Dr. Ambedkar Institute of Technology

ELECTRONIC AND INSTRUMENTATION ENGINEERING

Scheme and Syllabus of 5th and 6th Semester 2021-22 Regulation
Academic Year 2023-24

Dr.AmbedkarInstituteofTechnology,Bengaluru-560056
Outcome Based Education (OBE) and Choice Based Credit System(CBCS) (AsperNEP2020)
B.E Electronics and Instrumentation Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2021-22

V Semester

Sl. No.	Course Category	Course Code	Course Title	Teaching Department (TD)/ Paper setting Board(PSB)	Teaching Hrs/ Week					Examination				Credits
					L	T	P	S	Total	Duration (Hrs)	CIE Marks	SEE Marks	Total Marks	
1	PCC	21EIT501	Communication Technology	EIE	3	0	0	0	03	03	50	50	100	3
2	IPCC	21EIT502	Embedded Systems using ARM Controller	EIE	3	0	2	0	05	03	50	50	100	4
3	PCC	21EIT503	Process Automation and Control	EIE	3	0	0	0	03	03	50	50	100	3
4	PCC	21EIT504	Machine Learning with Python Programming	EIE	3	0	0	0	03	03	50	50	100	3
5	PCCL	21EIL505	Machine Learning with Python Programming Lab	EIE	0	0	2	0	02	03	50	50	100	1
6	AEC	21RMT506	Research Methodology &Intellectual property rights	TD: Any department PSB: As identified by the Institute	2	0	0		02	02	50	50	100	2
7	HSSC	21CVT507	Environmental Studies	TD: Civil/Chemistry PSB: Civil Engg.	1	0	0		01	01	50	50	100	1
8	AEC	21EIT508X	Ability enhancement course – V	Concerned Board	If offered as Theory courses					01	50	50	100	1
					1	0	0							
					If offered as Lab Courses					02				
					0	0	2							
9	HSSC	21HSN509	Aptitude and Verbal ability skills		1	0	1	0		02	50	--	PP/ NP	0
										Total	450	400	800	18

Ability Enhancement Course-V			
Code	Course title	Code	Course title
21EIL5081	**Arduino and Raspberry Pi Lab**	**21EIL5083**	**Signal Analysis using SCI Lab**
21EIT5082	**Industry 4.0 and IIoT**	**21EIL5084**	**Verilog Programming Lab**

Note: BSC: Basic Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, AEC –Ability Enhancement Course INT – Internship, **HSSC:** Humanity and Social Science Courses.
L–Lecture, T –Tutorial,P-Practical/Drawing,S–SelfStudyComponent,CIE:Continuous Internal Evaluation, SEE: Semester End Examination.

Integrated Professional Core Course (IPCC): refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCCcan be 04 and its Teaching – Learning hours (L:T:P) can be considered as (3:0:2) or (2:2:2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE.
For more details the regulation governing the Degree of Bachelor of Engineering/Technology (BE/B.Tech.)2021-22 may be referred.

Dr. Ambedkar Institute of Technology,Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System(CBCS)(AsperNEP2020)
B.E Electronics and Instrumentation Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2021-22

VI Semester

Sl. No.	Course Category	Course Code	Course Title	Teaching Department	Teaching Hrs/ Week					Examination				Credits
					L	T	P	S	Total	Duration (Hrs)	CIE Marks	SEE Marks	Total Marks	
1	HSSC	21EIT601	This course is to be as per the requirement of the concerned program. However, the title of the course should have the word Management and the syllabus has to have management topic/s	EIE						03	50	50	100	3
2	IPCC	21EIT602	IOT and Wireless Sensor Networks	EIE	3	0	2	0	5	03	50	50	100	4
3	PCC	21EIT603	PLC, SCADA and DCS	EIE	3	0	0	0	3	03	50	50	100	3
4	PEC	21EIT604X	Professional Elective course –I	EIE	3	0	0	0	3	03	50	50	100	3
5	OEC	21EIT605X	Open Elective course- I	**Concerned department**						03	50	50	100	3
6	PCCL	21EIL606	Process Control and Automation Lab	EIE	0	0	2	0	2	03	50	50	100	1
7	MP	21EIM607	Mini Project	EIE	**Two contact hours/week for interaction between the faculty and students**					----	100	---	100	2
8	INT	21EII608	Innovation/Entrepreneurship/ Societal internship	**Completed during the intervening period of IV and V semesters.**						----	100	----	100	3
9	HSSC	21HSN609	Analytical and reasoning skills	**Placement cell**	2	0	0	-	02	---	50	--	PP/ NP	0
Total											550	300	800	22

Note: HSSC: Humanity and Social Science Courses, **IPCC:** Integrated Professional Core Course, **PCC:** Professional Core Course,
PEC: Professional Elective Courses, O**EC**–Open Elective Course, **MP**–Mini Project, INT –Internship.
L–Lecture, **T**–Tutorial, **P**-Practical/Drawing, **S**–Self Study Component, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Examination.

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with Practical of the same course. Credit for IPCCcan be 04 and its Teaching – Learning hours (L:T:P) can be considered as(3:0:2) or (2:2:2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by CIE only and there shall be no SEE. **For more details, there gelation governing the Degree of Bachelor of Engineering/Technology(BE/)2021-22maybereferred.**

Professional Elective Courses(PEC):

A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course out of five courses. The minimum students strength for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the programme is less than10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are noten titled for the open electives offered by their parent Department. However, they can opt an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/Advisor/Mentor.

Selection of an open elective shall **not be allowed** if,

(i) The candidate has studied the same course during the previous semesters of the program.
(ii) The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
(iii) A similar course under any category, is prescribed in the higher semester of the program.

In case, any college is desirous of offering a course (not included in the Open Elective List of the University) from streams suchas Law, Business(MBA), Medicine, Arts, Commerce, etc., can seek permission, at least one month before the commencement of the semester, from the University by submitting a copy of the syllabus along with the details of expertise available to teach the same in the college.

The minimum students' strength for offering open electives is10.However, this conditional shall not be applicable to cases where the admission to The programme is less than 10.

Mini-project work: Mini Project is a laboratory-oriented course which will provide a platform to students to enhance the practical knowledge and skills by the development of small systems/applications.

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini-project can be assigned to an individual student or to a group having not morethan4 students.

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wiseatthecollegelevelwiththeparticipationofalltheguidesoftheproject.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill, and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

No SEE component for Mini-Project.

VII semester Classwork and Research Internship / Industry Internship(21XXI802)

Swapping Facility:

(1) Institutions can swap VII and VIII Semester Scheme of Teaching and Examinations to accommodate research internship/industry internship after the VI semester**.**

(2) Credits earned for the courses of VII and VIII Semester Scheme of Teaching and Examinations shall be counted against the corresponding semesters whether VII or VIII semester is completed during the beginning of IV year or later part of IV year of the program.

Elucidation:

At the beginning of IV year of the programme i.e., after VI semester, VII semester classwork and VIII semester Research Internship /Industrial Internship shall be permitted to be operated simultaneously by the University so that students have ample opportunity for internship. In other words, a good percentage of the class shall attend VII semester classwork and a similar percentage of others shall attend to Research Internship or Industrial Internship.

Research/Industrial Internship shall be carried out at an Industry, NGO, MSME, Innovation centre, Incubation centre, Start-up, Centers of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations / institutes. The internship can also be rural internship.

The mandatory Research internship /Industry internship is for **24 weeks**. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during the subsequent Institute/University examination after satisfying the internship requirements.

