RAMAIAH
Institute of Technology

CURRICULUM
Outcome Based Education
(Effective from the Academic Year 2025– 2026)
Batch-2022

DEPARTMENT OF
ELECTRONICS AND INSTRUMENTATION ENGINEERING

VII & VIII Semester B. E.

RAMAIAH INSTITUTE OF TECHNOLOGY
(Autonomous Institute, Affiliated to VTU)
BANGALORE – 54

About the Institute:

Dr. M. S. Ramaiah a philanthropist, founded 'Gokula Education Foundation' in 1962 with an objective of serving the society. M S Ramaiah Institute of Technology (MSRIT) was established under the aegis of this foundation in the same year, creating a landmark in technical education in India. MSRIT offers 18 UG programs and 15 PG programs. All these programs are approved by AICTE. All eligible UG and PG programs are accredited by National Board of Accreditation (NBA). The institute is accredited with 'A+' grade by NAAC in March 2021 for 5 years. University Grants Commission (UGC) & Visvesvaraya Technological University (VTU) have conferred Autonomous Status to MSRIT for both UG and PG Programs since 2007. The institute has also been conferred autonomous status for Ph.D. program since 2021. The institute is a participant to the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. The institute has 380 competent faculty out of which 70% are doctorates. Some of the distinguished features of MSRIT are: State of the art laboratories, individual computing facility for all faculty members, all research departments active with sponsored funded projects and more than 300 scholars pursuing Ph.D. To promote research culture, the institute has established Centre of Excellence for Imaging Technologies, Centre for Advanced Materials Technology, Centre for Antennas and Radio Frequency systems (CARFS), Center for Cyber Physical Systems, Schneider Centre of Excellence & Centre for Bio and Energy Materials Innovation.

The Entrepreneurship Development Cell (EDC) and "Ramaiah Evolute" have been set up on campus to incubate startups. MSRIT has a strong Placement and Training department with a committed team, a good Mentoring/Proctorial system, a fully equipped Sports department, large air-conditioned library with good collection of book volumes and subscription to International and National Journals. The Digital Library subscribes to online e-journals from Elsevier Science Direct, IEEE, Taylor & Francis, Springer Link, etc. The Institute is a member of DELNET, CMTI and VTU E-Library Consortium. The Institute has a modern auditorium, recording studio, and several hi-tech conference halls with video conferencing facilities. The institute has excellent hostel facilities for boys and girls. MSRIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association.

As per the National Institutional Ranking Framework (NIRF), MoE, Government of India, M S Ramaiah Institute of Technology has achieved 75th rank among 1584 top Engineering Institutions & 31st Rank among 131 Schools of Architecture in India for the year 2025.

About the Department:

The Department was established in the year 1992 as Instrumentation Technology and was renamed as Electronics and Instrumentation Engineering (EIE) in the year 2014 by VTU. The department offers UG course which is recognized by AICTE and accredited by NBA, four times. The department is recognized as a Research Centre by VTU, Belagavi and offers Ph.D and MSc.(Engg.) by research programs. All the faculty members are doctorates and are actively engaged in R&D activities. The department is focused on empowering the students with technical knowledge and practical skills in the areas of Instrumentation Technology and Industrial Automation System in line with Industry 4.0. The department is equipped with modern laboratories including Allen Bradley PLCs, SCADA from Schneider Electric, Ocean Optics Optical Spectrometer and research software such as Neuroshell predictor and classifier to name a few.

The course and curriculum is basically multi-disciplinary in nature and revolves around electronics, computers and embedded systems. The focus is on the design and control of automated systems. In line with Industry 4.0 standards, the department is also focused on offering courses on automation, bridging the gap between academia and industries. The emphasis is on hands on training with PLCs, SCADA, Robotics, Automation and IoT. With wide exposure to theory and hands-on training in the modern laboratories, the students are well equipped to get into core industries and/or higher studies in India and abroad.

Our Board of Studies involves experts from IISc, HAL, ISRO, DRDO and our alumni giving inputs to the curriculum design and modifications. The department has an MoU with Mitsubishi Electric India Private Limited, Schneider Electric India Private Limited and S M Electronic Technologies Private Limited. The department has externally funded research project and has several consultancy projects and linkages with industries. Consultancy projects are in the areas of internet of things (IoT), PLC based pneumatic and hydraulic experimental setup, low cost accessories for biomedical devices, and automation. The department has a student chapter with International Society of Automation (ISA) and the Society of Instrumentation Professionals (ISOI -IISc).

VISION OF THE INSTITUTE

To be an Institution of International Eminence, renowned for imparting quality technical education, cutting edge research and innovation to meet global socio-economic needs

MISSION OF THE INSTITUTE

RIT shall meet the global socio-economic needs through

1. Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization.
2. Establishing research clusters in emerging areas in collaboration with globally reputed organizations.
3. Establishing innovative skills development, techno-entrepreneurial activities and consultancy for socio-economic needs.

QUALITY POLICY

We at Ramaiah Institute of Technology strive to deliver comprehensive, continually enhanced, global quality technical and management education through an established Quality Management System complemented by the synergistic interaction of the stake holders concerned.

VISION OF THE DEPARTMENT

To become centre of excellence in the field of Electronics and Instrumentation Engineering for education and research.

MISSION OF THE DEPARTMENT

To empower and imbibe students with technical knowledge and practical skills in the field of Electronics and Instrumentation Engineering, enabling them to work as professionals in globally competitive environment and contribute to the society through research and higher studies.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

Graduates of EIE are able to

PEO 1: Demonstrate technical competency in the core areas of electronics & Instrumentation to excel in the respective industrial and research sectors.

PEO 2: Develop solutions for the global challenges in the field of sensors, signal and image processing, embedded systems, control and automation, in their diverse careers.

PEO 3: Exhibit professional attitude, leadership, and project management skills to work effectively in a multidisciplinary team for sustainable development.

PROGRAM OUTCOMES (POs):

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSOs):

PSO1: Demonstrate technical competency in measurements, instrumentation and automation domains for industrial and research sectors.

