MALNAD COLLEGE OF ENGINEERING, HASSAN

(An Autonomous Institution Affiliated to VTU, Belgaum)

Autonomous Programmes

Bachelor of Engineering

DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING

SYLLABUS

III& IV Semester (2022 Admitted Batch)

(2nd Year)

Academic Year 2023-24

MALNAD COLLEGE OF ENGINEERING, HASSAN
(An Autonomous Institution Under VTU, Belagavi)

Department of Electronics & Instrumentation Engineering

VISION of the Department

The Department will be a center of excellence for Electronics and Instrumentation studies driven by research in association with industry and society

MISSION of the Department

1. To augment infrastructure in emerging technologies .
2. To provide student centered environment for effective learning by giving hands-on experience.
3. To develop research culture and create facilities for transforming ideas into products to cater to society and industrial needs.
4. To collaborate with industry, academia and research organizations for contribution to the higher order learning and research.
5. To prepare students to meet the challenges of dynamic industrial requirements and higher education.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The Students are expected to Possess:

1. Capacity to undertake automation jobs having competency in design of controllers, installation, commissioning, operation and maintenance of process plants in coordination with interrelated domain team.
2. Social responsibility, leadership capability and integrity in their professional career.
3. Acumen to pursue higher education in interrelated domains of instrumentation.
4. Ability to design and implement projects relevant to industry and community taking into account social, ethical and environmental considerations.
5. Knowledge of computational platforms and software applications related to domain needs.

PROGRAM OUTCOMES (POs)

1. **Engineering Knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/Development of Solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct Investigations of Complex Problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12**. Life-long Learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOS)

PSO1: Adopt concepts of measurement and transduction for instrumentation.
PSO2: Employ knowledge of instrumentation for process automation.

Scheme of Evaluation (Theory Courses)

Assessment	Marks
THREE CIE's conducted for a total of 40 marks	40
Activities as decided by course faculty	10
SEE	50
Total	100

Scheme of Evaluation (Laboratory Courses)

Assessment	Marks
Continuous Evaluation in every lab session by the Course coordinator	**10**
Record Writing	**20**
Laboratory CIE conducted by the Course coordinator	**20**
SEE	**50**
Total	**100**

Examination	Maximum Marks	Minimum marks to qualify
CIE	**50**	**20**
SEE	**50**	**20**

THIRD SEMESTER					
Course Category	**Course Code**	**CourseTitle**	**L-T-P**	**Credits**	**Contact Hours**
BSC	**22EI301**	**Mathematics for Electronics**	**2-2-0**	**3**	**04**
IPCC	**22EI302**	**Electronic Devices and Circuits**	**3-0-2**	**4**	**05**
PCC	**22EI303**	**Network Analysis**	**2-2-0**	**3**	**04**
PCC	**22EI304**	**Logic Design**	**2-2-0**	**3**	**04**
IPCC	**22EI305**	**Measurement and Instrumentation**	**3-0-2**	**4**	**05**
ESC	**22EI306**	**ESC/ETC/PLC**	**3-0-0**	**3**	**03**
UHV	**22SCR**	**Social Connect and Responsibility**	**0-0-2**	**1**	**02**
AEC / SEC	**22EI307**	**Ability Enhancement Course/Skill Enhancement Course – III**	**0-0-2**	**1**	**02**
			Total	**22**	**29**

Engineering Science Course (ESC/ETC/PLC)			
22EI306A	OOPs and Data Structures	22EI306C	Managing Innovations
22EI306B	Java Programming	22EI306D	E-Waste Management
Ability Enhancement Course – III			
22EI307A	Digital System Design Lab using Multisim	22EI307C	AEC Lab using LTSPICE
22EI307B	Circuit Analysis Lab using LTSPICE		

Course Category:

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course(Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **SDA**: Skill Development Activity,

ESC: Engineering Science Course, **ETC**: Emerging Technology Course

Note : AEC, SEC, ETC courses are to be chosen suitably by the BOS of the programme

FOURTH SEMESTER

Course Category	Course Code	CourseTitle	L-T-P	Credits	Contact Hours
PCC	**22EI401**	**Linear ICs and Signal Conditioning Circuits**	**3-0-0**	**3**	**03**
PCC	**22EI402**	**Process Instrumentation**	**3-0-2**	**4**	**05**
PCC	**22EI403**	**Introduction to Microprocessor**	**3-0-2**	**4**	**05**
PCC	**22EI404**	**Lasers & Biomedical Instrumentation**	**3-0-0**	**3**	**03**
ESC	**22EI405**	**ESC/ETC/PLC**	**3-0-0**	**3**	**03**
AEC/SEC	**22EI406**	**Ability Enhancement Course/Skill Enhancement Course-IV**	**0-0-2**	**1**	**02**
BSC	**22EI407**	**Biology For Engineers**	**2-0-0**	**1**	**02**
UHV	**22EI408**	**Universal Human Values**	**2-0-0**	**1**	**02**
			Total	**20**	**25**

Engineering Science Course (ESC/ETC/PLC)			
22EI405A	Introduction to VHDL Programming	22EI405C	Internet of Things
22EI405B	Statistics & Probability		
Ability Enhancement Course – IV			
22EI406A	Signal Conditioning Lab	22EI406C	Static & Dynamic Characteristics and Error Analysis in Instrumentation Systems
22EI406B	Digital Systems Design using Xilinx	22EI406D	Statistics with R Lab for Machine Learning

Course Category:

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course(Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **SDA**: Skill Development Activity,

ESC: Engineering Science Course, **ETC**: Emerging Technology Course

Note : AEC, SEC, ETC courses are to be chosen suitably by the BOS of the programme

Mathematics for Electronics& Instrumentation Engineering

Course Code: 22MA301 **L-T-P-C-2-2-0-3**
Exam Hours: 3 **SEE: 50 Marks**
Lecture Hours-28 **Tutorial Hours-28**

Course Objective:
To introduce linear algebra and transform calculus which may be employed as tools in solving engineering application problems.

Course Outcomes:
At the end of the course students will be able to:

COs	Outcomes	PO1	PO2
CO1	Utilise the concept of consistency of system of equations to solve the engineering application problems and compute the number of linearly independent vectors.	3	2
CO2	Examine for the existence of diagonalization of matrix, find the suitable matrix of transformations so as to get the required image and analyze the system of equations to compute the number of linearly independent Eigen vectors.	3	2
CO3	Apply Laplace transform on simple functions and compute Fourier series of periodic functions.	3	-
CO4	Examine for adopting different techniques of integration so as to compute Fourier series, Fourier transforms, Laplace transform of a given function.	3	2
CO5	Model the real life problems/engineering application problems and solve the same.	3	2

Course Contents

Module-1

Laplace Transforms: Introduction, Definition, Importance of Laplace transform in engineering applications, properties, Laplace transform of standard functions, Laplace transform of derivatives, Laplace transform of periodic functions, unit-step functions.
Inverse Laplace Transforms: Definition and general properties, Convolution theorem – illustrative examples, Initial value problems. To solve Applications of initial value problems in engineering using Laplace transform
Self Study--Unit impulse functions (Dirac – delta function). Application of Fourier series to Laplace equation, heat conduction. Curve fitting- Piecewise spline interpolation-linear, quadratic, cubic spline method. Double interpolation.

10 Hours

Module–2

Fourier Series: Periodic functions and their graphical representation, to find the function for standard graphs, to find Fourier series by change of interval method. To represent the experimental data as a Fourier series using the method - Practical harmonic analysis. Application of Fourier series in engineering-to represent the signal (wave form) in terms of Fourier series, Fourier series representation for the excitation described by the wave form, graphs of Fourier series approximating the given function. Half range series method. Fourier transforms, Fourier sine transform and cosine transform.
Self Study-- Applications of Fourier series**,** Fast Fourier transforms, Discrete Fourier transforms in electronics engineering.

10 Hours

Module–3

. **Linear Algebra:** Importance of Matrices in engineering. Rank of a matrix. Consistency of nonhomogeneous and homogeneous system of equations, Solution of the system of linear equations by Gauss elimination method and Gauss – Seidel iterative method. Linearly dependent and independent vectors.

Special matrices-matrix of rotation, reflection, translation. To find the matrix of transformation when the image of some points is given. **Applications** of solution of system of equations to balance the chemical equations.

Self Study-- Traffic flow problem. To find the suitable combination of food stuff so as to get the desired nutrients as prescribed by a dietician.

10 Hours

Module–4

Linear Algebra: Eigen values and Eigen vectors, properties, Illustrative examples, **applications**-Stretching of an elastic membrane, to determine the growth of a population model. Role of eigenvalues, eigenvectors in determining natural frequency, mode shapes of equations of motions (Spring mass system). Rayleigh power method to find the highest eigen value.

Diagonalization and powers of 3X3 matrices when Eigen values are already given.

Self Study-- Stability analysis of differential equations which governs the dynamical systems using the concept of eigen value, eigen vectors. Application of eigen value eigen vectors in electronics engineering. Applications of Jordan canonical forms

10 Hours

Note – 1. Theorems and properties without proof. Applicable to all the Modules.

2. Self study part is not included for Semester End Examination.

Text Books:

1. Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 44th edition, 2016.
2. Linear algebra by David c lay,3rd edition, Pearson education, 2002.

Reference Books:

1. R K Jain and S R K Iyengar, Advanced Engineering mathematics by Narosa publishers, 2nd edition, 2005.
2. Calculus by Thomas Finney, 9th edition, Pearson education, 2002.

   Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd. 8th Edition (Wiley student edition) 2004.

ACTIVITIES:

a. To represent sawtooth periodic motion of a follower operated by a Cam which rotates uniformly, in the form of Fourier series.

b. Application of Fourier series to Laplace equation, heat conduction.

c. Fourier series representation for the excitation described by the wave form,

d. Role of eigenvalues, eigenvectors in determining natural frequency, mode shapes of equations of motions (Spring mass system).
e. Lenovo input output method – application to balance the economy of a Country.
f. Applications of factorization of matrices-google recommendation.
g. Jordan canonical form when minimal polynomial and characteristic polynomial is given and its application in Engineering.
h. Diagonalize a matrix and determining the principal stresses.
i. Application of Laplace transformation.
j. Application of eigen value eigen vectors in data compression, Signature testing, Face recognition. Google page ranking.
k. Least square solution of system of equations- a matrix approach.
l. Unit impulse functions (Dirac – delta function)- application.

Course Title:	**ELECTRONIC DEVICES AND CIRCUITS**	**L**	**T**	**P**	**C**
Course Code:	**22EI302**	**3**	**0**	**2**	**4**
Hours / week: 5	**CIE: 50 Marks SEE: 50 Marks** **Total hours: 40**	**Exam hours: 3**			

Prerequisites: Basic Electronics
Course Outcomes: Upon the completion of this course student will be able to:
CO1: Explain DC biasing of BJT and **pnpn** and other devices.
CO2: Explain basic FET and DC biasing of FET.
CO3: Illustrate frequency response of BJT and JFET amplifiers and determine operating pointsusing h parameters.
CO4: Analyze the feedback concepts in oscillators and performance of different power supplies.
*Note: Evaluation of lab component of this course is done based on the rubrics which will be shared with the students by the course faculty.