21XXI802 Research Internship/Industry Internship/Rural Internship:

Research internship: A research internship is intended to offer the flavor of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

The faculty coordinator or mentor has to monitor the students 'internship progress and interact with them to guide for the successful completion of the internship. The students are permitted to carry out the internship anywhere in India or abroad. University shall not be are annex pansies in corroding respect of internship.

Professional Elective Courses-I		**Open Elective Courses-I**	
Subject Code	**Title**	**Subject Code**	**Title**
21EIT6041	Bio Medical Instrumentation	21EIT6051	Sensors & Applications
21EIT6042	Industrial Drives and Control	21EIT6052	Virtual Instrumentation
21EIT6043	Java Programming		
21EIT6044	Digital Image Processing		

Course Title	**Communication Technology**						
Course Code	**21EIT501**						
Category	Integrated Professional Core Course **(PCC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	00	00	00	03	40	03
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objectives

1. To discuss the principles and working of Analog and Digital Communication techniques.
2. To know the various multiple access techniques.
3. To understand the Wireless communication.
4. To discuss fundamentals of optical fibre communication and its importance.

Unit		**No. of Hrs**
1	**Analog Communication:** AM, DSBSC, SSBSC: Time domain description, frequency domain description, generation, and detection. Comparison of AM techniques, AM transmitter, AM receiver model: Signal to noise rations for coherent reception,	**8**
2	**Angle modulation**: Basic concept, frequency modulation, NBFM, WBFM, power & bandwidth of FM wave, generation of FM wave, Phase lock loop of FM. FM receiver model, noise in FM reception, pre-emphasis and de-emphasis in FM systems	**8**
3	**Pulse modulation:** sampling theorem, Sample and hold circuit, natural sampling, flat top sampling, quantization of signals, quantization error, PCM system, DPCM, Delta modulation, adaptive delta modulation. **Digital modulation techniques:** ASK, BPSK, BFSK, QPSK, **Multiple access technique**: FDMA, TDMA, CDMA.	**8**
4	**Introduction to Wireless Communication Systems**: Generations: 2G, 3G, 4G, 5G. Wireless Local Area Networks: IEEE 802.11 WLANs, MAC and PHY layer variants; Wireless Personal Area Networks: Bluetooth (IEEE 802.15.1), ZigBee (IEEE 802.15.4); Bluetooth and Personal Area networks, Broadband Wireless Access- WiMAX Technology. Wireless Spectrum allocation, Standards.	**8**
5	**Overview of optical fiber communication:** The general system, advantages of optical fiber communications. Optical fiber wave guides- Introduction, Ray theory transmission, Optical fiber Modes and configuration, Mode theory for circular Waveguides, Step Index fibers, Graded Index fibers. Single mode	**8**

	fibers- Cut off wavelength, Mode Field Diameter, Effective Refractive Index. Fiber Material and its Fabrication Techniques	

Course outcome:

1. Understand the basic theories, principles of analog and digital modulation techniques.
2. Analyse the performance of a Digital Communication techniques
3. Illustrate wireless access technologies for various applications.
4. Explain the theory of optical communication techniques.

	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	Po10	Po11	Po12	Pso1	Pso2	Pso3
Co1	**3**	**2**	**1**										**1**	**2**	**1**
Co2	**2**	**3**	**2**	**2**									**1**	**2**	**2**
Co3	**2**	**2**	**1**	**1**								**2**	**1**	**3**	**3**
Co4	**2**	**1**	**1**	**2**	**1**							**2**	**1**	**2**	**2**

Text Book:

1. Analog and Digital communication- Simon Haykin, John Willey. 2nd Edition Jan 2012
2. Andrea Goldsmith, Wireless Communications, Cambridge University Press, 2005
3. John M. Senior, "Optical Fiber Communications", PEARSON, 3rd Edition, 2010.

Online sources:

1. NPTEL Couse: https://archive.nptel.ac.in/courses/117/102/117102062/#
2. https://www.youtube.com/watch?v=qhjj6WG7Rgc&list=PLwjK_iyK4LLArUHRm3SvPLT0XWlVhpl4h

Reference Book:

1. "Principles of Electronics Communication Systems- Louis E. Frenzel Jr., fourth edition, McGrawHill Education 2016.
2. David Tse and Pramod Viswanath, Fundamentals of Wireless Communication, Cambridge University Press, 2005.
3. Govind P. Agrawal, "Fiber Optic Communication Systems", John Wiley, 3rd Edition, 2004

Course Title	**Embedded Systems using ARM Controller**						
Course Code	**21EIT502**						
Category	Integrated Professional Core Course **(IPCC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	00	02	00	05	40+12	04
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objective:

The objective of the course is to:

1. Understand ARM design philosophy and ARM processor architecture and fundamentals
2. Learn the ARM Instruction set of ARM microcontroller and to learn the assembly programming
3. understand Thumb instructions of ARM controller
4. Understand Various Interrupts and exception handling in ARM controller
5. Learn interfacing and to write C-program for LED, Keyboard, LCD, DC motor, Stepper motor using LPC2148 microcontroller.

Unit No	**Syllabus**	**No of Teaching hours**
1	**Introduction to Embedded systems:** Definition of Embedded system, Embedded VS General computing system, classification of embedded systems, Major application areas **Typical embedded system:** Core of embedded system, Memory, Sensors and Actuators, Communication Interface, Embedded Firmware.	**08**
2	**ARM embedded systems:** The RISC design philosophy, The ARM design philosophy, embedded system hardware, embedded system software.ARM Architecture. **ARM processor fundamentals:** Registers, current program status register, pipeline, core extensions, Architecture revisions, ARM processor families	**08**
3	**troduction to ARM instruction Set:** Data Processing Instructions, Branch Instructions, Load Store Instructions, Software Interrupt Instruction, Program Status Register Instructions, Loading Constants, ARMv5E Extensions, and Conditional Execution.	**08**
4	**troduction to the THUMB Instruction set:** Thumb register Usage, ARM-Thumb Interworking, other branch instructions, Data Processing Instructions, Single register Load –store Instructions, Multiple register Load Store Instructions, Stack Instructions, and Software Interrupt Instruction.	**08**
5	**Interrupts & Exception Handling:** Exceptions, Exception Handling**,** Interrupts, Interrupt handling schemes, vector table. **LPC 2148:** - Salient features, applications, block diagram, memory mapping GPIO-Features, Design of system using GPIO's Blink a group of 8 LEDs with a delay, Stepper motor control, DC motor control LCD interface, 4 x 4 Keypad, Timers	**08**

Practical Component

Sl No	Experiments
1	Write an assembly program to Exchange block of 10 data
2	Write an assembly program to find the smallest/largest number out of 10 data stored in memory
3	Write an assembly program to sort 10 data stored in Memory
4	Write an assembly program to divide a 32 bit numbers and store quotient and remainder.
5	Write an assembly program to find factorial of given number using recursive procedure.
6	Write an assembly program to convert 3 digit Hexadecimal to BCD
	Interfacing Programmes
1	Interface LED to LPC2148 and write C program to blink 8 LED's which are
2	connected to P0.0 to P0.8
3	Interface switch & LED to LPC2148. Write C program to read the status of switch and display same on LED
4	Interface 2 *16 LCD and write C program to display a string
5	Interface LED & write program to implement binary up-counter(8-bit). The counter should increment for every one second. Use internal timer
6	Write C - Program to interface DC motor
7	Interface 4 x 4 keyboard and write C program to identify the key pressed

