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CURRICULUM ESSENTIALS

Handbook on Outcome Based Education

ELECTRONICS AND INSTRUMENTATION ENGINEERING

NARULA INSTITUTE OF TECHNOLOGY

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Institute Vision

To make the Institute excellent in technological education and research by imparting equitable, inclusive, ethical, flexible and multidisciplinary knowledge to budding technologists to serve the society.

Institute Mission

- To establish continuously improving academic ambience in the Institute in order to prepare the students with beyond curriculum knowledge, creativity, innovation, problem solving abilities, teamwork, communication skills etc. for their holistic development.
- To collaborate with Institutes of higher education, Professional Societies, R&D and Industrial organizations for continuous improvement of academic, research environment in the Institute and to build a strong Industry-Institute interface.
- To promote and nurture entrepreneurial and innovative quality of the students providing proper education, training and supportive facilities so that future entrepreneurs emerge with flying colors.
- To strengthen quality and knowledge-base of faculty through faculty development programmes for continuous up gradation to remain in tune with dynamically changing technology.
- To become a responsible contributor in the socio-economic development of the society through excellence in education and research.

Institute Quality Policy

- Adoption of appropriate standards and practices for good governance, to bring in transparency of all operations and thereby improve credibility at all levels.
- Industry-ready professionals to be developed through interactive teaching learning process involving state of the art class rooms, laboratories, libraries, corporate exposure and innovative project work.
- Higher studies/research for faculty & staff to be encouraged for up gradation of knowledge through participation in Quality Improvement Programs, Seminars, Workshops, Webinars etc.
- Laboratory facilities would be upgraded in emerging areas to promote R&D activities including participation in Govt. and Industry funded projects.
- Industrial consultancy to be carried out in an effective manner for developing sense of accomplishment.
- Interaction with Professional Societies would be encouraged for the professional growth and development of the students, faculties and staff for mutual benefit.
- NBA Accreditation for all AICTE approved programs to be obtained at the earliest and maintained on a long-term basis.
- The innovative and entrepreneurial skills of the students to be nurtured through Innovation & Incubation centre, finally culminating in start-ups.

Department Vision

To uniquely position the Graduate as a Leader in Innovation and Excellence in Instrumentation, Control, Measurements and to recognise professional framework reflecting social Responsibility.

Department Mission

The Mission of the Department is to develop the next generation of Engineers in the Instrumentation sector by teaching them problem solving, leadership and teamwork skills, and the value of a commitment quality, ethical behaviour, and respect for others. To create and disseminate knowledge through research and to transfer our intellectual to enhance society in meaningful and sustainable ways.

Program Educational Objectives (PEOs)

B.Tech in Electronics and Instrumentation Engineering

The main objectives of the EIE Department are:

PEO1. To provide students with a strong foundation in Mathematical, Scientific and Engineering fundamentals.

PEO2. To acquaint students with necessary knowledge to formulate, solve and analyse engineering problems related to industry and research.

PEO3. To impart the state of the art technology to the students in the field of Electronics and Instrumentation Engineering.

PEO4. To foster the innovation, invention and entrepreneurship by enabling the students to transform their ideas to proof- of-concepts for high-tech applications.

PEO5. To inculcate in the students professional and ethical attitude, communication skills and the life-long learning skills needed for the successful professional career.

PEO6. To provide opportunity for the students to work as part of teams on multi-disciplinary projects.

PEO7. Work in core Instrumentation and allied industries and software companies and / or become successful entrepreneurs.

PEO8. Pursue their higher studies at the institutes of repute in India and abroad and work in educational institutions, research organizations and engineering consultancy companies.

PEO9. Have the highest integrity, social responsibility, teamwork skills and leadership capabilities in their profession or career.

Program Specific Outcomes (PSOs)

B.Tech in Electronics and Instrumentation Engineering

PSO1. Professional Skills: An ability to understand the basic concepts in Electronics and Instrumentation engineering and to apply them to various areas like electronics, sensors, transducer, industrial instrumentation, biomedical engineering etc., in the design and implementation of complex systems.

PSO2. Problem-solving skills: An ability to solve complex Electronics and Instrumentation engineering problems, using latest hardware and software tools along with analytical skills to arrive cost effective and appropriate solutions.

PSO3. Successful Career and Entrepreneurship: An understanding of social-awareness & environmental-wisdom along with ethical responsibility to have a successful career and to sustain passion and zeal for real-world applications using optimal resources as an entrepreneur.

Program outcomes (POs)

Engineering Graduates will be able to:

PO1. Apply knowledge of mathematics, science, engineering fundamentals and an instrumentation engineering specialization to arrive solution for complex engineering problems.

PO2. Identify, formulate and analyze complex engineering problems using first principles of mathematics, management and engineering.

PO3. Design solutions for instrumentation engineering problems and develop Instrumentation and related system components or processes that meet specified needs with appropriate consideration for public health, safety, cultural, societal and environmental issues.

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

PO5. Create, select and apply appropriate state-of-the-art techniques, resources and modern engineering and computing tools with an understanding of the limitations.

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

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

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

PO9. Function effectively as an individual, and as a member or leader in multidisciplinary teams.

PO10. 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. 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.

PO12. Demonstrate knowledge and understanding of 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.

Curriculum Structure

Department: Electronics and Instrumentation Engineering

1st Year 1st Semester								
Sl. No.	**Category**	**Paper Code**	**Subject**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. Theory								
1	BSC	PH101	Physics–I	3	0	0	3	3
2	BSC	M101	Mathematics–I	4	0	0	4	4
3	HSMC	HSMC101	Professional Communication	2	0	0	2	2
B. Practical								
4	BSC	PH191	Physics–I Laboratory	0	0	3	3	1.5
5	ESC	ME191	Workshop & Manufacturing Practices Lab	0	0	3	3	1.5
6	PROJ	PR191	Theme Based Project –I	0	0	1	1	0.5
7	PROJ	PR192	Skill Development – I:SoftSkill	0	0	1	1	0.5
C. Mandatory Activities/Courses								
8	MC	MC181	Induction Program	2	0	0	0	2
Total of Theory, Practical and Mandatory Activities/Courses								**13**

1st Year 2nd Semester								
Sl. No.	**Category**	**Paper Code**	**Subject**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. Theory								
1	BSC	CH201	Chemistry–I	3	0	0	3	3
2	BSC	M201	Mathematics– II	4	0	0	4	4
3	BSC	EE201	Basic Electrical Engineering	3	0	0	3	3
4	ESC	CS201	Programming for Problem Solving	3	0	0	3	3
B. Practical								
5	BSC	CH291	Chemistry–I Laboratory	0	0	3	3	1.5
6	HSMC	HSMC291	Professional Communication Laboratory	0	0	2	2	1
7	ESC	EE291	Basic Electrical Engineering Laboratory	0	0	3	3	1.5
8	ESC	ME292	Engineering Graphics and Design Laboratory	0	0	3	3	1.5
9	ESC	CS291	Programming for Problem Solving Laboratory	0	0	3	3	1.5
10	PROJ	PR291	Theme Based Project – II	0	0	1	1	0.5
11	PROJ	PR292	Skill Development– II: Life Skill	1	0	0	1	0.5
C. Mandatory Activities/Courses								
12	MC	MC281	NSS / Physical Activities / Meditation and Yoga/Photography/Nature Club	0	0	3	3	3 units
Total of Theory,Practical and Mandatory Activities/Courses								**20**

2nd Year 3rd Semester								
Sl. No.	Category	Paper Code	Subject	Contact Hours/Week				Credit Points
				L	T	P	Total	
A. Theory								
1	BSC	M301	Mathematics III	3	0	0	3	3
2	ESC	EI301	Analog Electronic Circuits	3	0	0	3	3
3	ESC	EI302	Digital Electronic Circuits	3	0	0	3	3
4	PCC	EI303	Circuit Theory and Networks	3	0	0	3	3
5	PCC	EI304	Basic of Measurement Techniques	3	0	0	3	3
6	HSMC	HSMC303	Universal Human Values 2: Understanding Harmony	3	0	0	3	3
B. Practical								
7	ESC	MCS391	Numerical Method lab	0	0	3	3	1.5
8	ESC	EI391	Analog Electronic circuits Lab	0	0	3	3	1.5
9	ESC	EI392	Digital Electronic Circuits Lab	0	0	3	3	1.5
10	ESC	EI393	Circuit Network Lab	0	0	3	3	1.5
11	PROJ	PR391	Theme Based Project– III	0	0	1	1	0.5
12	PROJ	PR392	Skill Development–III: Technical Seminar Presentation	1	0	0	1	0.5
C. Mandatory Activities/Courses								
13	MC	MC301	Environmental Science	2	0	3	3	3
Total of Theory ,Practical and Mandatory Activities/Courses without MOOC Courses								**25**
D.MOOC Courses**								
14	MOOCS Courses	HM301	MOOC Course–I	1	3	1	4	4
Total of Theory ,Practical and Mandatory Activities/Courses with MOOC Courses								**29**

