firewall system

List of Experiments

Sr. No.	Details
1	Analysis of Security Management of Corporate
2	Hardening of Operating system
3	Demonstration of Security Evaluation Methodologies
4	Web application security implementation
5	Evaluation of Firewalls, VPNs, Intrusion Detection, and filters
6	Utilization of various Tools for improving system security
7	Understanding Android Security.
8	Linux security system

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			3									3
CO2			1									3
CO3			1				3					1
CO4			1					2				2

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	S1	S3	S4	S2
	CO1	CO2	CO3	CO4
Term Work (25 Marks)	05	05	10	05

Recommended Assessment Pattern

Assessment Pattern Level No.	Skill Level	Term Work
S1	Imitation	05
S2	Manipulation	05
S3	Precision	05
S4	Articulation	10
S5	Naturalization	00
Total		25

ET4061: Analog Integrated Circuit Design(Professional Elective)			
Teaching Scheme		**Examination Scheme**	
Lectures	**3hrs / week**	**Test I**	**15 Marks**
		Test II	**15 Marks**
Total Credits	**3**	**Teacher's Assessment**	**10 Marks**
		End Semester Exam	**60 Marks**

Prerequisites: Knowledge of Electronic Design Techniques, Microwave, Electronic Devices and Circuits

Course description: The course starts with review on semiconductor process, followed by description of devices and passives. Design and analysis of few transistor circuits are followed by more complex circuits. Application of Analog Circuits in signal conditioning, filtering, carrier generation, modulation and demodulation is discussed.

Course Objectives:

- To understand various advances in semiconductor technology moving from MOSFETs and HBTs to FinFETs and GAAFETs
- To design analog circuits of varying complexities
- To analyze the analog circuits and optimize their performance
- To integrate analog circuits into systems

Course Outcomes

After completing the course, students will be able to:

CO1	Understand devices and semiconductor technologies for analog applications	K2
CO2	Apply the knowledge of devices to design of circuits and systems	K3
CO3	Understand analog circuits and optimize them for applications	K2
CO4	Analyze analog circuits and systems for communication and signal conditioning	K4

Detailed Syllabus

Unit 1	**Introduction to Semiconductor Technologies** Si, Ge, SiGe, GaAs, GaN technologies, Intrinsic semiconductors, doping, PN-junction Diodes, MOSFETs, Short Channel Effects, FinFETs and GAAFETs, Metallization, On-chip passives- resistors, capacitors, inductors
Unit 2	**Simple Analog Circuits** Current Mirrors, CG, CS, CD Amplifiers- operation, design and frequency response, Differential Amplifier, Op-Amps, OTAs, Common Mode Feedback Circuits, Comparators
Unit 3	**Frequency Generation and Scaling Circuits** Voltage Controlled Oscillators, Gilbert Cell Mixer, Orthogonal Carrier Generation, Role of PLL in frequency scaling, channel selection, phase noise shaping, MASH 1-1-1 Sigma Delta Modulators, Phase Frequency Detectors, Charge Pumps, Loop Filters.
Unit 4	**Conversion Circuits** Analog to Digital Conversion, Successive Approximation ADC, Flash Converters, Sigma Delta ADCs, Digital to Analog Conversion DACs, R2R Ladder DACs, Thermometric DACs
Unit 5	**Analog Systems** Transceiver Topologies- Direct Conversion, Low IF, Super-heterodyne, Signal Conditioning Systems

Text Books

1. Analog Integrated Circuit Design, Tony Chan Carusone, David Johns, Kenneth Martin, John Wiley & Sons, 2011, ISBN 0470770104, 9780470770108
3. Phase Locked Loops 6/e: Design, Simulation, and Applications 6th Edition, Roland E. Best, McGraw-Hill Education, 2007, ISBN 0071493751, 978-0071493758

Reference Books

1.The Design of CMOS Radio - Frequency Integrated Circuits, Thomas H. Lee, Cambridge University Press; 2 edition, 2004, ISBN 0521613892, 978-0521613897

Mapping of Course outcome with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3									
CO2				1	2	1						
CO3		2	2	2								2
CO4												1

1 – High 2 – Medium 3 – Low

Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1. Quiz
2. Surprise Test
3. Presentation of advanced topic in detail
4. Question & answer / Numerical solution

Recommended Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test 1	Test 2	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	05	00	00	20
K2	Understand	10	05	00	12
K3	Apply	00	05	05	20
K4	Analyze	00	05	05	08
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	K2	K3	K2	K4
	CO1	CO2	CO3	CO4
Class Test 1 (15 Marks)	10	00	05	00
Class Test 2(15 Marks)	05	05	00	05
Teachers Assessment (10 Marks)	00	05	00	05
ESE Assessment (60 Marks)	20	12	20	08

ET4062: Analog Integrated Circuit Design			
Teaching Scheme		**Examination Scheme**	
Practical	**2hrs / week**	**Term Work**	**25 Marks**
Credits	**01**		

Lab Objectives

1) To design Analog Circuits in a CMOS Process, Layout and Package in Commercial Plastic Packages
2) To analyze analog circuits for communication and signal conditioning
3) To study a predesign Transceiver and Phase Locked Loop

Laboratory Course Outcomes

As an outcome of completing the Laboratory course, students will be able to:

CO1	Create schematic, perform simulation, visualize data	S1
CO2	Design and Characterize Analog Circuits	S2
CO3	Analysis and Design of Analog Systems	S3
CO4	Layout Analog Circuits	S2

List of Experiments

Sr. No.	Details
1	NMOS and PMOS Characterization and Layout
2	Current Mirror Design and Simulation
3	CS, CG, CD circuit design and simulation
4	Op-Amp design, simulation and analysis, implementation
5	Comparator Design and implementation
6	VCO Design and Simulations, implementation
7	Gilbert Cell Mixer Design and Simulations, implementation
8	Understanding PLL Components- PFD, CP, Loop Filter, Pre-scalar, Sigma Delta Modulator
10	Analysis of PLL Dynamics
11	Analysis of Transceivers

Mapping of Course outcome with Program Outcomes

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3			1								
CO2				2								
CO3				2								2
CO4	1			1								1

1 – High 2–Medium 3-Low

Assessment Table

Assessment Tool	S1	S2	S3	S2
	CO1	CO2	CO3	CO4
Term Work (25 Marks)	02	09	09	05

Assessment Pattern

Assessment Pattern Level No.	**Skill Level**	**Term Work**
S1	Imitation	02
S2	Manipulation	14
S3	Precision	09
S4	Articulation	00
S5	Naturalization	00
Total		25

ET 4063 : Digital VLSI (Professional Elective)	
Teaching Scheme **Lectures: 3 Hrs/Week** **Credits: 03**	**Examination Scheme** **Test I : 15 Marks** **Test II : 15 Marks** **Teachers Assessment : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Knowledge of Digital Electronics

Course description:

This course deals with the basics of MOS devices, fundamentals and concepts of digital VLSI design. An exposure will be given to static and dynamic characteristics of CMOS Inverter, CMOS Static and Dynamic Design and design of Latches and Registers.

Course Objectives:

1. To understand theory and to learn design of digital systems
2. Subject will involve design, layout and simulation of digital VLSI circuits using various modern tools.