Course outcome:

After successful completion of the course the student is able to:

1. Understand the features of embedded systems, architecture of ARM7 and applications.

2. Analyse and understand the instruction set and competency in assembly programming of ARM.

3. Analyse and understand the Thumbstate and switching back to ARM state and knowledge of Thumb instruction set.

4. Understand the exception, interrupts and interrupt handling schemes

5. Understand the architectural features of LPC2148 microcontrollers, its hardware and interfacing peripheral devices to LPC2148

Text Books:

1. Introduction to Embedded Systems : Shibu K. V. (TMH)

2. ARM system Developers Guide, Andrew N.Sloss, Elsevier, 2008

3. LPC 2148 User Manual

Reference Books:

1. ARM Assembly Language – Fundamentals and Techniques, William Hohl, CRC Press,2009
2. ARM Assembly language An Introduction, J.R.Gibson, Cengage Learning, 2010

CO-PO MAPPING															
CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	1	-	-	-	-	-	-	-	-	-	1	-	1
CO2	1	2	2	1	1	-	-	-	-	-	-	-	1	-	1
CO3	2	2	2	2	1	-	-	-	-	-	-	-	2	1	2
CO4	2	2	2	1	2	-	-	-	-	-	-	-	1	2	2
CO5	1	1	1	-	-	-	-	-	-	-	-	-	1	1	1

Course Title	**Process Automation and Control**						
Course Code	**21EIT503**						
Category	Integrated Professional Core Course **(PCC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	00	00	00	03	40	03
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objectives:

1. To introduce the terminology, concepts and practices in process modeling and automatic process control.
2. To impart knowledge in the design of control systems and PID controller tuning for processes.
3. In addition, the subject also introduces about discrete state process control and Batch process.
4. To know the concept about safety Instrumented Systems.

Unit No	Syllabus	No. of Teaching Hours
1	**Introduction To Process Control:** Line diagrams-Definition of P & I diagrams- Use of letter code of identification of Instruments-Introduction to standards that are widely used in instrumentation Viz.- ISI ANSI, BIS, ISA Introduction, Process control systems, Process-Control Block Diagram, control system evaluation, Stability. **Final control:** introduction to final control operation, signal conversions, actuators, control elements,	**07**
2	**Controller principles and modes**: Introduction, Process Characteristics, Process Equation, Process Load, Process Lag, Process Regulation, Control System Parameters. Continuous Controller Modes, Composite Controllers with Applications & Problems. **Discrete-State** Process Control: Introduction, definition and characteristics of discrete state process control.	**09**
3	**Analog controller Design**: Introduction, Electronic controllers, Error Detector, Design of an On/Off Controller, Design of Single-Mode, 2-Position and 3-Position continuous Controller Modes. **Control-loop characteristics**: Introduction, control system configuration. control system quality, stability, and process loop tuning	**09**
4	**Process control Applications:** Building conditioning control: Fan control and temperature control, batch control description and terminology: Batch Automation, Product Management, safety interlocking, Boiler control: role of sensors, safety interlocking, wastewater treatment control: two reagent control system, steam turbine controls :controls and optimization.	**08**
5	**Introduction to Safety Instrumented systems** - Safety Lifecycle , Introduction to Functional Safety, Difference between BPCS and SIS, Functions of different personnel's, Major fire hazards–Acronyms-Overview of Standards and Regulations	**07**

Course outcomes:

On successful completion of the course the student is able to

1. Able to understand technical terms and nomenclature associated with Process control domain.
2. Design the suitable controllers for process control systems
3. Analyze the controller tuning techniques for process control system
4. Choose the proper control system for the automatic control system
5. Apply proper safety norms in process industry

Text Books:

1. **Process Control Instrumentation Technology**-C D Johnson, PHI Publication. 8th Edition, 2009

2. **Safety Instrumented Systems Verification**- Practical Probalistic Calculation, William M Goble

3. **Instrument Engineers Handbook-(Vol 1 & 2)**-B G Liptak,Chilton Book Company, 4th edition 1995

Reference Books:

1. **Chemical Process Control an Introduction to theory and practice,** George Stephanopoulos, PHI, sixth reprint.1998,

2. **Computer Aided Process Control**- S K Singh, Prentice Hall of India, 2008

CO-PO MAPPING															
CO/ PO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	2	1											1	1	
CO2	3	3	2	2	2							1	3	3	
CO3	3	3	2	2	2							1	2	3	
CO4	3	2	1	2	2						1	1	3	3	
CO5	2	1										1		1	

Course Title	**Machine Learning with Python Programming**						
Course Code	**21EIT504**						
Category	Professional Core Course **(PCC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	00	00	00	03	40	03
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objective:

1. Describe the core syntax and semantics of python programming language.
2. Illustate the process of structuring the data using lists, dictionaries, tuples, and sets.
3. To impart the fundamental concepts of machine learning using python programming.
4. Demonstrate on the various machine learning models with their performance parameters.
5. Apply combination of different classical machine learning algorithms (Linear Regression, linear classification, regression, SVM, decision tree) for predictive modeling.

Unit No	Syllabus	**No. of Teaching hours**
1	**Python Programming Language:** Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output. **Control Flow Statements:** The if Decision Control Flow Statement, The if…else Decision Control Flow Statement, The if…elif…else Decision Control Statement, Nested if Statement, The while Loop, The for Loop, The continue and break Statements, **Functions:** Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables.	**08**
2	**Strings,** Creating and Storing Strings, Basic String Operations **Lists,** Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists. **Dictionaries**, Creating Dictionary, Accessing and Modifying key:value Pairs in Dictionaries, Built-In Functions Used on Dictionaries **Tuples and Sets,** Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries	**08**
3	**Introduction to Machine Learning: T**he Traditional and Machine Learning approach of programming, Examples of ML Applications, Types of Machine Learning Systems, Main Challenges of Machine Learning, Testing and Validating, Classification, Training a Binary Classified, Performance Measures, Multiclass Classification, Error	**08**

	Analysis, Multilabel Classification, Multioutput Classification.	
4	**Training** Models, Simple Linear Regression, Multiple Linear Regression, Least square gradient descent,Polynomial Regression Linear Classification, Logistic Regression, LearningCurves, Regularized Linear Models. **Support Vector Machines:** Linear SVM(Maximum margin linear separators.)Classification,Kernels for learning non-linear functions. Classification, SVM Regression, Under the Hood.	**08**
5	**Decision Trees,** Training and Visualizing a Decision Tree, Making Predictions, Estimating Class Probabilities, The CART Training Algorithm, Computational Complexity, Gini Impurity,Entropy,Regu1arization Hyperparameters, Regression, Instability. **Ensemble Learning and Random Forests:** Voting Classifiers, Bagging and Pasting, Random Patches and Random Subspaces, Random Forests, Boosting, Stacking, **Unsupervised Learning Techniques:** C1ustering, Gaussian Mixtures.	**08**

Course outcomes

1. Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.
2. Determine the methods to create and manipulate Python programs by utilizing the data structures like lists, dictionaries, tuples and sets.
3. Understand the machine learning concepts and can relate the supervised, unsupervised learning into the real-life problem.
4. Identify and solve the classification and regression problem.
5. Apply the different classical machine learning models and measure the performance parameter metrics.

