Dr. MAHALINGAM
COLLEGE OF ENGINEERING AND TECHNOLOGY
Enlightening Technical Minds Estd. 1998
An Autonomous Institution
(Since 2011)

Dr. MAHALINGAM
COLLEGE OF ENGINEERING AND TECHNOLOGY
Affiliated to Anna University, Chennai; Approved by AICTE ; Accredited by NAAC with Grade 'A++'
Accredited by NBA - Tier1 (Mech, Auto, Civil, EEE, ECE, E&I and CSE)
Udumalai Road, Pollachi - 642 003. Tel: 04259-236030/40/50 Fax: 04259-236070 www.mcet.in

Curriculum and Syllabi

B.E. Electronics and Instrumentation Engineering

Semesters I to VIII

Regulations 2019

Department of Electronics & Instrumentation Engineering

Vision

We develop globally competent instrumentation engineers and entrepreneurs with societal, environmental and human values

Mission:

- Supportive Learning Environment: Provide suitable learning environment to the graduates with innovative learning resources and adequate infrastructure.
- Engineering Skills: Enhance electronic, instrumentation and automation skills of the engineering graduates to fulfill the industrial requirements.
- Sustainable and Eco-Friendly: Create awareness among the graduates for sustainable, ecofriendly products and safety standards.
- Ethical and Professional Responsibility: Enrich continuous learning, communicative, collaborative and administrative skills of the engineering graduates to become ethical, social responsible engineers and entrepreneurs

Programme: B.E. Electronics and Instrumentation Engineering

Programme Educational Objectives (PEOs) - Regulation 2019

B.E. Electronics and Instrumentation Engineering graduates will:

PEO1. Technical Knowledge: Actively apply technical and professional skills in engineering practices towards the progress of the organization in competitive and dynamic environment.

PEO2.Higher studies and Research: Own their professional and personal development by continuous learning and apply the learning at work to create new knowledge

PEO3.Professional and Ethical knowledge: Conduct themselves in a responsible, professional and ethical manner supporting sustainable economic development which enhances the quality of life.

Programme Outcomes (POs) - Regulations 2019

On successful completion of B.E. Electronics and Instrumentation Engineering programme, graduating students/graduates will be able to:

PO.1. Engineering Knowledge: Apply the knowledge of Mathematics, Science and engineering to solve problems in the field of Electronics & Instrumentation Engineering.

PO.2. Problem Analysis: Identify, formulate/model, analyse and solve complex problems in the field of Electronics & Instrumentation Engineering.

PO.3. Design and Development: Design an electronic system/component, or process to meet specific purpose with due consideration for economic, environmental, social, political, ethical, health and safety issues.

PO.4. Conduct Investigations: Design and conduct experiment, analyse and interpret data to provide valid conclusions in the field of Electronics and Instrumentation Engineering.

PO.5. Modern Tool Usage: Apply appropriate techniques and modern software tools for design and analysis of Electronic systems with specified constraints.

PO.6. Engineer and Society: Apply contextual knowledge to provide engineering solutions with societal, professional & environmental responsibilities

PO.7. Environment and Sustainability: Provide sustainable solutions within societal and environmental contexts for problems related to Electronics & Instrumentation Engineering.

PO.8. Ethics: Comply with code of conduct and professional ethics in engineering practices

PO.9 Individual and Team work: Perform effectively as a member/leader in multidisciplinary teams.

PO.10. Communication: Communicate effectively to engineering community and society with proper aids and documents.

PO.11. Project Management & Finance: Demonstrate knowledge and understanding of the engineering and management principles to manage projects in multidisciplinary environment.

PO.12. Lifelong Learning: Recognise the need for, and have the ability to engage in independent and lifelong learning.

Programme Specific Outcomes (PSOs) - Regulations 2019

On successful completion of B.E. Electronics and Instrumentation Engineering programme, graduating students/graduates will be able to:

PSO1.Instrument Analysis: Analyze and monitor the characteristics of electronic measuring instruments to ensure performance, safety and quality of the processes

PSO2.Controller Selection: Select the suitable instruments, control schemes and controllers as per the requirements

Regulations 2019

Detailed Syllabi for

Semesters I to VIII

Dr. MAHALINGAM
MCET
COLLEGE OF ENGINEERING AND TECHNOLOGY
Enlightening Technical Minds Estd. 1998
An Autonomous Institution
(Since 2011)

Dr. MAHALINGAM
COLLEGE OF ENGINEERING AND TECHNOLOGY
Affiliated to Anna University, Chennai; Approved by AICTE ; Accredited by NAAC with Grade 'A++'
Accredited by NBA - Tier1 (Mech, Auto, Civil, EEE, ECE, E&I and CSE)
Udumalai Road, Pollachi - 642 003. Tel: 04259-236030/40/50 Fax: 04259-236070 www.mcet.in

Programme: B.E Electronics and Instrumentation Engineering
2019 Regulations
Curriculum for Semesters I to VIII

Course Code	Course Title	Duration	Credits	Marks
19SHMG6101	Induction Program	3 Weeks	-	100

Semester I(2020 Batch)

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19MABC1101	Matrices and Calculus	3	1	0	4	100	AU,CE,EC,EE, EI,ME &MC
19ENHG2101	Communication Skills – I	2	0	2	3	100	All
19CHBC2001	Chemistry for Electrical Sciences	3	0	2	4	100	EC,EE &EI
19EISN2101	Fundamentals of Instrumentation Engineering	3	0	2	4	100	-
19MESC2001	Introduction to Engineering	2	0	2	3	100	AU,EC,EE,EI, ME&MC
19PSHG6001	Wellness for Students*	0	0	2	-	-	All
Total		**13**	**1**	**10**	**18**	**500**	

Semester II (2020 Batch)

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19ENHG2201	Communication Skills - II	2	0	2	3	100	All
19MABC1201	Ordinary Differential Equations and Complex Variables	3	1	0	4	100	AU,CE,EC,EE, EI,ME&MC
19PHBC2001	Physics for Electrical Sciences	3	0	2	4	100	EC,EE&EI
19EISN1201	Electric Circuit Analysis	3	1	0	4	100	-
19CSSC2001	C Programming	3	0	2	4	100	AU,CE,EC,EE EI,ME&MC
19MESC4001	Engineering Drawing	1	0	3	2.5	100	AU,ME,MC,PR, EC,EI
19PSHG6001	Wellness for Students*	0	0	2	1	100	All
19CHMG6201	Environmental Sciences	1	0	0	-	100	All
Total		**16**	**2**	**11**	**22.5**	**800**	

* Annual Pattern

Passed in Board of Studies meeting

Approved in Academic Council meeting

BOS Convener

BOS Chairman

Semester III

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19MABC1302	Numerical Methods and Linear Algebra	3	1	0	4	100	EC,EE,EI
19EICN1301	Electron Devices and Circuits	3	0	0	3	100	-
19EICN1302	Electrical Machines and Measurements	3	0	0	3	100	-
19EECC2301	Digital Electronics	3	0	2	4	100	EE,EI
19EICN2301	Sensors and Transducers	3	0	2	4	100	-
19EICN3301	Electron Devices and Circuits Laboratory	0	0	3	1.5	100	-
19EICN3302	Electrical Machines and Measurements Laboratory	0	0	3	1.5	100	-
XXXXXXXXX	One Credit Course	0	0	2	1	100	-
Total		**18**	**3**	**12**	**22**	**900**	

Semester IV

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19MABG1401	Probability and Statistics	3	1	0	4	100	All
19EICN1401	Linear Integrated Circuits	3	0	0	3	100	-
19EICN1402	Signals and Systems	3	1	0	4	100	-
19EICN2401	Industrial Instrumentation	3	0	2	4	100	-
19CSSC2401	Data Structures and Algorithms	2	0	2	3	100	EE
19EICN3401	Signal Conditioning Laboratory	0	0	4	2	100	-
XXXXXXXXX	One Credit Course	0	0	2	1	100	-
19PSHG6002	Universal Human Values-2: Understanding Harmony	2	1	0	3	100	All
19EIPN6401	Mini-Project	0	0	4	2	100	All
Total		**14**	**2**	**14**	**26**	**800**	**-**

Course Code	Course Title	Duration	Credits	Marks
19EIPN6001	Internship or Skill Development*	2 Weeks	1	100

*Refer to clause: 4.8 in UG academic regulations 2019

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Semester V

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19EICN1501	Control System	3	1	0	4	100	-
19EICN1502	Microprocessor and Microcontroller	3	0	0	3	100	-
19CSSN2502	Object Oriented Programming	3	0	2	4	100	-
XXXXXXXXX	Professional Elective – I	3	0	0	3	100	-
XXXXXXXXX	Professional Elective – II	3	0	0	3	100	-
XXXXXXXXX	Open Elective – I	3	0	0	3	100	-
19EICN3501	Microprocessor and Microcontroller Laboratory	0	0	3	1.5	100	-
19EICN3502	Control System Laboratory	0	0	3	1.5	100	-
19PSHG6501	Employability Skills 1: Teamness and Interpersonal Skills	0	0	2	1	100	
Total		**17**	**0**	**9**	**24**	**800**	**-**