Course Outcomes

After completing the course, students will able to:

CO1	Gain the knowledge of digital circuit design using CMOS.	K1
CO2	Design digital circuits using CMOS keeping in view the design metrics and Energy Delay product.	K2
CO3	Understand the behavior of CMOS Inverter and CMOS gate	K2
CO4	Evaluate the static and dynamic performance of CMOS gate and CMOS Inverter	K3
CO5	Design sequencing elements like flip flops, latches, registers and pulsed latches and registers	K2

Detailed Syllabus:

Unit 1	**Introduction to design** Basic MOS structure and its static behavior, Quality metrics of digital design: Cost, functionality, robustness, power, and delay, Stick diagram and Layout, Electricals wire models.
Unit 2	**The CMOS Inverter** The static CMOS inverter, Static and Dynamic Behavior, Power, Energy and Energy Delay of CMOS Inverter.
Unit 3	**Static CMOS Design** Complementary CMOS, Ratioed Logic, Pass-Transistor Logic
Unit 4	**Dynamic CMOS Design** Dynamic Logic: Basic Principles, Speed and Power Dissipation of Dynamic Logic, Issues in Dynamic Design, Cascading Dynamic Gates
Unit 5	**Sequential Logic Circuit Design**Timing metrics, Static Latches and Registers, Dynamic Latches and Registers, Pulse amplifier and Sense amplifier based registers

Text and Reference Books

1. Digital integrated circuits: a design perspective, Jan M. Rabaey, AnanthaChandrakasan, Borivoje Nikolic, PHI
2. CMOS VLSI Design, Weste and Harris, Addison Wesley.
3. Modern VLSI Design - System-on-chip Design, Wayne Wolf, Prentice Hall India/Pearson Education
4. CMOS Digital Integrated Circuits, Analysis and Design, Sung-Mo Kang and Yusuf Lablebici, Tata McGraw-Hill Edition.

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2			2	3								
CO3			2			2						
CO4		1	2			1						
CO5		1	2			2						

1 – High **2 – Medium** **3 - Low**

Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Simulation
2) Application development
3) Presentation of case studies
4) Question & answer / Numerical solution

Assessment Pattern

Assessment Pattern Level No.	**Knowledge Level**	**Test I**	**Test II**	**Teachers Assessment/ Assignment**	**End Semester Examination**
K1	Remember	05	03	00	06
K2	Understand	10	12	05	42
K3	Apply	00	00	05	12
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	**K1**	**K2**	**K2**	**K3**	**K2**
	CO1	**CO2**	**CO3**	**CO4**	**CO5**
Class Test I (15 Marks)	05	10	00	00	00
Class Test II (15 Marks)	03	06	06	00	00
Teachers Assessment (10 Marks)	00	00	00	05	05
ESE Assessment (60 Marks)	06	12	18	12	12

ET 4064 -Lab Digital VLSI	
Teaching Scheme **Practical: 2Hrs/Week** **Credits: 01**	**Examination Scheme** **Term Work : 25 Marks**

Laboratory Course Outcomes

As an outcome of completing the Laboratory course, students will able to:

CO1	To understand the fundamentals of CMOS Technology in Digital Domain
CO2	Design a digital system using given specifications and design constraints.
CO3	To demonstrate the ability for using backend tools in IC technology

List of Experiments

Sr. No.	Details
1.	Introduction to Hiper Silicon(tanner) software
2.	Learn to use software for CMOS designing
3.	Understand the behavior of MOS transistor by analyzing I_D v/s V_{DS} curve and I_D v/s V_{GS} curve
4	Design simulate, layout and test various logic gates
5.	Design a CMOS inverter in schematic and simulate for Transient Characteristics
6.	Design, prepare layout and simulate CMOS Inverter for the given specifications
7.	Design and plot the characteristics of a positive and negative multiplexers based latches
8.	Design and plot the characteristics of a 4x1 digital multiplexer using pass transistor logic
9.	Design and plot the characteristics of a master-slave positive and negative edge triggered registers based on multiplexers.

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				2	3							
CO2				1	2							
CO3				1	1							

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	S1	S2	S3
	CO1	CO2	CO3
Term Work (25 Marks)	05	10	10

Assessment Pattern

Assessment Pattern Level No.	**Skill Level**	**Term Work**
S1	Imitation	05
S2	Manipulation	10
S3	Precision	10
S4	Articulation	00
S5	Naturalization	00
Total		25

ET4065: Digital Image Processing (Professional Elective)	
Teaching Scheme **Lectures: 3 Hrs/Week** **Credits: 03**	**Examination Scheme** **Test I : 15 Marks** **Test II : 15 Marks** **Teachers Assessment: 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Knowledge of Digital Signal Processing

Course description: This course covers representation of image in matrix form. Various operations carried out on image to boost the quality of image or to compress the image are covered. Algorithms based on morphology, segmentation lead to important applications. Course covers all the spatial and frequency domain techniques for image enhancement. This also exposes to representation and classification of images.

Course Objectives:

- To explain image matrix formation
- To impart knowledge of image enhancement techniques
- To elaborate various morphological processes
- To expose to segmentation techniques
- To introduce applications of image processing

Course Outcomes:

After completing the course, students will able to:

CO1	Understand digital representation of image	K2
CO2	Learn the signal processing algorithms for image enhancement and restoration	K2
CO3	Appreciate image processing techniques and their applications to real world problems	K3
CO4	Conduct independent study and analysis of image processing problems and techniques	K2

Detailed Syllabus:

Unit 1	Fundamental of Image Processing: Image Sensing and Acquisition, Image Sampling and Quantization, Digital Image Representation, Basic Relationship between Pixels, Linear and Nonlinear Operations, Image formats,2D Fourier Transforms, Image Enhancement in Spatial Domain and Frequency Domain Filtering, Color Image Processing,
Unit 2	Image Registration and Restoration: Image Registration, Models of Image Degradation /Restoration Process, Noise Models, Restoration in presence of Noise, Periodic Noise Reduction by Frequency Domain Filtering, Linear Position Invariant Degradation, Estimating Degradation Function , Inverse Filtering, Wiener Filtering, Constrained Least Square Filtering, Geometric Mean Filtering, Geometric Transformations

Unit 3	Image Compression: Fundamentals, Compression Models, Entropy Computation, Loss less andLossy Compression, Image Compression Standards
Unit 4	Morphology: Dilation, Erosion, Opening and Closing, Basic Morphological Algorithms, Binary and Gray Scale Morphology
Unit 5	Image Segmentation and Description: Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region Based Segmentation, Use of Motion in Segmentation, Representation and Description: Representation Schemes, Boundary Descriptors, Regional Descriptions, Relational Descriptors

Text and Reference Books

Rafel Gonzales and Richard Woods, Digital Image Processing, Third Edition, Pearson Education

K. Jain, Fundamentals of Digital Image Processing, PHI

Rafel Gonzales and Richard Woods, Digital Image Processing with MATLAB, Pearson Education

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2										
CO2		2	2									
CO3			2							1	1	1
CO4		3	2								1	1

1 – High 2 – Medium 3 - Low

Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following:

1) Block Simulation
2) Application development
3) Case study on role of Image Processing in Industry processes, medical application etc. and its presentation