Text Book

1. Gowrishankar S, Veena A, "**Introduction to Python Programming**", 1st Edition, CRC Press/Taylor & Francis, 2018. ISBN-13: 978-0815394372

2. AurélienGéron, "**Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems**", 2nd Edition, O'Reilly Publications/Shroff Publishers and Distributors Pvt. Ltd., 2019. ISBN-13: 978- 1492032649.

3. Machine Learning -Tom M. Mitchell, Mc Graw Hill, 2017.

Reference Book

1. Jake VanderPlas, "**Python Data Science Handbook: Essential Tools for Working with Data**", 1st Edition, O'Reilly Media, 2016. ISBN-13: 978-1491912058

2. Andreas C. Müller and Sarah Guido,"**Introduction to Machine Learning with Python: A Guide for Data Scientists**", 1'[t] Edition, O'Reilly Publications/Shroff Publishers and Distributors Pvt. Ltd., 2019.ISBN-13: 978-9352134571

Co-Po Mapping															
CO/ PO	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	Pso 1	Pso 2	Pso 3
CO1	2	3	2	2	3										
CO2	3	3	2	2	3										2
CO3	3	3	3	3	3										2
CO4	2	2	2	2	3										2

Course Title	**Machine Learning with Python Programming Lab**						
Course Code	**21EIL505**						
Category	Integrated Professional Core Course Lab **(PCCL)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	00	00	02	00	02	13	01
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Note : To set up a Python programming environment. We recommend using the Anaconda Python Distribution with Jupiter notebook as the integrated development environment (IDE).

Course objective:

1. To write, test, and debug simple Python programs.
2. To implement Python programs with conditionals and loops, Use functions for structuring Python programs.
3. Represent compound data using Python lists, tuples, and dictionaries.
4. To implement simple machine learning classical algorithms for classification and regression model

Sl. No	**Programs**
1	Write a Python program to find GCD of two numbers.
2	Write a Python Program to find the square root of a number by Newton's Method
3	Write a Python program to find the exponentiation of a number.
3	Write a Python Program to find the maximum from a list of numbers.
4	Write a Python Program to perform Linear Search and Binary search
5	Write a Python Program to perform selection sort and insertion sort.
6	Write a Python program to multiply matrices
7	Write a Python Program to perform Merge sort.
8	Write a Python program to find first n prime numbers.
9	By using the concept of inheritance write a python program to find the area of triangle, circle and rectangle.
10	Demonstrate python program to read the data from the spreadsheet and write the data in to the spreadsheet.
11	Write a python program for the Implementation of Simple Linear Regression in Machine Learning.
12	Write a python program for the Implementation of Logistic Regression (LR) in Machine Learning.
13	Write a python program to the Implementation Kernel Support Vector Machine (SVM).
14	Solve Case Study problems by implementing Machine Learning models.

Course Outcomes:

Upon completion of the course, students will be able to

1. Write, test, and debug simple Python programs. Implement Python programs with conditionals and loops,
2. Develop Python programs step-wise by defining functions and calling them.
3. Use Python lists, tuples, dictionaries for representing compound data.
4. Implement classical machine learning models for the classification and regression problems.

(CO-PO Mapping):

	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**	**Pso 3**
Co1	3	3	2	2	3							2			3
Co2	3	2	2	2	3							2			3
Co3	3	3	3	2	3							2			3
Co4	3	2	2	2	3							2			3

Course Title	**Arduino and Raspberry Pi Lab**						
Course Code	**21EIL5081**						
Category	Ability Enhancement Course **(AEC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	00	00	02	00	02	13	01
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objective:

To study the use of Arduino and Raspberry Pi's and investigate the practicality of integrating them into the laboratory classes

Expt. No.	Syllabus
1	Implement digital output from the Arduino board
2	Implement digital input using the Arduino board.
3	Implement an Arduino based simple digital I/O system
4	Implement serial I/O between the Arduino board and the PC using the serial monitor graphical user interface (GUI)
5	Controlling relay state based on input from IR sensors
6	Using the Arduino board/ Rapberry pi board read data from a sensor. Experiment with both analog and digital sensors
7	Implement Blinking LED using Arduino board
8	Controlling relay state based on ambient light levels using LDR sensor
9	Basic Burglar alarm security system with the help of PIR sensor and buzzer.
10	Interfacing stepper motor with R-Pi
11	Interface a 2x16 LCD in 4-bit mode to the Arduino board
12	Upload humidity & temperature data to Thing Speak
13	Controlling LEDs, relay & buzzer using Blynk app

Course Outcome:

1. Understand the uses of App like Think speak and Blynk
2. Design a system using Arduino board and Raspberry Pi
3. Implement various functions using Arduino board and Raspberry Pi

Text Book:

1. Programming Arduino: Getting Started with Sketches. 2nd edition. Simon Monk. McGraw Hill. ISBN-13: 978-1259641633

CO-PO MAPPING															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	-	-	1	-	1
CO2	3	3	3	1	1	-	-	-	-	-	-	-	1	2	1
CO3	2	2	3	2	2	-	-	-	-	-	-	-	1	1	2
CO4	2	2	2	1	-	-	-	-	-	-	-	-	1	-	1
CO5	2	2	2	1	-	-	-	-	-	-	-	-	1	1	1

Course Title	**Industry 4.0 and IIoT**						
Course Code	**21EIT5082**						
Category	Ability Enhancement Course **(AEC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	02	00	00	00	02	15	01
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objective:

To provide students with

1. knowledge of Industrial IOT Systems for various application.
2. Impart basics of Industry 4.0Systems for various application.

Unit No	Syllabus	No. of Teaching hours
1	**Overview of Industry 4.0 and Industrial Internet of Things:** Introduction, Industry 4.0, Industrial revolution phases of Development, Evolution of Industry 4.0	3
2	Environmental impacts of industrial revolution, Applications of Industry 4.0,	3
3	Industrial Internet (IIoT), IIoT benefits, Prerequisites of IIoT, Basic of CPS, CPS and IIoT	3
4	Applications of IIoT, Impacts of Industry 4.0: Economy, Business, Global perspective, Impact of Industrial Internet.	3
5	**Industrial Process:** features of IIoT for Industrial Processes, Industrial plant-the future architecture. Smart factories: Characteristics, Technologies	3

Course outcome:

After successful completion of the course the student is able to:

1. Understand basic concepts of Industry 4.0, cyber physical system and the emerging applications
2. Gain knowledge of Industrial applications with IIoT capability and its applications
3. Understand environmental impacts of IIoT and Industry 4.0
4. Understand the concept of smart manufacturing with smart factories

Text Books:

1. "Introduction to Industrial Internet of Things and Industry 4.0" Sudip Misra, Chandana Roy, Anandarup Mukherjee, first edition published 2021by CRC Press ISBN: 978-0-367-89758-1

CO-PO MAPPING															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	-	-	-	-	1	1	-	-
CO2	2	2	1	1	-	-	-	-	-	-	-	1	2	1	1
CO3	2	1	1	1	-	-	-	-	1	-	-	2	1	1	-
CO4	2	1	2	2	1	-	-	-	1	-	-	1	1	2	2

Course Title	**Signal Analysis using SCI Lab**						
Course Code	**21EIL5083**						
Category	Ability Enhancement Course **(AEC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	00	00	02	00	02	13	01
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objectives:

The objectives of the course are to equip the students with the knowledge on:

1. Understand the concepts and advantages of digital signal processing techniques
2. To understand the frequency domain analysis techniques of discrete time signals using DFT
3. To determine DFT using FFT
4. To learn the design of Digital IIR and FIR filters using different techniques
5. Apply digital signal processing techniques for various applications

Expt.No.	Syllabus
1	DFT / IDFT of given Discrete Time Signal
2	Frequency Response of a System
3	Implementation of FFT of a given Sequence
4	Determination of Power Spectrum of a given Signal
5	Implementation of Lowpass FIR Filter for given specifications
6	Implementation of IIR Filter for given specifications
7	Generation of DTMF Signals
8	Implementation of Decimation Process
9	Implementation of Interpolation Process
10	Implementation of Sampling rate conversion by a factor I/D
11	Impulse response of First order and Second order systems
12	Finding the Fourier Series Coefficients of a Periodic Discrete Time Signal
13	Generation of Sinusoidal signal based on recursive difference equation

Course Outcome:

Students who complete this course will be able to:

CO1: Understand the concepts of digital signal processing

CO2: Understand and apply Fast Fourier Transform techniques.