MODULE 1

DC Biasing-BJTs: Operating point, Fixed-Bias Configuration, Emitter-Bias Configuration, Voltage-Divider Bias Configuration, Collector Feedback Configuration, Emitter-Follower Configuration, Common-Base Configuration
Bias Stabilization and BJT AC Analysis: Bias Stabilization, Practical Applications**,** Introduction to BJT AC Analysis, Application in the AC Domain, BJT Transistor Modeling, h-Parameters, graphical determination of h-parameters.**PNPNDevices, characteristics and applications:** Introduction, Silicon-Controlled Rectifier, Basic Silicon-Controlled Rectifier Operation, SCR Characteristics and Ratings
Self- study components: SCR Applications, Silicon-Controlled Switch, Diac, Triac, Uni-junction Transistor, Opto- Isolators

10Hours

MODULE 2

Field-Effect Transistors: Introduction, Construction and Characteristics of JFETs, Transfer Characteristics, Specification Sheets (JFET), Instrumentation, Important Relationships, Depletion-Type MOSFET, Enhancement-Type MOSFET, MOSFET Handling, CMOS. **FET Biasing:** Introduction, Fixed-Bias Configuration, Self-Bias Configuration, Voltage-Divider Biasing, Common-Gate Configuration, Special Case V_{GSQ} = OV.
Self-study components: Enhancement-Type MOSFETs, Depletion- Type MOSFETs

10Hours

MODULE 3

BJT and JFET Frequency Response: Introduction, Logarithms, Decibels, Frequency Considerations, Normalization Process, Low Frequency Response of BJT Amplifier, Low Frequency Response of FET Amplifier, Miller Effect Capacitance, High – Frequency Response- BJT Amplifier, High – Frequency Response- FET Amplifier. **Feedback Circuits**: Feedback Concepts, Feedback Connection Types.

Self-study components: Practical Feedback Circuits, Feedback Amplifier-Phase and Frequency Considerations

10Hours

MODULE 4

Oscillator Circuits: Oscillator Operation, Phase shift oscillator, Wein Bridge Oscillator, Tuned Oscillator circuit and Crystal Oscillator, Uni-junction Oscillator**. Power Supplies:** Introduction, General filter Considerations, Capacitor filter, RC filter, Discrete Transistor Voltage Regulation, IC voltage regulators and practical applications.

10Hours

Design of Circuits to draw the Characteristics and Verification of basic Parameters

1. Determination of operating point for CE configuration.
2. Design of single stage R−C coupled BJT amplifier and determination of the gain-frequency response, input and output impedances.
3. Determination of FET input and Output Characteristics
4. Design of BJT voltage series feedback amplifier and determine the gain, frequency response,
5. Testing of half wave rectifiers using diode(with/without RC filter)
6. Testing of full wave rectifiers using diode(with/without RC filter)
7. Determination of static characteristics of SCR and Diac.
8. Design and testing of the performance of BJT Hartley oscillator.
9. Design and testing of single ended diode clipping circuits.
10. Design and testing of double ended diode clipping circuits.
11. Design and testing of diode clamping circuits (positive clamping and negative clamping).

Text Book:

1. Electronics Devices and Circuit Theory, Robert L.Boylestad and Louis Nashelsky ,PHI, 11th Edition.

Reference Book:

2. Integrated Electronics: Analog and Digital Circuits, Jacob Millman and Christos C Halkias, , TMH, 2001.

E-Books:

1. www.pyroelectro.com/edu/analog
2. http://freevideolectures.com/Course/3020/Circuits-for-Analog-System-Design

MOOCs:

1. https://www.mooc-list.com/course/electronic-systems-and-digital-electronicsuninettuno?static=true
2.http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-012-microelectronic-devices-and-circuits-spring-2009/
3. Introductory Analog Electronics Laboratory (Spring 2007) by MIT Open Courseware |Reviews and Ratings

CO-PO, PSO Mapping

EI 302	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1.	1	3											2	3
CO2.	1	3												
CO3.	1	2												
CO4.	1		3											

Course title:	NETWORK ANALYSIS	L	T	P	C
Course Code:	22EI303	2	2	0	3
Hours / week: 4	CIE: 50 Marks SEE: 50 Marks Exam hours: 3 Total hours: 52				

Prerequisites: Basic Electrical Engineering

Course Outcomes: Upon the completion of this course student will be able to:

CO1: Explain different types of electrical energy sources and linear electrical circuits using basic principles and theorems

CO2:Design series and parallel resonance circuits

CO3:Evaluate initial conditions to find out the complete response.

CO4: Determine Laplace transform for various signals and circuits

CO5: Evaluate two port network parameters

MODULE-1

Basic Concepts: Practical sources, Source transformations, Loop and node analysis with linearly dependent and independent sources for DC and AC networks, Concepts of super node and super mesh. **Network Topology:** Graph of a network, Concept of tree and co-tree, incidence matrix, tie -set, tie-set and cut-set schedules, Principle of duality.

Self-study component: Star-Delta configuration for impedance and admittance circuits, Formulation of equilibrium equations in matrix form, Solution of resistive networks,

10 Hours

MODULE-2

Network Theorems: Superposition, Reciprocity and Millman's theorems (Numerical only on independent sources) Thevinin's and Norton's theorems; Maximum Power transfer theorem (Numerical only on independent sources)

Self-study component: Numerical with dependent sources.

10 Hours

MODULE-3

Resonant Circuits: Series and parallel resonance, frequency response of series and Parallel circuits, Q –factor, Bandwidth. Relevant derivations and numerical.**Transient behavior and initial conditions:** Behavior of circuit elements under switching condition and their Representation, evaluation of initial and final conditions in RL, RC and RLC circuits for DC excitations. Relevant derivations and numerical.

Self-study component: Deriving conditions for frequencies corresponding to V_L Max and V_cMax. Evaluation of initial and final conditions in RL, RC and RLC circuits for AC excitations.

10 Hours

MODULE-4

Applications of Laplace Transformation: Step, Ramp and Impulse responses, waveform Synthesis, Solution of networks using Laplace transforms, Initial and final value theorem and numerical. **Two port network parameters:** Definition of z, y, h parameters and modelling with these parameters and relationship between parameters sets. Relevant derivations and numericals.

Self-study component: Transmission parameters, Interconnection of two port networks.

10 Hours

Text Book:

1. Network Analysis, M. E. Van Valkenburg, PHI / Pearson Education, 3rd Edition.

Reference Book:

1. Networks and systems Roy Choudhury, 2nd edition, 2006 Re-print, New Age International Publications

E-Books:

1. nptel.ac.in/courses/108105065- Networks signals and systems by Prof T.K. Basu, IIT Kharagpur
2. nptel.ac.in/courses/108102042- Circuit Theory by Prof Dutta Roy S.C, IIT Delhi

3. www.electrodiction.com/circuit-theory

MOOCs:
1. http://elearning.vtu.ac.in/06ES34.html
2. https://www.coursera.org/course/circuits

CO-PO, PSO Mapping

EI 303	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1.	2	2	2											
CO2.	1	2	2											
CO3.	1	2	2										3	3
CO4.	1	2	1											
CO5.	1	1	2									1		

Course Title:	LOGIC DESIGN	L	T	P	C
Course Code:	22EI304	2	2	0	3
Hours / week: 4	CIE: 50 Marks SEE: 50 MarksExam hours: 3 Total hours: 40				

Prerequisites: Basic Electronics
Course Outcomes: Upon the completion of this course student will be able to:
CO1: Design optimal logic circuit based on digital fundamentals
CO2: Construct combinational logic circuits using various code conversion techniques
CO3: Design various combinational logic circuit using MSI components,registers, counters and sequence generators
CO4: Design various sequential circuits using basic memory components.

MODULE - 1

Principles of combinational logic:, Normal and Canonical forms (Minterm and maxterm equations), Karnaugh maps-2, 3 and 4 variables; Completely and Incompletely specified functions (Don't Care terms), Simplifying Min term and Max term equations using K-map, Determination of minimal sum and minimal product expressions using essential prime implicants and essential prime implicates, synthesis and Analysis of combinational logic circuits, code conversion: Binary to gray, Gray to Binary, Binary to BCD, BCD to Binary, BCD to excess-3 code, etc., VEM for completely specified functions.
Self-Learning Component: Review of Boolean algebra, Realization of logic circuits using Universal gates Quine-McCluskey Method and VEM for incompletely specified functions.

10 Hours

MODULE - 2

Analysis and design of combinational logic: General approach, Adders and subtractors –Binary parallel adder &subtractors, Look ahead carry full adder, BCD adder and Magnitude comparators. Design BCD to Excess-3 code converter, Excess – 3 code to Binary converter (using Binary parallel Adder). Decoders-realization of Canonical expressions, Realization of BCD to Excess-3 code converter and Excess – 3 code to Binary converter, Encoders, Digital multiplexers
Self-Learning Component: Realization of Boolean canonical expressions using multiplexers.

10 Hours

MODULE - 3

Basic Sequential Circuits and their Applications: SR Latch and $\overline{SR}$ latch, Applications of SR and SR Latch, A Switch Debouncer: The gated $\overline{SR}$ Latch, The gated D Latch, The Master-Slave Flip-Flops (Pulse-Triggered Flip-Flops): The Master-Slave SR Flip-Flops, The Master-Slave JK Flip- Flop, T – FF, Edge Triggered Flip-Flop: The Positive Edge-Triggered D Flip-Flop, Negative-Edge Triggered D Flip-Flop. Characteristic Equations of all basic sequential circuits. Registers, Counters - Binary Ripple Counters, Synchronous Binary counters, Counters based on Shift Registers, Design of Synchronous counters,

Self-Learning Component: Design of a Synchronous Mod-6 Counter using clocked JK Flip-Flops, Design of a Synchronous Mod-6 Counter using clocked D, T, or SR Flip-Flops.

10 Hours

MODULE - 4

Sequential Design: Structure and operation of clocked synchronous sequential networks, analysis of clocked synchronous sequential networks:excitation and output expressions, transition equations, transition tables, excitation tables, state tables, state diagrams,State diagram of an Up/down synchronous decode counter, State diagram for sequence detectors.

Self-Learning Component: Design of a Synchronous Counter using clocked D, T, SR and JK Flip-Flops based on Mealy and Moore models.

10 Hours

Text Books:

1. **Digital Principles and Design**, Donald D Givone, Tata McGraw Hill Edition, 2002.
2. **Digital Logic Applications and Design**, John M Yarbrough, , Thomson Learning, 2001.

