DR AMBEDKAR INSTITUTE OF TECHNOLOGY, BENGALURU-56

DEPARTMENT OF ELECTRONICS AND INSTRUMENTATION ENGINEERING

FIFTH AND SIXTH SEMESTER

Scheme and Syllabus - CBCS – 2022 -2023 Regulation
Academic Year 2025-26

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. Electronics and Instrumentation Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2024-25
2022 Scheme

V SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/ Drawing	Self - Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
					L	T	P	S					
1	HSMS	22EIT501	Management and Entrepreneurship	EIE	3	0	0		03	50	50	100	3
2	IPCC	22EIU502	Digital Signal Processing	EIE	3	0	2		03	50	50	100	4
3	PCC	22EIT503	Machine learning	EIE	4	0	0		03	50	50	100	4
4	PCCL	22EIL504	Machine learning Lab	EIE	0	0	2		03	50	50	100	1
5	PEC	22EIT505x	Professional Elective Course	EIE	3	0	0		03	50	50	100	3
6	PROJ	22EIM506	Mini Project	EIE	0	0	4		03	100		100	2
7	AEC	22RMT507	Research Methodology and IPR	EEE department	2	2	0		02	50	50	100	3
8	MC	22CVT508	Environmental Studies	TD: CV PSB: CV	2	0	0		02	50	50	100	2
9	HS	22CDN509	Aptitude and Verbal Ability Skills	Placement Cell	2	0	0		--	50	--	50	PP/ NP
10	MC	22NSN510	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	PP/ NP
		22PEN510	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		22YON510	Yoga	Yoga Teacher									
								Total		500	300	800	22

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, L: Lecture, T: Tutorial, P: Practical, S= Self-Study CIE: Continuous Internal Evaluation, SEE:Semester End Evaluation. K : The letter in the course code indicates common to all the stream of Engineering. PROJ: Project /Mini Project. PEC: Professional Elective Course

Professional Elective Course 22XXT505x			
22EIT505A	**Digital Image Processing**	**22EIT505C**	**Advanced Control Systems**
22EIT505B	**Bio-Medical Instrumentation**	**22EIT505D**	**Analytical Instrumentation**

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical's of the same course. Credit for IPCC can 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 only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23

National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of Degree.

Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or amultidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 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 the 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 batches mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of the 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.

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. The minimum number of students' strengths for offering a professional elective is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Dr. Ambedkar Institute of Technology, Bengaluru-560056
Outcome Based Education(OBE) and Choice Based Credit System
B.E. Electronics and Instrumentation Engineering
Tentative Scheme of Teaching and Examination effective from the Academic Year 2024-25
2022 Scheme

VI SEMESTER

Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Teaching Hours /Week				Examination				Credits
				Theory Lecture	Tutorial	Practical/ Drawing	Self - Study	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	T	P	S					
IPCC	22EIU601	Embedded System using ARM Controller	EIE	3	0	2	--	03	50	50	100	4
PCC	22EIT602	PLC and SCADA	EIE	4	0	0	--	03	50	50	100	4
PEC	22EIT603x	Professional Elective Course	EIE	3	0	0	--	03	50	50	100	3
OEC	22EIT604x	Open Elective Course-I		3	0	0	--	03	50	50	100	3
PROJ	22EIP605	Major Project Phase I	EIE	0	0	4	--	03	100	--	100	2
PCCL	22EIL606	Process Automation Lab	EIE	0	0	2	--	03	50	50	100	1
AEC/SDC	22EIT607x OR 22EIL607x	Ability Enhancement Course/ Skill Development Course V	EIE	If the course is offered as a Theory				01	50	50	100	1
				1	0	0	--					
				If course is offered as a practical								
				0	0	2	--					
HS	22CDN608	Analytical and Reasoning Skills	Placement Cell	2	0	0	--	--	50	--	50	PP/ NP
MC	22NSN609	National Service Scheme (NSS)	NSS coordinator	0	0	2			100	---	100	PP/ NP
	22PEN609	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
	22YON609	Yoga	Yoga Teacher									
									500	300	800	18

				Total	

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Professional Elective Course: 22XXT603x			
22EIT603A	**Deep Learning Techniques**	**22EIT603C**	**Robotics and Automation**
22EIT603B	**Medical Imaging Techniques**	**22EIT603D**	**Aircraft Instrumentation**
Open Elective Course 22XXT604x			
22EIT604A	**Robotics and Applications**	**22EIT604C**	
22EIT604B	**Sensors and Actuators**	**22EIT604D**	

Ability Enhancement Course / Skill Enhancement Course-V 22XXT607x OR 22XXL607x			
22 EIL607A	**Digital Image Processing Lab**	**22 EIL607C**	**Virtual Instrumentation Lab**
22 EIT 607B	**Technical Writing Skills**	**22 EIL607D**	**Robotics Lab**

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National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education(PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first Week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the Degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of Degree.

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. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall

not be applicable to cases where the admission to the program is less than 10.

Open Elective Courses: Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they canopt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under theguidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.
Project Phase-I : Students have to discuss with the mentor /guide and with their help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

Course Title	**Management and Entrepreneurship**						
Course Code	**22EIT501**						
Category							
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 impart the knowledge about the Management concepts, evolution and Management functions.
2. To familiarize the student on Entrepreneurship and Entrepreneurial process.
3. To understand the role of SSI in economic development and gain an insight of funding agencies.
4. To have a clear understanding of concept of project, preparation of project & its screening.

Module No	**Syllabus**	**No of Teaching hours**
1	MANAGEMENT: Introduction- Meaning, characteristics of management, functions of Management- POSDCORB, Levels and Skills of Management, Roles of Managers Management as science or an art or profession, Development of management thought - Early management approaches (in brief)- Psychological, Bureaucratic, Scientific theory and Administrative theory and Human Relations Movement, Modern management approaches (in brief)- Behavioral, Systems, Quantitative, and Contingency approach FUNCTIONS OF MANAGEMENT- PART I: PLANNING: Types of Plans: Single use & Standing plans, Steps in Planning process. ORGANIZING: Types of organization (Line, Staff, Line & Staff, Matrix and Committee form) Departmentation (Functional, Product, Process, Territorial and Customer), MBO and MBE.	**08**
2	FUNCTIONS OF MANAGEMENT – PART II STAFFING: Sources of recruitment, Process of selection, DIRECTING: Leadership: Definition, Leadership styles - Autocratic, Democratic, Charismatic, Laissez faire and Participative, Motivation:– Definition, Maslow, Herzberg & McGregor's Theory X & Y. Communication– Definition, types, communication process and barriers of communication, CO-ORDINATION: importance, CONTROLLING: steps in controlling, REPORTING: importance, BUDGETTING: importance Case study discussion with respect to Indian context.	**08**
3	ENTREPRENEUR: Definition & Meaning, Characteristics, types of entrepreneurs- Imitative, Innovative, Fabian and drone and Others, Intrapreneur- meaning, Difference between Entrepreneurs, Intrapreneur & Manager, Stages in Entrepreneurial process, barriers to entrepreneurs,	**08**

	Role of Entrepreneurs in economic development and Business Plan. Rural entrepreneurship– Definition, challenges & opportunities. Women Entrepreneurs – Definition, challenges, and Institutional support to Women Entrepreneurs in India. Family Business: Meaning and Definition, types of family business and reasons for failure of family business. Corporate Social Responsibility- Meaning, definition and benefits. Case study discussion with respect to Indian context. Activity: Profile of successful entrepreneur and Writing Business plan	
4	MSME: Definition of MSME (latest). SMALL SCALE INDUSTRY: Meaning, and definition, Characteristics, steps to start SSI, role of SSI in economic development, problems faced by SSI. Introduction to GATT, WTO &LPG, Sources of financing (brief), Forms of ownership - Sole proprietorship, Hindu Undivided Family, Partnership, and Cooperative. Institutional Support: Central level Institutions – NBMSME, KVIC, NSIC, SIDBI, Indian Institute of Entrepreneurship (IIE), EDI and NABARD. State level Institutions- DIC, KSFC, KIADB, TECSOK. STARTUP COMPANIES-Meaning and Challenges. Make in India concept and MUDRA Bank Initiative. Activity for students: Schemes for startup companies.	**08**
5	PREPARATION OF PROJECT: Project- Meaning, Classification of project, Project identification, Project selection, Project Appraisal, Project implementation. Project Report –Outline, Feasibility Study- Financial, Technical, Marketing, and Social Feasibility Study, PESTLE Analysis for Project and errors in preparation of project report. Activity for students: Preparation of project report	**08**

Course Outcomes :

CO1: The students will gain domain knowledge on management concepts, evolution, management functions.

