Dr Ambedkar Institute of Technology, Bengaluru-56

Department of Electronics and Instrumentation Engineering

Scheme and Syllabus - CBCS – 2021 -2022 Regulation

Academic Year 2024-25

Seventh and Eighth Semester Syllabus

Dr. Ambedkar Institute of Technology, Bangalore-56
Outcome Based Education (OBE) and Choice Based Credit System (CBCS) (As per NIP 2020)
Name of the Programme: Electronics and Instrumentation Engineering
Tentative Scheme (2021 Scheme) of Teaching and Examination Effective from the Academic Year 2024-25

VII Semester

Sl No.	Course Category	Course Code	Course Title	Teaching Department	Teaching Hours / Week					Examinations				Credits
					L	T	P	S	Total	Duration (Hrs)	CIE Marks	SEE Marks	Total Marks	
1	PCC	21EIT701	Industrial Data Communication	EIE	3	0	0	0	3	3	50	50	100	3
2	PCC	21EIT702	Optical Instrumentation & Applications	EIE	2	0	0	0	2	2	50	50	50	2
3	PEC	21EIT703x	Professional Elective Course - II	EIE	3	0	0	0	3	3	50	50	100	3
4	PEC	21EIT704x	Professional Elective Course – III	EIE	3	0	0	0	3	3	50	50	100	3
5	OEC	21EIT705x	Open Elective - II	Concern Department	3	0	0	0	3	3	50	50	100	3
6	PROJECT	21EIP706	Project Work	EIE	2 Contact Hours / Week interaction between faculty and students					3	100	100	200	10
									Total	-	350	350	700	24

Note:
PCC: Professional Core Course, **PEC:** Professional Elective Courses, **OEC**: Open Elective Course, **AEC:** Ability Enhancement Courses.
L – Lecture, **T** – Tutorial, **P** - Practical / Drawing, **S** – Self Study Component, **CIE:** Continuous Internal Evaluation, **SEE:** Semester End Examination.

PROJECT WORK (21XXP706): The objective of the Project work is

1) To encourage independent learning and the innovative attitude of the students.
2) To develop interactive attitude, communication skills, organization, time management, and presentation skills.
3) To impart flexibility and adaptability.
4) To inspire team working.
5) To expand intellectual capacity, credibility, judgment and intuition.
6) To adhere to punctuality, setting and meeting deadlines.
7) To install responsibilities to oneself and others.
8) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty

Professional Elective Courses - II		Professional Elective Courses - III		Open Elective Courses - II	
Course Code	**Course Title**	**Course Code**	**Course Title**	**Course Code**	**Course Title**
21**EI**T7031	Analytical Instrumentation	21**EI**T7041	Aircraft Instrumentation	21**EI**T7051	Air Craft Instrumentation
21**EI**T7032	Robotics and Automation	21**EI**T7042	Advanced Control System	21**EI**T7052	Robotics and Applications
21**EI**T7033	Augmented Reality	21**EI**T7043	VLSI Design	21**EI**T7053	
21**EI**T7034	Artificial Intelligence in Industrial Automation	21**EI**T7044	Power Plant Instrumentation	21**EI**T7054	

members of the Department, one of whom shall be the Guide.

2) The CIE marks awarded for the project work shall be based on the evaluation of project work 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.
3) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work shall be based on the evaluation of project work 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.
4) SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the ratio 50:25:25.

Note: VII and VIII semesters of IV year of the programme

(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.

Dr. Ambedkar Institute of Technology, Bangalore-56
Outcome Based Education (OBE) and Choice Based Credit System (CBCS) (Asper NEP 2020)
Name of the Programme: Electronics and Instrumentation Engineering
Tentative Scheme (2021 scheme) of Teaching and Examination Effective from the Academic Year 2024-25

VIII Semester

Sl No.	Course Category	Course Code	Course Title	Teaching Department (TD)/ Paper setting Board(PSB)	Teaching Hours / Week					Examinations				Credits
					L	T	P	S	Total	Duration (Hrs)	CIE Marks	SEE Marks	Total Marks	
1	Seminar	21EIS801	Technical Seminar	EIE	One Contact hour/ week for interaction between the faculty and students					-	100	-	100	1
2	Internship	21EII802	Research Internship/ Industry Internship		Two contact hours /week for interaction between the faculty and students.					03 (Batch wise)	100	100	200	15
3	NCMC	21CDN803	National Service Scheme (NSS)	NSS	Completed during the intervening period of III semester to VIII semester.					-	50	50	100	PP/NP
									Total	-	250	150	400	16

TECHNICAL SEMINAR (21XXS801):

The objective of the seminar is to inculcate self-learning, present the seminar topic confidently, enhance communication skill, involve in group discussion for exchange of ideas. Each student, under the guidance of a Faculty, shall choose, preferably, a recent topic of his/her interest relevant to the programme of Specialization.