Reference Book:

1. **Digital System Design**, Ronald J Tocci, PHI, 2nd edition

E Books:

1. http://www.free-engineering-books.com/2014/11/digital-fundamentals-by-thomasl-floyd.html
2. https://books.google.co.in/books/about/Fundamentals_of_Digital_Circuits.html?id=BOVkrtiLUcEC

MOOCs:

1. http://freevideolectures.com/blog/2010/11/130-nptel-iit-online-courses/
2. http://freevideolectures.com/blog/2010/11/130-nptel-iit-online-courses/
3. www. pyroelectrom.com/edu
4. http://nptel.ac.in/courses/117106086
5. http://nptel.ac.in/courses/117105080
6. Digital Circuits and Systems, Youtube - S. Srinivasan, IIT Madras
7. Digital Integrated Circuits, Youtube – AmitavaDasgupta, IIT Madras

CO-PO, PSO Mapping

EI 304	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1.	3													
CO2.		3	2											
CO3.		3	2									1	2	
CO4.		2												
CO5.								3	3	3				

Course title:	MEASUREMENT AND INSTRUMENTATION	L	T	P	C
Course Code:	22EI305	3	0	2	4
Hours/week:5	CIE: 50 Marks SEE: 50 Marks Exam hours: 3 Total hours: 40+12				

Prerequisites: Basic Electronics, Basic Electrical Engineering

Course Outcomes: Upon the completion of this course student will be able to:

CO1: Explain the various types of measurement errors in electronic system and working of measuring Instruments and Signal generators.

CO2: Measure RLC parameters using bridges.

CO3: Distinguish functional elements of a system and transducers.

CO4: Analyze the static characteristics and dynamic characteristics of instruments.
CO5: Examine the instrument response in time and frequency domain.
*Note: Evaluation of lab component of this course is done based on the rubrics which will be shared with the students by the course faculty.

MODULE 1

Introduction: Measurement Errors: Gross errors and systematic errors, Absolute and Relative errors. Voltmeters: Multi-range voltmeter. **Digital Instruments:** Digital Voltmeters – Introduction, DVM's based on V – T, V – F and Successive approximation principles, Digital Multi-meters, **Oscilloscopes:** Introduction, Basic principles, CRT features, Block diagram, applications, Digital storage oscilloscopes-block diagram, **Signal Generators:** AF sine and Square wave generator, Function generator

Self- study component: Accuracy and Precision of digital Instruments,Logic Analyser, Square and Pulse generator,

10 Hours

MODULE 2

DC Potentiometers: Principle of operation, standardization of DC Potentiometer, calibration of Ammeter, Voltmeter.**DC bridges:** Whetstone's bridge, derivation for sensitivity of quarter, half and full bridges, Kelvin's Bridge, Kelvin's double bridge, applications and numericals**. AC bridges:** Maxwell's inductance-capacitance bridge, Andersons Bridge, Desauty'sbridge,Wien's bridge (derivation and numerical)
Self- study component: Laboratory type Potentiometer, calibration of Wattmeter.

10 Hours

MODULE-3

Introduction: Functional elements of an instrument: analog & digital modes of operation, I/O configuration of measuring instruments & instrument system- methods of correction for interfering & modifying inputs Definition of a transducer, Active and Passive Transducers, Primary and Secondary Transducers, Advantages of Electrical Transducers and Selection of Transducers. **Static Characteristics of Instruments:** Definition, Static Calibration, Static Error & correction, accuracy & Precision, linearity, Resolution & Threshold, Sensitivity, Reproducibility, Repeatability, Range, Span and Bias, Drift, Dead time & Dead zone, Hysteresis, Stability.
Self-study component: Study of various types of errors, Relationship with various static characteristics.

10 Hours

MODULE-4

Dynamic Characteristics of Instruments (Time and frequency Domain Analysis): Zero Order Instruments, 1st & 2nd Order Instruments – Step, ramp, & Impulse Responses, (Derivations excluding second order system), Time Domain Specifications: Rise time, Delay time, Peak Overshoot & Settling time. Definition for Speed of Response, measuring lag, Fidelity, Dynamic Error, dead time, Frequency response of 1st & 2nd order Systems,
Self-study component: Correlation between time and Frequency response of 2nd Order Instruments.

10 Hour

Lab Component:

1. To study the dynamic characteristics of first order system (RC Network only).
2. To study the static characteristics of RTD.
3. To study the static characteristics of Thermocouple.
4. To study the static characteristics of Thermistors.
5. To study the static characteristics of L.V.D.T.
6. To study the static characteristics of LDR.

7. To study the static characteristics of strain gages mounted on cantilever beam (quarter, half and full bridge).
8. Measurement of rpm using magnetic sensor and optical sensor.
9. Measurement of resistance by Wheatstone bridge and Determination of its sensitivity using quarter, half and full bridge configurations.
10. Measurement of self-inductance by Maxwell's bridge and Anderson's Bridge.

Text Book:

1. **Electrical & Electronic Measurements &Instrumentation**,A.K. Sawhney, 17th edition

Reference Books:

1. **Measurement Techniques**, E.O.Doeblin, McGraw Hill publications. 6th edition
2. **Modern electronic instrumentation and measuring techniques**, Cooper D & A D Helfrick,, PHI, 1998.

Course Title:	**OOP AND DATA STRUCTURES**	**L**	**T**	**P**	**C**
Course Code:	**22EI306A**	**3**	**0**	**0**	**3**
Hours / week: 3	**CIE: 50 Marks SEE: 50 Marks Exam hours: 3 Total hours: 40**				

Course Outcomes: Upon completion of this course, students should be able to:
CO1: Distinguish between programming Paradigms, user-defined data types and functions
CO2: Develop C++ programs using classes, objects and polymorphism concepts
CO3: Develop C++ programs using the concepts of code re-usability and pointers
CO4: Illustrate elementary data structures
CO5: Develop C++ programs to multidisciplinary domain applications

Module-1

C++ programming basics: Need for object-oriented programming, procedural languages, characteristics of OOP, preprocessor directives, data types, manipulators.
Structures: Structures as user defined data types, enumerated data types, Functions: passing arguments, returning values, reference arguments, overloaded functions, inline functions.

10 Hours

Module 2

Objects and classes: Objects as data types, constructors, destructors, overloaded constructors. Arrays: Arrays as class member data types, passing arrays, arrays as objects, strings.
Operator overloading: Overloading of unary operators, binary operators and data conversion.

10 Hours

Module 3

Inheritance: Derived and base class, levels of inheritance, multiple inheritance, Hybrid inheritance and virtual base class.
Pointers: Pointers in C++, pointers to objects, files and streams, input/output operations.

10 Hours

Module 4

Data structures-1: Data representation stacks and linked list.

Data structures-2: Queues: Single ended, D-queue and Priority queues; binary trees and its representation.

10 Hours

Textbooks:

1. **Object oriented programming in TURBO C++**, Robert Lafore, Galgotia Publications, 2nd Edition.
2. **Data Structures, Algorithms and Applications in C++**, SartajSahni, Tata McGraw Hill Publications. 2nd Edition.

Reference Books:

1. **C++ Programming**, BjrneStrounstrap, Addison-Wesley Publications, 3rd Edition.
2. **Object Oriented Programming with C++**, E Balaguruswamy, Tata McGraw Hill Publications, 3rdEdition.

E-Books:

1. www.ddegjust.ac.in/studymaterial/mca-3/ms-17.pdf
2. https://programesecure.com/balaguruswamy-c-pdf-free-download/

MOOCs

1. https://www.mooc-list.com/course/object-oriented-programming-edx
2. https://www.mooc-list.com/course/object-oriented-programming-java-coursera
3. http://nptel.ac.in/video.php?subjectId=108102043
4. http://nptel.ac.in/courses/108101037/41
5. http://nptel.ac.in/courses/106102064/

Course Title:	JAVA PROGRAMMING	L	T	P	C
Course Code:	22EI306B	3	0	0	3
Hours / week: 3	CIE: 50 Marks SEE: 50 Exam hours: 3Total hours: 40				

Prerequisites: C & C++ Programming

Course Outcomes: Upon completion of this course, student should be able to:

CO1: Explain the fundamentals of Java programming.
CO2: Design software systems with object-oriented java programming.
CO3: Illustrate decision structures.
CO4: Apply loops and files in java programming.
CO5: Develop Java programs using methods and classes.
CO6: Explain inheritance, polymorphism, and exceptions handling.

MODULE 1

Introduction to Java: A History of Java, Java Applications and Applets, What Is a Program Made of? Java fundamentals: The Parts of a Java Program, The print and println Methods, and the Java API, Variables and Literals.

Java fundamentals (Continued): Primitive Data Types, Arithmetic Operators, Combined Assignment Operators, Conversion between Primitive Data Types and Creating Named Constants with final, The String Class.

10 Hours

MODULE 2

Decision Structures: The if Statement, The if-else Statement, Nested if Statements, The if-else-if Statement, Logical Operators, Comparing String Objects, More about Variable Declaration and Scope, The Conditional Operator (Optional), The switch Statement.

Loops and Files: The Increment and Decrement Operators, The while Loop, Using the while Loop for Input Validation, The do-while Loop, the for Loop, Nested Loops, The break and continue Statements.

10 Hours

MODULE 3

Methods: Introduction to Methods, Passing Arguments to a Method, More about Local Variables, Returning a Value from a Method, Problem Solving with Methods.

A First Look at Classes: Objects and Classes, Writing a Simple Class, Step by Step, Instance Fields and Methods, Constructors, Passing Objects as Arguments, Overloading Methods and Constructors.

10 Hours

MODULE 4

Inheritance: What Is Inheritance?, Calling the Super class Constructor, Overriding Super class Methods, Protected Members, Chains of Inheritance and Polymorphism.

Exceptions and Advanced File I/O: Handling Exceptions and Throwing Exceptions

10 Hours

Text Book:

1. Tony Gaddis, "Starting out with JAVA", 6th Edition, Pearson, 2016.

Reference Book:

1. Y. Daniel Liang, "Introduction to JAVA Programming", 6th Edition, Pearson Education, 2007.

Course Title:	**Managing Innovations**	**L**	**T**	**P**	**C**
Course Code:	**22EI306C**	**3**	**0**	**0**	**3**
Hours / week: 3	**CIE: 50 Marks SEE: 50 Marks Exam hours: 3** **Total hours: 40**				

Course Outcomes: Upon completion of this course, student should be able to:

CO1: Explain concepts and types of innovation.
CO2: Identify challenges and corresponding innovation activities.
CO3: Build innovation sand box, margin of safety and innovative leadership.
CO4: Illustrate different types of innovation

MODULE 1

Introduction: Understanding the Concept of Innovation and its Importance, Types of Innovation, Innovation in Organization,

Lay the Foundation and Create a Challenge Book: Step one: Lay the Foundation, Create a Challenge Book, Let's Discuss Step One and Two, The Innovation Activity.