2nd Year 4th Semester								
Sl. No.	**Category**	**Paper Code**	**Subject**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. Theory								
1	BSC	PH(EIE)401	Physics-II	3	0	0	3	3
2	PC	EI401	Sensors and Transducers	3	0	0	3	3
3	PC	EI402	Microprocessors and Microcontrollers	3	0	0	3	3
4	PC	EI403	Digital Signal Processing	3	0	0	3	3
5	PC	EI404	Electrical & Electronic Measurement & Instrumentation	3	0	0	3	3
6	HSMC	HSMC402	Gender Culture and Development	2	0	0	2	2
B. Practical								
7	BSC	PH(EIE)491	Physics-II Lab	0	0	2	2	1
8	PC	EI491	Sensors and Transducers Lab	0	0	3	3	1.5
9	PC	EI492	Microprocessors and Microcontrollers Laboratory	0	0	3	3	1.5
10	PC	EI493	Digital Signal Processing Laboratory	0	0	3	3	1.5
11	PC	EI494	Electrical & Electronic Measurement & Instrumentation Laboratory	0	0	3	3	1.5
12	PROJ	PR491	Theme Based Project – IV	0	0	1	1	0.5
13	PROJ	PR492	Skill Development – IV: Soft Skill and Aptitude–I	1	0	0	1	0.5
C. Mandatory Activities/Courses								
14	MC	MC401	Environmental Protection Initiatives	2	0	0	3	3
Total of Theory, Practical and Mandatory Activities/Courses without MOOC Courses								**25**
D.MOOC Courses**								
14	MOOC	HM401	MOOC Course–II	3	1	0	4	4
Total of Theory ,Practical and Mandatory Activities/Courses with MOOC Courses								**29**

3rd Year 5th Semester								
Sl. No.	**Category**	**Paper Code**	**Subject**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. Theory								
1	HSMC	HSMC505	Principles of Management	2	0	0	2	2
2	PC	EI501	Industrial Instrumentation	3	0	0	3	3
3	PC	EI502	Analog and Digital Communication	3	0	0	3	3
4	PC	EI503	Control theory	3	0	0	3	3
5	PE	EE504	A. Power Plant Instrumentation B. Virtual Instrumentation C. Advanced Microprocessors and Microcontrollers	3	0	0	3	3
B. Practical								
7	PC	EI591	Industrial Instrumentation Laboratory	0	0	3	3	1.5
8	PC	EI592	Analog and Digital Communication Laboratory	0	0	3	3	1.5
9	PC	EI593	Control Laboratory	0	0	3	3	1.5
10	OEC	EE594	A. Power Plant Instrumentation Laboratory B. Virtual Instrumentation Laboratory C. Advanced Microprocessors and Microcontrollers Laboratory	0	0	3	3	1.5
11	PROJ	PR591	Minor Project I	0	0	3	3	1
12	PROJ	PR592	Skill Development – V: Soft Skill and Aptitude–II	1	0	0	1	0.5
C. Mandatory Activities/Courses								
13	MC	MC501	Constitution of India	2	0	0	3	3
Total of Theory, Practical and Mandatory Activities/Courses without MOOC Courses							**34**	**21.5**
D. MOOC Courses**								
14	MOOC	HM501	MOOC Course–III	3	1	0	4	4
Total of Theory, Practical and Mandatory Activities/Courses with MOOC Courses								**25.5**

3rd Year 6th Semester								
Sl. No.	**Category**	**Paper Code**	**Subject**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A. Theory								
1	HSMC	HSMC604	Economics for Engineers	2	0	0	2	2
2	PC	EI601	Process control-I	3	0	0	3	3
3	PC	EI602	Biomedical Instrumentation	3	0	0	3	3
4	PC	EI603	A. Robotics Engineering B. Advanced Sensors C. Embedded System	3	0	0	3	3
5	OEC	EI604	A. Non Destructive Testing B. Optoelectronics and Fibre Optics C. Soft Computing	3	0	0	3	3
6	PE	EI605	A. Data Structures and Algorithms B. Database Management System C. Software Engineering	3	0	0	3	3
B .Practical								
7	PC	EI691	Process Control Laboratory	0	0	3	3	1.5
8	PC	EI692	Biomedical Laboratory	0	0	3	3	1.5
9	PE	EI693	A. Robotics Laboratory B. Advanced Sensors C. Embedded System	0	0	3	3	1.5
10	PE	EI694	A. Destructive Testing B. Optoelectronics and Fibre Optics C. Soft Computing	0	0	2	2	1
11	OE	EI695	A. Data Structures and Algorithms Lab B. Database Management System Lab C. Software Engineering Lab	0	0	3	3	1.5
12	PROJ	PR692	Minor Project–II	0	0	2	2	1
13	PROJ	PR693	Skill Development – VI: Soft Skill and Aptitude–III	1	0	0	1	0.5
C. Mandatory Activities/Courses								
13	MC	MC601	Intellectual Property Right	2	0	0	3	3
Total of Theory, Practical and Mandatory Activities/Courses without MOOC Courses							**34**	**25.5**
D. MOOC Courses**								
14	MOOC	HM601	MOOC Course– IV	3	1	0	4	4
Total of Theory ,Practical and Mandatory Activities/Courses with MOOC Courses							**38**	**28.5**

4thYear7thSemester								
Sl. No.	Category	Paper Code	Subject	Contact Hours/Week				Credit Points
				L	T	P	Total	
A. Theory								
1	PE	EI701	A. Telemetry & Remote Control B. Analytical Instrumentation C. Digital Image Processing	3	0	0	3	3
2	PE	EI702	A. Process Control II B. Introduction to MEMS C. Artificial Intelligence	3	0	0	3	3
3	OE	EI703	A. Power Electronics B. Industrial Drives C. Non-conventional Energy	3	0	0	3	3
4	OE	EI704	A. Satellite Communication B. Wireless Sensor Network C. Quantum Computing	3	0	0	3	3
B. Practical								
6	PCC	EI791	A. Telemetry & Remote Control Lab B. Analytical Instrumentation Lab C. Digital Image Processing Lab	0	0	2	3	1.5
8	PROJ	PR791	Major Project–I	0	0	0	4	2
9	PROJ	PR792*	Industrial Training/ Internship	0	0	0	0	1
10	PROJ	PR793	Skill Development–VII: Seminar and Group Discussion	1	0	0	1	0.5
C. Mandatory Activities/Courses								
11	MC	MC781	Entrepreneurship and Innovation Skill	0	0	3	3	3
Total of Theory ,Practical and Mandatory Activities/Courses without MOOC Courses								**17**
D.MOOC Courses**								
12	MOOC	HM701	MOOC Course– V	2	1	0	4	4
Total of Theory ,Practical and Mandatory Activities/Courses with MOOC Courses								**21**

4thYear 8thSemester								
Sl. No.	**Category**	**Paper Code**	**Subject**	**Contact Hours/Week**				**Credit Points**
				L	**T**	**P**	**Total**	
A.Theory								
1	PE	EI801	A. Plant Automation and IIOT B. Nano Electronics C. Biomedical Signal Processing	3	0	0	3	3
2	OE	EI802	A. Computer Networking B. Computer graphics and Multimedia C. Object-Oriented Programming	3	0	0	3	3
3	OE	EI803	Mobile Communication VLSI and Microelectronics Microwave Theory and Technique	3	0	0	3	3
B.PRACTICAL								
4	PROJ	PR891	Major Project II	0	0	0	12	6
5	PROJ	PR892	Grand Viva	0	0	0	0	1
C. Mandatory Activities/Courses								
6	MC	MC881	Essence of Indian Knowledge Tradition	2	0	3	3	3
Total of Theory, Practical and Mandatory Activities/Courses without MOOC Courses								**16**

Curriculum and Syllabus for B.Tech
Under Autonomy
Applied Electronics & Instrumentation Engineering

COURSE NAME: PHYSICS –I

CODE: PH 101

Course Outcomes (COs):

After attending the course students' should be able to

CO1: describe various types of mechanical resonance and its electrical equivalence

CO2: explain basic principles of Laser, Optical fibers and Polarization of light

CO3: apply superposition principle to explain interference and diffraction

CO4: analyze different crystallographic structures according to their co-ordination number and packing factors

CO5: justify the need of a quantum mechanics as remedy to overcome limitations imposed by classical physics

CO-PO Mapping:

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

COURSE NAME: MATHEMATICS-I

COURSE CODE: M 101

Course Outcomes (COs):

On successful completion of the learning sessions of the course, the learner will be able to

CO1: Recall the properties and formula related to matrix algebra, differential calculus, multivariable calculus, vector calculus and infinite series.

CO2: Determine the solutions of the problems related to matrix algebra, differential calculus, multivariable calculus, vector calculus and infinite series.

CO3: Apply the appropriate mathematical tools of matrix algebra, differential calculus, multivariable calculus, vector calculus and infinite series for the solutions of the problems.

CO4: Analyze different engineering problems linked with matrix algebra, differential calculus, multivariable calculus, vector calculus.

CO-PO Mapping:

PO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	-	-	-	-	-	-	-	-	-	2
CO 2	3	2	-	-	-	-	-	-	-	-	-	2
CO 3	3	2	2	-	-	-	-	-	-	-	-	2
CO 4	2	3	2	2	-	-	-	-	-	-	-	2

COURSE NAME: PROFESSIONAL COMMUNICATION

COURSE CODE: HSMC 101

Course Outcomes (COs):

After attending the course students' should be able to

CO1: apply the modalities and nuances of communication in a workplace context.

CO2: analyze communication across cultures and societies.

CO3: apply the basic formats, templates of business and official communication.

CO4: employ formal communication modes in meetings and reports.

CO5: justify importance of culturally neutral language in interpersonal and business communication.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	2	-	-	3	-	2

COURSE NAME: PHYSICS I LAB

CODE: PH 191

Course Outcomes (COs):

After attending the course students' will be able to

CO1 : demonstrate experiments allied to their theoretical concepts

CO2 : conduct experiments using LASER, Optical fiber, Torsional pendulum, Spectrometer

CO3 : participate as an individual, and as a member or leader in groups in laboratory sessions actively

CO4 : analyze experimental data from graphical representations , and to communicate effectively them in Laboratory reports including innovative experiment.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	2	2	-	3	-	-	-	-	-	-	-	2
CO3	2	2	-	-	-	-	-	-	3	-	-	2
CO4	2	2	-	-	-	-	-	-	-	3	-	2

COURSE NAME: WORKSHOP/MANUFACTURING PRACTICES

COURSE CODE: ME191

Course Outcomes (COs):

After completion of this course students will be able to

CO1: Identify and operate various hand tools related to variety of manufacturing operations

CO2: Safely fabricate simple components with their own hands.