CO3: Identify and apply different digital filtering techniques in signal processing for DSP applications.

Text Books:

1. Digital Signal Processing Principles, Algorithms and Applications, John G Proakis and Manolakis, Pearson, Fourth Edition, 2014

2. Digital Signal Processing- S K MITRA, Mc Graw-Hill. Publication 4th Edition, 2010

Reference Books:

1. Digital Signal Processing with Matlab Examples volume1, Jose Maria Giron-Sierra, © Springer Science+Business Media Singapore 2017.

2.Digital Signal Processing Fundamentals and Applications, Li Tan Purdue, Jean Jiang

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1	1	-	-	-	1	-	1	1
CO2	1	2	2	1	1	-	-	-	1	-	1	1
CO3	1	2	2	1	1	-	-	-	1	-	1	1

Course Title	**Verilog Programming Lab**						
Course Code	**21EIL5084**						
Category	Ability Enhancement Course **(AEC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	00	00	02	00	02	13	01
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Note: Programming can be done using Xilinx ISA Compiler. Download the programs on a FPGA board.

Course Learning Objectives: This course will enable students to:

- Familiarize with the CAD tool to write HDL programs.
- Understand simulation and synthesis of digital design.
- Program FPGAs/CPLDs to synthesize the digital designs.
- Interface hardware to programmable ICs through I/O ports.
- Choose either Verilog or VHDL for a given Abstraction level.

Note: Programming can be done using Xilinx ISA Compiler. Download the programs on a FPGA board.

Sl. No	Programs
1	To convert a Boolean expression into logic gate circuit and simulate it in different dataflow/structural description
2	Verilog Code for Shift register
3	Verilog Code for ALU
4	Verilog Code for Instruction Memory
5	Verilog code for 16-bit single-cycle MIPS processor
6	License Plate Recognition in Verilog HDL
7	How to load a text file into FPGA using Verilog HDL
8	Verilog code for Traffic Light Controller
9	Verilog code for PWM Generator
10	Verilog code for counter
11	Design a finite state machine in Verilog to detect the given sequence of bits.
12	Write Verilog code using FSM to simulate elevator operation

Course Outcome:

1. Understand the basics of Hardware Description Languages, Program structure and basic language elements of Verilog
2. Understand types of modelling, modules, functions of Verilog and simulate and synthesize related Programs.
3. Design, Simulate and Synthesize various Verilog descriptions for Combinational circuits.
4. Design, Simulate and Synthesize various Verilog descriptions for Sequential circuits.

Text Books:

1. "HDL Programming VHDL and Verilog"- Nazeih M.Botros, 2009 reprint, Dreamtech press(units 1,2,3,4,5-verilog description)

REFERENCE BOOKS:

1. Fundamentals of logic Design", Charles H Roth, Jr Cengage learning

2. "VHDL: Programming Examples"-Douglas perry-Tata McGraw-Hill 4th edition 2004

3. "Fundamentals of HDL" by Cyril P R Pearson/Sanguin 2010

	Po 1	**Po 2**	**Po 3**	**Po 4**	**Po 5**	**Po 6**	**Po 7**	**Po 8**	**Po 9**	**Po 10**	**Po 11**	**Po 12**	**Pso 1**	**Pso 2**	**Pso 3**
Co1	2	1	1	2	3							2		2	3
Co2	2	2	2	2	3							2		2	3
Co3	2	2	2	2	3							2		2	3
Co4	2	2	2	2	3							2		2	3

Course Title	**IoT and Wireless Sensor Networks**						
Course Code	**21EIT602**						
Category	Integrated Professional Core Course **(IPCC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	00	02	00	05	40+12	04
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objective:

The objective of the course is to:

1. Understanding the need for migrating towards software defined networks andintegrating time series data from wireless sensor networks.
2. Know about communication protocols, Hardware platforms and operating systemscommonly used in IoT systems.
3. Describe different modules in a wireless sensor node and design of wireless sensornetworks for different applications

Unit No	Syllabus	No of Teaching hours
1	**Overview of Internet of Things:** Introduction to Internet of Things Introduction-Definition & Characteristics of IoT , IoTConceptual Framework, IoT Architectural View, Technology Behind IoT, Sources of IoT,M2M communication, Difference between IoT and M2M, Modified OSI Model for the IoT/M2M Systems, data enrichment, data consolidation anddevice management at IoT/M2M Gateway.	8
2	**Architecture and Design Principles for IoT:** Internet connectivity, Internet-based communication, IP Addressing in the IoT,Application layer protocols: HTTP, HTTPS, FTP, TELNET and ports. **Data Collection, Storage and Computing using a Cloud Platform:** Introduction, Cloud computing paradigm for data collection, storage and computing, Cloud service models, IoT Cloud- based data collection, storage and computing	8
3	**Prototyping and Embedded device for IoT and M2M:** Embedded computing basics, Embedded platforms for prototyping, Things always connected to Internet/cloud. **IoT applications:** for Smart homes, cities, environment-monitoring and agriculture.	8
4	**Overview and Architectures of Wireless Sensor Networks:** Introductio to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Mobile Adhoc networks	8

	(MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks Sensor Node Hardware and Network Architecture: Single-node architecture, Hardware components, Operating systems and execution environments, Network architecture, Optimization goals and figures of merit, Design principles for WSNs, Service interfaces of WSNs, Gateway concepts	
	Communication Protocols: MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC , The Mediation Device Protocol, Wakeup Radio Concepts, Contention based protocols - CSMA, Schedule based protocols -LEACH. **Applications of WSN:** WSN Applications - Home Control - Building Automation - Industrial Automation - Medical Application.	8

Practical Component

Sl. No	Experiment
1	Introduction to Arduino platform and programming using Arduino UNO and Node MCU. i) Blinking built-in / external LED. ii) Control the ON/OFF of LED using switch
2	Interfacing the touch sensor indicated by LED connected to GPIO pin of Arduino/Node MCU.
3	Precise control of angular position of a servo motor interfaced to Arduino/Node MCU.
4	Interfacing DHT11 temperature sensors to Arduino/Node MCU to measure temperature and humidity on the serial monitor.
5	Arduino Program to Control the intensity of LED using analog Pin A0 (using potentiometer) or by software
6	Introduction to Raspberry PI platform and python programming: i) Blinking of LED to GPIO pin ii) Monitoring temperature and humidity with sensors interfaced to GPIO pins
7	Interfacing ultrasonic sensors to RaspberryPI to measure distance using Ubidots.
8	Python program to print random values in Ubidots using ESP32 by connecting to wi-fi network
9	Python Program to vary the intensity of the LED By varying the PWM Value in Ubidot Slider Widget
10	Python Program to for Controlling Single Led/Buzzer Using Switch Widget in Ubidots

11	Establish Communication between Arduino and Raspberry PI
12	IoT Based Temperature and Humidity Monitoring over Thingspeak using ESP32.