10Hours

MODULE 2

Build Participation and Experiment with Low-cost at High –speed: Choosing the Right "Role Model", Ways to Motivate Innovation Activity in Organization, Role of Catalyst in Building Participation in Innovation Process, How to Overcome Velocity Problem? Failure Fallacy, Encouraging Experimentation, Prototyping

Go Fast from Prototyping to Incubation and Iterate on The Business Model: Being a Champion, Iterating on Business Model, Design of a Pitch, Business Model Metaphors

10Hours

MODULE 3

Build an Innovation Sandbox and Create a Margin of Safety: Ways to Enhance the Batting Average Problem, Sand box, Platform and Open-Source Approach, Intellectual Property Protection, Risk Management, Big Bets Risks, Where Do We Stand?

Innovative Leadership in Growing Companies. The Path to Entrepreneurship: Seven Rules for Business Success, Plan to Succeed

10Hours

MODULE 4

The Evolution of an Innovative Business Unit, Disruptive Innovation, Mission Driven Innovation, Extraordinary Measures, Leveraging Collaboration for Innovation, Building Innovative Partnerships to Heal the World.

10Hours

Textbooks:

1. **8 STEPS TO INNOVATION Going from Jugaad to Excellence**VinayDabholkarRishikesha T. Krishnan, HarperCollins Publishers, First Edition, 2113.
2. **Entrepreneurship and Innovation**, James C. Barood, Rothman Institute of Entrepreneurship, 2110.

Reference Books:

1. Lateral Thinking, De Bano, Penguin UK, 2116
2. Innovation and Entrepreneurship, Peter F. Drucker, Butterworth-Heinemann,2112

MOOCs:

1. https://swayam.gov.in/nd2_imb19_mg05

Mode of evaluation for 10 marks component of continuous internal evaluation:

1. Student has to present a Seminar on Cutting edge developments in selected domain - 5 marks
2. Student batch has to do case study and submit a report on selected topics -5 marks

Course Title:	**E-Waste Management**	**L**	**T**	**P**	**C**
Course Code:	**22EI306D**	**3**	**0**	**0**	**3**
Hours / week: 3	**CIE: 50 Marks SEE: 50 Marks Exam hours: 3**	**Total hours: 40**			

Course Outcomes (COs) At the end of the course the student will be able to:

COs	**Statement**	**POs**
1.	Understand Multidisciplinary nature of environmental studies and Investigate how and why things happen, and make their own decisions about complex environmental issues by developing and enhancing critical and creative thinking skills.	6,7,12
2.	Understand how their decisions and actions affect the environment, builds knowledge and skills necessary to address complex environmental issues	6,7,12
3.	To develop the sense of awareness among the students about the environment and its various problems.	6,7,9,12
4.	Acquiring the basic knowledge about environment and the social norms that provides unity with environmental characteristics and create positive attitude about the environment.	6,7,12

Course Contents:

Module -1	**Teaching Hours**
Multidisciplinary nature of environmental studies- Definition, scope and importance. Need for public awareness. Natural Resources-Renewable and non-renewable resources: Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and	10 Hours

tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer, pesticide problems, water logging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources, Case studies. f) Land resources: Land as a resource, land degradation, man induced and slides, soil erosion and desertification Role of individual in conservation of natural resources. Equitable use of resources for sustainable life styles.	
Module -2	
Biodiversity and its conservation-Introduction Biogeographical classification of India, Value of biodiversity: consumptive, productive, social, ethical, aesthetic and option values. India as a mega-diversity nation Hot-spots of biodiversity Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts Endangered and endemic species of India. Environmental Pollution-Definition Causes, effects and control measures of Air pollution Water pollution Soil pollution Marine pollution Noise pollution Thermal pollution nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution case studies Disaster management: floods, earthquake, cyclone and landslides.	10 Hours
Module -3	
E-waste growth- An overview, hazards of E-waste, what is E-waste, digital dump yard, how to minimize E-waste, Hazardous substances waste Electrical and Electronic Equipment, characteristics of pollutants, batteries, electrical and electronic components, plastic and flame retardants, circuit boards, pollutants in waste electrical and electronic equipment.	10 Hours
Module -4	
E-Waste Recycling Technologies for recovery of resources from electronic waste, resource recovery potential of e-waste, steps in recycling and recovery of materials-mechanical processing, technologies for recovery of materials.	10 Hours

TEXT BOOK:

1. **Bharucha Erach**, Text Book of Environmental Studies for undergraduate Courses. University Press, IInd Edition 2013
2. E-Waste Managing the Digital Dump Yard, Edited by **Vishakha Munshi**, ICFAI University Press (Chapter 1)
3. E-waste: Implications, Regulations and Management in India and Current Global Best Practices, Edited by **Rakesh Johri**, The Energy and Resources Institute, New Delhi (Chapter 1, 5)

Course Title:	**Digital System Design Lab Using Multisim**	**L**	**T**	**P**	**C**
Course Code:	**22EI307A**	**0**	**0**	**2**	**1**
Hours / week: 2	**CIE: 50 Marks SEE: 50 Marks Exam hours: 3 Total hours: 12**				

Part-A

1. Realization of parallel adder/ Subtractor using 7483 chip; BCD to Excess-3 code conversion and vice versa.
2. Realization of One bit comparator and study of 7485 magnitude comparator.
3. Truth table verification of Flip-Flops: (i) JK Type (ii) T type (iii) D type (iv) SR type and (v) JK Master slave.
4. Realization of 3 bit counters as a sequential circuit and MOD – N counter design (7476, 7490, 74192, 74193).

5. Shift Registers: SIPO, SISO, PISO, PIPO operations using 7495S; Design and testing Ring counter/Johnson counter using 7495S.

Part-B

1. Implementation of De Morgan's theorem and SOP/POS expressions using Multisim.
2. Implementation of Half Adder, Full Adder, Half Subtractor and Full Subtractor using Multisim.
3. Design and implementation of 4-bit Parallel Adder/ Subtractor using IC 7483 using Multisim.
4. To realize Binary to Gray code conversion and vice versa using Multisim.
5. To realize Priority encoder and 3:8 Decoder using Multisim.
6. To realize One / Two bit comparator using Multisim.
7. To realize 4:1 Multiplexer and 1:8 Demux using gates with Multisim.
8. To realize the following flip-flops using NAND Gates (a)T type (b) JK Master slave (c) D type using Multisim.
9. To design and implement the 3-bit Mod-N synchronous counters using Multisim.
10. To design and implement the Binary ripple counters (up/down) using Multisim.

Course Title:	**Circuit Analysis Lab using LTSPICE**	**L**	**T**	**P**	**C**
Course Code:	**22EI307B**	**0**	**0**	**2**	**1**
Hours / week: 2	**CIE: 50 Marks SEE: 50 Marks Exam hours: 3 Total hours: 12**				

1. Verification of KVL for dc circuits.
2. Verification of KCL for dc circuits.
3. Design and verification of Superposition theorem for dc circuits.
4. Verification of Theveninn's theorem for dc circuits.
5. Verification of Norton's theorem for dc circuits
6. Verification of Maximum power transfer theorem for dc circuits
7. Verification of Reciprocity theorem for dc circuits
8. Verification of Millman's theorem for dc circuits

Course Title:	**AEC LAB USING LTSPICE**	**L**	**T**	**P**	**C**
Course Code:	**22EI307C**	**0**	**0**	**2**	**1**
Hours/week:3	**CIE: 50 Marks SEE: 50 MarksExam hours: 3 Total slots: 12**				

Prerequisites: Basic Electronics, Electronic devices & Circuits.
Course Outcomes: Upon the completion of this course student will be able to:
CO1: Illustrate the characteristics of basic electronic devices
CO2: Design various electronic circuit using basic components and device
CO3: Adapt delivered instructions for working and writing reports

1. Experiments to realize diode clipping (single, double ended) circuits.
2. Experiments to realize diode clamping (positive, negative) circuits.
3. Experiments to realize Full wave rectifier without filter (and set-up to measure the ripple factor, Vp-p, Vrms, etc.).

4. Design and conduct an experiment on Series Voltage Regulator using Zener diode to determine line/load regulation characteristics.
5. Realize BJT Darlington Emitter follower without bootstrapping and determine the gain, input and output impedances (other configurations of emitter follower can also be considered).
6. Experiment to realize Input and Output characteristics of BJT Common emitter configuration and evaluation of parameters.
7. Experiments to realize Transfer and drain characteristics of a MOSFET.
8. Set-up and study the working of class A power amplifier and calculate the efficiency
9. Set up and study the response of a two stage RC-coupled amplifier and calculate gain and bandwidth
10. To design and test the Common emitter-Common base cascade amplifier to determine the gain and bandwidth from its frequency response.
11. Design and set-up the Wein bridge oscillator and determine the frequency of oscillation
12. Design and set-up the oscillator circuits (Hartley/ Colpitts using BJT/FET) and determine the frequency of

Course Title	**Social Connect & Responsibility**		
Course Code	**22SCR**	**L-T-P**	**(0-0-2)1**
Exam	**3 Hrs.**	**Hours/Week**	**2**
SEE	**50 Marks**	**Total Hours**	**15**

Course Objective: Provide a formal platform for students to communicate and connect withtheir surroundings and create a responsible connection with society

Course outcomes: At the end of course, student will be able to:

#	Course Outcomes	Mapping to PO's	Mapping to PSO's
1	Describe societal challenges and build solutions to alleviate these complex social problems through immersion, design & technology.	6	-
2	Communicate and connect with their surroundings.	7,12	-

MODULE – 1

Plantation and adoption of a tree: Plantation of a tree that will be adopted by a group of students. They will also make an excerpt either as a documentary or a photo blog describingthe plant's origin, its usage in daily life, and its appearance in folklore and literature.

MODULE – 2

Heritage walk and crafts corner: Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photoblog and documentary on evolution and practice of various craft forms.

MODULE -3

Organic farming and waste management: Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus.

MODULE -4

Water Conservation: knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices. **Food Walk** City's culinary practices, food lore, and indigenous materials of the region used in cooking.

Course Conduction

A total of 14-20 hrs engagement per semester is required for the course. Students will be divided into teams and each team will be handled by two **faculty mentors**. Faculty mentors will design the activities for evaluation.

Guideline for Assessment Process:
Continuous Internal Evaluation (CIE)
After completion of, the social connect, the student shall prepare, with daily **diary** as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor.

Bridge Course for Diploma Students
BRIDGE COURSE MATHEMATICS - I
(Common to all Branches of Engineering)
(Audit Course)

Course Code: 21BCM301 **L-T-P-C—3-0-0-0**
Lecture Hours-42

Course Objective – To introduce simple concepts of calculus and numerical methods.