PSO2: Apply sensors knowledge and electronics principles for problem analysis, design and development of solutions.

PSO3: Implement appropriate engineering practices and state of the art technology tools for Electronics and Instrumentation domain.

Curriculum Course Credits Distribution Batch 2022-26

Semester / Course Category	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Total Credits
Basic Sciences (BSC)	08	08	03	03	--	--	--	--	22
Engineering Sciences (ESC)	08	09	--	--	--	--	--	--	17
Humanities, Social Sciences and Management (HSMC)	02	02	--	--	03	03	--	--	10
Ability Enhancement Course (AEC)	02	01	01	01	01	--	02	--	08
Universal Human Values (UHV)	--	--	02	--	--	--	--	--	02
Professional Core Courses (PCC)	--	--	11	12	12	06	04	--	45
Integrated Professional Core Course (IPCC)	--	--	04	04	03		04	--	15
Professional Elective Courses (PEC)	--	--	--	--	03	06	03	--	12
Institutional Open Elective Courses (IOE)	--	--	--	--	--	03	03	--	06
Internship (INT)	--	--	--	✔	--	--	--	05	05
Mini Project / Project Work (PW)	--	--	--	--	--	04	--	14	18
Non Credit Mandatory Courses (NCMC)	--	--	--	--	✔	--	--	✔	--
Total Credits	20	20	21	20	22	22	16	19	160

B.E.in Electronics & Instrumentation Engineering
SCHEME OF TEACHING
Batch - 2022

VII SEMESTER

Sl. No.	Course Code	Course Name	Category	Credits				Total Contact Hours/Week
				L	T	P	Total	
1.	EI71	Advanced Control Systems	IPCC	3	0	1	4	5
2.	EI72	Industrial Data Networks	PCC	3	0	0	3	3
3.	EIE73x	Program Elective course – Group 4	PEC	3	0	0	3	3
4.	xxOE0x	Institutional Open elective – 2	IOE	3	0	0	3	3
5.	EIL74	Industrial Data Networks Lab	PCC	0	0	1	1	2
6.	EIL75	Skill Enhancement Lab	AEC	0	1	1	2	4
			Total	**12**	**1**	**3**	**16**	**20**

Elective Code	Group 4 - Elective Title	Teaching Dept.	Category	L	T	P	Total Credits	Total Contact Hours/Week
EIE731	Power plant and Petrochemical Instrumentation	EIE	PEC	3	0	0	3	3
EIE732	Cyber physical systems	EIE	PEC	3	0	0	3	3
EIE733	Statistical Quality Control	EIE	PEC	3	0	0	3	3
EIE734	Principles of CMOS VLSI	EIE	PEC	3	0	0	3	3
Open Elective								
EIOE02	Industrial IoT	EIE	IOE	3	0	0	3	3

Nomenclature: IPCC: Integrated Professional Core Course**, PCC:** Professional Core Course**, PEC:** Professional Elective Courses, **IOE:** Institutional Open Elective, **AEC**–Ability Enhancement Courses.

L –Lecture, T – Tutorial, P- Practical/ Drawing

Note: EIE73x , where x=1,2,3,4
EIOE0x*, where x=1,… continued from previous

Professional Elective Courses: A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in Engineering and Technology curriculum. Multidisciplinary courses that are added to supplement the latest trend and advanced technology in the selected stream of engineering. Each group provides an option to select one course out of five courses. The minimum student's strength for offering professional electives is 10.

Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled for the open electives offered by their parent department. However, they can take an elective offered by other departments, provided they satisfy the prerequisite condition, if any. Registration to open electives shall be documented under the guidance of the Proctor.

Selection of an open elective shall not be allowed if,

The candidate has studied the same course during the previous semesters of the program.
The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
A similar course, under any category, is prescribed in the higher semesters of the program.
The minimum students' strength for offering open electives is 10.

AICTE Activity Points to be earned by students admitted to BE program:

Every regular student, who is admitted to the 4-year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years Degree Program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students VIII Semester grade card. The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled. Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. In case student fail to earn the prescribed activity points; VIII semester Grade Card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the VIII Semester grade card.

B.E.in Electronics & Instrumentation Engineering
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VIII SEMESTER

Sl. No.	Subject Code	Course Name	Category	Credits				Total Contact Hours/Week
				L	T	P	Total	
1.	EIP81	Project Work	PW	0	0	14	14	-
2.	INT82	Research/Industrial Internship	INT	0	0	5	5	-
3.	PE83/YO83/NS83	Physical Education Yoga/Yoga/NSS	NCMC	0	0	0	0	
			Total	**0**	**0**	**19**	**19**	

Note:

Internship

1. The student can do the internship during the summer vacation between 6th and 7th sem or during 8th semester.
2. The duration of the internship is minimum of 6-8 weeks.
3. The marks awarded for internship are considered/ added in the 8th semester.
4. The report of the internship needs to be submitted during the 8th semester.
5. The evaluation rubrics have to be specified by the department.
6. The department needs to constitute a committee for the evaluation process.

Physical Education Yoga/Yoga/NSS

1. The student should earn the required grade for PE83/YO83/NS83 to be eligible for the award of the degree.

Nomenclature: PW: Project Work, **NCMC**: Non-credit Mandatory Course**, INT –**Internship
L –Lecture, T – Tutorial, P- Practical/ Drawing

VII SEMESTER

ADVANCED CONTROL SYSTEMS	
Course Code: EI71	**Credits: 3:0:1**
Prerequisite: Control Systems	**Contact Hours: 42 + 28**
Course Coordinator: Dr. H S Niranjana Murthy	

Course Content

Unit I

State Space Analysis for continuous and discrete time systems: Review of State Variables and State Model, State Models for Linear Continuous-Time Systems, State space representation of Discrete-Time Systems, Discretization of continuous time systems, Diagonalization, Solution of State Equations.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://archive.nptel.ac.in/courses/108/107/108107115/
- Lab Sessions: (simulation)
  - Transformation of state space models for continuous time systems
  - Time response of linear continuous time systems
  - Time response of homogeneous and non-homogeneous state equations
  - Discretization of Continuous time systems