(i) Carry out literature surveys, systematically organize the content.
(ii) Prepare the report with your own sentences, avoiding a cut and paste act.
(iii) Type the matter to acquaint yourself with the use of Microsoft equation and drawing tools or any such facilities.
(iv) Present the seminar topic orally and/or through PowerPoint slides.
(v) Answer the queries and involve in debate/discussion.
(vi) Submit a typed report with a list of references.
(vii) The participants shall take part in the discussion to foster a friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Evaluation Procedure:

The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question and answer session, and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three teachers from the department with the senior-most acting as the Chairman.

Marks distribution for CIE of the course:

Seminar Report: 50 marks, Presentation skill: 25 marks
Question and Answer: 25 marks. **No SEE component for Technical Seminar**

Non – credit mandatory courses (NCMC):
National Service Scheme/Physical Education (Sport and Athletics) / Yoga:

1) Securing 40% or more in CIE, 35 % or more marks in SEE and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.
2) In case, students fail to secure 35 % marks in SEE, they have to appear for SEE during the subsequent examinations conducted by the University.
3) In case, any student fails to register for NSS, PE or Yoga/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements subsequently to earn the qualifying CIE marks subject to the maximum program period.
4) Successful completion of the course shall be indicated as pass (PP) in the grade card. Non-completion of the course (NP) shall be indicated as Unsatisfactory.
5) These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

Course Title	**Industrial Data Communication**						
Course Code	**21EIT701**						
Category	**Professional Core Courses (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

This course is designed to

Sl.no	Description
1	Understand the role of standards and protocols
2	Understand the principles of communication standards
3	To know the protocol used in communication systems.
4	Understand the principles of communication systems for industrial applications

Unit		No. of Hrs
1	**Introduction:** History, Standards, OSI model, Protocols, Physical Standards, Modern Instrumentation and Control systems. Communication principles, communication modes, Asynchronous systems, synchronous systems, Error detection, transmission characteristics.	8
2	**Serial communication standards**: standards organizations, serial data communication standards, balanced and unbalanced transmission lines, RS-232 interface standard, troubleshooting a serial data communications circuits, RS- 422 standard, RS-485 standard, troubleshooting and testing with RS 485, comparison of EIA interface standards, GPIB, USB	8
3	**Introduction to protocols:** binary synchronous control (BSC) protocol, HDLC, SDLC, file transfer protocol, data communications for instrumentation and control	8
4	**Industrial protocols:** Introduction, ASCII based protocols, MODBUS –RTU protocol, Token ring network ,Daisy chain, Industrial Ethernet	8
5	**HART protocol:** Introduction, HART, Physical layer, Data link Layer, Application Layer **Field bus and Net systems**: Introduction AS-I, CAN bus, Device Net Profibus, Foundation field bus, FIP	8

Course outcome:

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

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

Sl.No	Description	Description Bloom's Taxonomy Level
CO1	Understand the role of standards and protocols	Understand(Level 2)
CO2	Apply the principles of communication standards in communication systems	Understand, Apply (Level 2, Level 3)
CO3	Understand the different protocols used in industry.	Understand(Level 2)
CO4	Use of protocol in different industries.	Understand, Apply (Level 2, Level 3)
CO5	Apply the standards of industrial protocol in the different communication system.	Understand, Apply (Level 2, Level 3)

CO-PO MAPPING														
CO/PO	**Po1**	**Po2**	**Po3**	**Po4**	**Po5**	**Po6**	**Po7**	**Po8**	**Po9**	**Po10**	**Po11**	**Po12**	**Pso1**	**Pso2**	**Pso3**
Co1	2											1			
Co2	2											1			
Co3	2	2										1		1	
Co4	2	2										1		2	
Co5	2	2										1		2	

TEXT BOOKS:

1. Practical Data Communications for Instrumentation and Control John Park, Steve Mackay, Edwin Wright 1 st Edition 2003

REFERENCE BOOKS:

1. Real time control network Daniel T Miklovic, , ISA 1993.
2. Process software and digital networks Bela G Liptak, , 3 rd edition, 2002.
3. Computer Networks Andrew S. Tanenbaum, , 4 th Edition, PHI/Pearson Education. 2002.
4. Data Communications and Networking Behrouz A. Forouzan, , 2 nd update Edition, Tata McGraw Hill Publishing Company, New Delhi, 2000.
5. Computer Networks and Internets Douglas E. Comer, 2 nd Edition, Pearson Education Asia, 5 th Indian reprint, 2001.