CO2: The students will be able to gain domain knowledge on Entrepreneurship, entrepreneurial process

CO3 : The students will get an in depth knowledge of entrepreneurial process & contribute to the betterment of the society.

CO4 : Students will be able to identify business opportunities & design a project report.

Text Books:

1. Entrepreneurship and Management- S Nagendra and V S Manjunath- Pearson Publication 4 /e,2009.

2. Principles of Management – PC Tripathi, and P N Reddy – Tata MacGrawHill.

3. Entrepreneurship Development – Poornima M Charanthimath Pearson Education 2ndEdition.

Reference Books:

1. Dynamics of Entrepreneurial Development and Management-Vasant Desai-Himalaya Publishing House.

Latest edition.

2. Entrepreneurship and management - Shashi k Gupta- Kalyani publishers, Latestedition**.**

3. Financial Management- Shashi k Gupta- Kalyani publishers, Latest edition.

Course Title	**Digital Signal Processing**						
Course Code	**22EIU502**						
Category	Integrated Professional Core Course **(IPCC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	04	00	00	00	04	52	04
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:

- To understand DFT anf FFT techniques.
- To design and understand IIR digital filter.
- To design and understand FIR digital filter.
- To discuss DSP processors and word length issues multi rate signal processing and application.

Module No	**Syllabus**	**No of Teaching hours**
1	**Discrete Fourier Transforms (DFT):** Frequency domain sampling and Reconstruction of Discrete Time Signals, The Discrete Fourier Transform, DFT as a linear transformation, Properties of the DFT: Periodicity, Linearity and Symmetry properties, Multiplication of two DFTs and Circular Convolution, Additional DFT properties and computation of IDFT.	**08**
2	**Linear filtering methods based on the DFT:** Use of DFT in Linear Filtering, Filtering of Long data Sequences. **Fast-Fourier-Transform (FFT) algorithms:** Efficient Computation of the DFT: Radix-2 FFT algorithms for the computation of DFT and IDFT Decimation-In- time and decimation-in-frequency algorithms.	**08**
3	**Design of FIR Filters:** Characteristics of practical frequency -selective filters, Symmetric and Antisymmetric FIR filters, Design of Linear-phase FIR filters using windows- Rectangular, Hamming, Hanning, and Kaiser windows.	**08**
4	**IIR Filter Design:** Infinite Impulse response Filter Format, Bilinear Transformation Design Method, Analog Filters using Lowpass prototype transformation. Normalized Butterworth Functions, Bilinear Transformation and Frequency Warping, Bilinear Transformation Design Procedure, Digital Butterworth Filter Design using BLT.	**08**

5	**Digital Signal Processors:** DSP Architecture, DSP Hardware Units, Fixed point format, Floating point Format, IEEE Floating point formats, Fixed point digital signal processors, Floating point processors, FIR and IIR filter implementations in Fixed point systems.	**08**

Course Outcome:

Students who complete this course will be able to:

CO1: Analyze the discrete time signals in the frequency domain

CO2: Design FIR and IIR digital filters and Identify various filter structures

CO3: Comprehend the architectural features of digital signal processors.

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

Low-1 Medium-2 High-3

Text Books:

1. Oppenheim A V and Shehafer R W, "Discrete Time Signal Processing", Prentice Hall (1989).
2. Digital Signal Processing Principles, Algorithms and Applications, John G Proakis and Manolakis, Pearson, Fourth Edition, 2014.
3. 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

Second edition, Elsevier publication,2013.

Practical component: Experiments are conducted using MATLAB/ SCI Lab and implement using Processor

Sl. No	Experiments
1	Write a program to verify the sampling theorem and aliasing effects with various sampling frequencies
2	Determine linear convolution, Circular convolution and Correlation of two given sequences. Verify the result using theoretical computations.
3	Generation of discrete-time sequences.
4	Determine the linear convolution of two given point sequences using FFT algorithm.
5	Determine the correlation using FFT algorithm.
6	Determine the spectrum of the given sequence using FFT
7	Design and test FIR filter using Windowing method (Hamming window and Kaiser window) for the given order and cut-off frequency
8	Design and test FIR filter using frequency sampling method
9	Design and test Butterworth 2nd order low pass & high pass filter
10	Design and test Chebyshev 2nd order low pass& high pass filter.
11	Generation and detection of DTMF signal using a software
12	Implementation of Real-time echo generation
13	Demonstration of open ended project using the concept of above mentioned Experiments.

Course Title	**Machine Learning**						
Course Code	**22EIT503**						
Category	Professional Core Course **(PCC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	04	00	00	00	04	52	04
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objectives:

1. To introduce the basic concepts and techniques of Machine Learning with python programming.
2. To enable design and implementation of machine learning solutions to classification, regression problems.
3. Apply suitable machine learning techniques for data handling and to gain knowledge from it.
4. Evaluate the performance of algorithms and to provide solution for various real-world applications.

Module No	**Syllabus**	**No of Teaching hours**
1	**Introduction to Machine Learning**: Overview of machine learning: Definition, history, and applications. Types of machine learning: Supervised, unsupervised, reinforcement learning. Machine learning process: Data collection, preprocessing, model training, evaluation, deployment. Terminology and concepts: Features, labels, instances. Data Preprocessing and Exploration Data cleaning and preprocessing techniques. Handling missing data and outliers. Exploratory Data Analysis (EDA).	**12**
2	**Supervised Learning:** Linear Regression: single & multiple variables, Gradient descent, Bias variance trade-off, Overfitting & Under fitting, Regularization & Generalization. Classification: Logistic regression - Decision Trees, Naive Bayes, Support Vector Machines - linear and non-linear kernel functions. Model evaluation metrics-Accuracy, precision, recall, F1-score, ROC, AUC	**10**
3	**Unsupervised Learning**: Clustering basics, Partitioned, Hierarchical and Density based K-Means clustering, K-Mode clustering, Expectation maximization, Dimensionality reduction- t-SNE. Anomaly detection techniques.	**10**

4	**Ensemble Learning:** Random forests, Bagging and Boosting, Random forests, Adaboost, XG boost inclusive, Metrics & Error Correction. Optimization of hyper parameters. Ethical considerations: Bias, fairness, transparency, and accountability	**10**
5	**Reinforcement Learning (RL):** Basics of reinforcement learning: Agents, environments, rewards. Markov Decision Processes (MDPs). Q-learning and Deep Q Networks (DQNs). Policy gradients and actor-critic methods and applications	**10**

Course Outcome:

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

Sl.no	Description	Description Bloom's Taxonomy Level
CO1	Understand and apply basic concepts and techniques of Machine Learning using Python programming.	Knowledge, Apply (Level 1, Level 3)
CO2	Design and implement machine learning solutions for classification and regression problems.	Understand, Apply (Level-2, Level-3)
CO3	Apply appropriate machine learning techniques for data processing and knowledge extraction.	Apply, Analyze, (Level-3, Level-4)
CO4	Analyze the performance of machine learning algorithms and discuss solutions for real-world applications.	Apply, Analyze, (Level-3, Level-4)

Mapping of COs with POs

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

Text Books:

1. Introduction to Machine Learning, Ethem Alpaydin, 4th Edition, 2020, Publisher: MIT Press.
2. Machine Learning: The Art and Science of Algorithms That Make Sense of Data, Peter A. Flach, Illustrated Edition, 2012, Publisher: Cambridge University Press.
3. Foundations of Machine Learning, Mehryar Mohri, Afshin Rostamizadeh & Ameet Talwalkar, 2nd Edition, 2018, Publisher: MIT Press.

Reference Books:

1. Foundations of Machine Learning, Mehryar Mohri, Afshin Rostamizadeh & Ameet Talwalkar, 2nd Edition, 2018, Publisher: MIT Press .
2. Machine Learning, Tom M. Mitchell, 1st Edition, 1997, Publisher: McGraw-Hill.

Course Title	**Machine learning Lab**						
Course Code	**22EIL504**						
Category	**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**		

Course Objectives:

1. To introduce the basic concepts and techniques of Machine Learning with python programming.
2. To enable design and implementation of machine learning solutions to classification, regression problems.
3. Apply suitable machine learning techniques for data handling and to gain knowledge from it.
4. Evaluate the performance of algorithms and to provide solution for various real-world applications.