COS	**Having studied this course, students will be able to**	**PO1**
CO1	Solve simple problems on determinants, matrix multiplication, partial differentiation, and integration.	1
CO2	Compute the roots of transcendental equations and interpolate when the experimental data is given.	1
Co3	Expand the given function in terms of Taylor/ Macluarin's series.	1

Course Contents

Module - 1	Basic Formulas: Partial fractions. Matrices and determinants: matrix multiplication, evaluation of determinants, finding inverse. Differentiation-I: Review of limit and Continuity, differentiation- Basic formulas, Sum rule, product rule, quotient rule, chain rule and problems. Differentiation-II: Taylor's series, and Macluarin's series of simple functions for single variable, simple problems.	**10 hours**
Module - 2	Partial Differentiation: Definition, Illustrative examples on Partial differentiation, Total differentiation, chain rule, Differentiation of composite and implicit functions, Jacobians, illustrative examples and problems, simple problems.	**10 hours**
Module - 3	Integration: Basic formulas, Illustrative examples, evaluation of definite integrals, Integration by parts, Bernoulli's rule of Integration. Integral calculus: Reduction formula for functions$sin^n x$, $cos^n x$(without proof), Simple problems, Double & triple integration, simple problems with standard limits.	**10 hours**
Module - 4	Numerical Methods - Numerical Solution of algebraic & transcendental equations by Bisection method, Newton Raphson method, Regular Falsi method. Numerical Interpolation-Definition of forward, backward differences, Newton's forward and backward interpolation formulae, Lagrange's interpolation formula, central difference formulas-Bessel and Stirling formulas, illustrative examples.	**12 hours**

Note - Theorems and properties without proof. Applicable to all the units.

Text Books:

1. Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 40th edition (2007).
2. Erwin Kreyszig, Advanced Engineering Mathematics, Tata McGraw Hill Publications, 8th edition (2007).

Reference Books:

1. Calculus by Thomas Finney, 9th edition, Pearson education, 2002.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

IV Semester Syllabus

Course Title:	**LINEAR ICs AND SIGNAL CONDITIONING CIRCUITS**	**L**	**T**	**P**	**C**
Course Code:	**22EI401**	**3**	**0**	**0**	**3**
Hours / week: 3	**CIE: 50 Marks SEE: 50 MarksExam hours: 3 Total hours: 40**				

Prerequisites: Basic Electronics

Course outcomes: Upon the completion of this course student will be able to**:**

CO1: Explain fundamentals of Opamp and its behavior in open loop configuration

CO2: DesignOpamp circuits with positive and negative feedback and their applications.

CO3: Design Opampcircuits with diodes and capacitors for special applications.
CO4: Design circuits to generate basic signals using Opamp and timer.
CO5: Design SCC for specified instrumentation applications.

MODULE 1

1. **Introduction to OPAMPs:** Basic internal circuit of OPAMP (Differential Amplifier), Block diagram representation of a typical OPAMP, OPAMP terminals and its ideal characteristics /Specifications; OPAMP in Open loop configuration: Open loop voltage gain, Zero Crossing detector: Inverting & Non Inverting ZCDs; Positive and Negative voltage level detectors, LM 339-Quad Comparator, Generation of PWM using LM339. **OPAMPs with negative feedback and its applications:** Inverting and Non Inverting amplifier: Closed loop voltage gain, Input impedance, Output impedance, Bandwidth with feedback, Applications: Adder (Multichannel amplifier), Inverting averaging amplifier, Non Inverting Adder, Voltage follower, Difference amplifier: Subtractor and design problems.
   Self -study component: Ideal voltage source

10 Hours

MODULE 2

2. **OPAMPs with positive feedback and its applications:** Effect of noise on comparator circuits, Design aspects of ZCD with Hysteresis (Schmitt trigger),(Design aspects of Voltage level detectors with Hysteresis (both Inverting and Non Inverting), Applications: independently adjustable set point controller.**DC performance and AC performance of OPAMPs:** Measurement and effect of OPAMP Parameters: Input bias current, Input offset current, Input offset voltage, Frequency response of OPAMP: Open loop and Closed loop configurations.
   Self -study component: Slew rate and output voltage.

10 Hours

MODULE 3

3. **Special Applications of OPAMPs:** V-I (both floating load and grounded load) converter and their Applications: Diode match finder, design of high input impedance DC/AC voltmeter using ammeter, I-V converter and its applications; design of I-V circuit for Photo based sensor, Precision rectifiers: Half wave and Full wave;, Frequency response of Integrator, Differentiator and their Design. **Waveform Generators:** Multivibrators using OPAMPs: Free running (square wave generator) and oneshotmultivibrators, Triangular wave generator, Design problems, 555 Timer: Introduction, Astablemultivibrators and Mon stable multivibrators: applications and their applications**.**
   Self- study component: Zener diode tester, Phase shift oscillator

10 Hours

MODULE 4

4. **Active Filters:** Introduction to Filters: Design aspects of Low pass Butterworth filter; first order and Second order filters, Design aspects of High pass Butterworth filter; first order and Second order filters, Higher order filters, Design aspects of Band pass filter and Band rejection filter. **Signal conditioning circuits:** Basic differential Amplifiers, differential versus single input amplifiers, Instrumentation amplifier, Basic Bridge Amplifiers, Balancing and linearization techniques for the bridges**.**
   Self-study component Design of Signal conditioning circuits for Strain gauge, Thermistor

10 Hours

Text Books:

1. **Operational Amplifiers and Linear Integrated Circuits**, Robert. F. Coughlin &Fred.F. Driscoll, , PHI/Pearson, 2006
2. **Operational Amplifiers and Linear Integrated Circuits**, Ramakant A. Gayakwad, , 4th edition, PHI

Reference Book:

1. Linear Integrated Circuits, D. Roy Choudhury and Shail B. Jain, , 2nd edition, Reprint 2006, New Age International

E Books:

1. http://freevideolectures.com/Course/2321/Electronics-for-Analog-Signal-Processing-I
2. http://freevideolectures.com/Course/2322/Electronics-for-Analog-Signal-Processing-I

MOOCs:

1. http://ocw.tudelft.nl/courses/microelectronics/analog-integrated-circuitdesign/course-home/
2. Introductory Analog Electronics Laboratory (Spring 2007) by MIT Open Courseware |Reviews and Ratings
3. http://www.pannam.com/blog/free-resources-to-learn-electrical-engineering/

CO-PO, PSO Mapping

EI 402	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1.	3		2											
CO2.		3												
CO3.		3												
CO4.			3										2	1
CO5.		3	2											
CO6.			3											

Course Title:	PROCESS INSTRUMENTATION	L	T	P	C
Course Code:	22EI402	3	0	2	4
Hours / week: 5	CIE: 50 Marks SEE: 50 Marks Exam hours: 3 Total hours: 40				

Prerequisites: Transducers and Instrumentation

Course outcomes: Upon the completion of this course student will be able to**:**

CO1: Explain measurement techniques for displacement, force, torque and shaft power for rotating members

CO2: Illustrate the working of various temperature, pressure and level measurement techniques.

CO3: Adapt specific flow meters andmeasurement methods for industrial applications.

CO4: Measure process parameters using suitable instruments.

*Note: Evaluation of lab component of this course is done based on the rubrics which will be shared with the students by the course faculty.

MODULE - 1

Measurement of Displacement, Force, Torque & Shaft Power: Resistive potentiometer, capacitance pickup, Variable Inductance and Reluctance Pickup, Eddy Current Non contacting Transducers, ultrasonic transducer. Introduction to force, Hydraulic Load cell, Pneumatic Load cell, Strain Gauge Torque Meter, Angular Twist Type Torsion Meters, Gear Dynamometer.

Self Learning Component:LVDT ,Belt Dynamometer ,Absorption Dynamometer

10 Hours

MODULE - 2

Temperature Measurement: Thermal expansion methods-bimetallic thermometers, liquid-in-glass thermometers, reference junction consideration, electrical resistance sensors- resistance thermometers, Radiation Temperature Sensors: Automatic null balance radiation thermometers, Optical Pyrometer, Black body-tipped fiber optic radiation thermometer.
Self LearningComponent: common thermocouples, ThermistorFluro-optic temperature measurement

10 Hours

MODULE - 3

Pressure Measurement: Introduction, manometers, Bourdon Pressure Gauge , Low pressure measurement- McLeod gage, thermocouple vacuum gauge, ionization gauge, Knudsen gauge,**Flow Measurement**: positive displacement meters (Nutating disc meter), secondary meters, variable head meters, pitot static tube, target flow meter, turbine flow meter, ultrasonic flow meters, Electromagnetic flow meters, Hot wire and hot film anemometer.
Self Learning Component: Calibration of pressure gauges: Manometricmethod , Dead weight tester , Calibration of flow meters

10 Hours

MODULE - 4

Level Measurement: Direct Liquid Level measurements: Dip-stick method, sight glass method, hook gauge, indirect Liquid Level measurements: hydrostatic pressure level measurement device, purge technique, capacitance level gauge, ultrasonic level gauge. Miscellaneous Instruments: measurement of pH value, environmental air pollution parameters, orsat apparatus for exhaust gas analysis, smoke density measurement.
Self LearningComponent: floatgauge, nucleonic gauge.

10 Hour

Lab Component

1. P-I and I-P Converter.
2. Measurement of flow rate using Orifice Plate.
3. Measurement of flow rate using Venturi tube.
4. Measurement of flow rate using Pitot static tube/Rotameter
5. Indirect measurement of liquid Level.
6. Measurement of Torque.
7. Measurement of Pressure using Bourdon tube/Diaphragm pressure gauge.
8. Measurement and verification of thickness of different material (standard flats) using Ultrasound technique

Text Books:

1. **Measurement systems application and design**, ERNEST O DOEBELIN, 6th Edition, McGraw-Hill. (Module 1 & 2)
2. **Instrumentation Measurement and analysis**, B.C.Nakra and K.K.Chaudhry, TMH,2002(Module 1 , 3, 4 & 5)

Reference Books:

1. **Instrumentation Devices & Systems**, Rangan, Mani, Sharma, , 2nd Edition TMH.
2. **Instrument Engineers Hand book (process measurement)** B G LIPTAK, Chilton book Company

E Books:

1. http://nptel.ac.in/courses/112103174/pdf/mod2.pdf

2. https://www.youtube.com/watch?v=1uPTyjxZzyo
3.http://nptel.iitg.ernet.in/courses/Elec_Engg/IIT%20Bombay/Electrical%20and%20Electronic%20 Measurements.htm
4. http://www.nptelvideos.in/2012/11/industrial-instrumentation.html
5. http://onlinevideolecture.com/?course_id=385&lecture_no=32

MOOC:
1. http://nptel.ac.in/courses/112103174/3

CO-PO, PSO Mapping

21EI 403	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	3	2				1							3	2
CO2	3	3	3	1		1								
CO3	3	3				1								
CO4		3												
CO5								3	3	3				

Course Title:	**INTRODUCTION TO MICROPROCESSOR**	**L**	**T**	**P**	**C**
Course Code:	**22EI403**	**3**	**0**	**2**	**4**
Hours / week: 5	**CIE: 50 Marks SEE: 50 Marks Exam hours: 3 Total hours: 40 +12**				

Prerequisites: Logic Design
Course outcomes: Upon the completion of this course student will be able to**:**
CO1: Explain the architecture, minimum and maximum mode operations of 8086.
CO2: Illustrate functioning of 8086 instructions and assembler directives.
CO3: Develop ALP for elementary applications.
CO4: Explain various interrupts of 8086 and interfacing concepts.