Semester VI

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19EICN1601	Process Control	3	0	0	3	100	-
19EICN1602	Embedded System Design	3	0	0	3	100	-
XXXXXXXXX	Professional Elective – III	3	0	0	3	100	-
XXXXXXXXX	Professional Elective – IV	3	0	0	3	100	-
XXXXXXXXX	Open Elective – II	3	0	0	3	100	-
19EICN3601	Process Control Laboratory	0	0	3	1.5	100	-
19EICN3602	Embedded and IoT Laboratory	0	0	3	1.5	100	
19EIPN6601	Innovative and Creative Project	0	0	4	2	100	-
19PSHG6601	Employability Skills 2: Campus to Corporate	0	0	2	1	100	-
Total		**15**	**0**	**12**	**21**	**900**	**-**

Course Code	Course Title	Duration	Credits	Marks
XXX	Internship or Skill Development*	2 or 4 Weeks	1	100

*Refer to clause: 4.8 in UG academic regulations 2019

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Semester VII

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19EICN1701	Introduction to Machine Learning	3	0	0	3	100	-
19EICN1702	Industrial Automation System	3	0	0	3	100	-
XXXXXXXXX	Professional Elective – V	3	0	0	3	100	-
XXXXXXXXX	Professional Elective – VI	3	0	0	3	100	-
XXXXXXXXX	Open Elective – III	3	0	0	3	100	-
19EICN3701	Industrial Automation Laboratory	0	0	3	1.5	100	
Total		**15**	**0**	**3**	**16.5**	**600**	**-**

Semester VIII

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
19EIPN6801	Project	0	0	16	8	200	-
Total		**0**	**0**	**16**	**8**	**200**	**-**

Course Code	Course Title	Duration	Credits	Marks
XXX	Internship or Skill Development*	8 or 16 weeks	4	100

*Refer to clause: 4.8 in UG academic regulations 2019

Semester	I	II	III	IV	V	VI	VII	VIII	Total Credits
Credits	18	22.5	22	27	24	22	16.5	12	**164**

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Professional Electives

Course Code	Course Title	Hours/Week			Credits	Marks	Common to Programmes
		L	T	P			
Electronics Engineering							
19EIEN1001	Industrial Data Communication Networks	3	0	0	3	100	-
19EIEN1002	Digital Signal Processing	3	0	0	3	100	-
19EIEN1003	VLSI Design	3	0	0	3	100	-
19EIEN1004	Automotive Electronics	3	0	0	3	100	-
19EIEN1005	Image and Video Processing	3	0	0	3	100	-
Sensors and Instrumentation Engineering							
19EIEN1006	Modern Electronic Instrumentation	3	0	0	3	100	-
19EIEN1007	Fiber Optics and Laser Instrumentation	3	0	0	3	100	-
19EIEN1008	Smart and Wireless Instrumentation	3	0	0	3	100	-
19EIEN1009	Bio Medical Instrumentation	3	0	0	3	100	-
19EIEN1010	Analytical Instrumentation	3	0	0	3	100	-
19EIEN1011	Automobile and Aircraft Instrumentation	3	0	0	3	100	-
19EIEN1012	Agricultural Instrumentation	3	0	0	3	100	-
19EIEN1013	Instrumentation System Design	3	0	0	3	100	-
Control and Automation							
19EIEN1014	Thermal and Fluid Mechanics	3	0	0	3	100	-
19EIEN1015	Power Electronics and Drives	3	0	0	3	100	-
19EIEN1016	Non-Linear Control System	3	0	0	3	100	-
19EIEN1017	Digital Control Engineering	3	0	0	3	100	-
19EIEN1018	Fluid Power System	3	0	0	3	100	-
19EIEC1001	Robotics and Automation	3	0	0	3	100	EE,EI
19EIEN1020	Power Plant Instrumentation	3	0	0	3	100	-
19EIEN1021	Instrumentation in Process Industries	3	0	0	3	100	-
19EIEN1022	Industrial safety and standards	3	0	0	3	100	-
19EIEN1023	Industrial Internet of Things	3	0	0	3	100	-

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Software Engineering							
19CSEC1001	Programming using JAVA	3	0	0	3	100	-
19CSEC1002	Data Mining And Analytics	3	0	0	3	100	-
19CSEC1003	Software Testing	3	0	0	3	100	-
19CSEC1004	Database Management System Concepts	3	0	0	3	100	-
19CSEN1001	Introduction to Python Programming	3	0	0	3	100	-
Management							
19EEEC1004	Disaster Management	3	0	0	3	100	EE,EI,EC
19MEEC1014	Engineering Economics and Cost Analysis	3	0	0	3	100	-
19MEEC1015	Principles of Management	3	0	0	3	100	-
19EIEN1024	Introduction to Total Quality Management	3	0	0	3	100	-

Open Electives

Course Code	Course Title	Hours/Week			Credits	Marks
		L	T	P		
19EIOC1001	Industrial Measurement Systems	3	0	0	3	100
19EIOC1002	Electronics System Design	3	0	0	3	100
19EIOC1003	Industrial Internet of Things	3	0	0	3	100
19EIOC1004	Smart Sensor Technology	3	0	0	3	100
19EIOC1005	Factory Automation	3	0	0	3	100
19EIOC1006	Internet of Medical Things	3	0	0	3	100
19EIOC1007	Virtual Instrumentation	3	0	0	3	100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19SHMG6101	Course Title: Induction Program (common to all B.E/B.Tech Programmes)
Course Category: Mandatory Non-Credit Course	**Course Level: Introductory**
Duration: 3 Weeks	**Max. Marks:100**

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Explain various sources available to meet the needs of self, such as personal items and learning resources
2. Explain various career opportunities, opportunity for growth of self and avenues available in the campus
3. Explain the opportunity available for professional development
4. Build universal human values and bonding amongst all the inmates of the campus and society

List of Activities:

1. History of Institution and Management: Overview on NIA Education Institutions-Growth of MCET – Examination Process-OBE Practices – Code of Conduct – Centre of Excellence
2. Lectures by Eminent People, Motivational Talk – Alumni, Employer
3. Familiarization to Dept./Branch: HoD Interaction – Senior Interaction – Department Association
4. Universal Human Value Modules: Module 1, Module 2,Module 3 and Module 4
5. Orientation on Professional Skill Courses
6. Proficiency Modules – Mathematics, English, Physics and Chemistry
7. Introduction to various Chapters, Cell, Clubs and its events
8. Creative Arts: Painting, Music and Dance
9. Physical Activity: Games and Sports, Yoga and Gardening
10. Group Visits: Visit to Local areas and Campus Tour

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Explain various sources available to meet the needs of self, such as personal items and learning resources through visit to local areas and campus	Understand
CO2: Explain various career opportunities and avenues available in the campus through orientation sessions	Understand
CO3: Explain the opportunity available for professional development through professional skills, curricular, co-curricular and extracurricular activities	Understand
CO4: Build universal human values and bonding amongst all the inmates of the campus and society for having a better life	Apply

Course Articulation Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	-	-	-	-	-	-	2	1	2	-	-	-	-
CO2	1	-	-	-	-	-	-	2	1	2	-	-	-	-
CO3	1	-	-	-	-	-	-	2	1	2	-	-	-	-
CO4	2	-	-	-	-	-	-	2	1	2	-	-	-	-

High-3; Medium-2;Low-1

Assessment Pattern

Component	Marks	Details
Attendance	10	Minimum 80% and 1 mark for every 2% observed
Knowledge Test	40	Objective type questions
Work plan for future	50	Career plan developed consulting mentor
Total	**100**	

Non-letter Grades

Marks Scored	Performance Level
70 & above	Good
30 – 69	Average
< 30	Fair

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Semester - I

Course Code:19MABC1101	Course Title: Matrices and Calculus (Common to AU,ME,PR,CE, MC,EE,EC and EI)		
Course Category: Basic Science		Course Level: Introductory	
L:T:P(Hours/Week) 3: 1: 0	Credits:4	Total Contact Hours:60	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Determine the canonical form of a Quadratic form using Orthogonal transformation
2. Use different testing methods to check the convergence of infinite series
3. Apply differential and integral calculus to determine the evoluteof a curve and improper integrals
4. Apply partial derivatives to find extreme values of functions of two variables
5. Apply multiple integrals to find area of plane curves and volume of solids

Unit I Matrices 9+3 Hours

Rank of a matrix - System of linear equations – Symmetric - Skew symmetric and orthogonal matrices-(Definitions and examples only) - Eigenvalues and Eigenvectors - Diagonalization of symmetric matrices through orthogonal transformation – Cayley-Hamilton Theorem - Transformation of quadratic forms to canonical forms through orthogonal transformation.