Sl. No	Programs
1	Extract the data from database using python.
2	Write a program to create histograms for all numerical features and analyze the distribution of each feature. Generate box plots for all numerical features and identify any outliers. Use California Housing dataset.
3	Write a program to Compute the correlation matrix to understand the relationships between pairs of features. Visualize the correlation matrix using a heatmap to know which variables have strong positive/negative correlations. Create a pair plot to visualize pairwise relationships between features. Use California Housing dataset.
4	Write a Program to implement and demonstrate the Find-S algorithm to output a description of the set of all hypotheses consistent with the training examples.
5	Write a program to demonstrate the working of Linear Regression and Polynomial Regression. Use Boston Housing Dataset for Linear Regression and Auto MPG Dataset (for vehicle fuel efficiency prediction) for Polynomial Regression.
6	Write a program to implement Principal Component Analysis (PCA) for reducing the dimensionality of the Iris dataset from 4 features to 2.
7	Write a program to demonstrate the working of the decision tree algorithm. Use Breast Cancer Data set for building the decision tree and apply this knowledge to classify a new sample.
8	Write a program to implement the Naive Bayesian classifier considering Olivetti Face Data set for training. Compute the accuracy of the classifier, considering a few test data sets.
9	Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions. Python ML library classes can be used for this problem
10	Develop a program to implement k-means clustering using Wisconsin Breast Cancer data set and visualize the clustering result.

Course Outcome:

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

Sl.no	Description	Description Bloom's Taxonomy Level
CO1	Extract and visualize data using Python for exploratory data analysis.	Knowledge, Apply (Level 1,Level 3)
CO2	Implement supervised learning algorithms for classification and regression tasks.	Understand, Apply (Level-2, Level-3)
CO3	Apply unsupervised learning techniques like clustering and dimensionality reduction.	Apply, Analyze, (Level-3, Level-4)
CO4	Evaluate and interpret machine learning models for real-world applications.	Apply, Analyze, (Level-3, Level-4)

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

Text Books:

1. Introduction to Machine Learning, Ethem Alpaydin, 4th Edition, 2020, Publisher: MIT Press.
2. Machine Learning: The Art and Science of Algorithms That Make Sense of Data, Peter A. Flach, Illustrated Edition, 2012, Publisher: Cambridge University Press.
3. Foundations of Machine Learning, Mehryar Mohri, Afshin Rostamizadeh & Ameet Talwalkar, 2nd Edition, 2018, Publisher: MIT Press.

Reference Books:

1. Foundations of Machine Learning, Mehryar Mohri, Afshin Rostamizadeh & Ameet Talwalkar, 2nd Edition, 2018, Publisher: MIT Press .
2. Machine Learning, Tom M. Mitchell, 1st Edition, 1997, Publisher: McGraw-Hill.

Course Title	**Digital Image Processing**						
Course Code	**22EIT505A**						
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 color models and compression methods

Module 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,	**08**

	Adaptive Filters, Periodic Noise Reduction by Frequency, Optimum Notch Filtering, inverse filtering, minimum mean square error (Wiener) filtering.	
5	**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. **Image Compression:** Compression: Fundamentals – Image Compression models – Error Free Compression – Lossy compression– Image Compression standards.	**08**

Course Outcome:

Students who complete this course will be able to:

1. Understand the concepts of digital image processing
2. Identify and apply different filtering techniques in both the spatial and frequency domains
3. understand and apply image restoration techniques and color image processing models.
4. Understand and explain the different image compression techniques.

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	-	-	-	3	-	-	-	3	2	-	2			
CO2	2	2	2	2	3	-	-	-	3	2	-	2			
CO3	2	2	2	2	3	-	-	-	3	2	-	2			
CO4	2	2	1	2	3	-	-	-	3	2	-	2			
CO5	2	2													

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	**Bio-Medical Instrumentation**						
Course Code	**22EIT505B**						
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

Sl.no	Description
1	Understand the Physiology of the heart, lung, blood circulation and respiration including different transducers used
2	Learn about various sensing and measurement devices of electrical and non-electrical origin.
3	Understand modern methods of imaging techniques and Study about medical assistance techniques and therapeutic equipments.

Module No	**Syllabus**	**No of Teaching hours**
1	**Fundamentals of Biomedical Instrumentatio**n: Sources of biomedical signals, Basic Medical Instrumentation system, Performance requirements of medical instrumentation systems. PC based medical instruments, General constraints in design of biomedical instrumentation systems. Bioelectric Signals and Electrodes : Origin of Bioelectric signals, Types of bioelectric signals-ECG, EEG, EMG, Recording electrodes: Electrode – Tissue interface, polarization, skin contact- impedance, Silver-silver chloride electrodes, Electrodes for ECG, EEG, EMG, Microelectrodes .	**08**
2	**Electrocardiograph:** Physiology of the heart, Electrical activity of the heart and Electrocardiogram (ECG), Normal & Abnormal cardiac Rhythms, Block diagram-description of an Electrocardiograph, ECG leads, Effects of artifacts on ECG Recordings, Multi- channel ECG machine. **Electroencephalograph:** Block diagram description of an Electroencephalograph, 10-20 electrode systems, computerized analysis of EEG. Electromyograph, Biofeedback instrumentation.	**08**
3	**Patient Monitoring System**: Bedside patient monitoring systems, Central monitors, Measurement of heart rate – Average heart rate meter, Instantaneous heart rate meter, Measurement of pulse rate, Definition of oximeter & Pulse oximeter. **Blood Pressure Measurement**: Introduction, Indirect methods of blood pressure measurement: Korotkoff‟s method, Rheographic method, differential auscultatory technique, Oscillometric technique.Measurement of Respiration Rate: Impedance pneumography, CO2 method of respiration rate measurement, Apnoea detectors.	**08**
4		**08**

	Blood Flow Measurement: Electromagnetic blood flow meter- Principle and Square wave electromagnetic flowmeter. Doppler shift blood flow velocity meter, Blood flow measurement by Doppler imaging. **Cardiac Output Measurement**: Measurement of continuous cardiac output derived from the aortic pressure waveform, ultrasound method. **Cardiac Pacemakers and Defibrillators:** Need for cardiac pacemaker, External pacemaker, Implantable pacemaker, Types of Implantable pacemakers, Programmable pacemakers, Power sources for Implantable pacemaker. Cardiac Defibrillator: Need for a Defibrillator, DC defibrillator, Pacer-Cardioverter-Defibrillator.	
5	**Therapeutic Instruments**: Cardiac-assist devices, Pump oxygenators, Total artificial heart, Hemodialysis, Lithotripsy, Ventilators, Infant incubators, Drug infusion pumps, Ambulatory and Implantable Infusion systems, Anesthesia Machines, Electrosurgical unit. **Patient Safety**: Electric shock hazards, Leakage currents, Electrical safety analyzer, Testing of Biomedical equipment	**08**

Course outcome:

Sl.No	Description	Description Bloom's Taxonomy Level
CO1	Define commonly used technical terms from Medicine and Biomedical Engineering.	Knowledge, Understand (Level 1, Level 2)
CO2	Describe bio-signals that emanate from the body. And learn the working principles of blood flow meters and Physiological assist devices	Knowledge, Understand (Level 1, Level 2)
CO3	Describe the engineering principles of commonly used medical devices and medical imaging systems, Realize safety requirements of biomedical instrumentation..	Knowledge, Analyze (Level 1, Level 4)

Course outcome mapping with Programme outcomes

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

TEXT BOOKS:

1. Leslie Cromwell, Biomedical Instrumentation and Measurement, Prentice hall of India, New Delhi,2007.
2. M.Arumugam, 'Bio-Medical Instrumentation', Anuradha Agencies, 2003.
3. Khandpur R.S, Handbook of Biomedical Instrumentation, , Tata McGraw-Hill, New Delhi, Edition,2003**.**

REFERENCES:

1. Suh, Sang, Gurupur, Varadraj P., Tanik, Murat M., Health Care Systems, Technology and Techniques,Springer, 1st Edition, 2011.
2. Joseph J.carr and John M. Brown, Introduction to Biomedical Equipment Technology, John Wiley and sons, New York, 4th Edition, 2012.