Recommended Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test1	Test2	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	05	05	00	10
K2	Understand	10	05	05	45
K3	Apply	00	05	05	05
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	**K2**	**K2**	**K3**	**K4**
	CO1	**CO2**	**CO3**	**CO4**
Class Test1 (15 Marks)	05	05	05	00
Class Test1 (15 Marks)	05	05	05	00
Teachers Assessment (10 Marks)	00	00	05	05
ESE Assessment (60 Marks)	20	16	18	06

Special Instructions if any: Nil

ET4066: Lab Digital Image Processing	
Teaching SchemePractical: 2Hrs/Week Credits:1	**Examination Scheme Term Work : 25 Marks**

Course Outcomes

As an outcome of completing the Laboratory course, students will able to:

CO1	Demonstrate image information
CO2	Manipulate various image operations
CO3	Manipulate image using various filters
CO4	Differentiate between spatial and frequency domain operation

List of Experiments

Sr. No.	Details
1	Study image information and various image formats
2	Write programs to perform arithmetic and logical operations on image
3	Write programs to perform geometric operations on image
4	Implement various Image enhancement algorithms
5	Implement various spatial domain filters on images
6	Implement various frequency domain filters on images
7	Perform different morphological operations on image
8	Implement image segmentation using different edge detection techniques
9	Implement image segmentation using thresholding for different images
10	Implement region based image segmentation for multiple applications

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				2								
CO2					2						2	3
CO3					2						2	1
CO4					1						1	

1 – High 2–Medium 3 -Low

Recommended Assessment Pattern

Preparation (S1)	05
Conduct of Experiment & Record(S2)	10
Observation and Analysis of Results (S3)	05
Mini-Project / Presentation/ Viva-Voce (S3)	05
Total	**25**

ET4067: Speech and Audio Processing (Professional Elective)	
Teaching Scheme **Lectures: 3 Hrs/Week** **Credits: 03**	**Examination Scheme** **Test I : 15 Marks** **Test II : 15 Marks** **Teachers Assessment: 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites:

Course description: On completion of this course, students will have understanding of fundamentals of speech production, time domain and frequency domain methods for audio, linear predictive analysis, cepstral analysis of speech signal, applications of speech and audio processing.

Course Objectives:

- To present fundamentals of speech signal.
- To explain various parameters of speech signal using time domain and frequency domain methods.
- To confer comprehensive understanding of Linear prediction analysis and cepstral analysis
- To explore the applications of speech and audio processing

Course Outcomes

After completing the course, students will able to:

CO1-k1	State fundamentals for speech signal.
CO2 -k2	Describe features of speech signal using different analysis methods.
CO3-k2	Understand the speech signal in time domain and frequency domain.
CO4-k3	Interpret applications of speech and audio processing.

Detailed Syllabus:

Unit 1	**Fundamentals of speech production** Anatomy and physiology of speech production, Human speech production mechanism. LTI model for speech production, Nature of speech signal, linear time varying model, articulatory phonetics, acoustic phonetics, Voiced and Unvoiced speech. Sound intensity and Decibel sound levels. Concept of critical band and introduction to auditory system as a filter bank, Uniform, non-uniform filter bank, mel scale and bark scale. Speech perception: vowel perception.
Unit 2	**Time and frequency domain methods for audio processing** Short-time energy, average magnitude, average zero crossing rate, autocorrelation function, average magnitude difference function. Pitch period estimation using autocorrelation method, Wavelet, Audio feature extraction, Spectral centroid, spread, entropy, flux, and roll-off. Spectrogram.
Unit 3	**Linear prediction analysis** Basic principles of linear predictive analysis. Autocorrelation method, covariance method. Solution of LPC equations: Cholesky decomposition, Durbin's recursive solution, lattice formulations and solutions. Frequency domain interpretation of LP analysis. Applications of LPC parameters as pitch detection and formant analysis.

Unit 4	**Cepstral Analysis** Homomorphic speech processing, Real and complex cestrum, pitch estimation, format estimation, Mel cepstrum
Unit 5	**Speech and Audio processing applications**Speech enhancement, Speech and Speaker recognition, Text to speech conversion, Musical instrument classification, Musical Information retrieval.

BOOKS:

1. Deller J. R. Proakis J. G. and Hanson J. H., "Discrete Time Processing of Speech Signals", Wiley Interscience
2. Ben Gold and Nelson Morgan, "Speech and audio signal processing" Wiley

REFERENCE BOOKS:

1. L. R. Rabiner and S.W. Schafer, "Digital processing of speech signals" Pearson Education.
2. Thomas F. Quateri , "Discrete-Time Speech Signal Processing: Principles and Practice" Pearson
3. Dr. ShailaApte, "Speech and audio processing", Wiley India Publication
4. L. R. Rabiner and B. H. Juang, "Fundamentals of speech recognition"
5. Theodoros Giannakopoulos and Aggelospikrakis, "Introduction to audio analysis: A MATLAB Approach:Elsevier Publication.

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3											
CO2	2											
CO3	2	2										
CO4	2		1						3			

1 – High 2 – Medium 3 - Low

Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Simulation
2) Presentation of case studies
3) Question & answer / Numerical solution

Assessment Pattern

Assessment Pattern Level No.	**Knowledge Level**	**Test 1**	**Test 2**	**Teachers Assessment/ Assignment**	**End Semester Examination**
K1	Remember	05	05	00	12
K2	Understand	10	10	00	42
K3	Apply	00	00	10	06
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	**K1**	**K2**	**K2**	**K3**
	CO1	**CO2**	**CO3**	**CO4**
Class Test I (15 Marks)	05	05	05	00
Class Test II (15 Marks)	05	05	05	00
Teachers Assessment (10 Marks)	00	00	05	05
ESE Assessment (60 Marks)	12	24	18	06

ET4068 Lab: Speech and Audio Processing	
Teaching Scheme **Practical: 2 Hrs/Week** **Credits: 01**	**Examination Scheme** **Term Work : 25 Marks**

Laboratory Course Outcomes

As an outcome of completing the Laboratory course, students will able to:

CO1 - s2	Display different parameters of speech signal.
CO2 - s2	Perform analysis of speech signal with different methods.

List of Experiments

Sr. No.	NOTE: To perform the experiments software like MATLAB, SCILAB or any appropriate open source software/DSP Processor kit/any speech processing hardware kit can be used.
1	Record speech signal and find Energy and ZCR for different frame rates and comment on the result.
2	Record different vowels as /a/, /e/, /i/, /o/ etc. and extract the pitch as well as first three formant frequencies. Perform similar analysis for different types of unvoiced sounds and comment on the result.
3	Write and execute program to identify voiced, unvoiced and silence regions of the speech signal
4	Record a speech signal and perform the spectrographic analysis of the signal using wideband and narrowband spectrogram. Comment on narrowband and wide band spectrogram
5	Write and execute program for extracting pitch period for a voiced part of the speech signal using autocorrelation.
6	Write and execute program to design a Mel filter bank and using this filter bank write a program to extract MFCC features
7	Write and execute program to perform the cepstral analysis of speech signal and detect the pitch from the voiced part using cepstrum analysis.
8	Write and execute program to find LPC coefficients
9	Write and execute program to enhance the noisy speech signal using spectral subtraction method.
10	Write and execute program to extract frequency domain audio features like SC, SF and Spectral roll off.