Unit II Sequences and Series 9+3 Hours

Sequences - Definition and Examples - Series- Tests for convergence- Power series - series for exponential, trigonometric and logarithm functions - Comparison Test – Integral Test - Cauchy's root test - D Alembert's ratio test - Alternating series- Leibnitz's test.

Unit III Differential and Integral Calculus 9+3 Hours

Curvature – Radius of curvature - Evolutes and Involutes - Evaluation of definite and improper integrals - Beta and Gamma functions and their properties.

Unit IV Multivariable Differentiation 9+3 Hours

Limit – continuity - Mean value theorems and partial derivatives-Taylor's series and Maclaurin's series – Jacobian – Maxima, Minima and saddle points - Method of Lagrange's multipliers.

Unit V Multivariable Integration 9+3 Hours

Multiple Integration: Double integrals - Change of order of integration in double integrals - Change of variables (cartesian to polar, cartesian to spherical and cartesian to cylindrical) - Triple integrals - Applications: areas and volumes.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Determine the canonical form of a Quadratic form using Orthogonal transformation	Apply
CO2: Use different testing methods to check the convergence of infinite series	Apply
CO3: Determine the evolute of a curve and evaluate improper integrals using beta gamma functions	Apply
CO4: Apply partial derivatives to find extreme values of functions of two variables	Apply
CO5: Apply multiple integrals to find area of plane curves and volume of solids	Apply

Text Book(s):

T1. Erwinkreyzig, Advanced Engineering Mathematics, 9th edition, John Wiley& Sons, 2006.

T2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, NewDelhi, 2008.

T3. Ramana B.V., higher Engineering Mathematics, Tata McGraw-Hill, New Delhi, 11th Reprint, 2010.

Reference Book(s):

R1. G.B.Thomas and R.L Finney, Calculus and Analytic Geometry, 9thedition, Pearson, Reprint, 2002.

R2. N.P.Bali and Manish Goyel, A text book of Engineering Mathematics, Laxmi Publication, Reprint, 2008.

R3. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Web References:

1. https://onlinecourses.nptel.ac.in/noc16_ma05
2. https://nptel.ac.in/courses/122101003/2
3. https://nptel.ac.in/syllabus/111104092/

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Passed in Board of Studies meeting

Approved in Academic Council meeting

BOS Convener

BOS Chairman

Assessment pattern

	Assessment Component	CO .No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code: 19ENHG2101		Course Title: Communication Skills – I (Common to all B.E/B.Tech Programmes)	
Course Category: Humanities		Course Level: Introductory	
L:T:P(Hours/Week) 2: 0: 2	Credits:3	Total Contact Hours:60	Max Marks:100

Pre-requisites

- The student should have undergone English as his/her first or second language in school.

Course Objectives

The course is intended to:

1. Listen and understand monologues and dialogues of a native speaker on par with B1 of CEFR level
2. Speak in simple sentences to convey their opinions and ideas on par with B1 of CEFR level
3. Read and infer a given text on par with B1 of CEFR level
4. Draft basic formal written communication on par with B1 of CEFR level

Unit I Listening **15 Hours**

Importance of active listening – Physical condition needed for active listening-Identifying relevant points while taking notes.- Framing questions at different linguistic contexts - Listening for specific details of concrete monologues and dialogues – Listening to organize ideas - Developing ideas – Listening to compose paragraphs – Paraphrasing the aural input.

Unit II Speaking **15 Hours**

Importance of note making to practice speaking - Traditional note making, developing Mind map - Collecting points from various sources - Identifying relevant ideas needed for the speech -Using mind-map to organize thought processing - Prioritizing the ideas - Types of sentences - Frequently used words (Institution, home and leisure) - Mother Tongue Influence - Expressing the thoughts in simple sentences - Tenses & Voices (Active & Passive) - Postures, gestures and eye contact - Intonation and Sentence stress - Express one's thoughts coherently.

Unit III Reading **15 Hours**

Reading strategies - Skimming -Scanning - Interpretation of visual data - Factual texts on subjects of relevance - Inferring texts – Reading to write a review – Checking the accuracy of reading while presenting the interpreted data – Reading to comprehend.

Unit IV Writing **15 Hours**

WritingSimple and short sentences **-** Writing E-mail, Memo, Note and Message - Letter Writing - Importance of punctuations -- Identifying the main points - Organising the main ideas - Writing a draft.

List of Tasks:

1. BEC Preliminary Listening Test-I & Speaking Test-1.
2. BEC Preliminary Listening Test-2 & Speaking Test-2.
3. BEC Preliminary Listening Test-3 & Speaking Test-3.
4. BEC Preliminary Listening Test-4 & Speaking Test-4.
5. BEC Preliminary Listening Test-5 & Speaking Test-5.
6. BEC Preliminary Listening Test-6 & Speaking Test-6.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Listen actively and paraphrase simple messages and specific details of concrete monologues and dialogues	Apply
CO2: Express one's views coherently in a simple manner	Apply
CO3: Read and comprehend factual texts on subjects of relevance	Understand
CO4: Write texts bearing direct meanings for different contexts maintaining an appropriate style	Apply

Text Book(s):

T1. Whitby Norman, Business Benchmark Pre-intermediate to Intermediate Students' Book CUP Publications, 2nd Edition, 2014

T2. Wood Ian, Williams Anne, Cowper Anna, Pass Cambridge BEC Preliminary, Cengage Learning,2nd Edition, 2015.

T3. Learners Book prepared by the Faculty members of Department of English.

Reference Book(s):

R1. BEC-Preliminary - Cambridge Handbook for Language Teachers, 2nd Edition, CUP 2000.

R2. Hewings Martin - Advanced Grammar in use - Upper-intermediate Proficiency, CUP, 3rd Edition, 2013.

Web References:

1. http://www.grammarinenglish.com -Jan 23,2018
2. https://www.northshore.edu/support_centre /pdf/listen-notes.pdf
3. http://www.examenglish.com/BEC/BEC_Vantage.html- Jan 23, 2018

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Articulation Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	2	3	3	-	2	-	-
CO2	-	-	-	-	-	-	-	2	3	3	-	2	-	-
CO3	-	-	-	-	-	-	-	1	-	3	-	2	-	-
CO4	-	-	-	-	-	-	-	1	-	3	-	2	-	-

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO .No.	Marks	Total
Continuous Assessment	CCET I	2,3,4	50	20
	CCET II	2,3,4	50	
	CCET III	2,3,4	50	
	Continuous Assessment – Practical	1,2	75	10
	Final Assessment – Practical	1, 2	50	10
End Semester Examination	ESE	2,3,4	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19CHBC2001		Course Title: Chemistry for Electrical Sciences (Common to EC,EE and EI)	
Course Category: Basic Science		Course Level: Introductory	
L:T:P(Hours/Week) 3: 0: 2	Credits:4	Total Contact Hours:75	Max Marks:100

Pre-requisites

- Higher Secondary Chemistry I and II

Course Objectives

The course is intended to:

1. Explain the principles of electrochemistry and batteries
2. Explain the mechanism of corrosion and corrosion control
3. Explain the concepts of spectroscopic techniques
4. Describe the basics of biofuels and fuel cells
5. Describe synthesis, properties and applications of nanomaterials

Unit I Electrochemistry and Batteries 9 Hours

Cells – Types of cells– galvanic and electrolytic cells – emf and its measurement – Nernst equation – Batteries – types and Characteristics, Construction, working and applications - Alkaline battery, Lead –Acid battery, Nickel-Cadmium battery, Lithium ion battery

Unit II Corrosion and its Control 9 Hours

Corrosion – dry and wet corrosion – mechanism of electrochemical corrosion – galvanic corrosion and concentration cell corrosion, Factors influencing corrosion. Corrosion Control methods – Cathodic protection methods, Metallic coating – Galvanizing, Tinning – Chrome plating and Electroless plating of Nickel

Unit III Spectroscopic Techniques 9 Hours

Spectroscopy- Electromagnetic spectrum, Absorption and Emission spectroscopy – Relationship between absorbance and concentration – Derivation of Beer-Lambert's law (problems). UV – Visible Spectroscopy, Atomic Absorption Spectroscopy, Flame photometry – Principle, Instrumentation and applications.

Unit IV Biofuels and Fuel Cells 9 Hours

Biomass – Biogas – Constituents, manufacture and uses. General outline of fermentation process – manufacture of ethyl alcohol by fermentation process. Combustion – Calorific values – Gross and bet calorific value – problems based on calorific value. Fuel cells – Construction working and applications of Hydrogen Oxygen fuel cells, methanol oxygen fuel cells, solid oxide fuel cells

Unit V Synthesis and Applications of Nano Materials 9 Hours

Introduction – Difference between bulk and Nano materials – size dependent properties. Nano scale materials –particles, clusters, rods and tubes. Synthesis of Nanomaterials: Sol-gel process, Electro deposition, Hydrothermal methods. Applications of Nano materials in

Electronics, Energy science and medicines. Risk and future perspectives of nano materials.