Course Title	**Advanced Control System**						
Course Code	**22EIT505C**						
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:

- To provide knowledge on design in state variable form
- To provide knowledge in phase plane analysis.
- To give basic knowledge in describing function analysis.
- To study the design of optimal controller.
- To study the design of optimal estimator including Kalman Filter

Module No	**Syllabus**	**No of Teaching hours**
1	**State Variable Analysis and Design:** State Variable Analysis: concept of State Variables & State Models, State model for Linear Continuous Time Systems, State-Space Representation Using Physical Variables, State-Space Representation Using Phase Variables, Examples of electrical circuits and dc servomotors	**08**
2	**State Variable Analysis and Design(Cont):** Diagonalization, Jordan Canonical Form, Solution of State Equations, Properties of State Transition Matrix, Computation of State-Transition Matrix (Using Laplace Transformation, Cayley-Hamilton Theorem).	**08**
3	**State feedback controller design:** Effect of state feedback on controllability and observability, Design of State Feedback Control through Pole placement. Full order observer and reduced order observer.	**08**
4	**State observer**: Introduction to state observer, Full order to state observer, Dual problem, Necessary & sufficient condition for state observation ,E ffects of the addition of the observer on a closed loop system, Minimum order observer, Design of regulator system with observer, Design of control system with observer, Quadratic optimal regulator systems.	**08**
5	**Compensator design**: Realization of compensators – lag, lead and lag-lead. Design of compensator using root locus. Design of P, PI and PID controller using Ziegler- Nichols tuning method	**08**

SI NO	**Descriptive**	**Descriptive blooms taxonomy level**
CO1	Discuss state variable approach for linear time invariant systems in both the continuous and discrete time systems	Knowledge, Understand (Level 1, Level 2)
CO2:	Apply vector and matrix algebra to find the solution of state equations for linear continuous – time and discrete – time systems	Apply, Evaluate (Level 3, Level 5)

CO3	Define controllability and observability of a system and test for controllability and observability of a given system	Knowledge, Analyze (Level 1, Level 4)
CO4	Design pole assignment and state observer using state feedback	Knowledge, Analyze (Level 1, Level 4)

	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	P10	Po11	Po12	Pso1	Pso2	Pso3
CO1	**3**	**2**	**1**	-	-	-	-	-	**1**	-	**2**	**2**			
CO2	**3**	**2**	**2**	**1**	**1**	**1**	-	-	**1**	-	**2**	**2**			
CO3	3	**2**	**2**	-	**1**	**1**	-	-	**1**	-	**2**	**3**			
CO4	**3**	**3**	**2**	**2**	**2**	**2**	-	-	**1**	-	**2**	**3**			
CO5	3	3	2	2	2	2	-	-	1	1	2	3			
Strength of correlation: Low-1, Medium- 2, High-3															

Text Books:

1. **Modern Control Engineering**-K. Ogata, Prentice, Hall of India publication 5th Edition, 2010
2. **Control system engineering**- I.J. Nagarath and M.Gopal, New age international publishers, 5th edition, 2007

Reference Books:

1. **Advanced control theory**- A. Nagoorkani. RBA Publication. 2 nd edition, 1999
2. **Digital control and state variable methods**-Madan Gopal, Prentice Hall of India. 2nd Edition, 2003
3. **Modern Control Engineering**-Roy Choudhury, Prentice Hall of India.2005

Course Title	**Analytical Instrumentation**						
Course Code	**22EIT505D**						
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:

1. To understand the concept and properties of Electromagnetic radiation **a**nd to provide various techniques and methods of analysis which occur in the various regions of the spectrum.
2. To study the concept on Spectro chemical methods used in analytical instrument application
3. To explain important methods of analysis and uses of infrared Spectroscopy, flame photometry, Mass and NMR spectroscopy
4. To give unique methods of separation of closely similar materials, using the most powerful being gas chromatography.

Module No	**Syllabus**	**No of Teaching hours**
1	**Introduction to Spectro chemical methods:** Properties of electromagnetic radiation, interaction to radiation and matter**.** UV – Visible Spectroscopy: Introduction, Electromagnetic Radiation, Laws relating to absorption radiation, Absorption Instruments, Ultraviolet and visible absorption spectroscopy, Calorimeters, spectrophotometer	**08**
2	**Infrared Spectroscopy:** Basic Components of IR Spectrophotometers, Type of Infrared Spectrophotometers, Sample Handling Techniques. **Flame photometers:** principle, constructional details of flame photometers, types of flame photometers, types of flame photometers, clinical flame photometers, accessories for flame photometer, expression for concentration, interferences in flame photometry, procedure for determinations. Atomic spectroscopy:	**08**
3	**Atomic absorption and Emission Spectroscopy:** Principles, sample atomization techniques, atomic absorption instrumentation, interferences in atomic spectroscopy, standard addition and internal standard methods of evaluation. Principles, arc, spark and plasma sources, emission based on plasma sources, emission Spectroscopy based on arc and spark sources	**08**
4	**Mass & NMR Spectroscopy:** Basic concept, types of mass spectrometer, components of mass spectrometer, resolution and applications. Principle of NMR, constructional details, sensitivity enhancement for analytical NMR spectroscopy. Use of computers with NMR spectrometers.	**08**

5	**Chromatographic Techniques:** classifications Chromatography behavior of solutes column efficiency and band broadening column performance gas and liquid chromatography Gas chromatograph- basic concepts, parts of gas chromatograph. Method of peak areas, liquid chromatography- basic concepts, types of liquid chromatography, the liquid chromatography.	**08**

Course Outcomes:

Upon completion of this course the students is able to

1. Understand the concept and properties of Electromagnetic radiation **a**nd to provide various techniques and methods of analysis which occur in the various regions of the spectrum.
2. Explain concept on Spectro chemical methods used in analytical instrument application
3. Describe the important methods of analysis of infrared Spectroscopy & flame photometry.
4. Illustrate the uses of radio chemical methods, Mass and NMR spectroscopy in structure determination.
5. Analyse unique methods of separation of closely similar materials, using the most powerful being gas chromatography.

	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	P10	Po11	Po12	Pso1	Pso2	Pso3
CO1	**3**	**1**		**1**		**1**						**1**			
CO2	**2**	**2**		**2**	**1**	**1**		**1**				**1**			
CO3	**3**	**1**	**1**		**2**	**1**				**1**		**1**			
CO4	**1**	**2**	**2**	**1**	**2**	**1**		**1**				**1**			
CO5	**2**	**2**			**2**	**1**						**1**			
Strength of correlation: Low-1, Medium- 2, High-3															

Text Books:

1. Hand book of analytical Instruments by R. S. Khandpur, TMH Publications, 2nd edition 2006, New Delhi

Reference Books:

1. Instrumental methods of analysis by H. H. Willard, L. L. Merritt & J. A. Dean, CBS Publications 7th Ed 1988.
2. Principles of Instrumental analysis by S. J. Holler & T. A. Nilman Saunders college Publications 5st Ed 1996

Course Title	**Embedded System using ARM Controller**						
Course Code	**22EIU601**						
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.

Module 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	**Introduction 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	**Introduction 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 connected to P0.0 to P0.8
2	Interface switch & LED to LPC2148. Write C program to read the status of switch and display same on LED
3	Interface 2 *16 LCD and write C program to display a string
4	Interface LED & write program to implement binary up-counter(8-bit). The counter should increment for every one second. Use internal timer
5	Write C - Program to interface DC motor
6	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:

Sl.No	Description	Description Bloom's Taxonomy Level
1.	Understand the features of embedded systems, architecture of ARM7 and various interrupt handling schemes.	Knowledge, Understand (Level 1, Level 2)
2.	Apply the instruction set and competency in assembly programming of ARM	Knowledge, Analyze (Level 1, Level 3)
3.	Analyse the Thumb-state and switching back to ARM state interworking	Knowledge, Understand (Level 1, Level 3)
4.	Evaluate the interfacing of LPC2148 microcontrollers with peripheral.	Understand ,Apply (Level 2, Level 4)

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	1	1										1	2	1
CO2	3	2	2	1	1								1	2	1
CO3	3	2	2	2	1								2	3	2
CO4	3	2	2	1	2								1	3	2

Text Books:

1. Introduction to Embedded Systems : Shibu K. V. (TMH) , thirteenth reprint 2014
2. ARM system Developers Guide, Andrew N.Sloss, Elsevier,2008, ISBN 1-55860-874-5
3. LPC 2148 User Manual

Reference Books:

1. ARM Assembly Language – Fundamentals and Techniques, William Hohl, CRC Press, 2nd edition2009
2. ARM Assembly language An Introduction, J.R.Gibson, Cengage Learning, 1st edition 2010

Course Title	**PLC and SCADA**						
Course Code	**22EIT602**						
Category	**Professional Core Course (PCC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	04	00	00	00	04	52	04
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objective:

Sl.no	Description
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

Module 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 **Programmable Logic Controller:** Parts of a PLC, Principles of Operation, The I/O Section, Analog and Digital I/O module. **PLC Programming Languages:** Ladder and functional block programming Ladder diagrams, Logic functions, Function blocks, Program examples	**12**
2	**Basic of PLC Programming:** Processor Memory Organization **Basic of PLC Programming:** Processor Memory Organization, PLC Programming Languages, Instruction List, Sequential function charts, Structured text, Internal relays, Ladder programs, One-shot operation, Set and reset, Jump and call: Jump, Subroutines.	**10**
3	**Advanced PLC Programming:** Timers, Counters, shift registers, data handling instructions, problems	**10**
4	**Applications:** Temperature Control, Valve Sequencing, Conveyor Belt Control, Control of a Process. **Introduction to 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	**10**
5	**Supervisory Control and Data Acquisition (SCADA):** 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,	**10**

	Elements of 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.	

Sl.No	Description	Description Bloom's Taxonomy Level
CO1	Identify different components of industrial Automation, PLC and SCADA	Knowledge, Understand (Level 1, Level 2)
CO2	Understand the operation and working of PLC and SCADA	Knowledge, Understand (Level 1, Level 2)
CO3	Develop the PLC program for digital circuits.	Knowledge, Apply (Level 1, Level 3)
CO4	Design Simple Control system using PLC programming Languages	Knowledge, Apply (Level 1, Level 3)
CO5	Apply the knowledge of Timer, counter, data manipulation to implement automatic control	Knowledge, Apply (Level 1, Level 3)

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	1	-	1	2	-	-	-	-	-	-	-	-	3	-

Text Book:

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

Reference Books

1. Programmable Logic Controller Frank D. Petruzella Fifth Edition TaTa McGraw-Hill Edition, 2017.
2. Programmable Logic Controllers, Garry Dunning, Third Edition, Delmer Learning, 2011
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

Course Title	**Deep Learning Techniques**						
Course Code	**22EIT603A**						
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

1. Understand the fundamentals of neural networks and deep learning architectures.
2. Design and implement various deep learning models for different tasks.
3. Apply optimization and regularization techniques to enhance model performance.
4. Utilize deep learning models for a range of applications in computer vision and natural language processing.

Module No	**Syllabus**	**No. of teaching Hours**
1	Introduction to Neural Networks: Historical trends in deep learning – Optimization techniques - Learning algorithms, capacity, overfitting and under fitting – Supervised and unsupervised learning algorithms - Basic concept of neurons - Perceptron algorithm - Feed forward and backpropagation networks	8
2	Deep Learning Networks: Feed forward neural networks – Gradient descent Back propagation algorithm – Vanishing gradient problem – Mitigation – RelU heuristics for avoiding bad local minima – Heuristics for faster training – Nestors accelerated gradient descent – Regularization – Dropout	8
3	CNN architectures – Convolution – Pooling layers – Convolution and pooling as an infinitely strong prior - Random or unsupervised features- Transfer learning – Image classification using transfer learning	8
4	LSTM, GRU, encoder/decoder architectures – Auto encoders – Standard- Sparse – Denoising – Contractive- Variational autoencoders – Adversarial generative networks – Autoencoder and DBM	8
5	Applications of Deep Learning: Image segmentation Object detection – Automatic image captioning – Image generation with generative adversarial networks Video to text with LSTM models – Attention models for computer vision, Topological Deep Learning (TDL) Case Study: Named entity recognition – Opinion mining using recurrent neural networks (RNN) – Parsing and sentiment analysis using RNN – Sentence classification using convolutional neural networks – Dialogue generation with LSTMs.	8

Course outcome:

At the end of the course, Students can able to

Sl.No.	Description	Bloom's Taxonomy Level
1.	**Understand** foundational concepts of artificial neural networks, including neurons, layers, and activation functions.	Remember, Understand (Level 1, Level 2)
2.	Implement various deep learning models such as feedforward neural networks, convolutional neural networks (CNNs), recurrent neural networks (RNNs), and autoencoders.	Apply (Level 3)
3.	Apply optimization techniques like gradient descent and its variants (e.g., Adam, RMSprop), and regularization methods including dropout and batch normalization to enhance model performance	Apply (Level 3)
4.	Apply deep learning models to tasks such as image classification, object detection, and natural language processing, utilizing architectures like CNNs, RNNs, and transformers.	Apply (Level 3)

CO-PO Mapping

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

Text Books:

1. Ian Goodfellow, YoshuaBengio, AaronCourville, "DeepLearning", MITPress, 2017.
2. Kevin P. Murphy, "Machine learning: A Probabilistic Perspective", MITPress, 2012.
3. Jason Brownlee, "Deep Learning with Python", ebook, 2016.

Reference Books

1. Francois Chollet, "Deep Learning with Python", Manning Publications, 2018.
2. Phil Kim, "Matlab Deep Learning: With Machine Learning
3. Neural Networks and Artificial Intelligence", Apress, 2017.
4. Ragav Venkatesan, Baoxin Li, "Convolutional Neural Networks in Visual Computing", CRC Press, 2018.
5. Navin Kumar Manaswi, "Deep Learning with Applications Using Python", Apress, 2018.
6. Joshua F. Wiley, "R Deep Learning Essentials", Packt Publications, 2016

Course Title	**Medical Imaging Techniques**						
Course Code	**22EIT603B**						
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:

1. The aim of the course is to show how to extract, model, and analyze information from medical data and Applications In order to help diagnosis, treatment and monitoring g of diseases through computer science.
2. Biomedical Engineering undergraduates integrate the knowledge core of traditional engineering disciplines and modern biology to solve problems encountered in living systems.
4. To analyze a problem from both an engineering and biological perspective; to anticipate the special difficulties in working with living systems and to evaluate a wide range of possible approaches to solutions.
5.

Module No	**Syllabus**	**No of Teaching hours**
1	X-Rays: Interaction between X-Rays and matter, Intensity of an X-Ray, Attenuation, X-Ray Generation and Generators, Beam Restrictors and Grids, Intensifying screens, fluorescent screens and Image intensifiers. X-Ray detectors, Conventional X-Ray radiography, Fluoroscopy, Angiography, Digital radiography, Dynamic spatial reconstruction	**08**
2	Computed Tomography: Conventional tomography, Computed tomography principle, Projection function Generations of CT machines, Electron beam CT, Reconstruction algorithms, Helical CT. Ultrasound Imaging: Ultrasound properties Ultrasonic transducers, Arrays, A mode, B mode, M mode scanners, Tissue characterization, Color Doppler flow imaging.	**08**
3	Fundamental Of Imaging Systems: Angular momentum, Magnetic dipole moment, Magnetization, Larmor frequency, Rotating frame of reference, Free induction decay, Relaxation times, Pulse sequences. Introduction to functional MRI.	**08**
4	Magnetic Resonance Imaging Systems: Slice selection, Frequency encoding, Phase encoding, Spin-Echo imaging, Gradient-Echo imaging, Imaging safety. Thermal Imaging: Medical thermography, Infrared detectors, Thermographic equipment, Pyroelectric vidicon camera.	**08**
5	Radionuclide Imaging: Interaction of nuclear particles and matter, Nuclear sources, Radionuclide generators, Nuclear radiation detectors, Rectilinear scanner, scintillation camera, SPECT, PET.	**08**

Course Outcomes:

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

After completion of this course the student is able to:

1. Analyze information from medical data and Applications In order to help diagnosis, treatment and monitoring of diseases through computer science.

2. Integrate the knowledge core of traditional engineering disciplines and modern biology to solve problems encountered in living systems.

3. To analyze a problem from both an engineering and biological perspective; to anticipate the special difficulties in working with living systems and to evaluate a wide range of possible approaches to solutions.