Unit II

Controllability and Observability: Controllability and observability of linear time invariant systems; conditions for complete controllability and complete observability. Pole Placement – State observer Design of Control Systems with observers.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://archive.nptel.ac.in/courses/108/107/108107115/
- Lab Sessions: (simulation)
  - Observability and Controllability investigation
  - State feedback controller design
  - Observer controller design

Unit III

Non-linear Systems: Common physical non-linearity, derivation of describing functions for common non-linearity –Describing function analysis of non-linear systems – Conditions for stability – Stability of oscillations.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://archive.nptel.ac.in/courses/108/107/108107115/

- Lab Sessions: (simulation)
  - Linear and Non-linear systems simulations
  - Investigate the stability of system with nonlinearities using describing function technique

Unit IV

Lyapunov Stability Analysis: Introduction, definition, first and second methods of Lyapunov: stability analysis of linear system using Lyapunov's second method. Stability analysis of Nonlinear system using second method of Lyapunov –Lyapunov's stability theorem, Generation of V-function using some formalized methods, Krasovskii's Theorem

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://archive.nptel.ac.in/courses/108/107/108107115/
- Lab Sessions: (simulation)
  - Verify Sylvester theorem for the definiteness of the Lyapunov Function
  - Determine the stability of the system and construct the Lyapunov function for Linear Time Invariant system

Unit V

Optimal and Adaptive Control: Introduction to optimal systems, Types of performance indexes, Introduction to adaptive control, MARC architecture, MIT rule, Direct and Indirect adaptive control, Model reference adaptive control, case studies.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://archive.nptel.ac.in/courses/108/107/108107115/
- Lab Sessions: (simulation)
  - Design of quadratic optimal regulator system using MATLAB

Text Books:

1. I.J. Nagrath and M. Gopal, Control Systems Engineering, New Age International Publishers, 7th Edition, 2021.
2. M.Gopal, Modern control system theory, New Age International Publishers, 4th Edition, 2021.

References Books:

1. Norman S Nise, Control Systems Engineering, Wiley India Ed, 7th Edition, 2014
2. K.Ogata, Modern Control Engineering, Pearson publisher, 5th Edition, 2009
3. K.Ogata, Discrete-Time Control Systems, Prentice Hall India Ltd, 2nd Edition, 2005
4. K.R.Varmah, Control Systems, McGraw Hill Education, 1st Edition, 2010

5. Ashish Tewari, Modern control Design with MATLAB and Simulink, John Wiley, New Delhi, 2002.

Course Outcomes (COs):

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

1. Model the linear continuous time systems and discrete time systems in state space form and determine the solution of state equation. (PO-1,2,3,5,9 PSO-1,3)
2. Design of state controllers and observer for control system. (PO-1,2,3,5,9 PSO-1,3)
3. Determine the stability of non-linear control system using describing function method. (PO-1,2,3,5,9, PSO-1,3)
4. Examine the stability of non-linear system using Lyapunov method. (PO-1,2,3,5,9 PSO-1,3)
5. Illustrate optimal control using various performance measures and adaptive control systems. (PO-1,2,3,5,9 PSO-1,3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Internal Test-I	30	CO1,CO2
Internal Test-II	30	CO3,CO4, CO5
Average of the two internal test shall be taken for 30 marks, other components for 20 marks		
Other components		
Quiz/Assignment	10	CO1-CO5
Lab experiments / Assignments	10	CO1-CO5
Semester End Examination (SEE) (Scaled to 50 marks)	**100**	CO1-CO5

INDUSTRIAL DATA NETWORKS	
Course Code: EI72	**Credits: 3:0:0**
Pre – requisites: Nil	**Contact Hours: 42**
Course Coordinator: Dr. J.V. Alamelu	

Course Content

Unit I

Data Network Fundamentals: Industry 4.0 – Architecture, basics, Network hierarchy and switching – Open system interconnection model of ISO OSI model [including Fiber optic communication]– Network Topologies and IEEE standards [IEEE 802.3,802.4,802.5].

- Pedagogy/Course delivery tools: Chalk and talk with presentation
- Links: https://nptel.ac.in/courses/106105195
  https://archive.nptel.ac.in/courses/106/105/106105082/

Unit II

Internetworking: Network Devices – Open system configuration with bridges and Gateways – Routing algorithms – Network addressing – IPV4, IPV6- TCP/IP [Industrial ETHERNET] - Special requirements of Networks used in control.

- Pedagogy/Course delivery tools: Chalk and talk with presentation
- Links: https://archive.nptel.ac.in/courses/106/105/106105082/

Unit III

Industrial Field Bus & Protocols: Field Bus Introduction – General Field Bus architecture – Basic requirements of field bus standard – Field bus topology – Foundation field bus HSE – MODBUS TCP – PROFINET – Ether CAT-Inter connectivity - comparisons.

- Pedagogy/Course delivery tools: Chalk and talk with presentation
- Links: https://hits.digimat.in/nptel/courses/video/108105088/L48.html

Unit IV

Industrial Network Protocols: Architecture and requirements, applications of CAN - PROFIBUS - SERCOS - IEEE1588 and other recent Industrial standards- Introduction to Industrial cyber security.

- Pedagogy/Course delivery tools: Chalk and talk with presentation
- Links: http://acl.digimat.in/nptel/courses/video/108105088/L49.html;

Unit V

HART and Group Displays Evolution of signal standards: HART communication protocol– Communication modes – HART Networks – Control system interface – HART and OSI standard comparison. Group Displays – used in DCS, Wireless standards – OPC-UA concepts, Implementation with Case studies.