List of Experiments **30 Hours**

1. Estimation of iron in water by spectrophotometry.
2. Estimation of Fe^{2+} by potentiometric titration.
3. Determination of corrosion rate by weight loss method.
4. Measurement of emf of electrochemical cell – Poggendorff's method.
5. Determination strength of acid by pHmetry.
6. Determination of strength of strong acid by conductance measurement

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Explain batteries based on their characteristics, construction, working principle and applications	Understand
CO2:Explain the mechanism of corrosion and its control techniques	Understand
CO3: Use Beer- Lambert's law and other spectroscopic methods for chemical analysis	Apply
CO4: Calculate energy potential of fuel cells and calorific value of biofuels	Apply
CO5:Describe synthesis, properties and applications of nano-materials	Understand

Text Book(s):

T1. P. C. Jain and Monica Jain, "Engineering Chemistry", 17th Edition.,DhanpatRai Pub, Co., New Delhi, 2018.

T2. Wiley Engineering Chemistry, 2nd Edition, Wiley India Pvt. Ltd. New Delhi, 2011.

Reference Book(s):

R1. Larry Brown and Tom Holme, Chemistry for Engineering Students, 3rd Edition, Cengage Learning, 2010.

R2. S. S. Dara, S. S. Umare "A text book of Engineering Chemistry" 12th Edition S. Chand & Co. Ltd., New Delhi, 2014.

R3. Charles P. Poole, Jr., Frank J. Owens "Introduction to Nanotechnology" Wiley India Pvt. Ltd. New Delhi, 2003.

Web References:

1. http://nptel.ac.in/courses/122101001/downloads/lec.23.pdf
2. https://nptel.ac.in/courses/104106075/Week1/MODULE%201.pdf
3. https://nptel.ac.in/courses/103102015/

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Assessment pattern:

	Assessment Component	CO .No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	20
	CCET II	3,4	50	
	CCET III	5	50	
	Continuous Assessment – Practical	1,2,3,4,5	75	10
	Final Assessment – Practical	1,2,3,4,5	50	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EISN2101	Course Title: Fundamentals of Instrumentation Engineering		
Course Category: Engineering Sciences		Course Level: Introductory	
L:T:P(Hours/Week) 3 : 0: 2	Credits:4	Total Contact Hours:75	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended for the learners to:

1. Explain the basics of electrical quantities and electrical devices
2. Describe the Electronics components
3. Elucidate the units and standards for measurement
4. Explain the Instrumentation system
5. Explain the basic control structure

Unit I BASICS OF ELECTRICAL COMPONENTS AND CIRCUITS 9 Hours

Definition of electrical quantities: Charge, Resistivity, Conductivity, Resistance, inductance, capacitance, Voltage, current, Power, Power factor, Energy - AC & DC circuits – Relays and types – Contactors - Solenoids

Unit II BASICS OF ELECTRONIC COMPONENTS AND CIRCUITS 9 Hours

Semiconductors – Energy band – Diodes – LED – LDR – Solar cell – Zener diode as voltage regulator – Rectifiers – AC ripple filters - Transistors as Amplifier and switch.

Unit III FUNDAMENTALS OF MEASUREMENTS 9 Hours

S.I Units and Standards –IEEE and ISA Standards – Unit conversion – Instrument signal levels: Current, voltage and pressure - Calibration – Types of errors – Recorders - Indicators – MC & MI Instruments

Unit IV BASICS OF INSTRUMENTATION SYSTEM 9 Hours

Block diagram of Instrumentation systems - Sensors and Transducers - Classification of Transducers – Signal conditioning circuits – Analog signal to digital conversion – Digital processing unit – Digital to Analog signal Conversion

Unit V APPLICATIONS OF CONTROL AND INSTRUMENTATION 9 Hours

Block diagram of open loop and closed loop system - Open loop system: Electronic weighing scale: Block diagram – Sensing system – Processor – Display System – Closed loop system: Temperature control system: Closed loop structure – Sensing system – controller – Heater driving system – Temperature display.

List of Experiments: 30 Hours

1.Serial and parallel circuit (Resistance connection)

2.Electrical wiring (Two switch or simple house wiring)

3.Power supply (AC-DC)

Passed in Board of Studies meeting

Approved in Academic Council meeting

BOS Convener

BOS Chairman

4.Soldering electronic components (Dot PCB board soldering)

5.Testing and calibration Measuring instruments (Function generator, CRO, etc)

6.RTD based Temperature measurement (Simple potential divider circuit)

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Explicate the electrical components and device operation	Understand
CO2: Elucidate the electronic components for device development	Understand
CO3: Summarize the units and standards for measurement	Understand
CO4: Illuminate the structure of Instrumentation system	Understand
CO5: Describe the operation of open and feedback system	Understand

Text Book(s):

T1. William H. HaytJr, Jack E. Kemmerly and Steven M. Durbin, “Engineering Circuits Analysis”, McGraw Hill publishers, 8th edition, New Delhi, 2013.

T2. Charles K. Alexander, Mathew N.O. Sadiku, “Fundamentals of Electric Circuits”, 2nd Edition, McGraw Hill, 2013.

T3. William Bolton, “Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering”, 5th Edition, PHI, 2013.

Reference Book(s):

R1. Chakrabarti A, “Circuits Theory (Analysis and synthesis), DhanpathRai& Sons, New Delhi, 1999.

R2. Jegatheesan, R., “Analysis of Electric Circuits,” McGraw Hill, 2015.

R3. Joseph A. Edminister, MahmoodNahri, “Electric circuits”, Schaum’s series, McGraw- Hill, New Delhi, 2010.

R4. M E Van Valkenburg, “Network Analysis”,Prentice-Hall of India Pvt Ltd, New Delhi, 2015.

R5. Sedra and Smith, Microelectronic Circuits, Oxford University Press, 2004.

Web References:

1. https://nptel.ac.in/courses/117103063/
2. https://nptel.ac.in/courses/112103174/3
3. https://nptel.ac.in/courses/101108056/module7/lecture13.pdf

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO.No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	20
	CCET II	3,4	50	
	CCET III	5	50	
	Continuous Assessment – Practical	1,2,3,4,5	75	10
	Final Assessment – Practical	1,2,3,4,5	50	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19MESC2001	Course Title: Introduction to Engineering (Common to AU,ME,PR,MC,EE,EC and EI)		
Course Category: Engineering Science		Course Level: Introductory	
L:T:P(Hours/Week) 2: 0: 2	Credits:3	Total Contact Hours:60	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Explain the career opportunities in engineering
2. Explain how to acquire engineering competencies
3. Explain how to remain, relevant and versatile as an engineer
4. Observe engineering products and processes
5. Take ownership for learning and development
6. Identify and rectify unsafe conditions and acts

Unit I **Career Opportunities in Engineering** **5 Hours**

Technicians, engineers and scientists, history of engineering. 17 sustainable development goals set by UNO, concept of small e to big E. career choices for an engineer, types of industries, academia and research as career choices, entrepreneurship as a career choice, various departments in engineering industries, roles available in engineering industries. innate skills, learnt skills (competencies), graduate attributes, roles of engineers and the corresponding competencies, career opportunities in engineering in terms of roles & competencies

Unit II **Developing Specific Skills and Competencies** **5 Hours**

OBE Model, PEOs and POs, technical POs, professional POs, mapping with Graduate attributes, Classification of courses, resources available in the campus and e-resources, resources and facilities available to acquire specific competencies, on-campus and off-campus activities, the methods by which students can systematically involve in activities, significance of professional skill courses, plan for utilizing the resources and facilities to develop specific competencies.

Unit III **Staying Relevant Through Continuous Improvement / Environmental Versatility** **7 Hours**

Rate of change, technology life cycle (TLC), features of a dynamic and complex environment in which students operate or will operate, impact of globalization & technical advancements,

importance of remaining, relevant and versatile in a dynamic and complex environment with the help of technology life cycle, activities/process to remain relevant and versatile, environmental scanning, Life- long learning.

Unit IV **Observe Every Product and Process With an Engineering Perspective and Inquisitiveness** **4 Hours**

Product -Need, purpose - primary and secondary function, various stages of manufacturing and its processes. Product - assembly of several simple engineering devices/systems. Product- Parts, principles and laws (mechanical, electrical and electronics), functional relationship between the parts, role of programming in engineering products. Significance of materials and their advancements in improvements in product.

Unit V **Learning and Development Leveraging The Resources and Infrastructure** **6 Hours**

Process Of Learning, Situated Learning with Examples, Own Learning (Not Copying), Differences between Real Life and Simulated Environment, the Sprit Of Experimentation, Various Learning Enablers, Measure the performance against the plan.