Course outcome:

After successful completion of the course the student is able to:

1. Understand basic concepts, principles and challenges in IoT and various network scenarios of wireless sensor networks.
2. Analyze network communication aspects and protocols used in IoT and wireless sensor networks
3. Illustrate functioning of hardware devices and sensors used for IoT.
4. Apply IoT for developing simple applications using Ardunio and Python programming
5. Study of IoT infrastructure for popular IoT and Wireless sensor network applications.

Text Books:

1. Raj Kamal, "Internet of Things-Architecture and design principles", McGraw Hill Education.
2. Holger Kerl, Andreas Willig, "Protocols and Architectures for Wireless Sensor Network", JohnWiley and Sons, 2005 (ISBN: 978-0-470-09511-9)

Reference Books:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, AcademicPress, 2014.
2. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on Approach)", 1st Edition, VPT, 2014
3. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, A press Publications, 2013
4. Waltenegus Dargie , Christian Poellabauer, "Fundamentals Of WirelessSensor Networks Theory And Practice", By John Wiley & Sons Publications ,2011
5. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks", Elsevierpublications, 2004

CO-PO MAPPING															
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	1	-	-	-	-	-	-	1	1	-	-
CO2	3	2	2	1	1	-	-	-	-	-	-	1	1	2	1
CO3	2	2	3	2	2	-	-	-	1	-	-	2	1	2	2
CO4	2	2	2	2	2	-	-	-	1	-	-	1	1	2	2
CO5	2	2	2	1	-	-	-	-	2	-	-	1	1	2	2

Low-1 Medium-2 High-3

Course Title	**PLC, SCADA and DCS**						
Course Code	**21EIT603**						
Category	**Integrated Professional Core Course (PCC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	00	00	00	03	40	03
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objective:

The objective of this course is to make the graduates to

1. Understand the fundamentals and importance of industrial automation systems
2. Understand the mechanism, architecture, working principles and applications of SCADA
3. Learn to develop a PLC program for an automatic control system and its applications
4. Impart the knowledge on mechanism, architecture, working principles and applications of on DCS

Unit No	**Syllabus**	**No of Teaching hours**
1	**Industrial Process Automation**: Definition of process, Meaning of Automation and Control Necessity and Evolution of Automation, Role of Automation in Process Industry, Architecture of Industrial Automation Network, Types of Automation Systems, Challenges of Process Automation, Industry 1.0 to Industry 4.0 **PLC Programming Languages:** Standards of PLC programming IEC 61131-3 Ladder and functional block programming: Ladder diagrams, Logic functions, Latching, Multiple outputs, Function blocks, Program examples	8
2	**PLC Programming:** Sequential function charts, Structured text, Internal relays, Ladder programs, One-shot operation, Set and reset, Jump and call**,** Jump, Subroutines, Shift Register, Data handling,	**8**
3	PLC Programming using Timer and Counter. Wiring Diagram. **Applications:** Temperature Control, Valve Sequencing, Conveyor Belt Control, Control of a Process.	**8**
4	**Distributed Control System (DCS):** Distributed Control System, History and Overview of DCS, Centralized versus Distributed Control, Configuration and Specification of DCS, DCS-Based Process Loop Designing, Hardware Units of DCS, Communications in DCS Architecture, Software Packages of DCS, Integration of DCS with PLC and SCADA Challenges with DCS, Future Trends in Process Automation.	**8**
5	**Supervisory Control and Data Acquisition (SCADA):** Introduction, SCADA Basics, Different SCADA System Topologies, Evolution of SCADA , SCADA Architecture, First Generation: Monolithic ,Second Generation: Distributed Third Generation: Networked, Fourth Generation: Internet of Things, Differences Between Different Generations, Functions of SCADA, Data Acquisition, Data Communication, Message-Based Polling Mode, Standard Polling Mode, Polled Report-by-Exception, Data Presentation, Control, Elements of	**8**

	SCADA, MTU (Master Terminal Unit), RTU (Remote Terminal Unit), Topology, Human-Machine Interface (HMI), Human-Computer Interface, (HCI) or Man-Machine , Application Areas of SCADA, SCADA and IIoT.	

Course Outcome

1. Identify different components of industrial Automation, PLC, SCADA, RTU, DCS
2. Understand the operation and working of PLC, SCADA, DCS
3. Develop the PLC program for an automatic control system using Ladder diagram
4. Apply the knowledge of Timer, counter, shift register data handling to implement digital circuits.

Text Book:

1. Programmable Logic Controller W Bolton 5th Edition ISBN: 978-1-85617-751-1, Elsevier Publication 2009
2. Chanchal Dey, Sunit Kumar Sen "Industrial Automation Technologies" CRC Press, Taylor & Framcis Group, First Edition 2020.

Reference Books

1. Programmable Logic Controllers, Garry Dunning, Third Edition, Delmer Learning, 2011
2. Programmable Logic Controller Frank D. Petruzella Third Edition TaTa McGraw-Hill Edition, 2010
3. Programmable Logic Controllers: Programming Methods and Applications, John R. Hackworth and Frederick D. Hackworth, Jr.
4. Practical SCADA for industry David Bailey Edwin Wright ISBN:0750658053, Elsevier Publication 2003

NPTEL course: https://youtu.be/oxMdDsud5vg
https://youtu.be/3N0kWzC6jmE

CO-PO Mapping															
CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	-	-	-	-	-	-	-	-	-	-	-	3	-
CO3	3	1	-	1	2	-	-	-	-	-	-	-	-	3	-
CO4	3	1	-	1	2	-	-	-	-	-	-	-	-	3	-
CO5	3	-	-		-	-	-	-	-	-	-	-	-	3	-

Course Title	**Bio Medical Instrumentation**						
Course Code	**21EIT6041**						
Category	Professional Elective Course **(PEC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	00	00	00	03	40	03
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objective:

1. To design and analyze a data acquisition system for bio-electrical signals.
2. To design methods for noise and interference cancellation in electro-physiological signals acquisition systems.
3. To design biomedical instrumentation amplifier suitable for ECG, EEG, EMG, EOG.
4. To study the instrumentation concerned with measuring the blood flow, blood pressure, heart rate, oxygen saturation etc.