- Pedagogy/Course delivery tools: Chalk and talk with presentation
- Links: http://acl.digimat.in/nptel/courses/video/108105088/L49.html

Text Books:

1. A.S. Tanenbaum, Computer Networks, Pearson Education, 3rd edition.
2. Steve Mackay Edwin Wright Deon Reynders John Park, Practical Industrial Data Networks Design, Installation and Troubleshooting, Elsevier.
3. Chanchal Dey and sumit kumar sen, Industrial Automation Technologies, CRC press, 2020.

References:

1. G. K. McMillan, Process/Industrial Instruments Hand book, Tata McGraw Hill, New York, recent version.
2. Romily Bowden, HART Application Guide and OSI communication Foundation, recent edition.

Course Outcomes (COs):

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

1. Describe the network Architecture functionalities and protocols of ISO OSI Reference model. (PO-2,3,4,9, PSO-1,2)
2. Interpret the concepts of subnetting, algorithms and networking protocols to design a simple network. (PO-2,3,4,9, PSO-1,2)
3. Analyze the features of different protocols through Field buses based on Ethernet standards. (PO-2,3,4,9,12, PSO-1,3)
4. Describe the operations of various protocols based on serial communication and optical fibers. (PO-2,3,4,6,8,9,12, PSO-1,3)
5. Elucidate the concepts of DCS, HMI, HART protocol used in Automation industries. (PO-2,3,4,6,8,9,12, PSO-1,3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Internal Test-I	30	CO1,CO2
Internal Test-II	30	CO3,CO4, CO5
Average of the two internal test shall be taken for 30 marks, other components for 20 marks		
Other components		
Assignment	10	CO1-CO5
Quiz	10	CO1-CO5
Semester End Examination (SEE) (Scaled to 50 marks)	**100**	CO1-CO5

POWER PLANT AND PETROCHEMICAL INSTRUMENTATION	
Course Code: EIE731	**Credits: 3:0:0**
Prerequisite: Measurement and Instrumentation	**Contact Hours: 42**
Course Coordinator: Dr. H.S. Niranjana Murthy & Dr. M. D. Nandeesh	

Course Content

Unit I

Power Generation: Hydro, thermal, nuclear, solar and wind power. Importance of instrumentation in thermal power plants, nuclear power plants, block diagram, **Analyzers:** Flue gas analyzer, -analyzers of impurities in feed water and steam- oxygen analyzer- chromatography-PH meter- fuel analyzers-pollution monitoring, radiation detector, smoke density measurement –dust monitor.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://online.vtu.ac.in/course-details/Power-Plant-Engineering

Unit II

Boiler Control: Combustion control, air-fuel ratio control-furnace draft control- drum level control-main steam and reheat steam temperature control, superheater control, aerator, de-aerator control, DCS /NCS in power plant, interlock mechanism in boiler control. **Turbine**: Measurement of turbine speed, vibration- shell temperature and control- team pressure control, lubricating oil temperature control- cooling system.

- Pedagogy/Course delivery tools: Chalk and talk
- Links:https://www.youtube.com/playlist?list=PLjoH8XiKuSWkSUgjmGNviE_NKQdKqLqPu

Unit III

Introduction to petrochemical industries: Petroleum Exploration, production and Refining, Sub-process, final product, by-products, constituents of Crude Oil. Atmospheric Distillation of Crude oil, Vacuum Distillation process, Thermal Conversion process.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://archive.nptel.ac.in/courses/103/102/103102022/

Unit IV

Controls of Chemical Reactors: Temperature Control, Pressure Control, Control of Dryers, Batch Dryers, Atmospheric and Vacuum, Continuous Dryers Control of Distillation Column, Temperature Control, Process control, Feed control, Reflux Control, Reboiler Control.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://www.iqsdirectory.com/articles/dryer/types-of-dryers.html

Unit V

Control of Pumps and evaporators: Centrifugal pump: On-Off level control, Pressure control, Flow control, Throttling control. Rotary pumps: On-Off pressure control. Reciprocating Pumps: On-Off control and Throttling control. Effluent and Water Treatment Control: Chemical Oxidation, Chemical Reduction, Naturalization, Precipitation, Biological control. Evaporators, Types of Evaporators.

- Pedagogy/Course delivery tools: Chalk and talk
- Links: https://archive.nptel.ac.in/courses/103/107/103107217/

Text Books:

1. Sam G. Dukelow, The control of Boilers, 2nd Edition ISA 2021.
2. Modern power station practice, vol-6, Instrumentation, Controls and testing, Pergamon Press, Oxford, 2008.
3. Elonka S.M. and Kohal A.L. Standard Boiler Operations, McGraw- Hill,1994
4. Dr. Ram Prasad, Petroleum Refining Technology, Khanna Publisher, 1st Edition, 2000.
5. Liptak B.G., Instrumentation in Process Industries, Chilton Book Company,2005

Course Outcomes (COs):

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

1. Analyze various power generation methods and controls. (PO-1,2,7,9,PSO-1,2,3)
2. Describe various measurement solutions for physical parameters monitored in the power plants. (PO- 1,2,3,4, PSO-1)
3. Describe the requirements of petrochemical industries. (PO-1,10, PSO-1,3)
4. Illustrate the working of chemical reactors, control heat exchangers and evaporators. (PO-1,10, PSO-1,3)
5. Analyze the performance of various control pumps in industries. (PO-1,10, PSO-1,3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Internal Test-I	30	CO1,CO2
Internal Test-II	30	CO3,CO4, CO5
Average of the two internal test shall be taken for 30 marks, other components for 20 marks		
Other components		
Assignment	10	CO1-CO5
Quiz/Presentation	10	CO1-CO5
Semester End Examination (SEE) (Scaled to 50 marks)	**100**	CO1-CO5

CYBER PHYSICAL SYSTEMS	
Course Code: EIE732	**Credits: 3:0:0**
Prerequisite: Logic Design	**Contact Hours: 42**
Course Coordinator: Dr. J. V. Alamelu	

Course Content

Unit I

Introduction to cyber physical systems – applications-design process – modelling, design and analysis concepts. Modelling dynamic behaviors- continuous dynamics - Newton mechanics – Actor models – properties of systems - Feedback control.