Unit VI **Unsafe Conditions and Acts and Following Environment Friendly Practices** **3 Hours**

Safety-definition, importance of personal safety. Statistics of road accidents. Unsafe condition and unsafe act- definition, cause and effects, identification of the unsafe conditions and acts in home/hostel, labs, class rooms, public places. Importance of environment friendly practices.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Explain the career opportunities in engineering in terms of roles & competencies	Understand
CO2: Explain how a student can acquire the competencies	Understand
CO3: Explain how to remain, relevant and versatile in a dynamic and complex environment	Understand
CO4: Observe every product and processes with an engineering perspective and inquisitiveness	Apply
CO5: Choose to take ownership for his/her learning and development leveraging the resources and infrastructure	Understand
CO6: Identify and rectify unsafe conditions and acts and follow environment friendly practices	Understand

Text Book(s):

T1. Worksheets and Handouts prepared by MCET team.

Reference Book(s):

R1. L. A Bloomfield, “How things work: The physics of everyday life”, Wiley, 5th Edition, 2013.

R2. C. Mason, “How things work,” Usborne Publishing Ltd 2009.

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

R3. D.K. Publishing, “How things work encyclopedia”, 2010.

R4. J. E. Gordon, “The New Science of Strong Materials or Why You Don't Fall through the Floor” Princeton University Press; With a New introduction by Philip Ball,2018.

R5. R.P. Feynman,” Six Easy Pieces: Essentials of Physics Explained by Its Most Brilliant Teacher”, Basic Books; 4th Edition 2011.

Web References:

1. https://en.wikibooks.org/General_Engineering_Introduction/Engineering_Science
2. https://science.howstuffworks.com/engineering-channel.html

List of RiaLab Exercises **30 Hours**

1. Career opportunities with roles and responsibilities

2. Observe every product and processes with an engineering perspective and inquisitiveness

a) Primary and Secondary functions of products and their equivalents

b) Primary and Secondary functions of parts of the products, their manufacturing processes and materials

c) Structural and functional relations of the product

3. Safe and unsafe acts and conditions in day-to-day life and professional practices.

4. Skills for Hobby project (At least TWO)

a) Soldering and de-soldering practices

b) Circuit and component testing using multi-meter & CRO

c) Battery operated circuit connections and testing

d) Simple switching circuits using relays and transistors

e) Adhesives used in part assembly

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	2	2	1	3	1	-	1	-	-
CO2	2	1	-	-	-	2	2	1	3	1	-	1	-	-
CO3	2	1	-	-	-	2	2	1	3	1	-	1	-	-
CO4	3	2	1	1	-	2	2	1	3	1	-	1	-	-
CO5	2	1	-	-	-	2	2	1	3	1	-	1	-	-
CO6	2	1	-	-	-	2	2	1	3	1	-	1	-	-

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO.No.	Marks	Total
Continuous Assessment	CCET I	1,4	50	20
	CCET II	2,3	50	
	CCET III	5,6	50	
	Continuous Assessment – Practical	1,2,3,4,5,6	75	10
	Final Assessment – Practical	2,4	50	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

Approved in Academic Council meeting

BOS Convener

BOS Chairman

Course Code:19PSHG6001	Course Title: Wellness for Students (Common to all B.E/B.Tech Programmes)		
Core/Elective: Core		Course Level: Introductory	
L:T:P(Hours/Week) 0: 0: 2	Credits:1	Total Contact Hours:30	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Set SMART goals for academic, career and life
2. Apply time management techniques
3. Articulate the importance of wellness for success in life
4. Understand the dimensions of wellbeing and relevant practices

Unit I GOAL SETTING

Understanding Vision and mission statements - Writing personal mission statements – 'Focus' as a way of life of most successful people. Clarifying personal values, interests and orientations – Awareness of opportunities ahead – Personal SWOT analysis - Principles driving goal setting: Principle of response and stimuli, Circle of influence and circle of concern, What you see depends on the role you assume. Potential obstacles to setting and reaching your goals - Five steps to goals setting: SMART goals, Inclusive goals, Positive stretch, Pain vs gain, Gun-point commitment.

Unit II TIME MANAGEMENT - TOOLS AND TECHNIQUES

Importance of planning and working to time. Pareto 80-20 principle of prioritization – Time quadrants as a way to prioritize weekly tasks – The glass jar principle - Handling time wasters – Assertiveness, the art of saying 'NO' – Managing procrastination

Unit III PRACTICES FOR PHYSICAL WELLNESS

Concept of wellness – impact of absence of wellness - Wellness as important component to achieve success. Wellbeing as per WHO - Dimensions of Wellbeing: Physical, Mental, Social, Spiritual – indicators and assessment methods

Simplified Physical Exercises. Fitness as a subset of Wellness – health related physical fitness - skill related physical fitness. Joint movements, Warm up exercises, simple asanas, WCSC simplified exercises.

Unit IV PRACTICES FOR MENTAL WELLNESS:

Meditation: Mind and its functions - mind wave frequency – Simple basic meditation – WCSC meditation and introspection tables. Greatness of friendship and social welfare – individual, family and world peace – blessings and benefits.

Food & sleep for wellness: balanced diet - good food habits for better health (anatomic therapy) – hazards of junk food - food and the gunas.

Passed in Board of Studies meeting | Approved in Academic Council meeting

BOS Convener | BOS Chairman

Unit V PUTTING INTO PRACTICE

Practicals: Using the weekly journal – Executing and achieving short term goals – Periodic reviews

Course Outcomes:	**Cognitive/ Affective**
At the end of this course, students will be able to:	
CO1: Set well-articulated goals for academics, career, and personal aspirations	Apply
CO2: Apply time management techniques to complete planned tasks on time	Apply
CO3: Explain the concept of wellness and its importance to be successful in career and life	Apply
CO4: Explain the dimensions of wellness and practices that can promote wellness	Apply
CO5: Demonstrate the practices that can promote wellness	Valuing

Text Book(s):

T1.Reading material, workbook and journal prepared by PS team of the college.

ReferenceBook(s):

R1. Stephen R Covey, “First things first”, Simon & Schuster U.K, Aug 1997.
R2. Sean Covey, “Seven habits of highly effective teenagers”, Simon & Schuster U.K, 2004.
R3. Vethathiri Maharishi Institute for Spiritual and Intuitional Education, Aliyar, “Value education for harmonious life (Manavalakalai Yoga)”, Vethathiri Publications, Erode, I Ed. (2010).
R4. Dr. R. Nagarathna, Dr.H.R. Nagendra, “Integrated approach of yoga therapy for positive health”, Swami Vivekananda Yoga Prakashana, Bangalore, 2008 Ed.
R5. Tony Buzan, Harper Collins, The Power of Physical Intelligence (English).

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Assessment Pattern

	Assessment Component	CO.No	Marks	Total
Continuous Assessment	Personal Effectiveness	1,2,5	35	75
	Yoga and physical Exercise: Physical Exercises Meditation Assessment of student's workbook	3,4,5	 20 10 10	
End Semester Examination	Written test (MCQ and short answers) Physical exercises Viva-voce	1,2,3,4,5	30 50 20	Marks out of 100 is reduced to 25
			Total	100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Semester - II

Course Code: 19ENHG2201		Course Title: Communication Skills – II (Common to all B.E/B.Tech Programmes)	
Course Category: Humanities		Course Level: Introductory	
L:T:P(Hours/Week) 2: 0: 2	Credits:3	Total Contact Hours:60	Max Marks:100

Pre-requisites

- Communication Skills - I

Course Objectives

The course is intended to:

1. Listen and understand monologues and dialogues of a native speaker on par with B2 of CEFR level.
2. Speak in simple sentences to convey their opinion and ideas on par with B2 of CEFR level.
3. Read and infer a given text on par with B2 of CEFR level.
4. Draft basic formal written communication on par with B2 of CEFR level.

Unit I LISTENING 15 Hours

Importance and purpose of extensive listening and intensive listening -Body Language – Listening tasks on complex and abstract themes- Correlating Ideas related to listening input – importance of empathetic- listening for main ideas – Paraphrasing- Listening to native speakers English – Compound and Complex sentences - Developing ideas – Listening to compose paragraphs.

Unit II SPEAKING 15 Hours

Jotting down ideas collected from listening to speak – organising the ideas – Expressing one's view coherently – Understanding grammatical elements (Noun – Pronoun Antecedent) – Expressing ideas assertively – Answering questions during presentations – Understanding the use of discourse markers – word stress and sentence stress – voice modulation and pauses – Highlighting significant points – interpretation of visual data – Using verbal cues - Preparing simple hand - outs.

Unit III READING 15 Hours

Reading strategies – Skimming & Scanning – Inferring meaning- Barriers to reading – sub vocalisation, Eye fixation, Regression – Speed Reading Techniques - Reading different types of texts and their contexts with speed – Note making – Reading a review – Paraphrasing – Reading to comprehend.

Unit IV WRITING 15 Hours

Reported speech & Concord (Subject - verb Agreement) - Report writing - Different kinds of Report - Structure of the report - Writing Proposal - Plagiarism – References – Appendices – Techniques for Report writing – Registers.