	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	P10	Po11	Po12	Pso1	Pso2	Pso3
CO1	3	2	3									1	1		
CO2	3	2	3	2								1	1		
CO3		2	3		2						2		1		
CO4	3		2	3		3						2	1		
CO5	3		2	3		3						2			
Strength of correlation: Low-1, Medium- 2, High-3															

Text Books:
1. Principles of Medical Imaging- Kirk shung, Academic Press. Inc, 1992
2. Handbook of Biomedical Instrumentation-R. S. Khandpur, Tata McGraw-Hill.
2 nd Edition, 2008,
Reference Books:
1. Medical Imaging Signals and Systems- Jerry L Prince and Jonathan M Links, Prentice Hall of India/Pearson Education 2009.
2. Fundamentals of medical Imaging- Zhong Hicho and Manbir singh, John Wiley 1993

Course Title	**Robotics and Automation**						
Course Code	**22EIT603C**						
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**		

Unit No	**Syllabus**	**No of Teaching hours**
1	**Introduction :** Robot definition, classification of robot, history, robot components, robot degrees of freedom, robot joints, coordinates, reference frames, asimov's laws of robotics, robot programming modes, characteristics, applications	**08**
2	**Sensors in Robotics:** Touch and Tactile sensors, proximity and range sensors, uses of sensors in robotics, Hydraulic and Pneumatic actuators. Machine Vision: Introduction to techniques, image acquisition and processing.	**08**
3	**Robot kinematics:** Rotation matrix, homogenous transformation matrix, Denavit- Hartenberg convention, Euler angles RPY representation, Direct and inverse kinematics for industrial robots for position and orientation.	**08**
4	Robot dynamics: Langrangian formulation and newton Euler formulation Robot Languages, Robot Programming	**08**
5	**Motion planning:** Introduction, General considerations on Trajectory planning, joint-interpolated Trajectories, calculation of a 4-3-4 Joint trajectory, Cubic Spline Trajectory.	**08**

Course outcomes:

At the end of this course the students is able to

Sl.No	Description	Description Bloom's Taxonomy Level
CO1	Demonstrate the technology and principles associated with robotics and automation systems	Knowledge, Understand (Level 1, Level 2)
CO2	Identify sensors, robotics vision, applications and also robot programming.	Knowledge, Understand (Level 1, Level 2)
CO3	Solve direct and inverse kinematics of simple robot manipulators.	Knowledge, Apply (Level 1, Level 3)
CO4	Apply spatial transformation and mathematical equations to obtain the forward kinematic equation of robot manipulators and path planning.	Knowledge, Apply (Level 1, Level 3)

CO-PO Mapping

	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	P10	Po11	Po12	Pso1	Pso2	Pso3
CO1	3	3	2	-	-	-	-	-	-	-	-	-	3	3	-
CO2	3	3	2	-	-	-	-	-	-	-	-	-	3	3	-
CO3	3	2	2	-	-	-	-	-	-	-	-	-	3	3	-
CO4	3	2	2	-	-	-	-	-	-	-	-	-	3	3	-
Strength of correlation: Low-1, Medium- 2, High-3															

Text Books:

1. **Introduction to robotics,** Saeed B Niku, Prentice Hall of India, 2005.
2. **Robotics control sensing Vision and Intelligence**- K.S.Fu R.C.Gonzalez, C.S.G. Lee,McGraw Hill, 1987.

Reference Books:

1. **Industrial Robotics: Technology, Programming and Applications,** Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey and Ashish Dutta, 2nd Edition, Tata McGraw Hill, 2012.
2. **Robot Technology Fundamentals -** James G.Keramas, 1st Edition, Cengage learningPublishers, 1998
3. **Introduction to robotics** John J Craig third Edition pearson Education Inc., 2005
4. **Introduction to robotics** SK Saha Tata Mc Graw Hill **,** 2008

Course Title	**Aircraft Instrumentation**						
Course Code	**22EIT603D**						
Category	**Professional Elective Courses (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

Sl. No.	Description
1.	Understand the Instrument display and Cockpit layout
2.	Understand the Operation of Flight instruments
3.	Study the characteristics of Gyroscopic Instruments
4.	Understand the operation of engine instruments and data recording system.

Module No	Syllabus	No. of teaching hours
1	AIRCRAFT INSTRUMENTS: Introduction-Qualitative and quantitative displays, basic T grouping of instruments, basics of Attitude Director Indicator(ADI) & Horizontal Situation Indicator, glass cockpit. AIR DATA INSTRUMENTS: Tyes of Air Data Instruments:-Pneumatic type and Air data computers, International Standard Atmosphere (ISA). Combined pitot and static probe, separate static ports. Pneumatic -type Air Data Instruments: Air speed indicator, altimeter and Vertical Speed Indicator and Instantaneous vertical speed indicator	**10**
2	AIR DATA WARNING SYSTEM: Mach warning system, altitude alerts system, airspeed warning system. Directional Systems: Earth's total magnetic field, horizontal and vertical components of total field, direct reading compass and its limitations, fluxgate detector units .	**7**
3	GYROSCOPIC AND ADVANCED FLIGHT INSTRUMENTS: Gyro scope and its properties, gyro system, Types of gyros-Conventional Mechanical, Ring laser gyros, Fiber optic gyros, basic mechanical gyro and its properties, Gyro horizon, Advanced direction indicator, Turn and bank indicator.	**7**

4	ENGINE INSTRUMENTS: Introduction, Engine Speed measurement- Electrical Tacho Generator, Optical Tachnometer, Hall Effect sensor, torque measurement- Hydro mechanical Transducer, Electronic Torque Meter, Pressure measurement	**7**
5	ENGINE FUEL INDICATORS: Fuel quantity indicator (FQI)- volumetric FQI,Fuel flow rate Indicator- Rotating vane flowmeter, Integrated flow meter. FLIGHT DATA RECORDING: Cockpit Voice Recorder, Flight Data Recorder, future developments	**8**

Course outcome:

Sl. No.	Description	Bloom's Taxonomy Level
1.	Develop basic knowledge on the behavior and the characteristics of various indicators in aircraft	Knowledge, Understand (Level 1,Level 2)
2.	Acquire knowledge on the aircraft computer systems	Knowledge, Understand (Level 1,Level 2)
3.	Identify the different types of aircraft instruments and their operation	Knowledge, Understand (Level 1,Level 2)
4.	Analyze the performance of aircraft instruments in functionality of Aircraft System	Understand, Analyze (Level 2,Level 4)

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

Text Book:

1. Aircraft Instrumentation and Systems- S.Nagabhushana, L.K Sudha, I.K.International Publishing House Pvt.Ltd. 2013.

Reference Books:

1. Aircraft digital electronic and computer systems - Michael H. Tooley, second edition, Taylor & Francis Group, 2022

2. Design and development of aircraft systems - Seabridge, Allan G, 3rd edition, Wiley; 3rd edition ,2020

3. Aircraft Instruments and Integrated Systems- EHJ Pallet, Longman Scientific & Technical, McGraw-Hill, 3rd edition,1992.

Course Title	**Process Automation Lab**						
Course Code	**22EIL606**						
Category	Professional Core Course laboratory **(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**		

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

Sl No	Experiments
1	Implementation of logic gates and Boolean functions
2	Study of PLC timer functions
3	Study of PLC Counter functions
4	Study of Shift Register functions
5	Study of PLC Data Handling Functions
6	PLC programming to control the car wash/ Dish wash 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 production line 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:

Sl. No.	**Description**	**Bloom's Taxonomy Level**
1.	Apply programmable logic controllers to demonstrate industrial controls in the laboratory	Apply, Analyze (Level 3,Level 4)
2.	Design the automatic control system using timers	Apply, Analyze (Level 3,Level 4)
3.	Design the automatic control system using counters	Apply, Analyze (Level 3,Level 4)
4.	Design the automatic control system using shift register, data handling instructions	Apply, Analyze (Level 3,Level 4)

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**	**PS O1**	**PS O2**	**PS O3**
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	

Text Book:

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

Reference Books

1. Programmable Logic Controller Frank D. Petruzella Fifth Edition TaTa McGraw-Hill Edition, 2017.
2. Programmable Logic Controllers, Garry Dunning, Third Edition, Delmer Learning, 2011
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

Course Title	**Digital Image Processing Lab**						
Course Code	**22 EIL 607A**						
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**		**CIE Marks: 50**		**SEE Marks: 50**		

Course Objectives:

1. To know about fundamentals of image operations using MATLAB tool.
2. To understand about image transforms in spatial and in frequency domain for image enhancement.
3. To understand the concepts of image restoration and color image processing techniques.