- Pedagogy/Course delivery tools: Chalk and talk with presentation
- Links: https://nptel.ac.in/courses/106105241

Unit II

Modelling discrete dynamics- Discrete systems – Finite state machine – extended state machines – Nondeterminism – Examples and applications.

- Pedagogy/Course delivery tools: Chalk and talk with presentation
- Links: https://nptel.ac.in/courses/106105241

Unit III

Hybrid systems – modal models – classes of hybrid system - Composition of state machines - Concurrent composition – Hierarchical state machines - Concurrent models of composition.

- Pedagogy/Course delivery tools: Chalk and talk with presentation
- Links: https://nptel.ac.in/courses/106105241

Unit IV

Energy Cyber Physical Systems – Introduction, Simulation model-scenarios, Smart Micro-grids, Cyber-Physical System for Transportation Applications.

- Pedagogy/Course delivery tools: Chalk and talk with presentation
- Links: https://nptel.ac.in/courses/106105241

Unit V

Medical Cyber Physical Systems-Introduction, Systems Description, Key design drivers and quality attributes, Practioners Implications.

- Pedagogy/Course delivery tools: Chalk and talk with presentation
- Links: https://nptel.ac.in/courses/106105241

Text Books:

1. Lee & Seshia, Introduction to Embedded Systems - A Cyber-Physical Systems Approach, second Edition, version 2.0.

References:

1. Fei Hu, Cyber-Physical Systems: Integrated Computing and Engineering
2. Design, CRC Press.
3. Cyber Physical Systems-Foundations, Principals and Applications by Houbing
4. Song, Rawat, Jeschke, Elesevier Publications (Unit4)
5. Cyber Physical Systems by Raj Rajkumar, Dionisio de Niz, Mark Klein Pub Addison Wesley, (Unit-5)

Course Outcomes (COs):

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

1. Interpret the concepts of cyber physical system. (PO-2,3,10, PSO-1,3)
2. Apply different actor models. (PO-2,3,10, PSO-1,3)
3. Implement finite state machines. (PO-2,3,6, 10,12, PSO-1,2,3)
4. Illustrate the applications of cyber physical system. (PO-2,3,6,8,10,12, PSO-1,2,3)
5. Summarize the knowledge of CPS for medical applications. (PO-2,3,6,10, PSO-1,2,3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Internal Test-I	30	CO1,CO2
Internal Test-II	30	CO3,CO4, CO5
Average of the two internal test shall be taken for 30 marks, other components for 20 marks		
Other components		
Assignment	10	CO1-CO5
Quiz	10	CO1-CO5
Semester End Examination (SEE) (Scaled to 50 marks)	**100**	CO1-CO5

STATISTICAL QUALITY CONTROL	
Course Code: EIE733	**Credits: 3:0:0**
Prerequisite: Process Control	**Contact Hours: 42**
Course Coordinator: Dr. A. Saravanan	

Course Content

Unit I

Quality Improvement in the Modern Business Environment: The Meaning of Quality and Quality Improvement, Dimensions of Quality, Quality Engineering Terminology, A Brief History of Quality Control and Improvement, Statistical Methods for Quality Control and Improvement, univariate process monitoring and control.

- Pedagogy/Course delivery tools: Chalk and talk with presentation
- Links: https://quality-one.com/spc/

Unit II

Methods And Philosophy of Statistical Process Control: Introduction, Chance and Assignable Causes of Quality Variation, Statistical Basis of the Control Chart Basic Principles, Choice of Control Limits, Sample Size and Sampling Frequency, Rational Subgroups Analysis of Patterns on Control Charts, Discussion of Sensitizing Rules for Control Charts, Control Chart Application, The Rest of the Magnificent Seven, Implementing SPC in a Quality Improvement Program, An Application of SPC, Applications of Statistical Process Control and Quality Improvement Tools in Transactional and Service Businesses.

- Pedagogy/Course delivery tools: Chalk and talk with presentation
- Links: https://quality-one.com/spc/

Unit III

Control Charts for Variables: Control Charts for $\overline{X}$ and R, Statistical Basis of the Charts, Development and Use of $\overline{X}$ and R Charts, Charts Based on Standard Values, Interpretation of $\overline{X}$ and R Charts, The Effect of Nonnormality on $\overline{X}$ and R Charts, The Operating-Characteristic Function, The Average Run Length for the $\overline{X}$ Chart, Control Charts for–x and s, Construction and Operation of $\overline{X}$ and s Charts, The $\overline{X}$ and s Control Charts with Variable Sample Size, Summary of Procedures for $\overline{X}$ and R, and s Charts, Applications of Variables Control Charts.

- Pedagogy/Course delivery tools: Chalk and talk with presentation
- Links: https://www.simplilearn.com/spc-charts-article

Unit IV

Control Charts for Attributes: The Control Chart for Fraction Nonconforming, Development and Operation of the Control Chart Variable Sample Size, Applications in Transactional and Service Businesses, The Operating-Characteristic Function and Average Run Length Calculations, Control Charts for Nonconformities (Defects).

- Pedagogy/Course delivery tools: Chalk and talk with presentation
- Links: https://www.simplilearn.com/spc-charts-article

Unit V

Other Statistical Process Monitoring and Control Technique: The Cumulative Sum Control Chart, Basic Principles: The CUSUM Control Chart for Monitoring the Process Mean, The Tabular or Algorithmic Cusum for Monitoring the Process Mean, Recommendations for Cusum Design, Exponential weighted moving average [EWMA], EWMA for Monitoring the Process Mean, design of EWMA, combining EPC[Engineering process control] and SPC, MINITAB software.