Course Title	**Optical Instrumentation & Applications**						
Course Code	**21EIT702**						
Category	**Professional Core Course (PEC)**						
Scheme and Credits	No. of Hours/Week					Total teaching hours	Credits
	L	T	P	SS	Total		
	02	00	00	00	02	26	02
CIE Marks: 50	**SEE Marks: 50**		**Total Max. marks=100**		**Duration of SEE: 03 Hours**		

Course Objectives

This course is designed to

Sl.no	Description
1	To introduce the fundamental concepts of Lasers, optical Fibers and their applications in the field of Instrumentation.
2	To understand the various laser applications and optical laser system.
3	To understand the concepts of different optical fiber sensors like optic gyroscope, rotation sensors, polarimetric sensors.
4	To use different fiber optic laser system in medical application

Unit		No. of Hrs
1	**LASER TYPES AND CHARACTERISTICS:** Principles, classification, construction of Ruby, He-Ne, Nd-YAG, semiconductor, Argon and Carbon dioxide lasers	5
2	**LASER APPLICATIONS:** Measurement of distance - Interferometric methods, beam modulation telemetry, pulse echo techniques.	5
3	**INTRODUCTION TO OPTICAL FIBERS**: light Modulation schemes, optical fibers, intermodal dispersion, graded index fiber, low dispersive fibers Fiber losses,	5
4	**OPTICAL FIBER SENSORS**: Introduction, Passive multimode fiber optic sensors, active fiber optic sensor, Fiber optic gyroscope, Polarization of light, current measurement by single-mode optical fiber sensors, fluro-optic temperature sensors,	5
5	**APPLICATIONS OF FIBER OPTIC LASER SYSTEMS IN MEDICINE:** Introduction, Fiberoptic laser systems in cardiovascular disease, Fiberoptic laser therapy in Angioplasty and Cardiology- Lasers in Neurosurgery, Endoscopic Nd:YAG Laser therapy in gastroenterology,	6

Course outcome:

Sl.No	Description	Description Bloom's Taxonomy Level
CO1	To understanding the principles, characteristics and construction of various types of Lasers.	Understand(Level 2)
CO2	To apply the basic engineering principles in understanding different type of Laser Applications.	Understand, Apply (Level 2, Level 3)
CO3	To analyze the working of different modulation schemes in optical fibers.	Analyze (Level 4)
CO4	To realize the working of optical fibre sensors and detectors for measurement of various parameters	Apply (Level 3)
CO5	To analyze the use of laser optic fiber system for a medical applications	Analyze (Level 4)

CO-PO MAPPING															
CO/PO	**Po1**	**Po2**	**Po3**	**Po4**	**Po5**	**Po6**	**Po7**	**Po8**	**Po9**	**Po10**	**Po11**	**Po12**	**Pso1**	**Pso2**	**Pso3**
Co1	2														
Co2	2	2											2		
Co3	2	2											2		
Co4	2	2											2		

TEXT BOOKS:

1. Optoelectronics: An Introduction - Wilson and Hawkes, 2nd Edition, Prentice-Hall of India, 2003.
2. Optoelectronics and Fiber Optics Communication – C.K.Sarkar and D.C. Sarkar, New Age Int. Pub., 2004.
3. Lasers and Optical Fibers in Medicine - by Abraham Katzir, Academic Press, 1998.

REFERENCE BOOKS:

1. Essentials of Opto Electronics with Applications - A.J. Rogers, CRC press 1997.
2. Principles of optical communication & opto Electronics - I. Ravi Kumar, Bala N.Saraswathi, Lakshmi Publications 2nd edition 2007.
3. Optoelectronic Devices and systems - Guptha, Prentice Hall of India 2005.

Course Title	**Analytical Instrumentation**						
Course Code	**21EIT7031**						
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.