LIST OF TASKS:

1. BEC Vantage Listening Test- I & Speaking Test-1.
2. BEC Vantage Listening Test-2 & Speaking Test-2.
3. BEC Vantage Listening Test-3 & Speaking Test-3.
4. BEC Vantage Listening Test-4 & Speaking Test-4.
5. BEC Vantage Listening Test-5 & Speaking Test-5.
6. BEC Vantage Listening Test-6 & Speaking Test-6.

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Listen actively and empathetically, and paraphrase discussions and presentations on complex and abstract themes and topics	Apply
CO2: Express one's views coherently, fluently and confidently highlighting the significant points with supporting details	Apply
CO3: Read and comprehend different types of texts and their contexts reasonably at moderate speed	Understand
CO4: Write detailed reports on variety of subjects synthesizing information gathered during listening & reading citing appropriate references	Apply

Text Book(s):

T1. Whitby Norman, Business Benchmark Upper Intermediate Students' Book CUP Publications, 2nd Edition, 2014.

T2. Learners Book prepared by the Faculty members of Department of English.

Reference Book(s):

R1. Cambridge BEC Vantage - Practice Tests, Self-study Edition, Cambridge University Press, 2002.

R2. Hewings Martin - Advanced Grammar in use - Upper-intermediate Proficiency, CUP, 3rd Edition, 2013.

Web References:

1. http://www.grammarinenglish.com -Jan 23, 2018
2. https://www.northshore.edu/support_centre /pdf/listen-notes.pdf
3. http://www.examenglish.com/BEC/BEC_Vantage.html - Jan 23, 2018

Course Articulation Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	2	3	3	-	2	-	-
CO2	3	2	1	1	-	-	-	2	3	3	-	2	-	-
CO3	2	1	-	-	-	-	-	1	-	3	-	2	-	-
CO4	3	2	1	1	-	-	-	1	-	3	-	2	-	-

High-3; Medium-2; Low-1

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Assessment pattern

	Assessment Component	CO .No.	Marks	Total
Continuous Assessment	CCET I	2,3,4	50	20
	CCET II	2,3,4	50	
	CCET III	2,3,4	50	
	Continuous Assessment – Practical	1,2	75	10
	Final Assessment – Practical	1, 2	50	10
End Semester Examination	ESE	2,3,4	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19MABC1201		Course Title: Ordinary Differential Equations and Complex Variables (Common to AU,ME,PR,CE,MC,EE,EC and EI)	
Course Category: Basic Science		Course Level: Introductory	
L:T:P(Hours/Week) 3: 1: 0	Credits:4	Total Contact Hours:60	Max Marks:100

Pre-requisites

- Matrices and Calculus

Course Objectives

The course is intended to:

1. Explain the concepts of vector differentiation and integration
2. Determine the solution of second and higher order ordinary differential equations
3. Construct analytic functions
4. Use the concept of complex integration to evaluate definite integrals
5. Apply Laplace transform techniques to solve ordinary differential equations

Unit I VECTOR CALCULUS 9+3 Hours

Gradient – Divergence – Curl – Line integrals – Surface integrals – Volume integrals – Theorems of Green, Gaussand Stokes (without proof)and their applications.

Unit II COMPLEX VARIABLES (DIFFERENTIATION) 9+3Hours

Cauchy-Riemann equations – Analytic functions – Properties – Harmonic functions – Finding harmonic conjugate – Conformal mapping (w=z+a, w= az, w=1/z) – Mobius transformation and their properties.

Unit III COMPLEX VARIABLES (INTEGRATION) 9+3 Hours

Contour integrals – Cauchy Integral formula (without proof) – Cauchy Integral theorem – Taylor's series – Singularities of analytic functions – Laurent's series–Residues – Cauchy Residue theorem(without proof) – Evaluation of real definite integrals around unit circle and semi-circle (Excluding poles on the real axis).

Unit IV ORDINARY DIFFERENTIAL EQUATIONS OF HIGHER ORDERS 9+3 Hours

Second and higher order linear differential equations with constant coefficients – Second order linear differential equations with variable coefficients (Cauchy - Euler equation–Legendre's equation) – Method of variation of parameters – Solution of first order simultaneous linear ordinary differential equations

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit V LAPLACE TRANSFORM 9+3 Hours

Laplace Transform – Properties of Laplace Transform – Laplace transform of integrals – Laplace transform of periodic functions -Inverse Laplace transforms - Convolution theorem – Solution of ordinary differential equations by Laplace Transform method– Applications on engineering problems.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Explain the concepts of vector differentiation and integration.	Apply
CO2: Use the concept of complex variables to construct analytic functions	Apply
CO3: Use the concept of complex integration to evaluate definite integrals	Apply
CO4: Determine the solution of second and higher order ordinary differential equations	Apply
CO5: Apply Laplace transform techniques to solve ordinary differential equations	Apply

Text Book(s):

T1. Erwinkreyzig, Advanced Engineering Mathematics, 9th edition, John Wiley& Sons, 2006.

T2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, NewDelhi, 2008.

T3. Ramana B.V., higher Engineering Mathematics, Tata McGraw-Hill, New Delhi, 11thReprint, 2010.

Reference Book(s):

R1. G.B.Thomas and R.L Finney, Calculus and Analytic Geometry, 9th edition, Pearson, Reprint, 2002.

R2. N.P.Bali and Manish Goyel, A text book of Engineering Mathematics, Laxmi Publication, Reprint, 2008.

R3. B.S.Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Web References:

1. https://onlinecourses.nptel.ac.in/noc16_ma05
2. https://nptel.ac.in/courses/122101003/2
3. https://nptel.ac.in/courses/111105035/22

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO .No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

Approved in Academic Council meeting

BOS Convener

BOS Chairman

Course Code:19PHBC2001		Course Title: Physics for Electrical Sciences (common to EC,EE and EI)	
Course Category: Basic Sciences		Course Level: INTRODUCTORY	
L:T:P(Hours/Week) 3: 0: 2	Credits:4	Total Contact Hours:75	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Explain the concepts of static electric field
2. Explain the concepts of static magnetic field
3. Explain the behavior of materials in electric and magnetic fields
4. Explain electric and magnetic fields using Maxwell's equation
5. Explain the phenomenon of Electromagnetic wave propagation

Unit I ELECTROSTATICS 9 Hours

Definition of electric charge-Coulomb's Law – Electric field intensity – Field intensity due to point and line charges – Electric flux density -Gauss's law- Application of Gauss's law: Due to a line charge and a plane sheet of charge – Electric potential-Equipotential surfaces-Potential gradient.

Unit II MAGNETOSTATICS 9 Hours

Definition of magnetic flux- magnetic field intensity-Lorentz Law of force- Biot –savart Law, Ampere's Law- Application of Ampere's Law: Magnetic induction due to a long linear conductor and solenoid - Magnetic field due to straight conductors- circular loop – Magnetic flux density (B) - Magnetic potential.

Unit III ELECTRIC AND MAGNETIC FIELDS IN MATERIALS 9 Hours

Dielectrics: An atomic view - Dielectric Polarization- Dielectrics and Gauss's law- Dielectric Strength- Energy stored in a dielectric medium - Capacity of a condenser - Capacitance - coaxial, Spherical capacitor- Poisson and Laplace Equation.

Magnetic susceptibility and permeability- properties of dia, para and ferro magnetic materials- hysteresis loop.

Unit IV ELECTROMAGNETIC INDUCTION 9 Hours

Faraday's law – Lenz's law – Time varying magnetic field - self Inductance - self Inductance of a solenoid- Mutual inductance- Mutual inductance of two solenoids. Charge conservation law - continuity equation- displacement current- Maxwell's equations.

Unit V ELECTROMAGNETIC WAVES 9 Hours

Maxwell's equations – Electromagnetic waves in free space - Poynting vector - Propagation of electromagnetic waves in dielectrics – Phase velocity- Propagation of electromagnetic waves through conducting media- penetration or skin depth.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

List of Experiments: **30 Hours**

1. Verification of Ohms' law.
2. Test the Faraday's hypothesis of magnetic field induction.
3. Determination of specific resistance of the given material using Carey foster's bridge.
4. Determination of Dielectric constant of a given material.
5. Determination of inductance using Maxwell's bridge.
6. Determination of wavelength of the given light source using spectrometer.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Explain the laws and concepts of static electric field	Understand
CO2: Explain the laws and concepts of static magnetic field	Understand
CO3: Explain the behavior of materials in electric and magnetic fields	Understand
CO4: Explain time varying electric and magnetic fields using Maxwell's equation	Understand
CO5: Explain the phenomenon of Electromagnetic wave propagation in different media	Understand

Text Book(s):

T1. R.K.Gaur and S.L.Gupta, "Engineering Physics", DhanpatRai publications, New Delhi, 8th Edition, 2011.