- Pedagogy/Course delivery tools: Chalk and talk with presentation
- Links: https://cqeacademy.com/cqe-body-of-knowledge/quantitative-methods-tools/statistical-process-control-spc/

Text Books:

1. Douglas Montgomery, Introduction to Statistical Quality Control 7th Edition, Wiley publications.

References:

1. John s. Oakland, Statistical process control, sixth Edition, Routledge.
2. Leslie m. Licinsk, Statistical process control.,P.Eng..
3. Peihua Qiu, Introduction to Statistical Process Control, CRC Press

Course Outcomes (COs):

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

1. Describe basic concepts of statistical Quality Control technique. (PO-1,2,4,5,11,12, PSO-1,2,3)
2. Apply SPC Tools for any manufacturing process. (PO-1,2,4,5,11 PSO-1,2,3)
3. Implement control charts for industry applications. (PO 1,2,4,5,11 PSO 1,2,3)
4. Apply control charts for attributes. (PO-1,2,4,5,9,11 PSO-1,2,3)
5. Describe various statistical process monitoring and control techniques. (PO-1,2,4,5,9,11 PSO-1,2,3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Internal Test-I	30	CO1,CO2
Internal Test-II	30	CO3,CO4, CO5
Average of the two internal test shall be taken for 30 marks, other components for 20 marks		
Other components		
Assignment	10	CO1-CO5
Quiz	10	CO1-CO5
Semester End Examination (SEE) (Scaled to 50 marks)	**100**	CO1-CO5

PRINCIPLES OF CMOS VLSI	
Course Code: EIE734	**Credits: 3:0:0**
Prerequisite: Logic Design	**Contact Hours: 42**
Course Coordinator: Dr. K. M. Vanitha	

Course Content

Unit I

Introduction: CMOS Logic Circuits - A Brief History, MOS Transistors, VLSI Design Flow, CMOS Inverter, NAND/NOR Gates, Compound gates, Pass-transistor circuits, Sequential Circuits Layout Design: Layout Design Rules, Layout Design, Stick Diagrams.

- Pedagogy/Course delivery tools: Chalk and talk with presentation
- Links: www.ee.iitm.ac.in/vlsi/courses/ee5311_2020
  www.cmosvlsi.com

Unit II

CMOS Transistor: V-I Characteristics, capacitance Models, Non-Ideal V-I Effects, DC Transfer Characteristics, Noise margins, Pass Transistor DC Characteristics
Fabrication: CMOS Processing Technology, MOSFET Scaling and Small-Geometry Effects, MOSFET Capacitances.

- Pedagogy/Course delivery tools: Chalk and talk with presentation
- Links: www.ee.iitm.ac.in/vlsi/courses/ee5311_2020;
  www.cmosvlsi.com

Unit III

Delay: Introduction, Transient response, Timing Definitions, RC Delay Model, Elmore Delay Model, Linear Delay Model, Method of Logical Effort, Buffer Design
Power: Dynamic Power Dissipation, Static Power Dissipation.

- Pedagogy/Course delivery tools: Chalk and talk with presentation
- Links: www.ee.iitm.ac.in/vlsi/courses/ee5311_2020
  www.cmosvlsi.com

Unit IV

Combinational Circuit Design: Combinational Circuit Design: Introduction, Static CMOS, Ratioed Logic, Dynamic CMOS. Sequential Circuit Design: Introduction, Circuit Design for Latches and Flip¬ Flops.
Dynamic Logic Circuits: Introduction, Basic Principles of Pass Transistor Circuits, Synchronous Dynamic Circuit Techniques, Dynamic CMOS Circuit Techniques.

- Pedagogy/Course delivery tools: Chalk and talk with presentation
- Links: www.ee.iitm.ac.in/vlsi/courses/ee5311_2020
  www.cmosvlsi.com

Unit V

Testing, verification and Simulation: Introduction: Role of testing, Testing during the VLSI life cycle, Challenges in VLSI testing, test economics, Yield, Fault coverage
Fault Modelling: Various fault models, Single Stuck-at fault – fault equivalence, fault collapsing.
Testability Measures: Controllability and Observability, SCOAP Testability analysis
Introduction to HDL: Modules, Simulation and synthesis.

- Pedagogy/Course delivery tools: Chalk and talk with presentation
- Links: www.ee.iitm.ac.in/vlsi/courses/ee5311_2020
  www.cmosvlsi.com

Text Books:

1. Neil Weste, David Harris, CMOS VLSI Design: A Circuit and Systems Perspective, 4th Edition, Pearson Education, 2015.

References:

1. Jan Rabaey, B.Nikolic, A.Chandrakasan, Digital Integrated Circuits: A Design Perspective, 3rd Edition, Pearson, 2003
2. Laung-Terng Wang, Cheng-Wen Wu andXiaoqing Wen, (Eds.), VLSI Test Principles and Architectures: Design for Testability, Morgan Kaufmann Publishers, 2006..

Course Outcomes (COs):

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

1. Explain the basic principles, design flow and draw the layout for CMOS logic circuits. (PO-1 PSO-3)
2. Describe the transistor theory and CMOS fabrication processes. (PO-1,2,4, PSO-2)
3. Determine the transient response, and static and dynamic power dissipation. (PO-1,2,4 PSO-1)
4. Analyse the combinational and sequential circuits for CMOS logic. (PO-1,2,4 PSO-2)
5. Determine fault models and testability measures of VLSI digital circuits.. (PO-1,2,4,5 PSO-3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Internal Test-I	30	CO1,CO2
Internal Test-II	30	CO3,CO4, CO5
Average of the two internal test shall be taken for 30 marks, other components for 20 marks		
Other components		
Assignment	10	CO1-CO5
Quiz/Case study/Project	10	CO1-CO5
Semester End Examination (SEE) (Scaled to 50 marks)	**100**	CO1-CO5

INDUSTRIAL IoT	
Course Code: EIOE02	**Credits: 3:0:0**
Prerequisite: -	**Contact Hours: 42**
Course Coordinator: Dr. H.S.Niranjana Murthy and Dr J V Alamelu	

Course Content

Unit I

Introduction to the Industrial Internet: Introduction to Industrial Internet, Key IIoT technologies – need, opportunities, benefits, Catalysts and Precursors of the IIoT, Innovation and the IIoT, Intelligent Devices, The Digital and Human Workforce
Industrial Internet Applications: Healthcare, Oil and Gas Industry, Smart Office, Logistics and the Industrial Internet, IoT Innovations in Retail