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2			2	3							
CO2	2			2	3				3			

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	S2	S2
	CO1	CO2
Term Work (25 Marks)	15	10

Assessment Pattern

Assessment Pattern Level No.	**Skill Level**	**Term Work**
S1	Imitation	05
S2	Manipulation	20
S3	Precision	00
S4	Articulation	00
S5	Naturalization	00
Total		25

ET4069: Cloud Computing (Professional Elective)	
Teaching Scheme **Lectures: 3 Hrs/Week** **Credits:3**	**Examination Scheme** **Class Test – I (15 Marks)** **Class Test – II (15 Marks)** **Teachers Assessment: 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Basic knowledge of computers as a data terminal.

Course Outcomes: As an outcome of completing the course, students will able to:

CO1	Analyze the components of cloud computing showing how business agility in an organization can be created.
CO2	Evaluate the deployment of web services from cloud architecture.
CO3	Critique the consistency of services deployed from a cloud architecture
CO4	Critically analyze case studies to derive the best practice model to apply when developing and deploying cloud based applications

Detailed Syllabus:

Unit 1	**Cloud Computing Fundamentals** Cloud Computing definition, Characteristics of Cloud Computing, Components of Cloud Computing. Models in Cloud Computing- a. Deployment models – Private cloud, Public cloud, Hybrid cloud, Community cloud. b. Service models- IaaS, PaaS, SaaS Concept of Tenancy, Multi-Tenancy. Introduction to Grid Computing Applications of cloud computing, Benefits of cloud computing, Limitations of cloud computing.
Unit 2	**Cloud architecture, Services** Cloud Architecture Introduction to Services- a. Infrastructure as a Service b. Platform as a Service c. Software as a Service d. Identity as a Service e. Security as a Service f. Compliance as a Service
Unit 3	**Cloud Infrastructure and Virtualization** Infrastructure – Clients, Security, Network and Services Introduction to Virtualization, Virtualization types a. Server virtualization b. Storage virtualization c. Network virtualization d. Service virtualization, Virtualization management, Virtualization technologies and architectures

	Introduction to Hypervisors, Types of Hypervisor. Concept of Load balancing
Unit 4	**Security** Cloud Security, Risks, Privacy, Operating system security, Security of virtualization, Data security. Concept of data privacy and data security Authentication in cloud computing, Client access in cloud, Cloud contracting Model, Commercial and business consideration Infrastructure Security, Network level security, Host level security, Application level security
Unit 5	Cloud implementation and applications Cloud Platforms: Amazon EC2 and S3, Cloudstack, Intercloud, Google App Engine, Open Source cloud Eucalyptus, Open stack, Open Nebulla, etc., Applications.

Recommended Books:

1. Barrie Sosinsky, " Cloud Computing Bible", Wiley
2. Gautham Shroff, "Enterprise Cloud Computing", Cambridge.
3. Stefan Poslad, "Ubiquitous Computing: Smart Devices, Environments and Interactions" by John Wiley & Sons, 2011.
4. A.Shrinivasan, J.Suresh, "Cloud Computing: A practical approach for learning and implementation", Pearson.
5. RajkumarBuyya, J.Broberg, A. Goscinski, "Cloud Computing Principles and Paradigms", Wiley.
6. Ronald Krutz,"Cloud Security: Comprehensive guide to Secure Cloud Computing", Wiley Publishing.
7. Anthony T. Velte, "Cloud Computing: Practical Approach", McGraw Hill.
8. Tim Mather, "Cloud Security and Privacy", O'REILLY.

List of Reference Sources for Classes and Assignments:

1. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper (Wiley India Edition)
2. Enterprise Cloud Computing by GautamShroff,Cambridge
3. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India
4. Google Apps by Scott Granneman,Pearson
5. Cloud Security & Privacy by Tim Malhar, S.Kumaraswammy, S.Latif (SPD,O'REILLY)
6. Cloud Computing : A Practical Approach, Antohy T Velte, et.al McGraw Hill,
7. Cloud Computing Bible by Barrie Sosinsky, Wiley India
8. Stefano Ferrettiet.al.QoS–aware Clouds", 2010 IEEE 3rd International Conference on Cloud Computing
9. Virtualization for Dummies : , Wiley India.

Resources available on e-learning site http://www.e-gecaect.com
Microsoft Technical Journal, Google Cloud Platform resources

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					2			3				1
CO2		3									1	2
CO3										1		1
CO4	1		2		3			1				

1 – High 2 – Medium 3 – Low

Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1. Simulation
2. Application development
3. Presentation of case studies
4. Question & answer / Numerical solution

Recommended Assessment Pattern

Assessment Pattern Level No.	**Knowledge Level**	**Test-I**	**Test-II**	**Teachers Assessment/ Assignment**	**End Semester Examination**
K1	Remember	05	05	00	10
K2	Understand	10	10	05	20
K3	Apply	00	00	05	25
K4	Analyze	00	00	00	05
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	K1	K2	K2	K3
	CO1	CO1,CO2	CO3	CO4
Class Test – I (15 Marks)	05	10	00	00
Class Test – II (15 Marks)	00	00	10	05
Teachers Assessment (10 Marks)	00	00	05	05
ESE Assessment (60 Marks)	10	20	15	15

Special Instructions if any: Nil

ET4070: Lab Cloud Computing	
Teaching Scheme **Practical: 2 Hrs/Week** **Total Credits:1**	**Examination Scheme** **Term Work : 25 Marks**

Laboratory Course Outcomes

As an outcome of completing the Laboratory course, students will able to:

CO1	Understand virtualization concept
CO2	Use cloud services provided by Amazon,Google,Azure
CO3	Understand Cloud Services SaaS, PaaS and IaaS
CO4	Use and administrate Open-stack services

List of Experiments

Perform any six experiments.

Sr. No.	Details
1	Installing Ubuntu (server edition) using virtual box, and study virtualization.
2	Installing Openstack cloud: Creating sand box environment using Virtual Box
3	Setting up and using an instance on public IaaS cloud
4	Setting up TeamViewer Software: a) Accessing remote PC on the host PC b) Sharing of files within the desktop shared PC
5	Exploring GitHub to learn features such as a. How to create repositories on GitHub. b. How source code can be uploaded/downloaded from repositories. c. Making code commits in repositories. d. GitHub issue tracking features.
6	Transfer larger files/folders to another computer using cloud storage service
7	Understanding Software as a Service: Sales Force
8	Understanding Platform as a Service: Microsoft Azure
9	Understanding Infrastructure as a Service: Amazon S3
10	Understand Google Apps and create Google forms.

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			3	3						1		3
CO2			1						2		2	3
CO3			1				3				2	1
CO4			1	2	2			2			1	2

1 – High 2 – Medium 3 - Low

Assessment Table

Assessment Tool	S1	S3	S4	S2
	CO1	CO2	CO3	CO4
Term Work (25 Marks)	05	05	10	05

Recommended Assessment Pattern

Assessment Pattern Level No.	**Skill Level**	**Term Work**
S1	Imitation	05
S2	Manipulation	05
S3	Precision	05
S4	Articulation	10
S5	Naturalization	00
Total		25

ET4071: Digital Forensics (Professional Elective)	
Teaching Scheme **Lectures : 3 Hrs/week** **Tutorial : ---** **Total credits : 03**	**Examination Scheme** **Test 1 : 15 Marks** **Test 2 : 15 Marks** **Teachers' Assessments : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Nil

Course description: The course is designed to give the basic concepts of Multimedia Forensics. Forensics as understood is application of science and technology for investigation of crime. During the course, students will explore interesting applications of engineering. The course will make the students understand the possible ways of tampering of multimedia files, such as image, video and audio and systematic approach for their detection.