MODULE-1

The Processor-8086: Register organization of 8086, Architecture of 8086, Signal Descriptions of 8086, Physical memory organization, Minimum mode 8086 systems and timings, Maximum mode 8086 systems and timings, mode of operation.

10Hours

MODULE-2

Instruction set: Data transfer, Arithmetic and logical, Bit manipulation, shift and rotate, String related, Processor control and Program execution transfer instructions of 8086.

10Hours

MODULE-3

Addressing modes of 8086, Assembler directives, A few machine level programs, Programming with an assembler, Assembly language example programs. Introduction to stack, Stack structure of 8086, Interrupts and Interrupt service routines, Interrupt cycle of 8086, Non-maskable&maskable interrupts.

10Hours

MODULE-4

Macros, Timings and delays, Semiconductor memory interfacing, Dynamic RAM interfacing. Special Purpose Programmable Peripheral Devices and Their Interfacing: Interfacing I/O ports, Programmable Peripherals Interface-8255,Programmable communication Interface 8251- USART.

10Hours

Laboratory Component:

1. Write an assembly language program to find the average of N 16-bit unsigned integers.
2. Write an assembly language program for multi precision addition and subtraction operations.
3. Write an assembly level program to convert BCD to Binary and vice versa.
4. Write an assembly level program to find smallest/largest of N 16-bit unsigned integers.
5. Write an assembly language program to convert a BCD number to 7-segment Code usinglook-up table.
6. Write an assembly language program to check whether the given number belongs to special code or not (eg. 2 out of 5 code).
7. Write an assembly program to perform the following: If contents of X = 1, then determine Z = (Y+W)/V. if contents of X = 0,then determine Z = (Y* W) – V. For other values of X store 00 in location Z. (Where Y, W, V are 16-bit unsigned integers).
8. Write an ALP to count the number of 0's & 1's in a set of 16-bit unsigned numbers.Display the result on screen.
9. Write an assembly language program to sort a set of N 16 bit unsigned integer numbers in ascending/ descendingorder using bubble sort algorithm. Length of the numbers N is in word memory location X and the integers start from wordmemory location X+l.

Evaluation criteria for laboratory component:

The 10 marks of the activity are allotted for the laboratory component. The 5 marks are allotted for record writing and 5 marks is forContinuous Evaluation.

Text Book:

1. **Advanced Microprocessors and Peripherals**, A.K.Ray and K.M. Bhurchandi, Tata McGraw Hill, 1st Edition, 1996,

Reference Book:

1. Microcomputer systems the 8086/8088 family, Architecture, Programming and Design, Yu-Cheng Liu & Glenn A Gibson, PHI, 2nd Edition.

E Book:

1. http://freevideolectures.com/Course/3018/Microprocessors-and-Microcontrollers

MOOCs:

1. Embedded Systems - Shape The World
https://www.edx.org/course/embedded-systems-shape-world-utaustinx-ut-6-02x
2. Electronic Interfaces: Bridging the Physical and Digital Worlds
https://www.edx.org/course/electronic-interfaces-bridging-physical-uc-berkeleyxee40lx-0

CO-PO, PSO Mapping

EI 405	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
					2									
			2		1									
					3							1		3
		3			2							1		
								2	2					

Course Title:	Lasers & Biomedical Instrumentation	L	T	P	C
Course Code:	22EI404	3	0	0	3
Hours / week: 3	CIE: 50 Marks SEE: 50 Marks Exam hours: 3 Total hours: 40				

Prerequisites:

Course outcomes: Upon the completion of this course student will be able to:

CO1: Explain the principle of generation of laser radiation and classes of lasers.

CO2: Illustrate the various techniques of laser generation.

CO3: Explain the different applications of laser.

CO4: Explain fundamentals of nature, behavior and acquisition of biomedical signals.

CO5: Adopt safety aspects and testing of biomedical equipment's

MODULE 1

Lasers -I: Introduction, Emission and absorption of radiation, Einstein relation, population inversion, threshold conditions, Line shape function, population inversion and pumping threshold conditions.

Lasers -II: LASER modes: Axial & Transverse modes; Classes of LASER: Doped insulator LASERs, semiconductor LASERs, GasLASERs, Liquid dye LASERs**.**

10 Hours

MODULE 2

Generation of Lasers: Single mode operation, frequency stabilization. Q-switching, modelocking, lasing threshold**.**

Applications of Laser: Measurement of distance: Interferometric methods, Beam modulation telemetry, Pulse echo techniques; Holography & its applications.

10 Hours

MODULE 3

Fundamentals: Sources of biomedical signals, basic medical instrumentation system, general constraints in design of biomedical instrumentation systems. electrodes for ECG, EEG, EMG.

Patient monitoring system: Bedside patient monitoring system, heart rate measurement-, instantaneous heart rate meter, measurement of pulse rate.

10 Hours

MODULE 4

Patient safety: Electric shock hazards, Gross shock, effects of electric currents on human body, micro current shock, types of leakage currents, precautions to minimize electric shock hazards,

Instrumentation for Surgery: Principle of surgical Diathermy, Surgical Diathermy Machine, Safety aspects in Electro- surgical Units, Surgical Diathermy Analyses

10 Hours

Textbooks:

1. **Optoelectronics- an Introduction-**Wilson & Hawkes, Prentice Hall of India.
2. **Handbook of Biomedical Instrumentation, -**R.S.Khandpur- Tata Mc-grawhill Co.2003 2 nd Edition

Reference Book:

1. **LASER Fundamentals-** William T. Silfvast, Cambridge University Press.
2. **Introduction to biomedical equipment technology-**Joseph.J.Corr and John.M.Brown,, Pearson education., 4 th Edition, 2001
3. **2. Principles of applied biomedical Instruments-**Leslie Cromwell and John M Brown,Pearson education, 4 th Edition, 2004

Course Title:	INTRODUCTION TO VHDL PROGRAMMING	L	T	P	C
Course Code:	22EI405A	3	0	0	3
Hours / week: 3	CIE: 50 Marks SEE: 50 MarksExam hours: 3 Total hours: 40				

Prerequisites: Logic Design

Course outcomes: Upon the completion of this course student will be able to**:**

CO1: Distinguish various identifiers, data objects, operators and data types

CO2: Design a flow model for given digital circuit

CO3: Identify suitable model for given application

CO4: Construct digital circuits using packages and library functions.

MODULE-1

Introduction: Fundamentals of VHDL, A Brief History of VHDL, Capabilities, Basic Terminology, Entity Declaration, Architecture Body, Identifiers, Data objects, Operators and Data types.**Data –Flow Modeling:** Concurrent Signal Assignment statement, Concurrent V/S Sequential Signal Assignment, Conditional signal Assignment Statement, Selected Signal Assignment Statement.

Self-study component: The Unaffected Value and Block Statement.

10 Hours

MODULE-2

Behavioral Modeling: Entity Declaration, Architecture Body, Process Statement, Variable Assignment Statement, Signal assignment statement, Wait, If, Case, Null Statements, Loop Next, Exit statement. **Structural Modeling and state Machines:** Component declaration, Component Instantiation and State machines.

Self-study component: Assertion, Report Statements Inertial delay model and Transport delay model, Multiple Processes.

10 Hours

MODULE-3

Generics and Configurations & Advance Features: Generics, Why Configurations, Configuration Specification, configuration Declaration, Default Rules, Generate statements. **Sub Programs &Advanced HDL Descriptions:** Functions, Procedures, Subprogram overloading, Operator Overloading, Functions File Processing.

Self-study component: Type Conversions, Attributes, examples of File Processing.

10 Hours

MODULE-4

Packages and Libraries: Package Declaration, Package Body, design File, design Libraries, Implicit Visibility, and Explicit Visibility. **Synthesis Basics:** Highlights of Synthesis, Synthesis information from Entity and Module, Mapping Process in the Hardware Domain.

10 Hours

Text Books:

1. **A VHDL Primer**- J.Bhaskar – PHI Publications
2. **Introduction to HDL Programming** - NazeihM.Botros- Dreamtech Press (Available through John Wiley – India and Thomson Learning).

Reference Books:

1. **Circuit design with VHDL**, VolneiA.Pedroni, PHI
2. **VHDL Programming by Examples** -Douglas perry-Tata McGraw-Hill.

EBooks:

1. http://access.ee.ntu.edu.tw/course/dsd_99second/2011_lecture/W2_HDL_ Fundamentals_2011-03-02.pdf
2. http://www.ics.uci.edu/~alexv/154/VHDL-Cookbook.pdf
3. http://ece.niu.edu.tw/~chu/download/fpga/verilog.pdf

MOOCs:

1. Electronic Design Automation http://nptel.ac.in/courses/106105083/
2. Digital system design with PLDs and FPGAs http://nptel.ac.in/courses/117108040/
3. Fundamentals of HDL (Lecture #008) https://www.youtube.com/watch?v=rdAPXzxeaxs&index=8&list=PLE3BC3EBC9CE15FB0

CO-PO, PSO Mapping

EI 406	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO1.	3	2												
CO2.		3	3		2									
CO3.		3			2							1		
CO4.			3		2								2	3
CO5.								3	3	3				

Course tittle:	STATISTICS & PROBABILITY		L	T	P	C
Course Code:	22EI405B		3	0	0	3
Hours / week: 3	CIE: 50 Marks SEE: 50 Marks	Exam hours: 3	Total hours: 40			

Course objective: The student will study Statistics, probability and calculus of a complex valued function

Course outcomes: The student will be able to

COs	Outcomes	PO1	PO2	PO3
CO1	Apply the concepts of analytic functions, conformal mapping, complex integration , singularities, residues to engineering oriented	3	2	

	problems such as stability of a system			
CO2	Adopt statistical techniques such as correlation/regression, curve fitting to analyze the data	3	2	2
CO3	Predict the probability of happening, through the concepts of random variables, study the system applications, through the suitable pdf, sampling theory and gain the capability to study the reliability of the system	3	2	2
CO4	Predict the behaviour of Markov chain based problems in the long run and study the correlation, covariance of random variables using joint PDF concept.	3	2	2

MODULE-1

Statistics: Curve fitting by least square method – Straight lines, parabola, (when the experimental output depends on one input)Correlation – Karl Pearson coefficient of correlation and Spearman's rank correlation coefficient. Physical interpretation of numerical value of the rank correlation coefficient. Linear Regression analysis(when the experimental output depends on one input). Illustrative examples from engineering field, Multiple regression analysis. (linear- when the experimental output depends on two inputs)**. Probability: Discrete Random Variables**: Definitions of PDF & CDF, Expectation and Variance. Binominal pdf, Illustrative examples.