T2. M.N.Avadhanulu and P.G.Kshirsagar, "Text Book of Engineering Physics", S. Chand & Company Ltd., New Delhi, 2014.

T3. W. H. Hayt and John A. Buck, "Engineering Electromagnetics", Tata McGraw Hill, New Delhi. 6thEdition, 2014.

Reference Book(s):

R1. David Griffiths, "Introduction to Electrodynamics", 4th Edition, Pearson Education, 2013

R2. D. Halliday., R. Resnick and J. Walker, "Fundamentals of Physics", Wiley Publications, 2008.

R3. K. A. Gangadhar and P. M. Ramanathan, "Electromagnetic Field Theory", Khanna Publishers, New Delhi, 5thEdition, 2013.

R4. Mathew. N. O. Sadiku, " Elements of Electromagnetics", 4th Edition, Oxford University Press, 2009

R5. John D. Kraus and Daniel A. Fleisch, "Electromagnetic with Applications", Tata McGraw Hill, New Delhi. 5thEdition, 2010.

Web References:

1. http://openems.de/start/index.php
2. http://nptel.iitm.ac.in

Passed in Board of Studies meeting — Approved in Academic Council meeting

BOS Convener — BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO .No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	20
	CCET II	3,4	50	
	CCET III	5	50	
	Continuous Assessment – Practical	1,2,3,4,5	75	10
	Final Assessment – Practical	1,2,3,4,5	50	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EISN1201	Course Title: Electric Circuit Analysis		
Course Category: Engineering Science		Course Level: Introductory	
L:T:P(Hours/Week) 3:1: 0	Credits:4	Total Contact Hours:60	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Analyze DC circuits
2. Analyze AC circuits
3. Analyze resonance and coupled circuits
4. Analyze three phase circuits
5. Determine transient response of the circuit

Unit I D.C. CIRCUIT ANALYSIS 9+ 3 Hours

Ohm's law – Ideal voltage and current sources – Independent sources – Dependent sources– Circuit elements – Kirchhoff's Laws – Voltage and Current division in series and parallel circuits, Network reduction – Mesh and Nodal analysis with voltage and current sources – Circuit theorems:- Superposition, Thevenin's, Norton's Reciprocity and Maximum Power Transfer – Source transformation – Y-Δ transformation .

Unit II A.C. CIRCUIT FUNDAMENTALS AND ANALYSIS 9 + 3 Hours

Sinusoidal voltage and current – RMS value – Form factor – Phasor representation of sinusoidal of voltages –Current and voltage relationship in R, L, and C circuits – Impedance and admittance, power factor concepts in RC, RL and RLC circuits – Impedance combinations– Real power, reactive power, complex power, apparent power – Analysis of simple series and parallel circuits.

Unit III RESONANCE AND COUPLED CIRCUITS 9 + 3 Hours

Resonance in parallel and series circuits – Half power frequencies – Bandwidth and Q factor of Resonant circuits – Mutual Inductance – Dot convention – Coefficient of coupling – Sinusoidal steady state analysis of network with coupled inductance.

Unit IV THREE- PHASE CIRCUIT ANALYSIS 9 + 3 Hours

Three-phase balanced and unbalanced voltage sources – Three - phase balance and unbalanced loads – Line voltage and phase voltage – Phasor diagram and Power in three-phase circuit – Three - phase circuit analysis with star and delta balanced and unbalanced loads – Phasor diagram – Power and power factor measurement in three-phase circuits.

Unit V TRANSIENT ANALYSIS AND TWO PORT NETWORKS 9 + 3 Hours

Source free RC and RL Circuit responses – Step response of RC and RL circuits – source free RLC series and parallel circuit responses – Step responses of RLC series and parallel circuits– Responses of RC, RL and RLC series circuits to sinusoidal excitation. **Two Port Networks:** One-port and two-port networks, driving point impedance and admittance, open and short circuit parameters. Interconnection of Two port networks T and π representations.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Analyze DC circuits using circuit reduction techniques and network theorems.	Analyze
CO2: Analyze AC circuits using circuit reduction techniques and network theorems.	Analyze
CO3: Determine circuit parameters in resonance ad coupled circuits.	Analyze
CO4: Analyze three phase circuit behavior with balanced and unbalanced three phase loads.	Analyze
CO5: Determine transient and steady state response of RL, RC and RLC circuit with step input and sinusoidal input.	Analyze

Text Book(s):

T1. Edminister, J.A. and Nahvi, M., "Electric Circuits", 4th Edition, Schaum's Outline series,McGraw-Hill, 2002.

T2. Husain, A., "Networks and Systems", Khanna Publishers, 2000.

Reference Book(s):

R1. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", 2nd Edition, McGraw Hill, 2013.

R2. Joseph A. Edminister, MahmoodNahri, "Electric circuits", Schaum's series, McGraw- Hill, New Delhi, 2010.

R3. Boylsted, R.L., "Essentials of Circuit Analysis", Prentice Hall, 2003.

R4. Hayt, Jr.W.H.,Kemmerly, J.E., and Durbin, S.M., "Engineering Circuit Analysis", TataMcGraw-Hill, 2002.

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Web References:

1.https://nptel.ac.in/courses/108102097/3

2.https://nptel.ac.in/courses/108102042/

3. https://nptel.ac.in/downloads/108105053/

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Assessment pattern

	Component	CO .No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorial & Quiz	1,2,3,4,5	30	10
End Semester Examination		1,2,3,4,5	100	60
			Total	100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19CSSC2001	Course Title: C Programming (Common to AU,CE,ME,MC,PR,EE,EC and EI)		
Course Category: Engineering Sciences		Course Level: Introductory	
L:T:P(Hours/Week) 3: 0: 2	Credits:4	Total Contact Hours:75	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Explain about computer organization and problem solving techniques
2. Write programs using appropriate programming constructs
3. Develop programs using arrays, functions & strings
4. Implement programs using pointers, structures& unions
5. Write programs using files & preprocessor directives

Unit I INTRODUCTION 7 Hours

Generation and Classification of Computers –Basic Organization of a Computer – Software development life cycle – Problem Solving Techniques :Algorithm,Pseudocode and Flow Chart.

Unit II C PROGRAMMING BASICS 10 Hours

Introduction to C programming – Structure of a C program – Keywords – Identifiers-Constants– Variables –Data Types– Operators and Expressions –Formatted & Unformatted I/O functions– Decision statements –Loop control statements.

Unit III ARRAYS, FUNCTIONS AND STRINGS 10 Hours

Arrays: Characteristics –One-dimensional and Two-dimensional arrays – Functions: Declaration & Definition of function –Built in function – User defined function –Types of functions –Call by value &reference– Strings: Formatting strings–String handling functions.

Unit IV POINTERS, STRUCTURES & UNION 9Hours

Pointers: Features and Types of pointers – Arithmetic operations with pointers–Pointers and Arrays –Structures: Features– Operations on Structures–Array of structures – Unions.

Unit V FILES & PRE-PROCESSOR DIRECTIVES 9 Hours

Introduction to Files –Stream and File Types–File operations (Open, close, read, write) – Command line arguments–Pre-processor Directives: Macro Expansion, File Inclusion, Conditional Compilation.

List of Exercises 30 Hours

1. Programs to process data types, operators and expression evaluation(any 1)
    a. To find area of rectangle/circle/square
    b. To find the simple interest and compound interest
2. Programs using decision and looping statements(any 2)
    a. To find the maximum number among 3 given numbers
    b. To check whether given year is leap year or not
    c. To display the Fibonacci series
    d. To find the factorial of a number

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

3. Programs using Arrays
    a. To search for particular number among N numbers(1D array)
    b. To compute matrix addition (2 D array)
4. Programs using Functions and Strings(any 2)
    a. To swap two numbers using call by reference
    b. To find the cube of a number
    c. To manipulate strings using string functions
    d. To check whether the string is palindrome or not
5. Programs using Pointer, Structure & Union
    a. To perform arithmetic operations using pointers
    b. To display the information of N students using Structure
    c. To display the employee details using Union
6. Programs using Files (any 1)
    a. To read the contents of a text file
    b. To copy the contents from one file into another

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Explain about computer organization and problem solving techniques	Understand
CO2: Write programs for the given scenario using appropriate programming constructs	Apply
CO3: Develop programs using arrays, functions & strings for the givenscenario	Apply
CO4: Implement programs for given application using pointers, structures& unions	Apply
CO5: Write programs using files & preprocessor directives for simple problems	Apply

Text Book(s):

T1. Ashok N.Kamthane, Amit.N.Kamthane, “Programming in C”, 3rd Edition, Pearson Education, 2015.

Reference Book(s):

R1. Ajay Mittal, “Programming in C-A Practical Approach ”,3rd Edition, Pearson Education, 2010.

R2. YashavantP.Kanetkar, “Let Us C”, 16th Edition, BPB Publications,2018.

R3. PradipDey, ManasGhosh, “Computer Fundamentals and Programming in C”, 2nd Edition, Oxford University Press,2013.