Course objectives: The course has the following objectives:

- To introduce an interesting application of engineering, i.e., multimedia forensics.
- To give basic ideas of multimedia evidences, such as image, video and audio.
- To make the students understand the basic concepts of forensic techniques.
- To give basic ideas about how multimedia evidences are useful in crime investigation.

Course Outcomes: After completing the course, the students will able to:

CO1	Explain various data capturing devices and processing of data	K2
CO2	Understand types of Forensics	K2
CO3	Know the standards involved in Forensics	K1

Detailed Syllabus:

Unit	Content
Unit-I	**Foundation to Multimedia Forensics** Introduction to digital signals: audio, image and video, Digitization process: sampling and quantization, Image Enhancement Techniques: Spatial and frequency domain, Image Compression Techniques: Introduction and techniques, Image description and representation techniques, Pattern clustering and classification
Unit-II	**Introduction to Multimedia Forensics** Introduction and scope of Multimedia Forensics, Basics of Multimedia, Devices for capturing image and video , Devices for capturing audio, Standard and best practices in Multimedia Forensics, Photogrammetry in Multimedia Forensics
Unit-III	**Image Forensics** Image Forensics: Introduction and scope, Active and passive image forensics, Blind and non-blind image forensics, Methods of source camera identification, Methods for tampering of digital image, Forensic authentication of digital image
Unit-IV	**Video Forensics** Video forensics: Introduction and scope, Standards for video transmission, Methods of tampering for digital video, Forensic authentication of digital video, Source camera identification from video, Enhancement of digital video
Unit-V	**Audio Forensics** Audio Forensics: Introduction and scope, Methods of tampering for digital

	audio, Forensic authentication of digital audio, Microphone Forensics, Enhancement of digital audio, Counter Forensics

Text and Reference Books

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Prentice-Hall, Inc. Upper Saddle River, NJ, USA, 2006
2. Alan Bovik, Handbook of Image and Video Processing, Academic Press, USA, 2000
3. HusrevTahaSencar and Nasir Memon, Digital Image Forensics: There is More to a Picture than Meets the Eye, Springer Science and Business Media, New York, 2013
4. Anthony T.S. Ho and Shujun Li, Handbook of digital forensics of multimedia data and devices, John Wiley & Sons, Ltd., UK, 2015.
5. HanyFarid, Photo Forensics, The MIT Press, Cambridge, First Edition, 2016

Mapping of course outcome with program outcomes:

Course outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO1	**2**											
CO2	**2**	**3**									**2**	
CO3	**3**										**3**	

1-High 2-Medium 3-Low

Teachers' Assessment: Teachers Assessments of 10 marks is based on one of the/or combination of few of the following

1. Simulation
2. Presentation of case studies
3. Question and Answer/Numerical solution
4. Study of processes in Industry/Forensic Lab and its presentation

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test 1	Test 2	Teachers' Assessment/ Assignment	End Semester Examination
K1	Remember	05	00	00	10
K2	Understand	10	15	10	50
K3	Apply	00	00	00	00
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks (100)		15	15	10	60

Assessment Table

Assessment Tool	K1	K2	K2
	CO1	CO2	CO3
Class Test 1 (15 Marks)	10	00	05
Class Test 2 (15 Marks)	05	10	00
Teachers' Assessment (10 marks)	05	05	00
ESE Assessment (60 marks)	30	25	05

ET 4072: Lab – Digital Forensic	
Teaching Scheme **Practical: 2 Hrs/Week** **Total Credits :01**	**Examination Scheme** **Term Work :25 Marks**

Laboratory Course Outcomes

As an outcome of completing the Laboratory course, students will able to:

CO1	Demonstrate audio, image and video information
CO2	Manipulate various audio, image and video operations
CO3	Demonstrate various multimedia forensic techniques

List of Experiments

Sr. No.	Details
1	Understanding Imaging modalities
2	Understanding Image Processing Signal Processing toolbox of MATLAB
3	Write and execute programs for different methods of image enhancement
4	Write and execute programs for image compression
5	Write and execute programs for video processing
6	Application of forensic tools for detection of tampering in images
7	Application of forensic tools for detection of tampering in audio
8	Application of forensic tools for detection of tampering in video
9	Write and execute programs for detection of image tampering
10	Write and execute programs for identification of source camera from the given images

Mapping of Course outcome with Program Outcomes

Course Outcome	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3			1	2							
CO2	3			1	2						3	
CO3				2	2	2					3	

1 –High 2 – Medium 3 – Low

Assessment Pattern

Preparation (S1)	04
Conduct of Experiment (S2)	04
Observation and Analysis of Results (S3)	08
Record (S2)	03
Mini-Project / Presentation/ Viva-Voce (S3)	06
Total	**25**

ET4073 : Radar & Satellite Communication (Professional Elective)	
Teaching Scheme **Lectures: 3 Hrs/Week** **Credits: 03**	**Examination Scheme** **Class Test I : 15 Marks** **Class Test II : 15 Marks** **Teachers Assessment : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Knowledge of Analog and Digital Communication

Course description: This course covers fundamental principles of Radar. It deals with various types of Radars and their applications. Exposure to Satellite communication, basic terms related to satellite, transponder, up link and down link budgets and also given accessing methods.

Course Objectives:

- To introduce the fundamental concepts of Radar & Satellite Communication.
- To explain different types of Radar systems.
- To impart knowledge of satellite segments, orbits, link budgets.
- To give exposure to various methods of satellite access.

Course Outcomes

After completing the course, students will able to:

CO1	Understand basics of Radar Communication and Satellite Communication	K2
CO2	Explain operations of various types of Radar Systems	K2
CO3	Apply various access techniques for satellite applications	K2
CO4	Analyze and design satellite communication links and tracking Radar systems	K3

Detailed Syllabus:

Unit 1	**Fundamentals of Radar** Introduction to Radars, Radar frequencies, Principles, Applications, Types & Displays. Pulse Radar: Block Diagram and Operation. Radar Range Equation, Range Performance of Radars, Minimum Detectable Signal, Noise Effects, Pulse Repetition Frequency and Range Ambiguities.
Unit 2	**CW and FM-CW Radar** Doppler Effect, Continuous wave Radar Principle, Block diagram, Bank of filters, Isolation between transmitter and receiver, Radial Velocity, Application. Frequency Modulated Continuous wave Radars Principle, Block diagram, Multiple CW Radar. Airborne Radar, Altimeter.
Unit 3	**MTI, Pulse Doppler and Tracking Radar** Introduction, Delay line Cancellers, Multiple & Staggered Pulse Repetition Frequencies, Blind Speed, Non-coherent MTI, Pulse Doppler Radar and MTI Radar Processors. Tracking with Radar, Monopulse Tracking, Conical scan and Sequential Lobing, Low angle Tracking.
Unit 4	**Satellite Communication, satellite segment & Space Link** Basic concepts of Satellite Communications, Satellite Orbits, Space Segment Introduction, TT&C Subsystem, Transponders, Transmit-Receive Earth Stations. Space Link: Introduction, Equivalent Isotropic Radiated Power, Transmission Losses, Link –Power Budget Equation, System Noise, Carrier to Noise Ratio, The Uplink, Saturation flux density, Input back-off, Downlink, Output back-off, Combined Uplink Uplink and Downlink C/N Ratio

	.
Unit 5	**Introduction to Satellite Access** Introduction, Single Access, Preassigned FDMA, Demand Assigned FDMA, Spade System, TDMA, Preassigned TDMA, Demand Assigned TDMA, Satellite Switched TDMA, Code Division Multiple Access.