10 Hours

MODULE-2

Continuous Random Variables: Definition of PDF and CDF, Expectation and Variance, illustrative examples. Uniform pdf, Normal/Gaussian pdf, discussion on the choice of PDF. Illustrative examples from engineering field.**Sampling Distribution**: Introduction, Testing a hypothesis, central limit theorem-statement, Level of significance, Simple sampling of attributes, Test of significance for large samples, Comparison of large samples, Student's t-distribution, Chi-square distribution

Self study- Exponential pdf, confidence intervals in sampling theory.

10 Hours

MODULE-3

Joint Probability Distribution & Stochastic Processes: Concept of joint probability, Joint distributions of discrete random variables, Independent random variables – problems. Joint expectation, co-variance and correlation. **Markov Chains:** Introduction, stochastic matrices, fixed probability vectors and regular stochastic matrices.**Functions of a complex variable**: Analytic functions. -Statement of Cauchy-Riemann equations in Cartesian form and illustrative examples,

Self study---Construction of an analytic function using Milne-Thomson method (Cartesian form). Illustrative examples from engineering field.

10 Hours

MODULE-4

Harmonic functions and Conformal Mapping: Properties of Harmonic functions and Illustrative examples (Cartesian form) Definition of Conformal transformation and discussion of some standard transformations ($w = z^2, w = e^z, w = z + \frac{k^2}{z}.$) Bilinear transformation, Illustrative examples. Applications of conformal mapping.

Complex Integration: – Evaluation of line integrals, Statement of Cauchy's theorem, generalized Cauchy's Integral formula- illustrative examples. Brief introduction to Taylor and Lorentz series and illustrative examples, Zeros of an analytic function, Singularities and Residues.

Self study--Calculation of residues, Evaluation of real definite integrals using Cauchy's residue theorem.

10 Hours

Note - Theorems and properties without proof. Applicable to all the Modules.

Text Books:

1. Dr. B. S. Grewal, Higher Engineering Mathematics, Khanna Publications, 44th Edition, 2016.
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India Pvt. Ltd 9th edition, 2014.
3. B V Ramana Higher Engineering Mathematics, Tata McGraw Hill Publications, 2nd edition, 2007.

Reference Books:

1. Scott L. Miller, Donald G. Childers: "Probability and Random Process with application to Signal Processing", Elsevier Academic Press, 2nd Edition,2013.
2. Statistics for engineers and Scientists, William Navide, Mc-Graw hill education, India pvt. Ltd., 3rd edition 2014.
3. T. Veerarajan: "Probability, Statistics and Random Process", 3rd Edition, Tata McGraw Hill Co., 2008.

Theory and problems of probability, Seymour Lipschutz and marclarslipson, schaum out line series, 2nd edition

Course tittle:	INTERNET OF THINGS AND APPLICATIONS	L	T	P	C
Course Code:	22EI405C	3	0	0	3
Hours / week: 3	CIE: 50 Marks SEE: 50 Marks Exam hours: 3	Total hours: 40			

Course Outcomes (COs):

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

CO1: Explain the basic concepts of IoT and about its domain specific.
CO2: Illustrate IoT system management and design methodologies.
CO3: Evaluate the data types, data structures and logical design using python.
CO4: Explain the concepts of Iot devices and its interfaces.

Module 1

Introduction & Concepts- Definition & Characteristics of IoT; Physical Design of IoT; Logical Design of IoT.IoT Enabling Technologies**:** WSN, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, Domain Specific IoTs- Introduction, Home Automation; Cities; Environment; Energy; Retail;

10 Hours

Module 2

Logistics; Agriculture; Industry; Health & Lifestyle, IoT and M2M-Introduction; M2M; Difference between IoT and M2M.Need for IoT Systems management; SNMP; Network Operator Requirements; IoT Systems management with NETCONF-YANF; NETOPEER

10 Hours

Module 3

Developing IoT- IoT Design Methodology: Purpose & Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification, Service Specification IOT Level Specification, Functional View Specification, Operational View Specification, Device & Component Integration & Application Development.Case Study on IOT System for weather Monitoring**,** Logical Design using Python- Introduction; Installing Python; Python Data Types & Data structures;

10 Hours

Module 4

Control Flow; Functions; Modules; Packages; File Handling; Date/Time Operations;**IoT Physical Devices and Endpoints**- What is an IoT device; Exemplary Device- Raspberry Pi; Linux on Raspberry Pi; Raspberry Pi Interfaces;

10 Hours

Text Book:
1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands on Approach)", 1stEdition, VPT, 2114

Reference Books:
1. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2113
2. CunoPfister, Getting Started with the Internet of Things, O"Reilly Media, 2111

EBooks:
1.http://www.internet-of-things-research.eu/pdf/IoT-From%21Research%21and%21Innovation%21to%21Market%21Deployment_IERC_Cluster_eBook_978-87-93102-95-8_P.pdf
2. http://support.ptc.com/WCMS/files/160474/en/PTC_eBook_Impact_of_the_IoT_on_Manufacturers.pdf

MOOCs:
1. https://www.coursera.org/specializations/internet-of-things
2. http://web.mit.edu/professional/digital-programs/courses/IoT/
3. https://www.mooc-list.com/tags/iot

Course Title:	Signal Conditioning Lab	L	T	P	C
Course Code:	22EI406A	0	0	2	1
Hours/week:2	CIE: 50 Marks SEE: 50 MarksExam hours: 3 Total slots: 13				

Prerequisites: Linear ICs and Signal Conditioning Circuits
Course outcomes: Upon the completion of this course student will be able to**:**
CO1: Measure various Opamp parameters
CO2: Design Opamp and timer circuits for various applications
CO3: Adapt delivered instructions for working and writing reports
*Note: Evaluation of lab component of this course is done based on the rubrics which will be shared with th students by the course faculty.

List of Experiments
1. Measurement of op-amp parameters
2. Op-amp in open loop configuration:
    a. Zero Crossing Detector
    b. Inverting and Non Inverting voltage level detectors
3. Op-amp in closed Loop configuration(with negative feedback): Inverting amplifier, Multi channel amplifier as adder and averager
4. Op-amp in closed Loop configuration(with positive feedback): Schmitt trigger; ZCD with hysteresis,
5. Op-amp in closed Loop configuration (with positive feedback): Inverting VLD with Hysteresis and Non-inverting VLD with Hysteresis.
6. Op-amp with Diodes: Half wave and Full wave Precision Rectifier
7. Op-amp with capacitors: Integrator and Differentiator
8. Wave form generators using Op-amp:
    a. AstableMultivibrator using Op-amp
    b. MonostableMultivibrator using Op-amp
9. Wave form generators using timer IC555:
    a. AstableMultivibrator
    b. MonostableMultivibrator
10. Butterworth Low pass & High pass Filters
11. Basic signal conditioning Circuits:
    a. Basic Differential Circuit and Subtractors

b. Instrumentation Amplifier

Course Title:	Digital Systems Design using Xilinx	L	T	P	C
Course Code:	22EI406C	0	0	2	1
Hours/week:2	CIE: 50 Marks SEE: 50 Marks Exam hours: 3 Total slots: 13				

1. Write VHDL code to realize all the logic gates
2. Write a VHDL program for 2 to 4 decoder
3. Write a VHDL program for 8 to 3 (encoder without priority & with priority)
4. Write a VHDL program for 4 bit binary to gray converter
5. Write a VHDL program for Multiplexer
6. Write a VHDL program for de-multiplexer
7. Write a VHDL program for comparator.
8. Write a VHDL code to describe the functions of a Full Adder Using three modeling styles.
9. Develop the VHDL code for the following flip-flops, SR, D, JK, and T.
10. Design 4 bit binary, BCD counters (Synchronous reset and Asynchronous reset) and "any sequence" counters

Course Title:	Static & Dynamic Characteristics and Error Analysis in Instrumentation Systems	L	T	P	C
Course Code:	22EI406C	0	2	0	1
Hours/week:2	CIE: 50 Marks SEE: 50 Marks Exam hours: 3 Total slots: 13				

Course Objectives:
CO1: To impart fundamentals of static and dynamic characteristics of instrumentation systems.
CO2: To acquire the basic knowledge of errors in measurement systems and their analysis.

Module-1

Measurement system performance, Static calibration and error calibration curve, accuracy and precision, indications of precision, significant figures, static error, static correction, scale range and scale span, reproducibility and drift, repeatability, static sensitivity, linearity, hysteresis, threshold, dead time and dead zone, resolution.

Module-2

Noise, signal to noise ratio, sources of noise, Johnson noise, power spectrum density, noise factor and noise figure, loading effects, Input and output impedances – input impedance, input admittance, output impedance, output admittance, generalized impedance and stiffness concepts, static stiffness and static compliance.

Module-3

Limiting errors, relative limiting errors, types of errors, gross errors, systematic errors, random errors, central value, Statistical treatment of data – histogram, arithmetic mean, measure of dispersion from the mean, range, average deviation, standard deviation, variance, normal or Gaussian curve of errors, probable error.

Module-4

Dynamic response – steady state and transient response, dynamic characteristics, Dynamic analysis of measurement systems – time domain analysis, different types of inputs, frequency domain analysis, Transfer function, Time domain response – zero order system, first order system, response of a first order system to step & ramp input, frequency response of first order system.

Textbook:

1. Electrical and Electronic Measurements and Instrumentation – A. K. Sawhney, 17th Edition (Reprint 2004),
DhanpatRai& Co. Pvt. Ltd., 2004.

Reference Books:

1. Electronic Instrumentation - H. S. Kalsi, TMH, 3rd Edition, 2012
2. Instrumentation: Devices and Systems- C. S. Rangan, G. R. Sarma, V. S. V. Mani, 2nd Edition (32nd Reprint), McGraw Hill Education (India), 2014.

Web links and Video Lectures (e-Resources):

- https://nptel.ac.in/courses/112107242
- https://www.youtube.com/watch?v=5eOgWyfXjr8
- https://www.youtube.com/watch?v=Hlvbr5DCEfM

Course Title:	**Statistics with R Lab for machine learning**	**L**	**T**	**P**	**C**
Course Code:	**22EI406D**	**0**	**2**	**0**	**1**
Hours/week:2	**CIE: 50 Marks SEE: 50 Marks Exam hours: 3 Total slots: 13**				

Course Objective: Students will be trained to acquire knowledge in linear algebra and Statistics With python/R Programming and its applications.