UNIT NO	Syllabus	No. of Teaching Hours
1	**FUNDAMENTALS:** Sources of biomedical signals, Basic instrumentation system, General constraints in design of biomedical instrumentation systems **BIOELECTRIC SIGNALS AND ELECTRODES:** Origin of bioelectric signals, Types of bioelectric signals, Recording electrodes, Electrode-Tissue interface, Polarization, Skin contact impedance, Silver-silver chloride electrodes, Electrodes for ECG, EEG, EMG, Microelectrodes.	8
2	**ELECTROCARDIOGRAPH:** Electrical activity of the heart, Genesis & characteristics of Electrocardiogram (ECG), Block diagram description of an Electrocardiograph, ECG lead system, Multi-channel ECG machine. **ELECTROENCEPHALOGRAPH:** Block diagram description of an Electroencephalograph, 10-20 electrode systems, the behavior of the EEG signal , the basic principles of EEG diagnosis.	**8**
3	**BLOOD PRESSURE MEASUREMENT :** Direct & Indirect method, Automatic blood pressure measuring apparatus using Korotkoff's method, Rheographic method, Oscillometric method, Ultrasonic Doppler shift method, Measurement of Respiration rate – Thermistor method, Impedance pneumography, CO2 method, Apnea detectors.	**8**
4	**Blood Flow Meters**: Electromagnetic blood flow meter, Types of electromagnetic blood flow meters, Ultrasonic blood flow meters, NMR blood flow meters, and Laser Doppler blood flow meters. **Cardiac Pacemakers and Defibrillators**: Need for Cardiac pacemaker, External Pacemaker, Implantable Pacemaker, Types of Implantable Pacemaker, Ventricular Synchronous Demand Pacemaker and Programmable Pacemaker. Need for a defibrillator, DC defibrillator. Defibrillator electrodes, DC defibrillator with synchronizer.	**8**

5	**Pulmonary Function Analyzer**: Pulmonary function measurement, Spirometry, Pneumotachometer, Measurement of volume by Nitrogen washout technique. **Hemodialysis machines:** Function of kidneys, Artificial kidney, Dialyzers, Hemodialysis machine, Portable kidney machines.	**8**

Course Outcome:

1. Remember and understand the basic concepts of a biomedical instrumentation system
2. Explain the basic need of biomedical instrumentation, Purpose of biomedical instrumentation and working of different Biomedical Instruments
3. Explain the physiology of biomedical system and different methods and principles in the design of biomedical instruments

TEXT BOOK:

1. **Handbook of Biomedical Instrumentation**-R. S. Khandpur, , Tata McGraw-Hill. 2nd Edition, 2003

REFERENCE BOOKS:

1. **Principles of applied biomedical instrumentation-** Lesely Cromwell & others., John Wiley and sons. 2nd Edition, 1989

2. **Encyclopedia of medical devices and instrumentation**-J. G. Webster, John Wiley, 1999

CO-PO MAPPING															
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**2**			
CO2	**1**	**2**	**2**	**1**	**3**	**-**	**-**	**-**	**1**	**1**	**-**	**2**			
CO3	**2**	**2**	**2**	**1**	**3**	**-**	**-**	**-**	**1**	**1**	**-**	**2**			

Low-1 Medium-2 High-3

Course Title	**Industrial Drives and Control**						
Course Code	**21EIT6042**						
Category	Professional Elective Course **(PEC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	00	00	00	03	40	03
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course objectives:

The objective of this subject is to:

1. To introduce the concept of selection, Justification and Utilization of Electric drives
2. Characterize the operation of motor, drive, sensor and mechanical power within the drive.
3. Understand the operation of DC and AC Motor drive.
4. Understand the method of starting and braking of electric motor.
5. To have a knowledge of various motor drive applications.

Unit No	**Syllabus**	**No of Teaching hours**
1	Concept of electric drive, Advantages of Electrical Drives, Power modulators, Dynamics of motor load system: Fundamental torque equations, Components of Load Torque, Classification of load torque, electrical braking, converter motor system, speed control and multiquadrant operation,	08
2	DC DRIVE: Starting and braking operations of DC motor drive-Speed control of DC motors - Ward Leonard scheme - Drawbacks - Ward Leonard Ilgener scheme - Thyristor converter fed DC Drives: single, two quadrant operation, Chopper fed DC Drives: control strategies - single, two quadrant operation.	**08**
3	UNIT III THREE PHASE INDUCTION MOTOR DRIVES: Speed control of three phase induction motors: Stator control - Stator voltage, frequency and voltage/frequency control - VSI,CSI. Rotor control : Rotor resistance control- Static control of rotor resistance using DC Chopper, slip power recovery schemes -Kramer and Scherbius drives.	**08**
4	UNIT IV THREE PHASE SYNCHRONOUS MOTOR DRIVES Speed control of three phase synchronous motors - types of control , Voltage source and current source converter fed synchronous, Effects of harmonics on the performance of AC motors, Closed loop control of drive motors, Marginal angle control and power factor control.	**08**
5	DRIVE APPLICATIONS : Selection of drives and control schemes for steel rolling mills, Paper mills, textile mills and cranes - Traction-conventional DC and AC Traction drives- DC Traction using Chopper Controlled Drives- Poly phase AC motors for Traction Motors	**08**

Course Outcome:

At the end of the course, the student is able to

1. Understand different types of drives and its application.
2. Analyze the construction, characteristics and application of D.C. motor

3. Design the converter for AC and DC drives.

4. Understand speed control of three phase synchronous motor drive.

5. Design torque, speed and position controller of motor drives Control schemes for steel rolling mills. Paper mills, lifts and cranes

Text Books:

1. Gopal K. Dubey, "Fundamentals of Electrical Drives", Alpha Science International Ltd, 2001.
2. Vedam Subramanyam, "Thyristor control of Electric Drives", Tata Mc Graw Hill, New Delhi 1991.
3. Rashid M.H., "Power Electronics circuits Devices and Applications", Prentice Hall, 3rd Edition, New Delhi, 2009

Reference Books:

1. Gopal K. Dubey, " Power Semiconductor Controlled Drives", Prentice Hall, 1989
2. PS.K.Pillai, " A First Course on Electrical Drives", New age international Publishers Pvt Ltd,1989,Reprint 2004.
3. **Thyristorized Power Controllers**- G. K. Dubey, S. R. Doradla, A. Joshi & R.M.K. Sinha, New Age International (P) Ltd. Publishers, 9th Reprint, 2009.
4. P.C.Sen, "Thyristor DC Drives", John Wiley & Sons New York 1981.
5. B.K.Bose, "Power Electronic & AC drives", Prentice Hall, 2006.

CO-PO MAPPING												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**2**	**1**	**1**	-	-	-	-	-	-	-	-	-
CO2	**3**	**3**	**2**	**1**	**1**	-	-	-	-	-	-	**1**
CO3	3	**2**	**2**	**1**	**1**	-	-	-	-	-	-	**2**
CO4	**3**	**3**	**2**	**2**	**2**	-	-	-	-	-	-	**2**
CO5	3	3	2	2	2	-	-	-	-	-	1	2

Course Title	**Java Programming**						
Course Code	**21EIT6043**						
Category	Professional Elective Course **(PEC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	00	00	00	03	40	03
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objectives:

In this course students will be able to:

1. To impart the core language features of Java and its Application Programming Interfaces (API).
2. To demonstrate the use of threads, exceptions, files and collection frameworks in Java.
3. To familiarize students with GUI based application development and database connectivity.