Unit 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 Hours**
2	**frared Spectroscopy:** Basic Components of IR Spectrophotometers, Type of Infrared Spectrophotometers, Sample Handling Techniques. **ame 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 Hours**
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 Hours**
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 Hours**
5	**Chromatographic Techniques:** classifications Chromatography behaviour of solutes column efficiency and band broadening column performance gas and liquid chromatography Gas chromatograph- basic concepts, parts of gas	**08 Hours**

	chromatograph. Method of peak areas, liquid chromatography- basic concepts, types of liquid chromatography, the liquid chromatography.	

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															

Course Title	**Robotics and Automation**						
Course Code	**21EIT7032**						
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 Hours**
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.	**08 Hours**
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.	**08 Hours**
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 Hours**
5	**Motion planning:** Introduction, General considerations on Trajectory planning, joint-interpolated Trajectories, calculation of a 4-3-4 Joint trajectory, Cubic Spline Trajectory.	**08 Hours**

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)

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

Reference Books:

1. **Robot Technology Fundamentals -** James G.Keramas, 1st Edition, Cengage learningPublishers, 1998
2. **Introduction to robotics** John J Craig third Edition pearson Education Inc., 2005
3. **Introduction to robotics** SK Saha Tata Mc Graw Hill **,** 2008

Course Title	**Augmented Reality**						
Course Code	**21EIT7033**						
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 importance of augmented reality in Industry 4.0 with real-time examples
2. To describe the history and recent developments of AR
3. To provide the need on emerging technologies AR
4. To discuss the revolution and impact of AR
5. To understand the applications of AR

Unit	Topics	No. of Hrs
1	**Introduction to Augmented Reality**: History of AR - Augmented reality characteristics – Difference between Augmented Reality and Virtual Reality – AR technological components – Technologies used in AR– Feature Extraction – Hardware components – AR devices – Importance of AR - Real world uses of AR – AR types – Software tools available for AR	**9**
2	**Need of technologies for Augmented Reality:** Hardware technology – virtual scenes – 3D objects – AR components – Display – HMD – Eyeglasses – Contact Lenses – significance of AR – AR powered devices – AR application development drawbacks – Compatibility – Performance	**9**
3	**Technology Integration and Implementation of AR:** Technology use and integration in industrial settings – Assistive training to faculty members – Planning and administration for implementation – AR implications – Practical data – AR labs – Platforms to form AR content – Coordinated utilization of AR applications.	**8**
4	**Tools and Applications of Augmented Reality:** Tools available for Augmented Reality and Recognition – Software Tools – Google Poly – Unity – software approaches – recognition types – native software solutions – ARKit – ARCore – software development kit -Cloud services	**8**
5	**Applications**: AR business applications – weather prediction – market prediction – smart cities - AR application for Education - AR application for Healthcare sector – Agriculture – Civil Engineering – Architecture – Archaeology – Crime and Security	**6**

Course outcome:

At the end of the course, Students can able to

1. Know Augmented Reality, the tool of Industry 4.0
2. Understand history and recent developments of AR

3. Learn technological components needed for AR
4. know the importance of augmented reality in Industry 4.0 with real-time example

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

Text Book:

1. Kaliraj P, Devi T, (2021). Innovating with Augmented Reality: Applications in Education and Industry (P. Kaliraj, Ed.) (1st ed.). Auerbach Publications. https://doi.org/10.1201/9781003175896

Online sources:

1. NPTEL Course https://onlinecourses.swayam2.ac.in/ntr24_ed76/preview
2. MOOC Courses:
   https://www.coursera.org/learn/ar
   https://www.udemy.com/share/101XPi/
   https://www.udemy.com/course/augmented-reality-in-depth-101-by-debayandey-

Reference Books:

1. Reference Books: 1. Schmalstieg, D., Höllerer, T., (2016), "Augmented Reality: Principles & Practice," Pearson, ISBN: 9789332578494
2. Craig, A. B., (2013), "Understanding Augmented Reality, Concepts and Applications," Morgan Kaufmann, ISBN: 978024082408
3. Alan B. Craig, "Understanding Augmented Reality", Concepts and Applications, Morgan Kaufmann,1st Edition, 2013 ISBN: 9780240824086

Course Title			**Artificial intelligence in Industrial Automation**				
Course Code			**21EIT7034**				
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 students will be able to:

Sl.no	Description
1.	To understand the role of logic in artificial intelligence.
2.	Study the concepts of Artificial Intelligence.
3.	Learn the methods of solving problems using Artificial Intelligence.
4.	Apply the concepts of AI to attain industrial automation