Text and Reference Books

1. Merrill I. Skolnik, "Introduction to Radar Systems", McGraw-Hill International.
2. Bassem R. Mahafza, "Radar Signal Analysis & Processing Using MATLAB", a Chapman & Hall Book, Special Indian Edition.
3. Dennis Roddy, "Satellite Communications", Tata McGraw Hill Publications, fourth edition.
4. Robert M. Gagliardi, "Satellite Communication", CBS Publishers & Distributors.
5. Anil K. Maini, Varsha Agarwal, "Satellite Technology, Principles and Applications", Wiley publications, Second Edition.

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2									3		
CO2	2									3		
CO3	2		3			1	3			3		
CO4	1	2	2			1	2			2		

1 – High 2 – Medium 3 – Low

Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Simulation
2) Application development
3) Presentation on Advanced topics
4) Question & answer / Numerical solution

Assessment Pattern

Assessment Pattern Level No.	**Knowledge Level**	**Test 1**	**Test 2**	**Teachers Assessment/ Assignment**	**End Semester Examination**
K1	Remember	05	05	00	10
K2	Understand	10	10	05	45
K3	Apply	00	00	05	05
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	**K2**	**K2**	**K2**	**K3**
	CO1	**CO2**	**CO3**	**CO4**
Class Test 1 (15 Marks)	05	10	00	00
Class Test 1 (15 Marks)	05	10	00	00
Teachers Assessment (10 Marks)	00	05	05	00
ESE Assessment (60 Marks)	20	20	15	05

ET 4074 - Lab Radar & Satellite Communication	
Teaching Scheme **Practical: 2Hrs/Week** **Credits: 01**	**Examination Scheme** **Term Work : 25 Marks**

Laboratory Course Outcomes

As an outcome of completing the Laboratory course, students will able to:

CO1	Understand fundamentals of Radar communication, satellite communication, satellite transponders and satellite accesses.	S2
CO2	Measure and analyze different parameters of Radar Systems	S3
CO3	Measure and analyze different parameters of Satellite links.	S3

List of Experiments

Sr. No.	Details
1.	Understand and setup basic Radar System
2.	Measure Range of pulse radar for different values of radar peak power.
3.	Measure Signal to Noise Ratio against target detection range for different values of target Radar cross section.
4	Object counting with the help of Radar.
5.	Understanding satellite communication frequency bands and orbits.
6.	To write a program to plot the degradation in downlink C/I.
7.	Time domain presentation of Echo wave pattern
8.	Understanding the antenna plane of transmission & reception for echo signal
9.	Antenna coupling & beam estimation of FMCW Radar
10	Time domain presentation of Echo wave pattern & comparison with and without target
11	Understanding the FFT , with and without target
12	DOPPLER Shift analysis and measurement using DSO
13	Characterization of σcs for different target material & Comparison
15	MATLAB based RADAR signal processing.

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1				2	3							
CO2				1	1							
CO3				1	2							

1 – High **2 – Medium** **3 - Low**

Assessment Table

Assessment Tool	S1	S2	S3
	CO1	CO2	CO3
Term Work (25 Marks)	9	8	8

Assessment Pattern

Assessment Pattern Level No.	**Skill Level**	**Term Work**
S1	Imitation	05
S2	Manipulation	10
S3	Precision	10
S4	Articulation	00
S5	Naturalization	00
Total		25

ET4075 : Real Time Operating Systems(Professional Elective)	
Teaching Scheme **Lectures: 3 Hrs/Week** **Credits: 3**	**Examination Scheme** **Class Test I: 15 Marks** **Class Test II : 15 Marks** **Teachers Assessment : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Knowledge of Embedded Systems

Course description: This course covers fundamental of operating systems. It deals with issues in real time operating systems, concepts of process scheduling and management, memory and I/O scheduling, and overview of features of different commercially available real time operating systems.

Course Objectives:

- To introduce the fundamental concepts of RTOS.
- Understand and compare different scheduling algorithms and schedulability criteria.
- To obtain comprehensive knowledge of interprocess communication, memory and I/O management.
- To give exposure to various commercial real time operating systems.

Course Outcomes

After completing the course, students will able to:

CO1	Enumerate fundamentals of operating systems & RTOS	K1
CO2	Understand concepts of operating systems, process management, memory and I/O management and commercial RTOS systems.	K2
CO3	Understand concepts of process synchronization and scheduling algorithm	K2
CO4	Apply concepts of operating system to design RTOS system.	K3

Detailed Syllabus:

Unit 1	**Introduction to OS and RTOS** Introduction to operating systems, operating systems objectives and functions, evolution of OS, structure of operating systems (monolithic, layered, kernel-based), introduction to RTOS, features and advantages of RTOS, applications of RTOS available in market
Unit 2	**Process Management of RTOS** Introduction to process, process states and transitions, process context and the process control block, context switching, types of process scheduling, scheduling algorithms: FCFS, SJF, Priority, Round Robin, SRT, Unix multi-level feedback queue scheduling, multiprocessor scheduling concepts, real time scheduling concepts
Unit 3	**Process Synchronization** Introduction to process synchronization, race conditions, critical sections, principle of concurrency, Mutual Exclusion, Semaphores and Mutex, Message Passing, Monitors, Classical Problems of Synchronization: Readers-Writers Problem, Producer Consumer Problem, Dining Philosopher problem, Deadlock: Principles of deadlock, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, An Integrated Deadlock Strategies
Unit 4	**Memory and I/O Management** Memory Management requirements, Memory partitioning: Fixed, dynamic, partitioning, Buddy System Memory allocation Strategies (First Fit, Best Fit, Worst Fit, Next Fit), Fragmentation, Swapping, Segmentation, Paging, Virtual Memory, Demand paging, Page Replacement Policies

	(FIFO, LRU, Optimal, clock) ,Thrashing, Working Set Model I/O Management and Disk Scheduling: I/O Devices, Organization of I/O functions, Operating System Design issues, I/O Buffering, Disk Scheduling (FCFS, SCAN, C-SCAN, SSTF), Disk Caches
Unit 5	**Commercial RTOS & Application Domain** Comparison and study of RTOS: VxWorks, µCOS-II Case Studies: RTOS for fault Tolerant systems, mobile

Text and Reference Books

1. Dhananjay M. Dhamdhere, "Operating Systems-A concept based approach", Tata McGraw Hill publications.
2. William Stallings, "Operating Systems: Internals and Design Principles", seventh edition, Pearson Prentice Hall publications.
3. Andrew S. Tanenbaum, "Modern Operating Systems", third edition, Pearson Prentice Hall publications.
4. Silberschatz, Galvin, Gagne, "Operating System Concepts", seventh edition, John Wiley & Sons. Inc.
5. C. M. Krishna and G.Shin, "Real Time Systems", McGraw Hill International Edition.
   Rajkamal, "Embedded System: Architecture Programming and Design", TMH Publication