CO3: Get practical knowledge of the dimensional accuracies and tolerances applicable for different manufacturing processes.

CO4: Produce small devices of their interest in project or research purpose.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	-	2	3	2	-	2	2	2	3
CO2	2	2	3	2	2	2	2	-	3	2	2	3
CO3	3	2	2	2	2	2	2	2	2	2	2	3
CO4	2	2	3	2	3	3	2	-	3	3	3	3

COURSE NAME: WORKSHOP/MANUFACTURING PRACTICES

COURSE CODE: ME191

Course Outcomes (COs):

After completion of this course students will be able to

CO1: Identify and operate various hand tools related to variety of manufacturing operations

CO2: Safely fabricate simple components with their own hands.

CO3: Get practical knowledge of the dimensional accuracies and tolerances applicable for different manufacturing processes.

CO4: Produce small devices of their interest in project or research purpose.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	-	2	3	2	-	2	2	2	3
CO2	2	2	3	2	2	2	2	-	3	2	2	3
CO3	3	2	2	2	2	2	2	2	2	2	2	3
CO4	2	2	3	2	3	3	2	-	3	3	3	3

COURSE NAME: CHEMISTRY

COURSE CODE: CH 201

Course Outcomes (COs):

After completion of this course students will be able to

CO1: Describe the fundamental properties of atoms & molecules, atomic structure and the periodicity of elements in the periodic table

CO2: Apply fundamental concepts of thermodynamics in different engineering applications.

CO3: Apply the knowledge of water quality parameters, corrosion control & polymers to different industries.

CO4: Determine the structure of organic molecules using different spectroscopic techniques.

CO5: Evaluate theoretical and practical aspects relating to the transfer of the production of chemical products from laboratories to the industrial scale, in accordance with environmental considerations.

CO-PO Mapping:

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

COURSE NAME: MATHEMATICS-II

COURSE CODE: M 201

Course Outcomes (COs):

On successful completion of the learning sessions of the course, the learner will be able to

CO1: Recall the properties and formula related to ordinary differential equations, improper integral, Laplace transform and numerical techniques.

CO2: Determine the solutions of the problems related to ordinary differential equations, improper integral, Laplace transform and numerical techniques.

CO3: Apply appropriate mathematical tools of ordinary differential equations, improper integral, Laplace transform and numerical techniques for the solutions of the problems.

CO4: Analyze engineering problems by using differential equation, Laplace Transform and Numerical Methods.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	3	2	-	-	-	-	-	-	-	-	-	2
CO3	3	2	2	-	-	-	-	-	-	-	-	2
CO4	2	3	2	2	-	-	-	-	-	-	-	2

COURSE NAME: BASIC ELECTRICAL ENGINEERING

COURSE CODE: EE201

Course Outcomes (COs):

After attending the course students' would be able to

CO1: understand and analyze basic electric circuits

CO2: study the working principles of electrical machines.

CO3: introduce the components of low voltage electrical installations

CO4: study the fundamentals of electrical Power systems and Control Systems.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	2	2	-	-	-	-	-	-	-	-	1
CO2	1	2	2	-	-	-	-	-	-	-	-	1
CO3	-	2	2	-	-	-	-	-	-	-	-	2
CO4	-	2	-	-	-	-	-	-	-	-	-	1

COURSE NAME: PROGRAMMING FOR PROBLEM SOLVING

COURSE CODE: CS 201

Course Outcomes (COs): After completion of the course students would be able to

CO1: Understand the fundamental concept of Computer and mathematical knowledge and apply them in designing solution to engineering problem.

CO2: Understand the basic concept of C programming and use of data types/operators/input/output function for developing and implementing complete program leading to solution of mathematical and engineering problem.

CO3: Use conditional branching, iteration, recursion and formulate algorithms and programs in solving mathematical/ scientific/ engineering problem leading to lifelong learning.

CO4: Understand the concept of arrays, pointers, file and dynamic memory allocation and apply it for problem solving and also create new data types using structure, union and enum.

CO5: Understand how to decompose a problem into functions and assemble into a complete program by means of modular programming possibly as a team.

CO–PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	-	-	-	-	-	-	-
CO2	2	2	3	2	-	-	-	-	-	-	-	-
CO3	2	3	2	2	-	-	-	-	-	-	-	3
CO4	3	2	2	2	3	-	-	-	-	-	-	-

CO5	2	2	2	2	-	-	-	-	3	2	-	-

COURSE NAME: CHEMISTRY LAB

COURSE CODE: CH 291

Course Outcomes (COs):

After attending this course, students would be

CO1: able to operate different types of instruments for estimation of small quantities chemicals used in industries and scientific and technical fields.

CO2: able to analyze and determine the composition of liquid and solid samples working as an individual and also as a team member.

CO3: able to analyze different parameters of water considering environmental issues.

CO4: able to synthesize drug and polymer materials.

CO5: Capable to design innovative experiments applying the fundamentals of chemistry.

CO-PO Mapping

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

COURSE NAME: PROFESSIONAL COMMUNICATION LAB

COURSE CODE: HSMC291

Course Outcomes (COs):

After attending the course students' would be

CO1: Able to explain advanced skills of Technical Communication in English through Language Laboratory.

CO2: Able to apply listening, speaking, reading and writing skills in societal and professional life.

CO3: Able to demonstrate the skills necessary to be a competent Interpersonal communicator.

CO4: Able to analyze communication behaviours.

CO5: Able to adapt to multifarious socio-economical and professional arenas with the help of effective communication and interpersonal skills.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	-	-	-	-	-	2	-	-	3	-	2
CO2	2	3	2	-	-	2	2	2	-	3	-	3
CO3	2	3	-	-	-	3	3	3	-	3	-	3
CO4	-	-	-	-	-	3	3	3	-	3	-	3

CO5	-	-	-	-	-	-	3	3	-	3	-	3

COURSE NAME: BASIC ELECTRICAL ENGINEERING LABORATORY

COURSE CODE: EE291

Course Outcomes (COs):

After completion of this course students will be able to

CO1: Identify and use common electrical components.

CO2: To develop electrical networks by physical connection of various components and analyze the circuit behavior.

CO3: Apply and analyze the basic characteristics of transformers and electrical machines.

CO-PO Mapping

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	-	-	-	-	-	-	1	-	-	1
CO2	-	2	2	2	-	-	-	-	2	-	-	1
CO3	-	2	-	2	-	-	-	-	2	-	-	1

COURSE NAME: ENGINEERING GRAPHICS & DESIGN

COURSE CODE: ME292

Course Outcomes (COs):

After attending the course students would

CO1: get introduced with Engineering Graphics and visual aspects of design.

CO2: know and use common drafting tools with the knowledge of drafting standards.

CO3: be able to apply computer aided drafting techniques to represent line, surface or solid models in different Engineering viewpoints.

CO4: be able to produce part models; carry out assembly operation and show working procedure of a designed project work using animation.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	2	2	2	2	-	2	2	2	2
CO2	2	2	3	2	2	2	2	2	2	2	2	2
CO3	2	2	3	2	3	2	2	-	2	2	2	3
CO4	2	2	3	3	3	3	2	2	3	3	2	2

COURSENAME: PROGRAMMING FOR PROBLEM SOLVING LAB

COURSE CODE: CS 291

Course Outcomes (COs):

After completion of the course students would be able to

CO1: Understand and propose appropriate command or function in running system or developing program for engineering and mathematical problems depending on the platform used even in changed environment leading to their lifelong learning.

CO2: Identify and propose appropriate data type, arithmetic operators, input/output functions and also conditional statements in designing effective programs to solve complex engineering problem using modern tools.

CO3: Design and develop effective programs for engineering and mathematical problems using iterative statements as well as recursive functions using modular programming approach possibly as a team maintaining proper ethics of collaboration.

CO4: Explain and organize data in arrays, strings and structures and manipulate them through programs and also define pointers of different types and use them in defining self-referential structures and also to construct and use files for reading and writing to and from leading to solution of engineering and mathematical problem.

CO5: Prepare laboratory reports on interpretation of experimental results and analyze it for validating the same maintaining proper ethics of collaboration.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	-	-	-	-	-	-	-	3
CO2	3	3	3	3	3	-	-	-	-	-	-	-
CO3	3	3	3	3	-	-	-	3	3	-	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	3	-	3	-	-

3rd Semester

Course Name: Mathematics- III

Course Code: M 301

Course Outcomes (COs):

On successful completion of the learning sessions of the course, the learner will be able to:

CO1: Recall the underlying principle and properties of Fourier series, Fourier transform, probability distribution of a random variable, calculus of complex variable, and partial differential equation.

CO2: Exemplify the variables, functions, probability distribution and differential equations and find their distinctive measures using the underlying concept of Fourier series, Fourier transform, probability distribution of a random variable, calculus of complex variable, and partial differential equation.

CO3: Apply Cauchy's integral theorem and the residue theorem to find the value of complex integration, and compute the probability of real world uncertain phenomena by indentifying probability distribution that fits the phenomena.

CO4: Solve partial differential equation using method of separation of variables

CO5: Find the Fourier series and Fourier transform of functions by organizing understandings of underlying principles and also evaluate the integral using Parseval's identity.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	1	1	-	-	-	-	-	-	-	-	1
CO2	3	2	1	-	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1
CO4	3	2	2	-	-	-	-	-	-	-	-	1
CO5	3	3	2	3	-	-	-	-	-	-	-	1

Course Name: Analog Electronic Circuits

Course Code: EI301

<u>Course Outcome:</u>

At the end of this course students will be able to

CO1: Explain the characteristics of diodes and transistors

CO2: Illustrate working principle of various rectifier and amplifier circuits and their application in real life.