Unit No	**Syllabus**	**No of Teaching hours**
1	**MODULE- I** : Introduction to AI , foundation of AI and history of AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation.	**08 Hours**
2	**MODULE-II** : Searching- Searching for solutions, uniformed search strategies – Breadth first search, depth first Search. Search with partial information (Heuristic search) Hill climbing, Problem reduction, Game Playing-Adversial search, Games, mini-max algorithm, optimal decisions in multiplayer games, Problem in Game playing, Alpha-Beta pruning, Evaluation functions.	**08 Hours**
3	**MODULE-III**: Knowledge representation issues, predicate logic- logic programming, semantic nets- frames and inheritance, constraint propagation, representing knowledge using rules, rules-based deduction systems. Reasoning under uncertainty, review of probability, Baye's probabilistic interferences .	**08 Hours**
4	**MODULE- IV**: First order logic. Inference in first order logic, propositional vs. first order inference, unification & lifts forward chaining, Backward chaining, Resolution, learning from observation Inductive learning, Decision trees, Explanation based learning, Statistical Learning methods, Reinforcement Learning	**08 Hours**
5	**ODULE- V:** Expert systems -Expert systems – Architecture of expert systems, Roles of expert systems –Knowledge Acquisition – Meta knowledge, Heuristics. Typical expert systems – MYCIN, DART, XOON. **dustrial AI applications and Case studies -** Applications of Industrial AI in	**08 Hours**

	Monitoring, optimization and control.AI applications in Industry Automation using natural language processing-computer vision-speech recognition-computer vision.	

Course Outcome:

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

Sl.no	Description	Description Bloom's Taxonomy Level
CO1	Understand basic AI algorithms	Knowledge, Understand (Level 1, Level 2)
CO2	Identify appropriate AI methods to solve a given problem.	Knowledge, Understand (Level 1, Level 2)
CO3	Acquire knowledge about AI/ ML/DL techniques in Industrial automation.	Knowledge, Acquired (Level 1, Level 3)
CO4	Analyse the levels of automation	Analyze (Level 4)

Text Books

1. Rich and Knight, "Artificial Intelligence", 3rd Edition, Tata McGraw Hill, 2014.
2. M.P.Groover,"Automation, Production Systems and Computer Integrated Manufacturing", 5th edition, Pearson Education, 2009.

Reference Books

1. Artificial Intelligence Engines: A Tutorial Introduction to the Mathematics of Deep Learning by James V Stone, Sebtel Press, 2019.
2. Artificial Intelligence by Example: Acquire advanced AI, machine learning, and deep learning design skills by Denis Rothman, 2nd Edition, 2020.
3. Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
4. Ethem Alpaydin, Introduction to Machine Learning, MIT Press, Prentice Hall of India, 2021.

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

Course Title	**Aircraft Instrumentation**						
Course Code	**21EIT7041**						
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

This course is designed to

Sl.no	**Description**
1	Understand qualitative and quantitative displays of an aircraft.
2	Gain knowledge on air data instruments and how they are incorporated in an aircraft.
3	Develop the knowledge of safety aspects of an aircraft such as warning systems.
4	Learn more about gyroscope and its related flight instruments.
5	Provide better view of engine instruments and ways to improve its efficiency.

Unit		**No. of Hrs**
1	**AIRCRAFT INSTRUMENTS:** Introduction-Qualitative and quantitative displays, basic T grouping of instruments, basics of Attitude Director Indicator (ADI) & Horizontal Situation Indicator, flight deck of modern aircraft, glass cockpit. **AIR DATA INSTRUMENTS**: pneumatic type and air data computers, International Standard Atmosphere (ISA), basic pneumatic air data system, combined pitot-static probe, separate static probe, air speed indicator, altimeters and instantaneous vertical speed indicator.	**8**
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..	**8**
3	**GYROSCOPIC FLIGHT INSTRUMENTS:** Types of gyros-Conventional Mechanical spinning wheel , Vibrating gyro, Ring laser gyros, Fiber optic gyros, basic mechanical gyro and its properties, Gyro horizon, Turn and bank indicator, Gyro stabilized direction indicating systems.	**8**
4	**ENGINE INSTRUMENTS:** Introduction, Engine Speed measurement- Electrical Tacho Generator, Optical Tachometer, Hall Effect sensor, torque measurement- Hydro mechanical Transducer, Electronic Torque Meter, Pressure measurement (EPRI), Temperature measurement (EGT), Vibration measurement.	**8**