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2										
CO2	2	2				3						
CO3	1	2				3						
CO4	2		1			2			1			2

1 – High2 – Medium3 - Low

Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Simulation
2) Application development
3) Power point presentation
4) Question & answer / Numerical solution
5) Quiz

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test 1	Test 2	Teachers' Assessment/ Assignment (10)	End Semester Examination
K1	Remember	05	00	00	06
K2	Understand	10	10	05	42
K3	Apply	00	05	05	12
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	**K2**	**K2**	**K2**	**K3**
	CO1	**CO2**	**CO3**	**CO4**
Class Test I (15 Marks)	05	10	00	00
Class Test II (15 Marks)	00	10	05	00
Teachers Assessment (10 Marks)	00	00	05	05
ESE Assessment (60 Marks)	06	24	18	12

ET4076: Lab Real Time Operating Systems	
Teaching Scheme	**Examination Scheme**
Practical: 2 Hrs/Week **Total credits : 01**	**Term Work : 25 Marks**

Laboratory Course Outcomes

As an outcome of completing the Laboratory course, students will able to:

CO1	Understand Multitasking Techniques in Real Time Operating System
CO2	Develop Application using Real Time Operating System
CO3	Write simple programs to implement Real Time Operating System Routines

List of Experiments

Perform any eight experiments from the following list or similar experiments based on the theory syllabus can be performed.

Sr. No.	Details
1	Write a program to get and print the following process identifiers. Process Id, parent process id, user id, group id .calls]
2	Write an "hello world\n" program. Write a separate program, which runs the hello World program using 'execv' system call
3	Open the serial device and get the control parameters of serial device and display them.
4	a) Write a program to create a semaphore with **semget** function. b) Write a program to set the current semaphore count. Write a separate program to read the semaphore count.
5	Write a program to create a pipe within a process, write a message to the pipe and read the message back from the pipe and display it.
6	Write a program to create a shared memory segment, write a string to it and read from the segment.
7	Create two tasks with different priorities. Task1 should delay for 5 sec and then task2 should delay for 10 sec continuously. Observe the sequence of execution of the task.
8	Create deadlock condition by creating the tasks with different priorities (low, middle, high) and resolve it by using priority inheritance.
9	Write a program to read the numbers written to the shared memory segment.
10	Implement a client server process as two separate programs communicating through shared memory.

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			3		3							
CO2			2		2	1	1					
CO3			3		3	1	1					

1 – High 2 – Medium 3 - Low

Assessment Table:

Assessment Tool	S1	S2	S2	S3
	CO1	CO2	CO3	CO4
Term Work (25 Marks)	04	07	08	06

Assessment Pattern

Preparation (S1)	04
Conduct of Experiment (S2)	04
Observation and Analysis of Results (S3)	08
Record (S2)	03
Mini-Project / Presentation/ Viva-Voce (S3)	06
Total	**25**

ET4077: Android Development and Programming (Professional Elective)	
Teaching Scheme **Lectures : 3 Hrs/week** **Total credits : 03**	**Examination Scheme** **Test 1 : 15 Marks** **Test 2 : 15 Marks** **Teachers' Assessments : 10 Marks** **End Semester Exam : 60 Marks**

Prerequisites: Strong knowledge of any programming language C/C++/Java,
Lecture: Online Video: Mobile Computing Nptel, MOOC, Coursera.

Course description:

The use of mobile communication and android based applications are increasing day by day. It is therefore necessary for students to know that how mobile communication works and how to build mobile apps for android operating system. This course covers the necessary concepts which are required to understand mobile communication and to develop Android Applications. Thus it is key course for computer engineers, who want to work in the area of communication.
In this course, we will learn android programming to create applications for Smartphones. We will also learn integration of mobile applications with cloud services to create mobile cloud applications

Course Outcomes:

After completing the course, students will be able to:

CO1	Understand the architecture of Android applications, life cycle of various components, manifest, Intents and the use of external resources for Android development.
CO2	Design and develop Android applications with compelling user interfaces by using extending and creating your own layouts and views and using menus.
CO3	Execute Android's Application Framework API to build complex Android applications.
CO4	Utilize the power of background services, threads, asynchronous tasks and notifications.
CO5	Apply various techniques on working with menu

Detailed Syllabus:

Unit 1	Introduction to mobile computing, installing of required software and preparing the working environment, **Introduction to ANDROID:** ANDROID SDK Features, Introduction to Development Features. **Basics of ANDROID:** Developing for ANDROID, developing for mobile and embedded devices, ANDROID development tools **Creating Applications using ANDROID:** Basics of an ANDROID application, introduction to manifest, externalizing resources, application lifecycle, ANDROID activities
Unit 2	**Building user interfaces:** Introduction to layouts, introduction to fragments, creating new views, introduction to adapters **Intents and broadcast receivers:** Introduction to intents, creating intents and broadcast receivers **Using Internet resources:** Downloading and parsing internet resources, using the download manager, using internet services
Unit 3	**Files, saving state and preferences:** Creating, saving and retrieving shares

	preferences, including static files as resources, working with the file system **Database and content providers:** Introducing ANDROID databases, content values and cursors, working with SQLite databases, creating content providers, using content providers, native ANDROID content providers **Working in background:** Introducing services, using background threads, using alarms
Unit 4	**Enhancing user experience:** Introduction and addition of action bar, menus and dialogs, drawables and gradients, custom animations **Hardware sensors:** Sensors and sensor manager, monitoring devices' movement and orientation **Maps and location based services:** Using location based services, selecting a location provider, finding your current location, creating map based activities
Unit 5	**Audio, video and using the camera:** Playing audio and video, manipulating raw audio, using camera to take pictures, recording video, adding media to media store **Telephony and SMS:** Hardware support for telephony API, using telephony API, introducing, how to send and receive SMS and MMS **Monetizing, promoting and distributing the applications** Signing and publishing applications, distributing applications, introduction to monetizing applications.

TEXT AND REFERENCE BOOKS

1. Android Programming (Big Nerd Ranch Guide), by Phillips, Stewart, Hardy and Marsican
2. Android Programming – Pushing the limits by Hellman
3. Building Android Apps,IN EASY STEPS,McGraw-Hill Education
4. Professional Android 2 Application Development,Reto Meier ,Wiley India Pvt Ltd
5. Beginning Android,Mark L Murphy,Wiley India Pvt Ltd
6. Pro Android,Sayed Y Hashimi and Satya Komatineni,Wiley India Pvt Ltd

Suggested Readings:

i. Android Studio Development Essentials by Neil Smyth

ii. The Definitive Guide to SQL Lite by Michael Owens

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1										3
CO2	2	2			1							
CO3		2	1		1							2
CO4						2	3					3
CO5			2		1	2						

1 – High 2– Medium 3-Low

Teacher's Assessment: Teachers Assessment of 10 marks is based on one of the / or combination of few of following

1) Simulation
2) Prototype development
3) Power point presentation of case studies
4) Question & answer / Numerical solution

Assessment Pattern

Assessment Pattern Level No.	Knowledge Level	Test	Test2	Teachers Assessment/ Assignment	End Semester Examination
K1	Remember	05	05	00	16
K2	Understand	04	04	05	24
K3	Apply	06	06	05	20
K4	Analyze	00	00	00	00
K5	Evaluate	00	00	00	00
K6	Create	00	00	00	00
Total Marks 100		15	15	10	60