CO3: Design and analysis of negative feedback amplifiers and oscillators.

CO4: Analyse the functioning of OP-AMP and design OP-AMP based circuits

CO5: Design ADC and DAC

CO-PO Mapping:

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	1	1	1	1	1	1	1	1	1	1	1
CO2	3	1	1	1	1	2	1	1	1	1	1	1
CO3	3	2	3	1	1	1	1	1	1	1	1	1
CO4	2	3	1	1	1	1	1	1	1	1	1	1
CO5	1	2	3	1	1	1	1	1	1	1	1	1

Course Name: Digital Electronic Circuits

Course Code: EI302

Course Outcome:

On completion of this Subject/Course the student shall be able to:

CO1: give Interpretation of the fundamental concepts and techniques used in digital electronics.

CO2: apply the concept of various number systems in digital design.

CO3: analyze and design various cost effective combinational and sequential circuits.

CO4: solve real life complex circuit problems by applying knowledge of digital electronics.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO1 0	PO11	PO1 2
CO1	3	3	2	2	2	1	1	1	1	1	1	1
CO2	3	2	2	1	1	1	1	1	1	1	1	2
CO3	3	2	2	2	1	1	1	1	1	1	1	1
CO4	2	3	2	2	1	1	1	1	1	1	1	2

Course Name : Circuit Theory and Networks

Course Code: EI303

Course Outcome:

On completion of this Subject/Course the student shall be able to:

CO1: Solve complex circuit problems by applying knowledge of circuit theorems.

CO2: Analyze dynamic performance of the networks using Laplace Transform.

CO3: Find out resonance of different circuits.

CO4: Analyze two port networks using A,B,C,D and Z,Y Parameter Model.

CO5: Design different types of filters.

CO-PO Mapping:

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

Course Name: Basic of Measurement Techniques

Course Code: EI304

<u>Course Outcome:</u>

On completion of this Subject/Course the student shall be able to:

CO1: Apply the knowledge to measure a particular parameter using an appropriate measuring instrument

CO2: Identify various types of errors that may occur during measurement and apply different steps to minimize them.

CO3: Calibrate and standardize the instruments applying the knowledge of calibration.

CO4: Apply the knowledge of the instrumentation and measurement systems in the real-life applications

CO-PO Mapping:

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

Paper name: Universal Human Values 2: Understanding Harmony

Paper code: HSMC403

Course outcomes:

By the end of the course,

CO1-To understand family, society and nature and build awareness of themselves CO2-To develop the knowledge how to become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.

CO3: To understand human values, human relationship and human society that help them to become more sensitive to their commitment.

CO4: To develop critical ability in handling problems and design sustainable solutions.

CO5: To applythe concepts for solving day to day real life problems.

CO-PO Mapping:

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

Course Name: Numerical Methods Lab

Code: M(CS) 391

Course Outcomes (COs):

On successful completion of the learning sessions of the course, the learner will be able to:

CO1: Understand the theoretical workings of numerical techniques with the help of C/ Matlab

CO2: Execute basic command and scripts in a mathematical programming language

CO3: Apply the programming skills to solve the problems using multiple numerical approaches.

CO4: Analyze if the results are reasonable, and then interpret and clearly communicate the results.

CO-PO Mapping:

PO CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
CO1	3	2	1	-	-	-	-	-	-	-	-	1
CO2	3	2	2	-	-	-	-	-	-	-	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1
CO4	3	3	2	3	-	-	-	-	-	-	-	1

Course Name: Analog Electronics Circuits Lab

Course Code: EI391

<u>Course Outcome:</u>

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

CO1: Verify the working of diodes, transistors and their applications.

CO2: Build a common emitter/base/collector amplifier and measure its voltage gain.

CO3: Explore the operation and advantages of operational amplifiers.

CO4: Design different types of filters and apply the same to oscillators and amplifiers.

CO5: Design a circuit to convert an analog signal to digital one.

CO-PO Mapping:

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	1	1	1	1	1	1	1	1	1	1
CO2	2	1	3	1	1	1	1	1	1	1	1	1
CO3	2	2	1	3	1	1	1	1	1	1	1	1
CO4	2	2	3	1	1	1	1	1	1	1	1	1
CO5	2	2	3	1	1	1	1	1	1	1	1	1

Course Name: Digital Electronic Circuits Lab

Course Code: EI392

Course Outcome:

On completion of this course students will be able to:

CO1: operate laboratory equipment.

CO2: design digital circuits

CO3: construct, analyze, and troubleshoot the digital circuits.

CO4: measure and record the experimental data, analyze the results and prepare a formal laboratory report.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO 9	PO10	PO1 1	PO12
CO1	2	2	2	2	3	1	1	1	1	1	1	1
CO2	2	2	3	1	1	1	1	1	1	1	1	2
CO3	2	2	3	2	1	1	1	1	1	1	1	1
CO4	3	3	2	2	1	1	1	1	2	1	1	2

Course Name: Circuit Network Lab

Course Code: EI393

Course Outcome:

On completion of this Subject/Course the student shall be able to:

CO1:Apply the techniques and skills of modern engineering tools necessary for engineering practice.

CO2:Identify, formulate and solve engineering problems with simulation software.

CO3:Analyze transient response of series /parallel R-L-C circuit using simulation software.

CO4: Determine frequency response of different filters using simulation software

CO-PO Mapping:

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

C. MANDATORY ACTIVITIES / COURSES

Course Name: Environmental Science

Course Code: MC301

Course Outcome:

After completion of this subject students will be able to:

CO1 : Study the mathematics and calculations of population growth, material balance and sustainable development.

CO2 : Study the components and diversity of eco system.

CO3 : Study the fundamental knowledge of air pollution, calculations of earth's surface temperature, atmospheric window and lapse rate.

CO4: Acquire fundamental knowledge of water pollution and its consequences knowledge and calculations regarding BOD, COD.

CO5: Understand the basic concepts regarding noise and musical sound, decibel unit and its relation with sound intensity, reasons and consequences of noise pollution.

CO6: Understand the concepts of land pollution and its remedies.

CO-PO Mapping:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
CO1	2	2	1	1	1	2	3	1	1	1	1	1
CO2	2	2	2	1	1	1	3	1	1	1	1	1
CO3	2	2	2	1	1	1	3	1	1	1	1	1
CO4	2	2	2	1	1	1	3	1	1	1	1	1
CO5	2	2	1	1	1	1	2	1	1	1	1	1

CO6	2	2	1	1	1	1	3	1	1	1	1	1

5th Semester

Paper name: Principles of Management

Paper Code: HSMC 505

Course outcome:

On completion of the course, students will be able to

CO1: To recall and identify the relevance of management concepts.

CO2: To apply management techniques for meeting current and future management challenges faced by the organization

CO3: To compare the management theories and models critically to solve real-life problems in an organization.

CO4: To apply principles of management in order to execute the role as a manager in an organization.

CO-PO Mapping:

CO	PO 1	PO 2	PO 3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12
CO1	**2**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**3**	**1**	**3**	**2**
CO2	**1**	**1**	**1**	**1**	**1**	**2**	**1**	**3**	**3**	**1**	**3**	**3**
CO3	**2**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**2**	**1**	**3**	**3**
CO4	**3**	**1**	**1**	**1**	**1**	**2**	**1**	**2**	**3**	**1**	**3**	**1**

Course Name: Industrial Instrumentation

Course Code: EI501

Course Outcomes:

CO1: Able to explain working principle of different measuring instruments.

CO2: Able to Describe the specification of different instruments and advantages and disadvantages.

CO3: Able to Measure different physical parameters like pressure, temperature, flow rate, level etc.

CO4: Able to install the instruments.

CO-PO Mapping:

Cos	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**P10**	**P11**	**P12**
CO1	3	2	3	1	2	1	3	2	2	2	1	2
CO2	2	1	1	2	2	2	2	3	3	3	2	2
CO3	2	3	2	2	1	1	2	1	1	2	2	2
CO4	2	2	2	2	2	2	2	2	2	2	2	2

Course Name: Analog & Digital Communication Theory

Course Code: EI502

Course Outcomes:

CO1: Able to analyze the performance of a baseband and pass band communication system in terms of error rate and spectral efficiency.

CO2: Able to perform the time and frequency domain analysis of the signals in a communication system.

CO3: Able to select the blocks in a design of communication system.

CO4: Able to analyze Performance of spread spectrum communication system.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	1	2	2	2	3	2	2	3	2	2	1	1
CO 2	1	2	1	3	2	1	1	2	3	1	2	3
CO 3	2	2	3	2	2	3	3	2	2	2	2	2
CO 4	1	3	2	3	3	2	2	3	3	3	2	2

Course Name: Control Engineering

Course Code: EI503

Course Outcomes:

CO1: Apply Laplace transform and state-space techniques to model dynamic systems.

CO2: Demonstrate an understanding of the fundamentals of control systems.

CO3: Determine the time-domain responses of first and second-order systems.

CO4: Analyze the system behavior in the frequency domain & the system stability using a compensator.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	1	1	1	2	2	2	2	2	1	1
CO2	1	2	3	3	3	2	2	2	1	1	2	2
CO3	1	3	2	3	3	2	3	2	2	2	2	3
CO4	3	3	1	2	3	2	2	3	2	3	2	2

Course Name: Power Plant Instrumentation

Course Code: EI504A

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	1	1	1	2	2	2	2	2	1	1
CO2	1	2	3	3	3	2	2	2	1	1	2	2
CO3	1	3	2	3	3	2	3	2	2	2	2	3
CO4	3	3	1	2	3	2	2	3	2	3	2	2

Course Name: Virtual Instrumentation

Course Code: EI504B

Course Outcomes:

After the successful completion of the course the students will be able to:

CO1: To explainthe working of LabVIEW.