5	**ENGINE FUEL INDICATORS:** Fuel quantity indicator(FQI)- volumetric FQI, Densitometer, Fuel flow rate Indicator- Rotating vane flow meter, Integrated flow meter. **AIRCRAFT SAFETY:** Introduction, Stall Warning System, Ground Proximity Warning System, Traffic collision avoidance	**8**

Course outcome:

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

Sl.No	Description	Description Bloom's Taxonomy Level
CO1	Understand the concept of different types of instrument, displays and indicators.	Understand(Level 2)
CO2	Appraise the elements of Aircraft Instrumentation and Integration of the system to meet the control Navigation and operational requirements of the Aircrafts	Understand, Apply (Level 2, Level 3)
CO3	Evaluate the performance of Aircraft control system and interpret the results.	Analyze (Level 4)
CO4	Analyze the working of Engine and fuel instruments in aircraft.	Analyze (Level 4)
CO5	Interpreted Case Studies with the theory learnt and hence develop a system concept operational in latest aircraft instrumentation.	Analyze (Level 4)

CO-PO MAPPING														
CO/PO	**Po1**	**Po2**	**Po3**	**Po4**	**Po5**	**Po6**	**Po7**	**Po8**	**Po9**	**Po10**	**Po11**	**Po12**	**Pso1**	**Pso2**	**Pso3**
Co1	2											1			
Co2	2	2			2							1	2		
Co3	2	2										1	2	1	
Co4	2	2			2							1	2	2	

TEXT BOOKS:

1. Aircraft Instruments and Integrated Systems- EHJ Pallet, Longman Scientific & Technical, McGraw-Hill, 1992.
2. Aircraft Instrumentation and Systems- S.Nagabhushana , L.K Sudha, I.K.International Publishing House Pvt.Ltd. 2010.

REFERENCE BOOKS:

1. Aircraft Instruments- C A WilliamsGalgotia Publications, New Delhi, 1973
2. Aircraft Propulsion- Bhaskar Roy, Elsevier publications, New Delhi., 2011

Course Title	**Advanced Control System**						
Course Code	**21EIT7042**						
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

Unit 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	**08Hours**
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).	**07 Hours**
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.	**08Hours**
4	**State observer**: Introduction to state observer, Full order to state observer, Dual problem, Necessary & sufficient condition for state observation ,Effects 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 Hours**
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 Hours**

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)

CO-PO MAPPING												
CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
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

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 outcomes:**

Course Title	**VLSI Design**						
Course Code	**21EIT7043**						
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 VLSI design Process, Advantages & Applications of VLSI technology.
2. Analyze the performance of MOS/CMOS transistors, transistor in logic components and their interconnect.
3. To implement the stick diagram, schematic of CMOS logic, specific layout rules in the placement and Routing of transistors and interconnect.
4. Design combinational, sequential logic, Memory cells at the transistor level, functional units.

Unit No	Syllabus	No of Teaching hours
1	**Introduction**: overview of VLSI design methodologies-VLSI design flow-Design Hierarchy- concepts of regularity, modularity, and locality-VLSI Design styles-Design quality-computer aided design technology. **Fabrication of MOSFETS**-fabrication process flow-Basic steps-layout design rules-CMOS n well process-full-custom mask layout design.	**08**
2	**MOS Transistor Theory**: n MOS / p MOS transistor, threshold voltage equation, body effect, latch up, MOS device design equation, sub threshold region, Channel length modulation. mobility variation, Tunneling, punch through, hot electron effect MOS models, CMOS inverter, ßn / ßp ratio, noise margin, staticload MOS inverters.	**08**
3	**CMOS Process Technology**: Lambda Based Design rules, scaling factor, semiconductor Technology overview, basic CMOS technology, p well / n well / twin well process. Circuit elements, resistor, capacitor, interconnects, sheet resistance & standard unit capacitance concepts delay unit time, inverter delays, driving capacitive loads, propagate delays, MOS mask layer, stick diagram, design rules and layout, symbolic diagram,	**08**
4	**Combinational and sequential MOS logic circuits:** MOS logic circuits with depletion nMOS loads, CMOS logic circuits, CMOS transmission Gate, Behavior of Bistable Elements, SR Latch Circuit, Clocked Latch and Flipflop Circuits, CMOS D latch and Edge Triggered Flip Flop**.**	**08**
5	**Dynamic CMOS circuit Techniques**: CMOS transmission gate logic-dynamic CMOS (precharge evaluate logic, Domino CMOS logic **Semiconductor memories:** equivalent circuits of memory cells, DRAM cells –configurations, three-transistor and one-transistor, flash memory, ferroelectric Random-access memory.	**08**