Assessment table

Assessment Tool	K1	K2	K3	K3	K2
	CO1	CO2	CO3	CO4	CO5
Class Test1 (15 Marks)	05	04	06	00	00
Class Test2 (15 Marks)	00	00	05	04	06
Teachers Assessment (20 Marks)	00	00	06	04	00
ESE Assessment (60 Marks)	20	08	10	10	12

ET4078 : Lab Android Development and Programming	
Teaching Scheme **Practical: 2 Hrs/Week** **Credits: 01**	**Examination Scheme** **TermWork:25Marks**

Laboratory Course Outcomes

As an outcome of completing the Laboratory course, students will be able to:

CO1	Use the development tools in the Android development environment and use of API
CO2	Describe the life cycles of Activities, Applications and Fragments
CO3	Be familiar with new UI components like Fragments and the Action Bar
CO4	Utilize Sensors like Gyroscopes, Accelerometers and GPS to add orientation and location to their apps Notifications

List of Major Equipment/ Instrument with Broad Specifications

i. **Hardware**: Necessary Kits or Environment to briefly introduce mobile technology environment like GSM, CDMA and GSM services, Computer with latest configuration

ii. **Software**: Java, Netbeans, Eclipse, Android SDK (open source)

Additional Resources of MIS that can be used for conducting Practical as well as case studies

http://www.tutorialspoint.com/android/ ii.
http://www.tutorialspoint.com/android/android_overview.htm iii.
http://www.codelearn.org/android-tutorial/android-introduction iv.
http://pl.cs.jhu.edu/oose/resources/android/Android-Tutorial.pdf v.
http://mobisys.in/blog/2012/01/introduction-to-android-sqlite-database/ vi.
www.appmakr.com/Android vii. www.telerik.com/android-development viii.
developer.android.com/training/basics/first app

SUGGESTED LIST OF EXERCISES/PRACTICAL

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (outcomes in psychomotor and affective domain) so that students are able to acquire the competencies/programming outcomes. Following is the list of practical exercises for guidance

Sr. No.	Details
1	Installation and setup of java development kit(JDK),setup android SDK, setup eclipse IDE, setup android development tools (ADT) plugins, create android virtual device
2	Create “Hello World” application. That will display “Hello World” in the middle of the screen using Text View Widget in the red color
3	Create application for demonstration of android activity life cycle
4	Create Registration page to demonstration of Basic widgets available in android
5	Create sample application with login module.(Check username and password) On successful login, Change Text View “Login Successful”. And on failing login, alert user using Toast “Login fail”
6	Create login application where you will have to validate username and passwords Till the username and password is not validated , login button should remain disabled
7	Create and Login application as above. Validate login data and display Error to user using set Error() method
8	Create an application for demonstration of Relative and Table Layout in android.
9	Create an application for demonstration of Scroll view in android
10	Create an application for demonstration of Explicitly Starting New Activity using Intent.
11	Create an application that will pass two number using Text View to the next screen , and on the next screen display sum of that number
12	Create spinner with strings taken from resource folder(res >> value folder). On changing spinner value, change background of screen.
13	Create an application that will get the Text Entered in Edit Text and display that Text using toast (Message).
14	Create an application that will Demonstrate Button on Click () Event and change the Text View Color based on button Clicked
15	Create an UI such that, one screen have list of all the types of cars. On selecting of any car name, next screen should show Car details like: name, launched date, company name
16	Create an application that will Demonstrate Dialog Box Control In Android

Mapping of Course outcome with Program Outcomes

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3			1								
CO2				2		1						
CO3				2								
CO4			3	1	2	1						

1 – High 2–Medium 3-Low

Assessment Table:

Assessment Tool	S1	S2	S2	S3
	CO1	CO2	CO3	CO4
Term Work (25 Marks)	02	09	09	05

Assessment Pattern

Assessment Pattern Level No.	**Skill Level**	**Term Work**
S1	Imitation	02
S2	Manipulation	18
S3	Precision	05
S4	Articulation	00
S5	Naturalization	00
Total		25

List of Professional Electives and Revision of course codes

Group I			
Old Professional Elective Course Codes		**New Professional Elective Course Codes**	
ET4051	Robotics 4+0+0	ET3051	Biomedical Instrumentation 3+0+0
ET3051	Biomedical Instrumentation 4+0+0	ET3052	Lab: Biomedical Instrumentation 0+0+1
ET3052	Telematics 4+0+0	ET3053	Mobile Communication 3+0+0
ET4052	Automotive Electronics 4+0+0	ET3054	Lab: Mobile Communication 0+0+1
ET4053	Real Time Operating System 4+0+0	ET3055	Information Theory & Coding 3+0+0
Group II		ET3056	Lab: Information Theory & Coding 0+0+1
ET4054	Optical Fiber Communication 3-0-1	ET3057	Digital System Design 3+0+0
		ET3058	Lab: Digital System Design 0+0+1
ET4056	Microwave Engineering 3-0-1	ET3059	Industrial Automation 3+0+0
		ET3060	Lab: Industrial Automation 0+0+1
ET4058	Network & Security 3-0-1	ET3061	Object Oriented Programming 3+0+0
		ET3062	Lab: Object Oriented Programming 0+0+1
ET3053	Mobile Communication 3-0-1	ET4051	Robotics 3+0+0
		ET4052	Lab: Robotics 0+0+1
ET4060	Analog IC design 3-0-1	ET4053	Automotive Electronics 3+0+0
		ET4054	Lab: Automotive Electronics 0+0+1
ET4062	Digital VLSI 3-0-1	ET4055	Optical Fiber Communication 3+0+0
		ET4056	Lab: Optical Fiber Communication 0+0+1
ET4064	Image Processing 3-0-1	ET4057	Microwave Engineering 3+0+0
		ET4058	Lab: Microwave Engineering 0+0+1
ET3055	Information Theory & Coding 3-0-1	ET4059	Network & Security 3+0+0
		ET4060	Lab: Network & Security 0+0+1
ET3057	Radar & Satellite 3-0-1	ET4061	Analog IC design 3+0+0
		ET4062	Lab: Analog IC design 0+0+1
ET4066	Speech Processing 3-0-1	ET4063	Digital VLSI 3+0+0
		ET4064	Lab: Digital VLSI 0+0+1
ET4068	Cloud Computing 3-0-1	ET4065	Digital Image Processing 3+0+0
		ET4066	Lab: Image Processing 0+0+1
ET3059	Digital System Design 3-0-1	ET4067	Speech & Audio Processing 3+0+0
		ET4068	Lab: Speech & Audio Processing 0+0+1

ET4070	Digital Forensic 3-0-1	ET4069	Cloud Computing 3+0+0
		ET4070	Lab: Cloud Computing 0+0+1
		ET4071	Digital Forensic 3+0+0
		ET4072	Lab: Digital Forensic 0+0+1
		ET4073	Radar & Satellite Communication 3+0+0
		ET4074	Lab: Radar & Satellite Communication 0+0+1
		ET4075	Real Time Operating Systems 3+0+0
		ET4076	Lab: Real Time Operating Systems 0+0+1
		ET4077	Android Development and Programming 3+0+0
		ET4078	Lab: Android Development and Programming 0+0+1