CO2: To Understand the various types of structures used in LabVIEW.

CO3: To analyze and design different types of programs based on data acquisition.

CO4: To apply the knowledge of LabVIEW for signal processing, image processing, etc.

CO-PO mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	1	2	2	2	2	2	1	3	3	1	1
CO2	1	1	1	3	2	3	3	3	1	3	3	1
CO3	1	3	1	2	1	1	1	3	3	-1	1	3
CO4	2	1	1	3	1	1	1	1	3	1	3	3

Course Name: ADVANCED MICROPROCESSORS AND MICROCONTROLLERS

Course Code: EI504C

Course Outcomes:

On completion of this course, students will be capable of

CO1: Understanding the advanced methods of 8085/8086 microprocessors and 8051 microcontrollers with their internal architecture and various addressing modes.

CO2: Analyzing various instructions and programs to implement in devices.

CO3: Applying the knowledge for communicating various real-time applications through interfacing techniques.

CO4: Designing various advanced systems based on microprocessors and microcontrollers.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	**3**	**2**	**1**	**-2**	**1**	**3**	**3**	**3**	**3**	**1**	**1**	**3**
CO2	**1**	**2**	1	**3**	**-2**	**3**	**2**	**3**	**2**	**3**	**3**	**3**
CO3	**1**	**2**	**2**	**1**	**2**	**3**	**3**	**3**	**2**	**3**	**2**	**3**
CO4	**3**	**3**	**1**	**2**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**2**

Course Name: Industrial Instrumentation Lab

Course Code: EI591

Course Outcomes:

CO1: Able to calibrate different instruments.

CO2: Able to measure different industrial parameters like pressure, temperature, flow, level, etc.

CO3: Able to understand the working principle of different instruments

CO4: Able to choose the suitable instrument for desired measuring parameter.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	2	1	1	3	3	3	3	1	1	3
CO2	1	2	1	3	2	3	2	3	2	3	3	3
CO3	1	1	2	2	1	3	3	3	2	3	2	3
CO4	3	3	1	2	2	3	3	3	3	3	3	2

Course Name: Analog & Digital Communication Lab

Course Code : EI592

Course Outcomes:

CO1: To learn signal and linear time-invariant system properties.

CO2: Study, design, and build modulation systems examining trade-offs in different communication systems.

CO3: To be able to perform experiments in converting analog information into digital data via sampling, quantization, and coding.

CO4: To be able to choose the necessary modulation technique for specific signal transmission.

CO-PO mapping:

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

Course Name: Control Engineering Laboratory

Course Code: EI593

Course Outcomes:

The students will be able to:

CO1. Apply to formulate transfer function for given control system problems.

CO2. Demonstrate an understanding of the fundamentals of control systems.

CO3. Determine the time response of the given control system model.

CO4. Analyze the system behavior through Root Locus, Bode plots & Nyquist plots for a given control system model.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	**2**	**2**	**3**	**1**	**2**	**2**	**3**	**2**	**3**	**2**	**2**	**3**
CO2	**1**	**3**	**1**	**3**	**2**	**2**	**1**	**2**	**2**	**2**	**2**	**2**
CO3	**2**	**2**	**3**	**1**	**2**	**2**	**2**	**1**	**2**	**3**	**2**	**1**
CO4	**3**	**3**	**1**	**2**	**1**	**2**	**2**	**2**	**3**	**2**	**3**	**2**

Course Name: POWER PLANT INSTRUMENTATION LABORATORY

Course Code: EI594A

Course Outcomes:

Upon completion of this course, the student will be able to

CO1: understand the operational functions of PLC, DCS, and SCADA.

CO2: analyze Industrial Networking, Networking protocols, and topologies.

CO3: demonstrate competence in maintaining and troubleshooting technology, detecting more serious problems, generating workable solutions to correct deviations, and recognizing when to get additional help. CO4: analyze the automation technologies in different types of plants.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	2	2	3	1	2	2	2	1	2	2	2	2
CO2	1	3	1	3	2	2	3	2	2	1	3	2
CO3	2	2	3	1	2	2	2	3	2	2	2	2
CO4	3	3	1	2	1	2	2	2	3	2	2	1

Course Name: Virtual Instrumentation Lab

Course Code: EI594B

Course Outcomes:

On completion of this course students will be able to:

CO1: Operate LabVIEW software.

CO2: Explore the various programming techniques of LabVIEW software

CO3: Design different types of programs based on data acquisition systems and control systems

CO4: Apply knowledge of VI into different real-time applications.

CO-PO mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	1	1	2	1	2	1	2	1	2	1
CO2	2	1	3	3	2	1	2	2	1	3	3	1
CO3	2	3	1	2	2	1	2	3	3	2	1	1
CO4	1	3	2	3	2	1	1	2	2	1	3	3

Course Name: Advanced Microprocessors and Microcontrollers Lab Course Code: EI594C

Contact: 0:0:3

Course Outcomes

CO1: Understanding the advanced methods of 8085/8086 microprocessors and 8051 microcontrollers with their internal architecture and various addressing modes.

CO2: Analyzing various instructions and programs to implement in devices.

CO3: Applying the knowledge for communicating various real-time applications through interfacing techniques.

CO4: Designing various advanced systems based on microprocessors and microcontrollers.

CO-PO mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	1	1	2	1	2	1	3	1	3	1
CO2	2	1	3	3	2	1	3	2	1	2	2	1
CO3	2	3	1	2	3	1	2	3	2	2	1	2
CO4	1	3	2	3	2	1	1	2	2	1	2	1

C. MANDATORY ACTIVITIES / COURSES

Course Name: Constitution of India

Course Code: MC501

Course Outcome:

Student will be able to:

CO1: Develop human values, create awareness about law ratification and significance of Constitution

CO2: Comprehend the Fundamental Rights and Fundamental Duties of the Indian Citizen to implant morality, social values and their social responsibilities.

CO3: Create understanding of their Surroundings, Society, Social problems and their suitable solutions.
CO4: Familiarize with distribution of powers and functions of Local Self Government.

CO5: Realize the National Emergency, Financial Emergency and their impact on Economy of the country.

<u>CO-PO Mapping:</u>

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

6th Semester

Paper name: Economics for Engineers

Paper Code: HSMC 604

Course Outcome:

CO1: To learn the identification of various uses for scarce resources.

CO2: To understand key economic concepts and implement them in real-life problems.

CO3: To design sustainable and effective economic models in real-life projects.

CO4: To apply critical thinking skills in analyzing financial data and their impacts.

CO-PO Mapping:

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

Course Name: Process Control-1

Course Code: EI601

<u>Course Outcomes:</u>

Upon successful completion of the course students will be able to:

CO1: Design a controller by applying the knowledge of different control action

CO2: Calculate controller parameters by applying different tuning methods

CO3: Describe different advanced control strategy

CO4: State the operation and use of the final control element

CO5: Develop ladder logic programs and understand the basics of DCS

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	2	**1**	**2**	**1**	1	**2**	**1**	**2**	2	2
CO2	**3**	**2**	1	**2**	**1**	**2**	**1**	**2**	**1**	**1**	**1**	2
CO3	2	1	1	**2**	1	**2**	**1**	**1**	**1**	**2**	**2**	3
CO4	1	1	1	**3**	**3**	**2**	**3**	**3**	**2**	**2**	**1**	2
CO5	3	2	3	**2**	**1**	**3**	**2**	**3**	**1**	**1**	**2**	2

Course Name: Biomedical Instrumentation

Course Code: EI602

<u>Course Outcomes:</u>

After completion of this course, the students will be able to

CO1: Able to understand the detailed physiology of various human anatomical systems.

CO2: Able to identify proper transducer for acquisition of a particular bioelectric potential.

CO3: Able to analyse various biological conditions from the measured bioelectric potentials.

CO4: Able to design biotelemetry systems for acquiring bioelectric potentials from long distance.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	2	2	2	2	1	2	1	2	2	1
CO2	3	3	2	2	2	2	1	1	1	1	3	3
CO3	3	3	2	3	3	1	2	1	2	2	1	3
CO4	3	3	3	3	3	2	2	3	1	2	2	1

Course Name: ROBOTICS ENGINEERING

Course Code: EI603A

<u>Course Outcomes:</u>

CO1: Perform kinematic and dynamic analyses with simulation. Design control laws for a simple robot.

CO2: Integrate mechanical and electrical hardware for a real prototype of the robotic device.

CO3:Select a robotic system for a given industrial application.

CO4: Use of robots in domestic applications.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	2	2	3	1	3	2	1	2	1	2	3
CO 2	1	2	2	3	2	1	3	2	4	2	1	2
CO 3	1	2	2	1	2	2	3	3	2	3	2	2
CO 4	1	3	2	1	3	2	1	3	3	3	2	3

Course Name: Advanced Sensors

Course Code: EI603B

Course Outcomes:

Students will be able to

CO1 Explain different techniques of sensors designing parameters.

CO2 Determine the specification of different types of sensors.

CO3 Understand and compare the different microsensor development techniques.

CO4 Design & Apply the microsensors using different techniques.

O-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	3	**1**	**1**	**1**	3	**1**	**2**	**3**	1	1
CO2	**1**	**3**	1	**1**	**1**	**3**	**2**	**3**	**3**	**3**	**2**	1
CO3	3	2	3	**2**	1	**3**	**3**	**1**	**3**	**2**	**1**	2
CO4	3	3	1	**3**	2	**3**	**3**	**3**	**1**	**3**	**1**	2

Course Name: Embedded System Design

Course Code: EI603C

Course Outcomes:

After completion of the course, the students will be able to

CO1: Understand the architecture and classifications of different embedded systems and the related programming knowledge.

CO2: Understand the concepts of embedded systems like I/O, timers, interrupts, interaction with peripheral devices

CO3: Choose case-specific debugging technique for an embedded system.