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation
- Links: https://archive.nptel.ac.in/courses/106/105/106105195/

Unit II

IIoT Architecture: IIC Industrial Internet Reference, Architecture, Industrial Internet Architecture Framework (IIAF), Viewpoints of Industrial Internet, Business, Usage Viewpoint, functional and Implementation. Topology – Three tier, Connectivity, Key System Characteristics, Data Management, Data Analytics.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation
- Links: https://archive.nptel.ac.in/courses/106/105/106105195/

Unit III

Design of Industrial Internet Systems: Networks for IIoT (proximity network), WSN Edge Node, WSN Network Protocols, Legacy Industrial Protocols, Modern Communication Protocols, Wireless Communication Technologies, Gateways.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation
- Links: https://archive.nptel.ac.in/courses/106/105/106105195/

Unit IV

Industry 4.0: Introduction, Benefits and need for Industry 4.0, Four Main Characteristics of Industry 4.0, The Value Chain, Industry 4.0 Design Principles, Building Blocks of Industry 4.0, Industry 4.0 Reference architecture.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation
- Links https://archive.nptel.ac.in/courses/106/105/106105195/

Unit V

Smart Factories: Introduction to Smart Factory, Smart Factories in Action, Importance and Need for Smart Manufacturing, Winners and Losers? Real-World Smart Factories – Manufacturing and factory automation, Standards for implementation.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation
- Links https://archive.nptel.ac.in/courses/106/105/106105195/

Text Books:

1. Alasdair Gilchrist, Industry 4.0: The Industrial Internet of Things, 1st edition, Apress Publications, 2016
2. Vijay Madisetti, Arshdeep Bahga, Internet of Things: A Hands-On- Approach, 1st edition, Orient Blackswan Pvt. Ltd., 2015

Reference Book:

1. Sudip Misra, Chandana Roy, Anandarup Mukherjee, Introduction to Industrial Internet of Things and Industry 4.0, 1st edition, CRC Press, 2020
2. Giacomo Veneri; Antonio Capasso, Hands-on Industrial Internet of Things: create a powerful Industrial IoT infrastructure using Industry 4.0, ,1st Edition, Packt Publishing, 2018
3. Francis daCosta, Byron Henderson, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, 1st Edition, Apress Publications, 2014

Course Outcomes (COs):

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

1. Explain the fundamental concepts of the Industrial Internet of Things (IIoT), including its key technologies, catalysts, precursors, and applications in industries (PO-1,2,6,9 PSO-1,3)
2. Illustrate the architecture of IIOT, viewpoints, topology and data management. PO-1,2,6,9 PSO-1,3)
3. Apply the knowledge of networks for IIOT systems, design and configure IIOT systems. (PO-1,2,6,9 PSO-1,3)
4. Understand the need of Industry 4.0 and its design principles (PO-1,2,6,9 PSO-1,3)
5. Analyse the development of smart factories in IIOT and industry 4.0 protocols(PO-1,2,6,9 PSO-1,3)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Internal Test-I	30	CO1,CO2
Internal Test-II	30	CO3,CO4, CO5
Average of the two internal test shall be taken for 30 marks, other components for 20 marks		
Other components		
Assignment	10	CO1-CO5
Quiz	10	CO1-CO5
Semester End Examination (SEE) (Scaled to 50 marks)	**100**	CO1-CO5

INDUSTRIAL DATA NETWORK LAB	
Course Code: EIL74	**Credits: 0:0:1**
Prerequisite: PLC and SCADA Lab	**Contact Hours: 28P**
Course Coordinator: Dr. J. V. Alamelu	

Course Content

List of Experiments*

1. Configuration of PLC (Controllers – RS Logix) with Factory Talk View tool (operator station) for Object tags.
2. Implementation of basic panel for an Industrial process
3. Implementation of Timer and counter based objects for an application
4. Usage of Trends for an industrial application with hardware interface
5. Utilization of multiple panels with various animation setup for an application.
6. Usage of Instruction set and advanced conditions in HMI for any application
7. Implementation of Industrial network protocols – Producer – consumer communication with one – one communication
8. Implementation of One - Many communication(s) with star topology.
9. Producer consumer for communication using drop line topology
10. Producer consumer for communication using Ring topology
11. Ring topology and interfacing with - Remote Supervision of Client / Server solutions with operator station.
12. Implementation of Industry applications with message communication with MODBUS
13. Home Automation Schneider setup – Demo based
14. Building Automation Schneider setup – Demo based

*All the concepts mentioned in the experiment list from 1 – 12 will be executed using different applications by interfacing with hardware/ simulation box and/ with HMI

Course Outcomes (COs):

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

1. Configure, utilize object tags with RS Logix 5000 series and factory talk view studio for industrial applications. (PO-2,3,4,5,9, PSO-1,3)
2. Utilize instruction set and communication modes within PLCs in DCS environment. (PO-2,3,4,5,9,12, PSO-1,2,3)
3. Implement graphical panel for HMI in remote environment. (PO-2,3,4,5,9,10,12, PSO-1,3)

Course Assessment and Evaluation:

Continuous Internal Evaluation CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Weekly evaluation of laboratory records/ reports after the conduction of every experiment. Follow up / Viva	20 10	CO1-CO3
Practical test	20	CO1-CO3
Semester End Examination (SEE)	**50**	CO1-CO3

SKILL ENHANCEMENT LAB	
Course Code: EIL75	**Credits: 0:1:1**
Prerequisite: -	**Contact Hours: 28T+28P**
Course Coordinator: Dr H S Niranjanamurthy, Dr M D Nandeesh, Dr Elavaar Kuzhali S, Dr J V Alamelu, Dr K M Vanitha.	