Sl. No	Experiments
1	Simulation and Display of an Image, Negative of an Image(Binary & Gray Scale) .
2	Implementation of Relationships between Pixels.
3	Implementation of Transformations of an Image.
4	Contrast stretching of a low contrast image, Histogram, and Histogram Equalization.
5	Display of bit planes of an Image.
6	Display of FFT(1-D & 2-D) of an image .
7	Computation of Mean, Standard Deviation, Correlation coefficient of the given Image .
8	Implementation of Image Smoothening Filters(Mean and Median filtering of an Image).
9	Implementation of image sharpening filters and Edge Detection using Gradient Filters.
10	Image Compression by DCT, DPCM, HUFFMAN coding.
11	Implementation of image restoring techniques.
12	Implementation of Image Intensity slicing technique for image enhancement.
13	Canny edge detection Algorithm Numerical Methods and their applications: Curve Fitting: Straight line fit, Polynomial fit.

Course Outcome:

Sl. No.	Description	Bloom's Taxonomy Level
1	Study fundamentals of image operations using MATLAB tool.	Knowledge, Understand (Level 1,Level 2
2	Understand about image transforms in spatial domain for image enhancement.	Knowledge, Understand (Level 1,Level 2)
3	Apply image transforms in frequency domain for image enhancement.	Understand, Apply (Level 2,Level 3)
4	Analyse the concepts of image restoration and color image processing techniques.	Analyse (Level 4)

MAPPING of Cos with Pos

	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	P10	Po11	Po12	Pso1	Pso2	Pso3
CO1	1	1	2	1								1		2	
CO2	1	2	2	3	3				1			1		2	
CO3	2	2	2	2	3				1			2		2	
CO4	1	2	3	2	3				1			2		2	
Strength of correlation : Low-1, Medium-2, High-3															

Text Books:

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

Reference Books:

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

Course Title	**Technical Writing skills**						
Course Code	**22 EIT607B**						
Category	Ability Enhancement Course / Skill Enhancement Course-V						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	02	00	00	00	02	15	1
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=50**		**Duration of SEE: 02 Hours**		

Course Objectives

Sl.No.	Description
1.	Understand the difference between technical writing with other forms of writing
2.	Study on report writing and proposal writing
3.	Knowledge on writing effective technical article.

Unit	Syllabus	No. of Hrs
1	Definition of technical writing? Difference between technical writing and other forms of writing. Qualities and qualifications of technical writers.	**3**
2	Roles and responsibilities of writers, editors/project managers.7 Cs of effective writing: Document formats – hard and soft copy versions designs. Principles of technical writing: styles in technical writing, clarity, precision, coherence and logical sequence in writing	**3**
3	Report Writing: Introduction, Importance of Reports ,Types of Reports, Writing Effective Reports :Report Formats , Structure of Formal Reports , Writing Strategies Proposal writing: Introduction, Types of Proposals: Non-Formal and Formal Proposals, Internal and External Proposals, Writing Effective Proposals: Structure of Formal Proposals, Writing Strategies.	**3**
4	Technical Article Writing : Introduction, Technical Articles versus General Articles, Types of Technical Articles: Journal Articles and Conference Papers, Review and Research Articles, Writing Effective Technical Articles: Structure of Technical Articles, Writing Strategies	**3**
5	Technical writing software tools: Microsoft word, Macro media robohelp, adobe frame maker, MS Visio, Powerpoint, Photoshop.	**3**

Course outcome:

Sl. No.	Description	Bloom's Taxonomy Level
1.	Demonstrate theoretical knowledge to create effective technical writing documents for end users	Knowledge, Understand (Level 1,Level 2)
2.	Apply and adapt flexible writing process strategies to produce clear and high-quality deliverables.	Understand, Apply (Level 2,Level 3)
3.	Use professional technical writing conventions for effective writing.	Knowledge, Understand (Level 1,Level 2)

	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	P10	Po11	Po12	Pso1	Pso2	Pso3
CO1								**3**		**3**					
CO2								**3**		**3**					
CO3								**3**		**3**					
CO4	1	2	3	2	3				1	2		2	1	3	
Strength of correlation: Low-1, Medium- 2, High-3															

Text Book:

1. Effective Technical writing - M Ashraf Rizvi I, 2nd edition, McGraw Hill Education (India) Private Limited, 2017

Reference Books:

1. Technical Writing Style - Dan Jones, Sam Dragga, Allyn & Bacon, Incorporated, 2019
2. Communication Skills by Sanjay Kumar and Pushp Lata**,** Oxford University Press-2018.

	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	P10	Po11	Po12	Pso1	Pso2	Pso3
CO1	3	2	2	1	3									1	
CO2	3	2	2	1	3									1	
CO3	3	2	2	1	3									1	
CO4	3	2	2	1	3									1	

Course Title	**Virtual Instrumentation Lab**						
Course Code	**22 EIL607C**						
Category	**Professional Core Course Laboratory (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**		

Course Objective:

Gaining skills at using LabVIEW software for instrument control, measurement, data acquisition and data handling.

Expt No	**Syllabus**
1	Basic operations, simple programming structure using LabVIEW. a. Basic arithmetic operations b. Boolean operations c. Sum of n numbers using for loop d. Sorting even numbers using while loop in an array
2	To explore the following programming tools in LabVIEW; a. Creating a Sub VI b. Working with Formula Nodes & Expression Nodes c. Working with Loops & CASE structures d. Usage of Charts and Graphs
3	To explore the following programming tools in LabVIEW; a. Shift Registers b. Arrays c. String handling d. File I/O
4	Design a VI for programmable Function Generator for the following functionalities. a. Waveform generating options for generating – Sine, Triangle, Saw tooth & Square Waveforms. b. Digital Display for Magnitude & Frequency c. Graphical chart for analog waveform.
5	Using VISA and serial communication, Design a VI for the following programmable Instrument with couple of LED indicators. **ASCII Command** / **Functionality** A – LED Indicator 1 - ON B – LED Indicator 1 – OFF C – LED Indicator 2 - ON D – LED Indicator 2 - OFF
6	To develop a VI to communicate with programmable Instruments using Ethernet.
7	To develop a VI to interface USB DAQ 6008 with LabVIEW and perform the following Operations: a. Analog Read

	b. Analog Write c. Digital Read d. Digital Write
8	Time domain and frequency domain measurement of Real-world signal using LabVIEW
9	Real Time Temperature measurement and Control using Virtual Instrumentation
10	Real time sequential control of bottle filling system
11	Design a real time batch processing using LabVIEW.
12	Design a PID controller using LabVIEW.

Course Outcomes: On completion of the course, students will be able to

CO1: Recognize the components of Virtual instrumentations and use them for PC Based Measurement.

CO2: Use and implement various types of structures used in LabVIEW.

CO3: Analyze and design different type of programs based on data acquisition.

CO4: Create a VI system to solve real time problems.

CO-PO MAPPING												
CO/PO	PO1	O2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	3	-	-	-	3	2	-	2
CO2	2	2	2	2	3	-	-	-	3	2	-	2
CO3	2	2	2	2	3	-	-	-	3	2	-	2
CO4	2	2	1	2	3	-	-	-	3	2	-	2

Course Title	**Robotics Lab**						
Course Code	**22 EIL607D**						
Category	**Professional Core Course Laboratory (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**		

Course Objective

The objective of the course is to enable students to

1. Understand robot configuration, structures, basic components, workspace and generations of robots.
2. Get acquainted with performing spatial transformations and solve kinematics of the robot
3. Get knowledge and analysis skills associated with trajectory planning
4. Learn about various sensors, actuators, robot programming

Expt No	**Syllabus**
1	Determination of maximum and minimum position of links.
2	Verification of transformation (Position and orientation) with respect to gripper and world coordinate system
3	Estimation of accuracy, repeatability and resolution.
4	Robot programming and simulation for pick and place
5	Robot programming and simulation for colour identification
6	Robot programming and simulation for Shape identification
7	Introduction to Robotic controller card like Arduino UNO board and write program to blink LED using Arduino instructions, C language & Assembly language.
8	Robot path planning
9	Interfacing drivers for Arduino Controller for Robotic application. Various sensor interfacing with Robotic Controller like Arduino UNO board
10	Motion control robot
11	Line following Robot
12	Obstacle avoidance robot

Course Outcome

Upon completion of this course the students will be able to

1. Demonstrate knowledge of industrial robots, characteristics, end effectors and actuators.

2. Apply spatial transformation to obtain forward and inverse kinematics

3. Solve robot dynamics problems, generate joint trajectory for path planning

4. Describe working principle of various sensors and program different operations

CO-PO MAPPING											
CO/PO	PO1	O2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	3	-	-	-	3	2	-	2
CO2	2	2	2	2	3	-	-	-	3	2	-	2
CO3	2	2	2	2	3	-	-	-	3	2	-	2
CO4	2	2	1	2	3	-	-	-	3	2	-	2

Text Books:

3. **Introduction to robotics,** Saeed B Niku, Prentice Hall of India, 2005.
4. **Robotics control sensing Vision and Intelligence**- K.S.Fu R.C.Gonzalez, C.S.G. Lee,McGraw Hill, 1987.