CO4: Design various real time systems using embedded systems.

Course Name: Non-Destructive Testing and Ultrasonic Instrumentation

Course Code: EI604A

Course Outcomes:

On the completion of this course, students will be able to

CO1.Understand the concept of non-destructive testing

CO2.Describe the various types of NDT tests carried out on components

CO3.Analyze the different types of tests carried out on components and surfaces.

CO4.Understand the properties of materials suitable for NDT.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	2	1	1	1	1	1	1	1	1	1	1
CO 2	2	3	2	2	3	1	2	1	1	2	1	1
CO 3	2	3	2	1	1	1	1	2	1	2	1	1

Course Name: Optoelectronics and Fibre Optic Sensors

Course Code: EI604B

Course Outcomes:

After the completion of the course, the learner will be able to:

CO1: compare double hetero junction LED, surface emitter LED, edge emitter LED, super luminescent LED, and semiconductor-based LASER (p-n junction laser, double heterojunction laser, stripe geometry) as optoelectronic sources based on working principles and applications

CO2: compare optoelectronic detectors (p-n photodiode, p-i-n photodiode, avalanche photodiode, Schottky photodiode, heterojunction diode, phototransistor, LDR, photovoltaic cells, photoemissive cells) based on detector parameters, which are responsivity, efficiency, and working principle

CO3: select a suitable optical fiber for an engineering application, based on the number of modes required, distance to be covered and V-parameter

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	3	**3**	**3**	**3**	1	**3**	**3**	**3**	2	1
CO2	3	**1**	3	**3**	**2**	**3**	**1**	**3**	**3**	**3**	2	3
CO3	3	1	2	**3**	**3**	**3**	2	**3**	**3**	**3**	**3**	2
CO4	3	1	3	**2**	3	**2**	**2**	**3**	**3**	**3**	2	2

Course Name: Soft Computing

Course Code: EI604C

Course Outcomes:

After the completion of the course, the learner will be able to:

CO1: justify the use of fuzzy logic for decision making in presence of uncertainty

CO2: design a fuzzy logic control system for a continuous-time plant with single i/p-single o/p

CO3: compare the supervised and unsupervised learning techniques in artificial neural networks

CO4: explain the operation of genetic algorithm-based optimization technique

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	2	2	2	3	3	3	3	3	1	2
CO2	3	2	3	2	3	3	2	3	3	3	3	2
CO3	3	3	1	2	1	3	3	2	2	3	3	2
CO4	3	2	1	2	1	3	3	3	3	1	3	2

Course Name: Data Structures & Algorithms

Course Code: EI605A

Course Outcomes:

On completion of the course, students will be able to

Differentiate how the choices of data structure & algorithm methods impact the performance of the program.

Solve problems based upon different data structures& also write programs.

Identify appropriate data structure & algorithmic methods in solving problems.

Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing

Compare and contrast the benefits of dynamic and static data structures implementations.

CO-PO Mapping

CO	PO1	PO2	POP3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	2	2	3	3	3	2	3
CO2	3	2	2	2	2	2	3	2	2	3	3	2
CO3	3	3	3	2	3	3	3	2	2	3	3	2
CO4	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	3	3	3	3	3	3	3	3	3

Course Name: Database Management System

Course Code: EI605B

<u>Course Outcomes:</u>

On completion of the course students will be able to

CO1: Apply the knowledge of Entity Relationship (E-R) diagram for an application.

CO2: Create a normalized relational database model

CO3: Analyze real world queries to generate reports from it.

CO4: Determine whether the transaction satisfies the ACID properties.

CO5: Create and maintain the database of an organization.

CO-PO Mapping:

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

Course Name: Software Engineering

Course Code: EI605C

Course Outcomes:

CO1: To identify, formulate, and solve software engineering problems, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements

CO2: To analyze, elicit and specify software requirements through a productive working relationship with various stakeholders of the project

CO3: To design applicable solutions in one or more application domains using software engineering approaches that integrates ethical, social, legal and economic concerns.

CO4: To develop the code from the design and effectively apply relevant standards and perform testing, and quality management and practice.

CO5: To identify modern engineering tools necessary for software project management, time management and software reuse, and an ability to engage in life-long learning.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	1	1	2	2	1	3	2	3	3	2	3	3
CO 2	2	2	1	2	3	3	3	2	3	1	2	3
CO 3	1	2	1	2	2	2	3	1	3	2	3	3
CO 4	3	3	2	3	3	3	2	3	3	1	1	2
CO 5	3	3	1	3	2	3	3	3	2	1	2	2

Course Name: Process Control Laboratory

Course Code: EI691

Course Outcomes:

After completion of the laboratory course students will be able to:

CO1: Recognize & explain basic process control loop elements via hands on experiment.
CO2: Control different process variable (flow, pressure, level & temperature) using different controller mode.

CO3: Use various PLC functions and develop PLC programs to control a real time system.

CO4 : Control& monitor different process variable through DCS.

CO-PO mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	2	2	1	3	3	2	3	3	1	3	2	3
CO2	2	2	1	1	2	3	1	3	2	3	3	3
CO3	2	3	3	3	3	1	3	1	1	3	2	3
CO4	1	2	2	3	3	2	3	3	1	3	2	3

Course Name: Biomedical Instrumentation Laboratory

Course Code: EI692

Contact: 0:0:3

Credits: 1.5

Course Outcomes:

After completion of this course, the students will be able to

CO1: Able to understand the detailed physiology of various human anatomical systems.

CO2: Able to identify proper transducer for the acquisition of particular bioelectric potential.

CO3: Able to analyze various biological conditions from the measured bioelectric potentials.

CO4: Able to design biotelemetry systems for acquiring bioelectric potentials from long distances.

CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	2	2	2	2	3	2	3	1	2	2	1
CO2	3	3	2	2	2	2	1	1	2	1	1	1
CO3	3	3	2	3	3	1	2	1	2	1	1	1
CO4	3	3	3	3	3	2	2	2	1	1	1	1

Course Name: Robotics Engineering Laboratory

Course Code : EI693A

Course Outcomes:

The students will be able to:

CO1. Apply formulate transfer function for given control system problems.

CO2. Demonstrate an understanding of the fundamentals of control systems.

CO3. Determine time response of given control system model.

CO4. Analyze the system behavior through Root Locus, Bode plots & Nyquist plot fora given control system model.

CO-PO Mapping:

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	1	3	2	1	2	1	2	3
CO2	1	2	2	3	2	1	2	3	4	2	2	2
CO3	1	2	4	1	2	3	3	3	2	3	2	2
CO4	2	3	2	1	3	2	1	3	3	3	4	3

Course Name: Advanced Sensor Laboratory

Course Code: EI693B

Course Outcomes:

Students will be able to

CO1: Explain different techniques of sensors designing parameters.
CO2: Determine the specification of different types of sensors.
CO3: Understand and compare the different micro sensor development technique.
CO4: Design & Apply the micro sensors using different technique.

CO-PO Mapping:

COs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	3	**3**	**2**	**3**	2	3
CO2	3	3	3	2	3	1	3	3	3	1	3	3
CO3	3	3	3	3	3	2	3	2	2	2	2	3
CO4	3	3	3	2	3	1	3	3	3	1	3	3

Course Name: Embedded Systems Design Laboratory

Course Code: EI693C

Course Outcomes:

CO1: Familiarization with PIC Microcontroller, ARM Microcontroller, FPGA, and their interfacing.

CO2: Design of different types real-time projects with digital controllers.

CO3: Program ARM microcontroller to perform various tasks.

CO4: Understand the key concepts of embedded systems such as I/O, timers, interrupts and interaction with peripheral devices.

CO-PO Mapping:

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	3	3	1	2	3	3	2	2	1	2	3
CO 2	3	3	3	2	3	1	3	3	3	1	3	3
CO 3	3	3	3	3	3	2	3	3	2	3	2	3
CO 4	3	3	3	2	3	1	3	3	3	1	3	3

Name of the Paper: Data Structures & Algorithms Laboratory

Paper Code: EI694A

Course Outcomes:

CO1: Choose appropriate data structure as applied to specified problem definition.

CO2: Handle operations like searching, insertion, deletion, traversing mechanism on various data structures.

CO3: Have practical knowledge on the applications of data structures.

CO4: Able to store, manipulate and arrange data in an efficient manner.

CO-PO Mapping:

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

Course Name: Database Management System Laboratory

Course Code: EI694B

<u>Course Outcomes:</u>

On completion of the course, students will be able to

CO1: Understand the basic concepts regarding the database, know about query processing and techniques involved in query optimization and understand the concepts of database transaction and related database facilities including concurrency control, backup and recovery.

CO2: Understand the introductory concepts of some advanced topics in data management like distributed databases, data warehousing, deductive databases and be aware of some advanced databases like partial multimedia and mobile databases.

CO3: Differentiate between DBMS and advanced DBMS and use of advanced database concepts and become proficient in creating database queries.

CO4: Analyze database system concepts and apply normalization to the database.

CO5: Apply and create different transaction processing and concurrency control applications.

CO-PO Mapping

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

Name of the Paper: Software Engineering Lab

Paper Code: EI694C

<u>Course Outcomes:</u>

CO1: To handle software development models through rational methods.

CO2: To prepare SRS document, design document, test cases, and software configuration management and risk management related document.

CO3: To develop function-oriented and object-oriented software design using tools like a rational rose.

CO4: To perform unit testing and integration testing

CO5: To apply various white box and black box testing techniques.

CO-PO Mapping:

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

C. MANDATORY ACTIVITIES / COURSES

Intellectual Property Rights

Code: MC 601

Course Outcome

After completion of this course student will able to

CO-1: Explain and describe various aspects of IPR including trademark, patent, and copyright.

CO-2: Select, interpret and use different techniques related to IPR specific issues

CO-3: Adopt methods commensurate with National & International Standard.