Course Content

Tutorials:

1. Excel
   - Table Operations
   - Querying and Transforming Data
   - Data Preparation and Formatting in Excel
2. Python
   - Table Operations
   - Querying and Transforming Data
3. Machine Learning Models
   - Regression
   - Classification
4. Convolution Neural Networks
   - Classification
   - Image segmentation
5. LLM Introduction and Hugging Face
   - Introduction to Hugging Face
   - NLP Tasks and Model Fine-Tuning
   - Model Deployment and Applied Case Study
6. LangChain
   - Introduction and Environment Setup for LangChain
   - Core Components and Integrations
   - Advanced Features: Agents and Memory
7. RAG
   - Embedding Techniques
   - Retrieval and Chain Architectures
   - Prompt Engineering and Multi-LLM Workflows
8. Memory/Chatbot
   - Memory Architecture and Configuration
   - Conversational Workflow Design
   - Multi-Document Interaction Tools
9. Applications of Queues and Stacks
   - Parenthesis Checker
   - Stack using two queues
10. Recursion: Functions calls itself directly or indirectly

- Fibonocci Sequence
- Sum of array elements using recursion

11. Graph Algorithm: Techniques used to analyze and process graphs
    - Depth First Traversal
    - Shortest Source to Destination Path

List of experiments:

1. Create and format a data table in Excel, perform querying and table operations.
2. Create data table and transform the data using power query.
3. Using Python to read data from Excel workbook, perform querying and table operations
4. Implement regression model using ML techniques
5. Implement classification using ML techniques
6. Perform classification/segmentation using CNN
7. Perform inference using a pre-trained Hugging Face model, and fine-tune it for text classification on a small dataset.
8. Set up LangChain, implement a simple LLMChain with prompt templates and output parsing, and extend it by integrating a vector database to build a conversational retrieval QA system.
9. Build a Retrieval-Augmented Generation (RAG) chain that retrieves context and uses an LLM to generate final answers, and demonstrate query routing across multiple LLMs for specialized tasks.
10. Implement short-term and long-term memory for a conversational agent, and extend it into a chatbot that can search across multiple uploaded documents with source referencing.
11. Create a LangChain agent that can call external tools, and extend it to compose multiple tools to answer complex multi-step queries.
12. Implement a stack-based program to validate balanced parentheses, and implement a stack using two queues.
13. Compute the Fibonacci series and the sum of array elements using recursion, and compare recursive and iterative approaches.
14. Implement graph traversal using Depth First Search (DFS), and shortest path algorithms using Breadth First Search (BFS) and Dijkstra's algorithm.

Course Outcomes (COs):

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

1. Implement data querying, transformation using Excel, python and apply ML, CNN models. (PO1, PO2, PO5, and PSO2).
2. Implement Hugging Face models, LangChain-based applications, RAG systems, LLM query routing, memory-enabled chatbots. (PO1, PO2, PO5, and PSO2).
3. Implement fundamental data structures and algorithms to solve computational problems. (PO3, PO5, PO9, PO10, PSO2)

Course Assessment and Evaluation:

Continuous Internal Evaluation CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Weekly evaluation of laboratory records/ reports after the conduction of every experiment. Follow up / Viva	20 10	CO1-CO3
Practical test	20	CO1-CO3
Semester End Examination (SEE)	**50**	CO1-CO3

VIII SEMESTER

PROJECT WORK	
Course Code: EIP81	**Credits: 0:0:14**
Pre – requisites: Nil	**Contact Hours: -**
Course Coordinator: Dr M D Nandeesh	

Course Content

The students will work on the approved Project and try to realize the entire circuit in each subsystem. They will be interacting with their guide and try to solve the problem under taken. The project can be Classified as proof of concept or demo model leading to a product. The project evaluation takes place continuously with three reviews, and finally with project demonstration and external evaluation with defined rubrics. The modules built by the students are demonstrated at the end of the academic year and evaluated for Semester end exam. It is important to note that, a significant part of the credits that is to be earned before their graduation is dedicated to projects.

The students are also motivated to publish their work in journals / conference; or exhibit their work in project competitions or exhibitions. The Institute also offers for every department a 'Best Project' award and evaluation for the same is performed by the external examiners, based on the rubric.

Course Outcomes (COs):

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

1. Identify a problem related to industries and/or societal needs, select a suitable method for implementation through conducting elaborate literature/ market survey. (PO-1,2,3,4,5,6,7,10,12 PSO-1,2,3)
2. Design, test and simulate functional blocks or sub-systems of the proposed solution. (PO-2,3,8,9,10,11, PSO-1,2,3)
3. Design, simulate, experiment, integrate and test systems. (PO-2,3,4,5,10, PSO-1,3)
4. Develop skills required for consistent documentation, result analysis and redesign, project management and problem solving. (PO-1,2,4,9,10, PSO-1,2,3)
5. Communicate technical information by means of written and oral presentations. (PO-2,6,7,8,10, 11,12, PSO-2,3)

RESEARCH/INDUSTRIAL INTERNSHIP	
Course Code: INT82	**Credits: 0:0:5**
Prerequisite: Nil	**Contact Hours: -**
Course Coordinator: Dr Elavaar Kuzhali S, Dr G.Shivaprakash	

Course Content

Students should undertake the internship for 6-8 weeks in Industry or in Research Institutes. The report of the internship with certificate from the company/Research Institute needs to be submitted to the department, along with a presentation.

Note: For guidelines regarding selection of internship, refer to the "AICTE-Internship Policy guidelines and procedures (2021)".

Course Outcomes (COs):

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

1. Integrate theory and practice. (PO – 1, 2, 3, 4, 9,10,12, PSO – 1,2,3)
2. Effectively use modern tools for the design and development of systems. (PO – 1, 2, 3, 4,5, 9,12, PSO – 1,2,3)
3. Develop communication, and interpersonal skills required to work in a team. (PO – 8,9,10,12, PSO-3)
4. Assess their abilities and interest in their field of study. (PO-1, 2, 3, 12 PSO – 1,2,3)
5. Present and write quality technical report on the work done during the internship (PO- 1, 2, 5,9,10,12, PSO-3)