Sl.No	Course outcomes	Bloom's Taxonomy Level
1	Explain the VLSI design flow, characteristics and fabrication process of MOS transistors.	**Knowledge, understand (Level-1, Level-2)**
2	Understand the performance of MOS/CMOS transistors ,circuit analysis models, including logic components and their interconnect	**Knowledge, Understand (Level-1, Level-2)**
3	Apply MOS technology specific layout rules in the placement and Routing of transistorsand interconnect, and to verify the functionality.	**Understand, Apply (Level-2, Level-3)**
4	To Analyse combinational, sequential logic, memory cells at the transistor level.	**Understand, Analyse (Level-2, Level-4)**

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

TEXT BOOK

1. Sung Mo Kang &YosufLederabic Law, "CMOS Digital Integrated Circuits: Analysis and Design", McGraw-Hill (ThirdEdition)
2. Neil Weste and K. Eshragian, "Principles of CMOS VLSI Design:A System Perspective," 2ndedition, Pearson Education (Asia) Pvt.. Ltd., 2000.

REFERENCE BOOKS:

1. Douglas A Pucknell& Kamran Eshragian ,"Basic VLSI Design" PHI 3rdEdition (originalEdition – 1994)
2. LSI Technology- 2nd Edition, S.M .Size, Tata Mcgraw Hill.

Course Title	**Power Plant Instrumentation**						
Course Code	**21EIT7044**						
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. Explain the operation traditional power plants and describe the instruments that make up their measurement and control systems
2. Analyze the various instruments used in power plant control systems and make recommendations for improving the control processes
3. Explain the environmental impact of electricity generation and show how adequate control processes may reduce or eliminate these impacts

Unit No	Syllabus	No of Teaching hours
1	**Overview Of Power Generation :**Survey of methods of power generation hydro, thermal, nuclear, solar and wind power Importance of instrumentation in power generation Thermal power plant Building blocks Combined Cycle System Combined Heat and Power System	**08 Hours**
2	**Measurements In Power Plants:** Measurement of feed water flow, air flow, steam flow and coal flow, Drum level measurement, Steam pressure and temperature measurement Turbine speed and vibration measurement, Flue gas analyzer , Fuel composition analyzer.	**08 Hours**
3	**Hydroelectric Power Plant-** Site selection, Hydrology, Estimation electric power to be developed, classification of Hydropower plants, Types of Turbines for hydroelectric power plant, pumped storage plants, storage reservoir plants.	**08 Hours**
4	**Boiler Control:** Combustion of fuel and excess air, Firing rate demand Steam temperature control, Control of deaerator , Drum level control Single, two and three element control, Furnace draft control ,implosion flue gas dew point control ,Trimming of combustion air.	**08 Hours**
5	**Solar Energy:** solar resource, solar energy conversion systems: Solar PV technology: Block diagram of PV system, advantages and limitations. Solar thermal energy system: Principle, solar collector and its types, solar concentrator and its types, safety. Nuclear Power Plant: Nuclear power generation, control station and reactor control	**08 Hours**

Course Outcomes:

After completion of this course the student is able to:

1. Explain the operation traditional power plants and describe the instruments that make up their measurement and control systems
2. Analyze the various instruments used in power plant control systems and make recommendations for improving the control processes
3. Explain the environmental impact of electricity generation and show how adequate control processes may reduce or eliminate these impacts

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**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**2**	
CO2	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**2**	
CO3	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**3**	
CO4	**2**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**1**	**2**	

Text Books:

1. Boiler Control Systems Engineering, by G.F. Gilman, 2005, ISA Publication
2. Power plant engineering, P.K.Nag, 3rd edition, 2010. McGraw Hill.

Reference Books:

1. "Power Plant Engg.", Domkundwar 5th Edition Arora, Domkundwar,1990,Dhanpat Rai & Co.1990
2. "Non-conventional energy resources", by B. H. Khan, McGraw Hill, New Delhi, 2009
3. "Renewable energy Technologyî, Chetan Singh Solanki, Prentice Hall Publication 2011