CO-4: Understand the impact of IPR on emerging issues like public health, climate change, domain name related disputes etc.

CO-PO Mapping:

CO Codes	Program Outcomes (POs)											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	-	-	-	-	-	3	2	2	-	-	-	-
CO2	-	-	-	-	-	2	-	3	-	2	-	-
CO3	-	-	-	-	-	-	3	3	-	2	-	-
CO4	-	-	-	-	-	3		3	-	-	-	2

7th Semester

Telemetry & Remote Control

Code: EI701A

Course Outcome:

Students will be able to

CO1: Understand the concepts and purpose of different Telemetry &Remote control systems in the Instrumentation field. Identify the concepts and utilities of telemetry systems

CO2: Recognize the various Telemetry systems, coding, modulation techniques, and Time Division Multiplexing and Frequency Division Multiplexing techniques and MODEM and concept of Wave propagation

CO3: Understand the concepts and applications of satellite Telemetry

CO4: Design and implement the Remote control system for various Industrial application purposes and the guidelines for solving different industry-related complex problem.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12	PSO1
CO1	1	1	2	2	1	1	1	1	1	1	1	1	3
CO2	1	1	1	3	1	1	1	1	1	1	1	1	3
CO3	1	2	1	1	2	1	1	1	1	1	1	2	2
CO4	1	1	1	3	-1	1	1	1	1	1	1	1	3

Course Name: Analytical Instrumentation

Course Code: EI701B

Course Outcome:

After completion of the course, the students will be

CO1: able to determine the physical properties of samples like pH, viscosity, humidity, and moisture.

CO2: able to quantitatively measure the composition of various gas and liquid samples.

CO3: able to identify the elements present in the given sample using analytical techniques.

CO4: able to apply and use chromatography in real-time industrial environment.

CO-PO mapping:

PO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	2	2	1	1	3	3	3	1	2	1	3	3
CO 2	2	3	1	1	3	3	2	1	2	1	1	3
CO 3	3	2	1	1	3	3	1	3	2	1	3	3
CO 4	2	2	1	1	3	3	1	1	2	1	2	3

Course Name: Digital Image Processing

Course Code: EI701C

Course Outcome:

CO1: Understand image formation and the role the human visual system plays in the perception of gray and color image data.

CO2: Get broad exposure to and understanding of various applications of image processing in the industry, medicine, and defense.

CO3: Learn the signal processing algorithms and techniques in image enhancement and image restoration.

CO4: Acquire an appreciation for the image processing issues and techniques and be able to apply these techniques to real-world problems.

CO5: Be able to conduct independent study and analysis of image processing problems and technique.

CO-PO mapping of course:

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

Course Name: PROCESS CONTROL- II

Code: EI702A

Course Outcome:

After the completion of the course, the learner will be able to:

CO1: carry out the discretization and reconstruction of a given signal by using an ideal sampler and zero-order hold, respectively

CO2: carry out z-transform and inverse z-transform for given functions

CO3: carry out mathematical modeling, stability analysis, and time response analysis of a linear time-invariant discrete-time control system

CO4: design digital PID controller and deadbeat controller for linear time-invariant single i/p-single o/p system

CO5: explain the functionality of DCS in a process plant, including control, communication, protocols, and network topology

CO6: compare the fuzzy logic control system with a conventional control system.

CO-PO matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	1	3	1	1	1	1	1	1	1	1	1
CO2	3	1	3	1	1	1	1	1	1	1	1	1
CO3	3	1	3	1	3	1	1	1	1	1	1	1
CO4	3	1	3	1	3	1	1	1	1	1	1	1
CO5	3	1	3	1	3	1	1	1	2	1	1	2
CO6	3	1	1	1	3	1	1	1	1	1	1	2

Course Name: Introduction to MEMS

Code:EI702B

Contact:3:0:0

Credits: 3

Total Contact Hours: 36

Course Outcomes:

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

Understanding the working principles of MEMS and NEMS devices.

Understanding the micromachining Techniques

Design and model MEM devices.

Analyzing the application areas.

CO-PO Mapping:

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

Course Name: Artificial Intelligence

Course Code:EI702C

Course Outcome

On completion of the course, students will be able to

CO1: Understand the concepts of Artificial intelligence

CO2:Analyze the dimensions along which agents and environments vary, along with key functions that must be implemented in a general agent

CO3: Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing

CO4: Represent knowledge of the world using logic and infer new facts from that Knowledge and working knowledge in PROLOG in order to write simple PROLOG programs and explore more sophisticated PROLOG code on their own.

CO-PO Mapping:

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

Course Name: Power Electronics

Code: EI703A

Course Outcome:

CO1: Acquire knowledge about fundamental concepts and techniques used in power electronics.

CO2: Ability to express characteristics of SCR, BJT, MOSFET, and IGBT

CO3: Ability to analyze & design various single-phase and three-phase power converter, inverters circuits and understand their applications

CO4: To develop skills to build, and troubleshoot power electronics circuits like SMPS, Intelligent power module, etc'.

CO-PO mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO 1	3	2	2	1	1	1	1	1	1	1	2	1
CO 2	1	2	3	1	2	1	1	1	1	1	1	1
CO 3	2	1	2	1	1	1	1	1	1	1	1	1
CO 4	1	1	1	1	3	1	1	1	1	1	1	1

Course Name: Industrial Drives

Course Code: EI703 B

Course Outcome

CO1: Demonstrate the basic requirements of dc drive and ac drive.

CO2: Illustrate the principles of speed control of dc motors and ac motors.

CO3: Classify the industrial applications of dc drive and ac drive.

CO4: Analyze the servo motors and servo drives

CO-PO Mapping:

	PO 1	PO 2	PO 3	PO 4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	2	1	1	1	1	1	1	2
CO2	3	2	2	1	3	1	1	1	1	1	1	2
CO3	3	1	1	1	2	2	1	1	1	1	1	2
CO4	3	1	1	1	2	2	1	1	1	1	1	2

Course Name: Non-Conventional Energy Sources

Code: EI703C

Course Outcome:

Students will be able to

CO1: Explain the different non-renewable sources.

CO2: Apply solar energy in different Fields using photovoltaic cells.

CO3: Analyses the performance and testing of different energy resources.

CO4: Select the design parameters of the non-conventional energy plants.

CO-PO Mapping:

CO	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	1	3	2	1	2	1	1	1	1	1	1
CO2	3	2	1	2	2	2	1	1	1	1	1	1
CO3	3	1	1	1	1	2	1	1	1	1	1	1
CO4	2	2	2	3	2	1	1	1	1	1	1	2

Course Name: Satellite Communication

Course Code: EI704A

Course Outcomes:

At the end of this course, students will demonstrate the ability to

CO1: Visualize the architecture of satellite systems as a means of high speed, high range communication system.

CO2: State various aspects related to satellite systems such as orbital equations, sub-systems in a satellite, link budget, modulation, and multiple access schemes.

CO3: Solve numerical problems related to orbital motion and design of link budget for the given parameters and conditions.

CO4: To analyze the sub-systems of a satellite system such as Telemetry

CO-PO Matrices:

COs	**PO1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO7**	**PO 8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	3	1	1	1	1	1	1	1	1	1
CO2	3	2	1	1	1	1	1	1	1	1	1	2
CO3	3	3	3	1	1	1	1	1	1	1	1	1
CO4	2	2	1	1	1	1	1	1	2	1	1	1

Course Name: Wireless Sensor Network

Course Code:EI704B

Course Outcomes:

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

CO1: Design wireless sensor networks for a given application

CO2: Understand emerging research areas in the field of sensor networks

CO3: Understand MAC protocols used for different communication standards used in WSN

CO4: Explore new protocols for WSN.

CO-PO Matrices:

COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO9	PO10	PO11	PO12
CO1	2	2	3	1	1	1	1	1	1	1	1	1
CO2	3	2	1	1	1	1	1	1	1	1	1	2
CO3	3	3	3	1	1	1	1	1	1	1	1	1
CO4	2	2	1	1	1	1	1	1	2	1	1	1

Course Name: Quantum Computing

Course Code: EI704C

<u>Course Outcome</u>:

After successful completion of the course, students will be able to

CO1: explain the basics of quantum computation

CO2: solve different quantum circuits

CO3: describe quantum Information and cryptography protocols

CO4: write quantum algorithm.

<u>CO-PO Matrices:</u>

COs	**PO1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO7**	**PO 8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	2	2	3	1	1	1	1	1	1	1	1	1
CO2	3	2	1	1	1	1	1	1	-	1	1	2
CO3	3	3	3	1	1	1	1	1	1	1	1	1
CO4	2	2	1	1	1	1	1	1	2	1	1	1

Course Name: Telemetry and Remote Control lab

Code: EI791A

<u>Course Outcome:</u>

After completion of the laboratory course students will be able to:

CO1: Recognize and explain basic computational properties of remote sensing data acquisition, storage, and processing.

CO2: Apply mathematical relationships describing fundamental physical, geometric, and computational principles relevant to remote sensing.

CO3: Recognize and explain at a basic level the fundamental physical principle of remote sensing.

CO4: Explain EM radiation interactions vary across a limited number of substances, geometries, and temperatures; and geometric properties of photographs and images.

CO5: Demonstrate proficiency and conceptual understanding in using software or manual techniques to carry out remote sensing image processing and analysis through a series of laboratory exercises and reports.

CO-PO Matrix of the Course:

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

Course Name: ANALYTICAL INSTRUMENTATION LAB

CODE: EI791B

Course Outcome:

After completion of the laboratory course students will be able to:

CO1: Recognize and explain basic computational properties of remote sensing data acquisition, storage, and processing.

CO2: Apply mathematical relationships describing fundamental physical, geometric, and computational principles relevant to remote sensing.