Unit No	Syllabus	No of Teaching hours
1	**Java Basics & Elementary programming** Java Basics: Java Design goal - Features of Java, basic programming constructs: control statements-if and for loop, data types, Literals and variables, Arrays -one dimensional and multi-dimensional, control statements-if, switch, iteration statements, jump statements.	**08**
2	**Object Oriented Programming** Class Fundamentals - Object reference, array of objects, constructors, overloading methods, nested and inner class, Inheritance - basics, use of super, packages and interfaces.	**08**
3	**Robustness and Concurrency** Exception Handling – fundamentals, Types of Exception, Use of try, catch, finally, throw, throws in Exception Handling Multithreading programming – Java thread model, thread priorities, synchronization, inter thread communication- deadlock.	**08**
4	**Files, Streams and Collection framework** Data structures: Java I/O streams, Working with files –reading and writing files, automatically closing a file. Lambda expressions-fundamentals, functional interfaces, examples. Collection framework – List Interface, Map Interfaces.	**08**

5	**GUI Programming and Database Connectivity** GUI programming using Swing, swing packages, applications, event handling, exploring swing-jLabel and ImageIcon, Jtextfield., swing buttons, Jlist, JcomboBox, Trees, JTable Relational database systems, accessing databases using JDBC connectivity.	**08**

Course Outcome:

1. Design applications involving Java programming fundamentals and Object Oriented Programming concepts
2. Design and build multi-threaded Java Applications.
3. Build software using concepts such as files, collection frameworks
4. Design and implement Java Applications for real world problems involving Database Connectivity

Text books:

1. Herbert Schildt, The Complete Reference-Java, OraclePress, Eleventh Edition, 2019.

2. Paul J. Deitel, Harvey Deitel ,Java SE8 for Programmers (Deitel Developer Series) 7th Edition, 2018.

3. Y. Daniel Liang, Introduction to Java programming-comprehensive version-Seventh Edition, Pearson ltd 2018.

Reference Books:

1. Paul Deitel Harvey Deitel ,Java, How to Program, Prentice Hall; 11th edition , 2017.

2. Cay Horstmann BIG JAVA, 4th edition, John Wiley Sons,2009.

CO-PO MAPPING														
CO/PO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	3										
CO2	3	3	2	2	3										
CO3	3	3	2	2	3										
CO4	3	3	2	2	3										

Course Title	**Digital Image Processing**						
Course Code	**21EIT6044**						
Category	Professional Elective Course **(PEC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	03	00	00	00	03	40	03
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objectives:

The objectives of the course are to equip the students with the knowledge on:

1. The basic concepts of digital image processing
2. The concepts of different image filtering in spatial and in frequency domain techniques
3. The concepts of different image restoration techniques and color models.
4. The different segmentation techniques and color models and compression methods

Unit No	Syllabus	No of Teaching hours
1	**Fundamentals of Image processing:** Introduction, Fundamental steps in digital image processing, components of Digital Image Processing, Elements of Visual Perception, Structure of the Human Eye, Image Formation in the Eye, A simple image formation model, Image sampling and quantization, Linear vs. Coordinate Indexing, Spatial and Intensity Resolution, Image Interpolation, Basic relationship between pixels.	**08**
2	**Intensity transformation and spatial filtering:** Basics of Intensity Transformations and Spatial Filtering, Some Basic Intensity Transformation Functions, Histogram Processing, Histogram Equalization, Histogram Matching (Specification), Local Histogram Processing, Using Histogram Statistics for Image Enhancement, Fundamentals of Spatial Filtering, The Mechanics of Spatial Filtering, Smoothing Spatial Filters, Smoothing Linear and non-linear filters, Sharpening Spatial Filters, Using the Second Derivative for Image Sharpening-The Laplacian, Using First-Order Derivatives for (Nonlinear) Image Sharpening.	**08**
3	**Image Enhancement In Frequency Domain:** Background of 1D and 2D DFT, The Basics of Filtering in the Frequency Domain, Additional Characteristics of the Frequency Domain, Frequency Domain Filtering Fundamentals, Correspondence Between Filtering in the Spatial and Frequency Domains, Image Smoothing Using Frequency Domain Filters, Image Sharpening Using Frequency Domain Filters, The Laplacian in the Frequency Domain, Unsharp Masking, Highboost Filtering, High-Frequency Emphasis Filtering-Homomorphic Filtering.	**08**
4	**Image Restoration and Reconstruction:** A Model of the Image Degradation/Restoration Process, Noise Models, Spatial and Frequency Properties of Noise, Some Important Noise Probability Density Functions, Restoration in the Presence of Noise Only-Spatial Filtering, Mean Filters, Order-Statistic Filters, Adaptive Filters, Periodic Noise Reduction by Frequency, Optimum Notch Filtering, inverse filtering, minimum mean square error (Wiener) filtering.	**08**

	Color Image Processing: Color Fundamentals, Color Models, The RGB Color Model, The CMY and CMYK Color Models, The HSI Color Model, Pseudo-color Image Processing, Intensity Slicing, Intensity to Color Transformations, Basics of Full-Color Image Processing.	
5	**Image Segmentation:** Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm. **Image Compression:** Fundamentals, Coding Redundancy, Spatial and Temporal Redundancy, Irrelevant Information, Measuring Image Information, Fidelity Criteria, Image Compression Models, Image Formats, Containers, and Compression Standards, Compression Methods: Huffman Coding, Arithmetic Coding, LZW Coding, Run-Length coding.	**08**

Course Outcome:

Students who complete this course will be able to:
CO1: Understand the concepts of digital image processing
CO2: Identify and apply different filtering techniques in both the spatial and frequency domains
CO3: understand and apply image restoration techniques and color image processing models.
CO4: Understand and explain the different segmentation procedures and image compression techniques.

CO-PO Mapping												
CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	1	1	1	-	-	-	1	-	1	1
CO2	1	2	2	1	1	-	-	-	1	-	1	1
CO3	1	2	2	1	1	-	-	-	1	-	1	1
CO4	1	2	2	2	-	-	-	-	1	-	1	1

Low-1 Medium-2 High-3

Text Books:

1. **Digital Image Processing** - Rafael C. Gonzalez & Richard E. Woods, Fourth Edition **2018,** Pearson International Edition.
2. **Fundamentals of Digital Image Processing –** Anil K.Jain, Pearson Education (Asia) Ltd./Prentice Hall of India 2004.

Reference Books:

1. **Digital Image Processing, analysis and computer Vision**- First edition, Milan Sonka, Cenage Learning, 2008.
2. **Digital image processing, First edition, S**.Jayaraman, S.Esakkirajan, J.Veerakumar, TMH-2008.
3. **Digital Image Processing using MATLAB** - Rafael C. Gonzalez & Richard E. Woods, Fourth Edition 2018, Pearson International Edition.

Course Title	**Process Automation and Control Lab**						
Course Code	**21EIL606**						
Category	Professional Core Course **(PCC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	00	00	02	00	02	13	01
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objective: To familiar with the software and hardware of PLC using ladder logic codes.

Sl No	Experiments
1	Characteristics of various type of control valves
2	Determine the closed loop response of Level, flow and temperature control loop with and without disturbance
3	Determine the Response of cascade control using DCS/PLC and SCADA
4	Design the signal conditioning circuit for strain measurement using Load cell
5	Design the signal conditioning circuit for temperature measurement using RTD
6	PLC programming to control the rejection process
7	PLC programming to control the traffic monitoring system
8	PLC programming to control the coffee vending machine process
9	PLC programming to control water level in overhead tank using SCADA
10	PLC programming to control the batching process
11	Implement the Elevator using PLC. The logic should be solved using ladder diagram technique
12	Implement the Bottle filling process using PLC. The logic should be solved using ladder diagram technique

Course Outcome:

1. Study the characteristics of control valves
2. Implement controllers for various processes
3. Tune the controller and improve the performance of the process
4. Design an automatic control system using PLC program
5. Apply programmable logic controllers to demonstrate industrial controls in the laboratory

CO-PO MAPPING															
CO/PO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	1	-	-	-	-	-		-	1	1	-	3	
CO2	3	2	2		1	-	-	-		-	1	1	2	3	
CO3	3	2	2		3	-	-	-		-	1	1	-	3	
CO4	3	2	1		3	-	-	-		-	1	1	3	3	
CO5	3	2	1		3								3	3	