Course Outcomes: Having studied this course, students will be able to

CO1: Write the programme for the mathematical procedure connected with probability, hypothesis testing, co-relation and regression.

CO2: Execute the programme and provide perfect output.

Experiments List:

1. To predict the conditional probabilities using Bayes theorem.
2. To predict the probability of discrete random variable- Binomial.
3. To predict the probability of discrete random variable- Poisson.
4. To predict the probability of discrete random variable- Hyper geometric.
5. To predict the probability of continuous random variable in an interval (Uniform random variable, exponential variable).
6. To predict the probability of continuous random variable in an interval (Normal random variable).
7. To predict the probability of application connected with Markov process in long run.
8. To compute the confidence interval for mean and standard deviation.
9. Hypothesis testing on application problem connected with mean, variance, proportions when sample size is large.

10. Hypothesis testing on application problem connected with mean, variance, proportions when sample size is less (student's T distribution, chi square distribution)
11. Examining the corelation of the experimental data.
12. Carryout linear regression and multiple regression analysis for the experimental data.

BIOLOGY FOR ENGINEERS

Course Code	**22BEEC/EE/EI407L-T-P-C**		**(1-0-0)1**
Exam : 3 Hrs.Hours/Week	**1**		
CIE	**100 Marks**	**Total Hours**	**14**

Course objective: Realization of relation between Natural Engineering and man- made Engineering.

Course Outcomes**:** At the end of the course, student will be able:

Course Outcomes

1. To familiarize engineering students with basic biological concepts in an Engineering perspective.
2. To involve students in an interdisciplinary vision of biology and engineering.
3. To gain the realization of translation of natural engineering in biological systems into novel devices in man-made engineering domain.
4. To develop automation-based engineering models by employing the natural automation concepts in human body.

MODULE-1

Introduction to Human Anatomy: Overview of human anatomy, Structural organization of the human body - cardiovascular system, endocrine system, digestive system, respiratory system, excretory system, lymphatic system, nervous system, muscular system and skeletal system.

3 Hrs

MODULE-2

Receptors (Sensors) and Effectors (Actuators): Comparative study of biological principles with Electrical principles, Sense Organs; External and Internal sense organs, Effectors; Muscles and glands, brief introduction to Sensory and motory nerves, Comparative Study of Sensors and Actuators (Engineering system) based on the concepts ofReceptors and Effectors in Human body.

4 Hrs

MODULE-3

Communication system in Human Body: Nervous system; Neurons, Organ of human body, Nerves; Cranial nerves, Spinal nerves and visceral nerves, Functioning of various nerves as Sensory nerves, Motory nerves and Relay nerves, Comparison of natural communication system with the design of engineering system.

3 Hrs

MODULE-4

Controls involved in Human Body: Introduction to Open loop and Closed loop system, Role of Endocrine system in control process of many parameters, study of natural Control in various

biological systems, Extending the concept of Biological Open loop and closed loop systems to the field of automation, Case studies.

4 Hrs

Text Books:

1. B D Chaurasia's, Handbook of General Anatomy, 4th Edition
2. Johnson A T (2018), Biology for Engineers, CRC Press

References:

Google links

Course Title:	**UNIVERSAL HUMAN VALUES**	**L**	**T**	**P**	**C**
Course Code:	**22UHV**	**0**	**1**	**0**	**1**
Hours/Week: 2 hrs.	**CIE: 50 Marks SEE: 50 Marks Exam hours: 3**	**Total hours: 28 hrs.**			

Course Outcomes: With mapping shown against the Program Outcomes (POs)} upon completion of the course, students shall be able to:

Cos	**Statement**	
1	Start exploring themselves, get comfortable with each other and withtheteacher and they start appreciating the need and relevance for the course.. Also they are able to note that the natural acceptance (intention) is always for living in harmony.	PO6, PO7, PO8, PO9, PO12
2	Differentiate between the characteristics and activities of different orders and study the mutual fulfillment among them and need to take appropriate steps to ensure right participation (in terms of nurturing, protection and right utilization) in the nature.	PO6, PO7, PO8, PO9, PO12
3	Present sustainable solutions to the problems in society and nature. They are also able to see that these solutions are practicable and draw roadmaps to achieve them.	PO6, PO7, PO8,PO9,PO12

CO-PO, PSO Mapping

EI 304	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO1 0**	**PO1 1**	**PO1 2**	**PSO 1**	**PSO 2**
CO1.				2	1	3	2			1				
CO2.				2	1	3	2			1				
CO3.				2	1	3	2			1				

MODULE -1

Introduction to Value EducationUnderstandingValueEducation,Self-explorationastheProcessforValueEducation, ContinuousHappinessandProsperity–theBasicHumanAspirations,Right Understanding,RelationshipandPhysicalFacility,HappinessandProsperity– CurrentScenario,MethodtoFulfilltheBasicHumanAspiration.

08hrs

MODULE -2

Harmony in the Human being. UnderstandingHumanbeingastheCo-existenceoftheSelfandtheBody, DistinguishingbetweentheNeedsoftheSelfandtheBody,TheBodyasan InstrumentoftheSelfLecture,UnderstandingHarmonyintheSelfTutorial, HarmonyoftheSelfwiththeBodytoensure self-regulatonandHealth.

08hr

MODULE -3

Harmony in the Family, Nature and Existence. HarmonyintheFamily–theBasicUnitofHumanInteraction,ValuesinHuman-to- HumanRelationship,'Trust'–theFoundationalValueinRelationship,'Respect'–as theRightEvaluation,UnderstandingHarmonyintheSociety,Visionforthe UniversalHumanOrder.Whole existence as Coexistence: Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature recyclability and self-regulation in nature. Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resourcesand roleof technology etc.

08hrs

MODULE -4

Implications of the Holistic, Understanding – a Look at Professional Ethics.NaturalAcceptanceofHumanValues,Definitivenessof(Ethical)HumanConductA BasisforHumanisticEducation,HumanisticConstitutionandUniversalHuman Order,CompetenceinProfessionalEthics,HolisticTechnologies,ProductionSystems andManagementModels,TypicalCaseStudies,StrategiesforTransitiontowards Value-basedLifeandProfession.

06 hrs

Self-Learning Activities-

1. Sharing about Oneself and Exploring Natural Acceptance
2. Exploring Harmony of Self with the Body
3. Exploring the Feeling of Respect
4. Exploring the Four Orders of Nature Lecture and Exploring Co-existence in Existence
5. Exploring Humanistic Models in Education, Exploring Steps of Transition towards Universal Human Order

Text Book and Teachers Manual-

1. The Textbook: A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1

2. The Teacher's Manual Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books-

1. JeevanVidya: EkParichaya, ANagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – PanditSunderlal.
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi.
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

Schemeof evaluation-

Theassessmentaimsatimpartialandreasonableimplicationoftheconcept tothestudent.Keypointsofassessmentare-

1. Student'sparticipationinclassroomdiscussions.
2. Assessmentofindividualandthepeeristobedonebythetutor.
3. CIEisconductedfor50marksinactivityformat.
4. SEEfor50marks:Labassessment.

Mode of EvaluationScheme:

CIEScheme:

Semester&Section:

Event	EvaluationScheme	Marks
Activity1	Module1-**Inscriptionofone'srole model-AimsatMotivation** 1. Writingthemotivationalstoryandexploringtheirstrugglesinachi evingthesame. 2. Understandingofindividual'sselfneeds,gettingclarityofwhatistheg oalofone-actionstobetakenbyselftoachievethesame.	20
Activity2	Module2-**AimsatSelf-realization,Self-knowledge&will power** Groupactivity- Discussthehitchesofindividual'sandlearntoshare.	10
Activity3	Module3-**AimsatRespectfulness&Empathy** Pendowntheactivitieswhichhelpedsatisfactionofoneselfbyservingthefamily ,friendsandsociety.	10

Activity4	Module4-**AimsatProfessionalism &ethics** Groupactivity- Discussionontheh umanbehavioralaspectinworkingenvironment.	10
Total		**50**

SEEScheme:

1. Theevaluationisconductedaspertheallottedbatches
2. Eachgroupsaresupposedtocomeupwithacasestudypertainingtomoduleortheconceptassig nedtothem.
3. Thecasestudyisexplainedtotheallottedexaminer.
4. Allocationofmarksispurelybasedonthe
    a) CaseStudyreport
    b) Vivavoce(Discussion)

Bridge Course for Diploma Students
Bridge Course Mathematics - II
(Common to all branches of Engineering)
(Audit Course)

Course Code 21BCM401L-T-P-C—3-0-0-0
WeeklyHours-3 **Total hours-40**

	Outcomes	**PO1**	**PO2**	**PO3**
CO1	Able to identify suitable methods to solve the differential equations analytically.	1		
CO2	Able to solve first order first degree D E, integration problems and simple PDE problems using numerical methods.			
CO3	Able to solve problems on Gradient, Divergence, Curl of a vector valued function and apply its physical meaning to the engineering applications.	1		

Course contents:

Module - 1

Differential Equations: Solution of first order first degree differential equations- Variable separable methods, Homogeneous Equations, Exact differential equations Illustrative examples from engineering field. (Without I.F direct problems), Linear & Bernoulli's differential equations, Illustrative examples from engineering field.

10 hours

Module - 2

Differential Equations: Solution of second and higher order equations with constant coefficient by inverse differential operator method$f(D)y = e^{ax}$,f(D)y = cos(ax + b)/sin (ax + b),$f(D) = ax^2 + bx + cf(D)y = e^{ax}cos(bx + c)/e^{ax}$sin $(bx + c$,$f(D)y = xcos(ax + b)/x$sin $(ax + b)$(Simple problems). Illustrative examples from engineering field.

Numerical solution of first order first degree ordinary differential equations: Taylor series method, Runge-Kutta method of fourth order, Milne's Predictor corrector methods.

10 hours

Module– 3

Solution of Partial Differential Equations: Solving PDE by variable separable method, to find all possible solutions of one dimensional wave equation, one dimensional Heat flow equation and two dimensional Laplace's equation by the method of separation of variables self-learning, numerical solution of Laplace equation by finite difference approximation method using standard five point formula and diagonal five point formula. Numerical solution of poison equation by finite difference approximation method using standard five point formula and iterative formulas.

10 hours

Module - 4

Numerical Integration: Computation of line integral by trapezoidal rule, Simpsons 1/3rd rule, weddles rule, Simpsons 3/8 th rule, Illustrative examples from engineering field.

Vector Algebra: vector addition, Multiplication (Dot and Cross product), Triple products, vector differentiation, velocity, acceleration of a vector point function, Gradient, divergence, curl

10 hours