Reference Books:

5. **Industrial Robotics: Technology, Programming and Applications,** Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey and Ashish Dutta, 2nd Edition, Tata McGraw Hill, 2012.
6. **Robot Technology Fundamentals -** James G.Keramas, 1st Edition, Cengage learningPublishers, 1998
7. **Introduction to robotics** John J Craig third Edition pearson Education Inc., 2005
8. **Introduction to robotics** SK Saha Tata Mc Graw Hill **,** 2008

Course Title	**Robotics and Applications**						
Course Code	**22EIT604A**						
Category	**Professional Core Course Laboratory (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**		

Course Objectives:

The main objective of the course is to

1. Understand the generic technology and principles associated with robotics and automation systems.
2. Understand the principles and operations of different sensors used for robotic applications an robot programming and machine vision.
3. Understand the kinematics and motion planning aspects of robotic system.

Module No	**Syllabus**	**No of Teaching hours**
1	**Introduction :** robot definition, classification of robot, history, robot components, robot degrees of freedom, robot joints, coordinates, reference frames, asimov's laws of robotics, robot programming modes, characteristics, applications	**08**
2	**Sensors in Robotics:** Transducers and sensors, characteristics of sensors, sensors in robotics, tactile sensors, proximity and range sensors, uses of sensors in robotics, problems, actuators.	**06**
3	**Machine Vision**: Introduction to machine vision, sensing and digitizing function in machine vision, image processing and analysis, training the vision system, robotic applications, problems. Robot Programming: Methods of robot programming, lead -through programming methods, a robot program as a path in space, motion interpolation, wait, signal and delay commands, branching, capabilities and limitations of lead-through methods, problems.	**10**
4	**Robot kinematics :** Rotation matrix, homogenous transformation matrix, Denavit- Hartenberg convention, Euler angles RPY representation, Direct and inverse kinematics for industrial robots for position and orientation.	**08**

5	**Motion planning:** Introduction, path control modes General considerations on Trajectory planning, joint-interpolated Trajectories, linear path with parabolic blend, calculation of a 4-3-4 Joint trajectory Future applications: Characteristics of future robot tasks, future manufacturing applications of robot, hazardous and inaccessible non-manufacturing environment	**08**

Course outcomes:

At the end of this course the students is able to

Sl.No	Description	Description Bloom's Taxonomy Level
CO1	Demonstrate the technology and principles associated with robotics and automation systems	Knowledge, Understand (Level 1, Level 2)
CO2	Identify sensors, robotics vision, applications and also robot programming.	Knowledge, Understand (Level 1, Level 2)
CO3	Solve for various path planning techniques for different motions of robotic system.	Knowledge, Apply (Level 1, Level 3)
CO4	Apply robotics in industry for real world scenarios	Knowledge, Apply (Level 1, Level 3)

CO-PO Mapping

	Po1	Po2	Po3	Po4	Po5	Po6	Po7	Po8	Po9	P10	Po11	Po12	Pso1	Pso2	Pso3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	1	3	1
CO2	3	2	-	-	-	-	-	-	-	-	-	-	3	3	2
CO3	3	2	1	1	2	1	-	-	-	-	-	-	-	3	2
CO4	3	2	1	1	2	2	-	-	-	-	-	-	1	3	2
Strength of correlation: Low-1, Medium- 2, High-3															

Text Books:

1. **Introduction to robotics,** Saeed B Niku, Prentice Hall of India, 2nd edition 2011.
2. **Robotics control sensing Vision and Intelligence**- K.S.Fu, R.C.Gonzalez, C.S.G. Lee, McGraw Hill, 2nd edition 2018.
3. **A textbook on Industrial Robotics,** Ganesh S Hegde University science press, 3rd edition, 2017

Reference Books:

1. **Robot Technology Fundamentals -** James G.Keramas, 1st Edition, Cengage learning Publishers, 2009
2. **Industrial Robotics: Technology, Programming and Applications,** Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey and Ashish Dutta, 2nd Edition, Tata McGraw Hill, 2012.

1.

NPTEL course :

1. https://onlinecourses.nptel.ac.in/noc24_ee56/preview

2. https://onlinecourses.nptel.ac.in/noc23_me51/preview

Course Title	**Sensors and Actuators**						
Course Code	**22EIT604B**						
Category	Open Elective Course **(OEC)**						
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 the course is to:

1. Impart the principles and working modes of various types of Resistive, Inductive, Capacitive, Piezoelectric and Special transducers.
2. Give an idea about the applications of various transducers and selection criteria of a transducer for a particular application.
3. Give an insight into the static and dynamic characteristics of different orders of instruments.
4. Explain the working principles and functions of different actuating systems

Module No	Syllabus	No. of teaching Hours
1	**Introduction to sensors and Application:** its significance and scope in the current scenario. Industrial applications, research and innovations related to sensors. **Transducers**: Definition of a transducer, Block Diagram, Active and Passive Transducers, Advantages of Electrical transducers. Resistive Transducers: Potentiometers: Characteristics, Loading effect, and problems. Strain gauge: Theory, Types, applications and problems. Thermistor, RTD: Theory, Applications and Problems.	**8**
2	**Sensor Systems:** Measurement of thermocouple output, compensating circuits, lead compensation, advantages and disadvantages of thermocouple. LVDT: Characteristics, Practical applications and problems. Capacitive Transducers: Capacitive transducers using change in area of plates, distance between plates and change of dielectric constants, Applications of Capacitive Transducers and problems.	**8**
3	**Piezoelectric Sensor Systems:** Principles of operation, expression for output voltage, Piezo-electric materials, equivalent circuit, loading effect, and Problems. **Smart, MEMS, and Nano Sensors:** Thin film sensors, and smart transducers: Principles and applications, Introduction to MEMS Sensors and Nano Sensors, Schematic of the design of sensor, applications.	**8**
4	**Sensors in Different Application Area:** Occupancy and Motion Detectors; Position, Displacement, and Level; Velocity and Acceleration, Proximity Sensors, Ultrasonic and Infrared Sensors for Distance and Motion Detection, Fluid Level Sensors	**8**

5	**Actuators:** Pneumatic Hydraulic system: Control valves, cylinder, rotary actuators, Mechanical actuating system: Types of Motion, Kinematics chains, Cams, Gear trains, Belts and chain drives, Electrical actuating systems: Solid-state switches, Solenoids, D.C. motors, AC motors, Stepper motors, Piezoelectric actuator, micro-actuators.	**8**

Course Outcome

At the end of the course, Students can able to

Sl.No.	Description	Bloom's Taxonomy Level
5.	Remember and understand the basic principles of transducers and smart sensors.	Remember, Understand (Level 1, Level 2)
6.	Apply the knowledge of transducers and sensors to comprehend digital instrumentation systems.	Apply (Level 3)
7.	Analyze performance of different sensors for various applications.	Analyze (Level 4)
8.	Identify and analyze different types of actuators and motion systems	Analyze (Level 4)

CO-PO Mapping

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

Text Books:

1. A.K. Sawhney "Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai and Sons, 18th Edition, 2008, ISBN 81-7700-016-0.
2. Clarence W.de Silva, "Sensor systems: Fundamentals and applications" CRC Press, 2016 Edition, ISBN 9781498716246.
3. D.V.S. Murthy "Transducers and Instrumentation", PHI Publication, 2nd Edition 2008, ISBN 978-81-203-3569-1.
4. Sensors And Actuators: Control System Instrumentation by Clarence W. De Silva Publisher

Reference Books:

1. Arun K. Ghosh, "Introduction to Measurement and Instrumentation", PHI 3rd Edition, 2009, ISBN: 978-81-203-3858-6.