CO3: Recognize and explain at a basic level the fundamental physical principle of remote sensing.

CO4: Explain EM radiation interactions vary across a limited number of substances, geometries, and temperatures; and geometric properties of photographs and images.

CO5: Demonstrate proficiency and conceptual understanding in using software or manual techniques to carry out remote sensing image processing and analysis through a series of laboratory exercises and reports

CO-PO Matrix of the Course:

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

Course Name: Digital Image Processing Lab

CODE: EI791C

Course Outcome:

After completion of the laboratory course students will be able to:

CO1: Recognize and explain basic computational properties of remote sensing data acquisition, storage, and processing.

CO2: Apply mathematical relationships describing the fundamental physical, geometric, and computational principles relevant to remote sensing.

CO3: Recognize and explain at a basic level the fundamental physical principle of remote sensing.

CO4: Explain EM radiation interactions vary across a limited number of substances, geometries, and temperatures; and geometric properties of photographs and images.

CO5: Demonstrate proficiency and conceptual understanding in using software or manual techniques to carry out remote sensing image processing and analysis through a series of laboratory exercises and reports.

CO-PO Mapping:

COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO9	PO10	PO11	PO12
CO1	2	2	3	1	1	3	3	1	1	1	1	1
CO2	3	2	1	1	1	1	1	1	1	1	1	2
CO3	3	3	3	1	1	3	3	1	1	1	1	1
CO4	2	2	1	1	1	1	1	1	2	1	1	2

Course Name: Entrepreneurship & Innovation Skill

Paper Code: MC781

Course Outcomes:

CO1 This will help to understand the basics and needs of Entrepreneurship.

CO2 This will help Entrepreneurs develop the need and nature so, that they can run their business

CO3 This unit helps to generate start-ups with various business decisions.

CO4 Helps the student to develop certain skills of Entrepreneurship.

CO5 This helps to develop business projects which develop to build business projects.

CO6 Student will able to describe examples of entrepreneurial business and actual practice, both successful and unsuccessful, and explain the role and significance of entrepreneurship as a career, in the firm, and in society.

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	---	---	---	---	---	---	---	---	---	2	2	---
CO2	---	---	---	---	---	---	3	---	---	2	---	3
CO3	2	1	---	---	---	2	---	---	---	2	---	---
CO4	---	---	---	---	---	---	---	---	---	2	3	---
CO5	---	---	---	---	---	---	3	---	---	2	2	3
CO6	2	---	---	---	---	---	3	---	---	2	---	3

8th Semester

Course Name: Plant Automation and IIOT

CODE: EI801A

Course Outcome:

Upon completion of this course, the student will be able to

CO1: Understand the operational functions of PLC, DCS, and SCADA.

CO2: Analyze Industrial Networking, Networking protocols, and topologies.

CO3: Demonstrate competence in maintaining and troubleshooting technology, detecting more serious problems, generating workable solutions to correct deviations, and recognizing when to get additional help.

CO4: analyze the automation technologies in different types of plants.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	3	1	1	3	2	1	1	1	1	1	1
CO2	2	2	1	2	2	1	1	1	1	2	1	1
CO3	2	1	1	1	3	2	1	1	1	1	1	1
CO4	2	1	1	1	1	1	1	1	1	1	1	1

Course Name: Nano-electronics

CODE: EI801B

<u>Course Outcome</u>:

Upon completion of this course, the student will be able to

Understand various aspects of nano-technology and the processes involved in making nano components and materials.

Leverage advantages of the nano-materials and appropriate use in solving practical problems.

Understand various aspects of nano-technology and the processes involved in making nano components and materials.

Leverage advantages of the nano-materials and appropriate use in solving practical problems.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	3	1	-	3	2	1	-	-	1	1	1
CO2	2	2	-	2	2	1	-	-	-	2	1	1
CO3	2	1	1	1	3	2	-	-	-	-	-	-
CO4	2	1	-	1	1	-	1	-	1	-	1	1

Course Name: Biomedical Signal Processing

CODE: EI801C

Course Outcome:

Upon completion of this course, the student will be able to

CO1: Understand the basics of digital signals and biological signals.

CO2: Apply knowledge of math, engineering and science to understand the principle of biomedical signal processing.

CO3: Demonstrate basics of signal pre-processing and digital filtering

CO4: Analyze the ECG pattern recognition and classification algorithms

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
CO1	3	3	1	-	3	2	1	-	-	1	1	1
CO2	2	2	-	2	2	1	-	-	-	2	1	1
CO3	2	1	1	1	3	2	-	-	-	-	-	-
CO4	2	1	-	1	1	-	1	-	1	-	1	1

Course Name: Computer Networking

Code: EI802A

Course Outcome:

After completion of the course, students will be able to

CO1: Understand Basic introduction of Computer Network along with Physical layer of OSI and TCP/IP model.

CO2: Analyze Datalink layer protocols with MAC and LAN technologies.

CO3: Design applications using internet protocols, routing, and UDP, TCP.

CO4: Develop application layer protocols and understand socket programming

CO-PO Mapping:

CO	PO1	PO2	POP 3	PO4	PO5	PO6	PO7	PO8	PO9	PO1 0	PO1 1	PO1 2
CO1	1	2	1	1	3	1	2	1	2	1	1	1
CO2	3	2	1	2	1	1	1	1	3	1	1	2
CO3	1	3	2	2	2	1	3	1	2	1	2	1
CO4	2	2	3	1	3	2	1	1	2	1	1	1

Course Name: Computer Graphics and Multimedia

Code: EI802B

Course Outcome

After completion of this course, students will be able to

CO1: Design and apply two-dimensional graphics and transformations.

CO2: Design and apply three-dimensional graphics and transformations.

CO3: Apply Illumination, color models, and clipping techniques to graphics.

CO4: Understood Different types of Multimedia File Format

CO-PO Mapping:

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

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Course Name: Object-Oriented Programming

Course Code: EI802C

Course Outcomes:

CO1: Design the process of interaction between Objects, classes & methods w.r.t. Object-Oriented Programming.

CO2: Acquire a basic knowledge of Object Orientation with different properties as well as different features of Java.

CO3: Analyze various activities of different string handling functions with various I/O operations.

CO4: Discuss Inheritance, Package, Interface, Exception handling, Multithreading, and Applet (Web programs in java) concepts in Java.

CO-PO Mapping:

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

Course Name: Mobile Communication

Course Code: EI803A

Course Outcome:

CO1: By the end of the course, the student will be able to analyze and design wireless and mobile cellular systems.

CO2: By the end of the course, the student will have the ability to work in advanced research wireless and mobile cellular programs.

CO3: By the end of the course, the student will be able to realize all the applications of wireless protocols

CO4: By the end of the course, the student will be able to design mobile networks.

CO-PO matrices:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO 8	PO9	PO10	PO11	PO12
CO1	1	2	1	2	1	3	3	1	2	2	1	1
CO2	2	2	1	1	3	1	1	1	2	3	3	2
CO3	2	2	1	2	1	1	2	1	3	2	3	3
CO4	2	2	1	3	1	1	3	2	2	2	3	3

Course Name: VLSI & Microelectronics

Course Code: EI803B

Course Outcome:

The Students will be able to

CO1: Understand the scale of integration and VLSI design flow and VLSI Design steps.

CO2: Calculate and analyze the different parameters related to the different MOS devices and design the combinational and sequential logic circuits.

CO3: Describe fabrication steps of IC and construct stick diagram & layout of CMOS inverter and basic gates based on Layout design rules.

CO4: Understand the VHDL basics and construct the combinational and sequential logic circuits.

CO-PO Mapping:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	3	1	1	1	1	1	2	1	1	1
CO2	3	2	1	2	1	2	2	1	2	1	1	2
CO3	3	3	3	2	1	2	2	1	2	1	1	2
CO4	2	2	1	1	1	1	1	1	2	1	1	2

Course Name: Microwave Theory and Technique

Course Code: EI803C

Course Outcome:

After successful completion of the course, students will be able to

CO1: Understand various microwave system components their properties.

CO2: Appreciate that during analysis/ synthesis of microwave systems, a different mathematical treatment is required compared to general circuit analysis.

CO3: Design principles of microwave measurement systems.

CO4: Understanding of application areas

CO-PO Mapping:

COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO9	PO10	PO11	PO12
CO1	2	2	3	1	1	3	3	1	1	1	1	1
CO2	3	2	1	1	1	1	1	1	1	1	1	2
CO3	3	3	3	1	1	3	3	1	1	1	1	1
CO4	2	2	1	1	1	1	1	1	2	1	1	2

Course Name: Essence of Indian Knowledge Tradition

Code: MC881

Course Outcomes:

CO 1: Identify the concept of Traditional knowledge and its importance.

CO 2: Explain the connection between Modern Science and Indian Knowledge System.

CO 3: Understand the importance of Yoga for health care.

CO 4: Interpret the effect of traditional knowledge on environment.

CO-PO Mapping:

COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO9	PO10	PO11	PO12
CO1	2	2	3	1	1	3	3	1	1	1	1	1
CO2	3	2	1	1	1	1	1	1	1	1	1	2
CO3	3	3	3	1	1	3	3	1	1	1	1	1
CO4	2	2	1	1	1	1	1	1	2	1	1	2

COs	Statements
CO1	Study the mathematics and calculations of population growth, material balance and sustainable development.
CO2	Study the components and diversity of eco system
CO3	Study the fundamental knowledge of air pollution, calculations of earth's surface temperature, atmospheric window and lapse rate
CO4	Acquire fundamental knowledge of water pollution and its consequences knowledge and calculations regarding BOD, COD
CO5	Understand the basic concepts regarding noise and musical sound, decibel unit and its relation with sound intensity, reasons and consequences of noise pollution
CO6	Understand the concepts of land pollution and its remedies

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