Web References:

1. http://www.cprogramming.com/
2. http://www.c4learn.com/

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO .No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	20
	CCET II	3,4	50	
	CCET III	5	50	
	Continuous Assessment – Practical	1,2,3,4,5	75	10
	Final Assessment – Practical	1,2,3,4,5	50	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

Approved in Academic Council meeting

BOS Convener

BOS Chairman

Course Code: 19MESC4001	Course Title: Engineering Drawing (Common to AU, ME, PR, MC, CS, IT EC and EI)		
Course Category: Engineering Science		Course Level: Introductory	
L:T:P(Hours/Week) 1: 0: 3	Credits: 2.5	Total Contact Hours: 60	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Develop skills for communication of concepts and ideas.
2. Expose them to existing national standards related to technical drawings.

Unit I ORTHOGRAPHIC PROJECTION 12 Hours

Importance of graphics in engineering applications – Use of drafting instruments – BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning. Projection of points, Projection of straight lines located in the first quadrant. Determination of true lengths and true inclinations. Visualization principles –conversion of pictorial into orthographic views.

Unit II PROJECTION OF SOLIDS 12 Hours

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one of the principal planes by rotating object method.

Unit III PROJECTION OF SECTIONED SOLIDS 12 Hours

Sectioning of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by cutting planes inclined to one reference plane and perpendicular to the other – Orthographic views of sections of simple solids.

Unit IV DEVELOPMENT OF SURFACES 12 Hours

Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones.

Unit V ISOMETRIC PROJECTION 12 Hours

Principles of isometric projection – Isometric scale – Isometric projections of simple solids and truncated solids.

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Sketch the orthographic projections of the given pictorial view of the object using first angle projection.	Apply
CO2: Sketch the projections of simple solids such as prism, pyramid, cylinder and cone using rotating object method.	Apply
CO3: Sketch the projections of simple sectioned solids with all necessary dimensions meeting the standards.	Apply
CO4: Sketch the lateral surface of simple solids using straight line and radial line development methods.	Apply
CO5: Sketch the isometric view of simple solids and truncated solids using principles of isometric projection.	Apply

Text Book(s):

T1. Cencil Jensen, Jay D.Helsel and Dennis R. Short, " Engineering Drawing and Design", Tata McGraw Hill India, New Delhi, 7th Edition, 2017.

T2. Bhatt N.D. and Panchal V.M., "Engineering Drawing", Charotar Publishing House, Gujarat, 53rd Edition, 2015.

T3. K. V. Natrajan, "A Text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 48th Edition, 2018.

Reference Book(s):

R1. BasantAgarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill India, New Delhi, 2nd Edition, 2013.

R3. John K.C., "Engineering Graphics", PHI Learning, Delhi, 1st Edition, 2009.

R4. Dhananjay A. Jolhe, "Engineering Drawing with an introduction to AutoCAD" TataMcGraw India, New Delhi, 3rd Edition, 2008.

Publications of Bureau of Indian Standards

1. IS 10711 – 2001: Technical products Documentation – Size and lay out ofdrawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods.

Web References:

1. http://nptel.ac.in/courses/112103019/
2. https://en.wikipedia.org/wiki/Engineering_drawing

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Articulation Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	-	-	2	3	2	-	2	2	2
CO2	3	2	2	2	2	-	-	2	3	2	-	2	2	2
CO3	3	2	2	2	2	-	-	2	3	2	-	2	2	2
CO4	3	2	2	2	2	-	-	2	3	2	-	2	2	2
CO5	3	2	2	2	2	-	-	2	3	2	-	2	2	2

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	**CO .No.**	**Marks**	**Scale To**
Continuous Assessment	Each Lab Experiment	1,2,3,4,5	75	75
	Cycle Test 1	1,2,3	50	25
	Cycle Test 2	4,5	50	
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19CHMG6201	Course Title: Environmental Sciences (Common to all B.E/B.Tech Programmes)	
Course Category: Mandatory Non-Credit Course	Course Level: Introductory	
L:T:P(Hours/Week) 1: 0: 0	Total Contact Hours:15	Max. Marks: 100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Create awareness for conservation and equitable use of natural resources.
2. Explain the measures of prevention of pollution and disaster management.
3. State the importance of environmental legislation in India.
4. Expose the general environmental issues relevant to human health.
5. Explain the innovative measures for day to day environmental issues.

Unit I NATURAL RESOURCES 2 Hours

Role of individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

Unit II ENVIRONMENTAL POLLUTION AND DISASTER MANAGEMENT 2 Hours

Role of an individual in prevention of pollution; Disaster management : floods, earthquake, cyclone and landslides.

Unit III ENVIRONMENTAL ETHICS AND LEGISLATIONS 2 Hours

Environmental ethics : Environment Protection Act; Air Act; Water Act ; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation.

Unit IV ENVIRONMENTAL ISSUES AND PUBLIC AWARNESS 2 Hours

Public awareness - Environment and human health

Unit V ENVIRONMENTAL ACTIVITIES 7 Hours

(a) Awareness Activities*:*

i) Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste
ii) Slogan making event
iii) Poster making event

(b) Actual Activities:

i) Plantation
ii) Cleanliness drive
iii) Drive for segregation of waste
iv) To know about the different varieties of plants
v) Shutting down the fans and ACs of the campus for an hour or so

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Describe the measures for conservation and equitable use of natural resources	Understand
CO2: Describe the measures for pollution prevention and disaster management	Understand
CO3: Brief the importance of environmental legislation in India .	Understand
CO4: Explain the general environmental issues in relevant to human health	Understand
CO5: Demonstrate innovative measures for day to day environmental issues	Understand

Text Book(s):

T1. Benny Joseph, "Environmental Studies", Tata McGraw Hill, New Delhi, 2006.
T2. Mackenzie Davis and Susan Masten, "Principles of environmental engineering and science", Mc-Graw Hill, 3rd Edition, 2014.

Reference Book(s):

R1. Trivedi R.K. "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol.I and II, Enviro Media.
R2. Cunningham, W.P.Cooper,T.H. Gorhani, "Environmental Encyclopedia", Jaico Publishing House, Mumbai, 2001.

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment Pattern

Component	Marks	Details
Attendance	10	Minimum 80% and 1 mark for every 2% observed
Knowledge Test	40	Objective type questions
Activity(ies)	50	Report on the activity performed
Total	**100**	

Non-letter Grades

Marks Scored	Performance Level
70 & above	Good
30 – 69	Average
< 30	Fair

Passed in Board of Studies meeting

Approved in Academic Council meeting

BOS Convener

BOS Chairman

Semester - III

Course Code:19MABC1302	Course Title: Numerical Methods and Linear Algebra (Common to EE,EC and EI)		
Course Category: Basic Science		Course Level: Introductory	
L:T:P(Hours/Week) 3: 1: 0	Credits:4	Total Contact Hours:60	Max Marks:100

Pre-requisites

- Matrices and Calculus
- Ordinary Differential Equation and Complex variables

Course Objectives

The course is intended to:

1. Solve the system of linear equations, nonlinear equations & Calculate the dominant Eigen value.
2. Determine the unknown values from the given set of data & Compute derivatives and integrals.
3. Solve first ordinary differential equation.
4. Apply the concept of vector spaces to electrical network problems.
5. Apply the concept of Inner product spaces in Fourier approximation.

Unit I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 9+3 Hours

Solution of system of linear equations – Direct methods: Gaussian elimination method – Indirect methods: Gauss Jacobi method, Gauss-Seidel method – sufficient conditions for convergence – Solution of nonlinear equations: Newton Raphson method – Power method to find the dominant Eigen value and the corresponding Eigen vector. Application of Eigen value and the corresponding Eigen vector.

Unit II INTERPOLATION, NUMERICAL DIFFERENTIATION AND INTEGRATION 9+3 Hours

Newton's forward, backward interpolation — Lagrange's interpolation. Numerical Differentiation and Integration — Trapezoidal rule — Simpson's 1/3 rule — Double integration using Trapezoidal rule.

Unit III NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATION 9+3 Hours

Numerical solution of first order ordinary differential equation-Single step method: Taylor's series- Euler's method –Runge-Kutta method of fourth order — Multi step method: Milne's and Adams – Bash forth predictor corrector methods for solving first order equations.

Unit IV VECTOR SPACES 9+3 Hours

System of linear equations -Vector spaces- Subspace of a vector space- basis and dimension of vector space - linear combination and spanning sets of vectors -linear independence and linear dependence of vectors-Row space, Column space and Null space- Rank and nullity of subspaces. Applications to linear equations: Simple electrical network problems to find loop

current using Kirchhoff's voltage law.

Unit V ORTHOGONALITY AND INNER PRODUCT SPACES 9+3 Hours

Inner product of vectors: length of a vector, distance between two vectors, and orthogonality of vectors-Orthogonal projection of a vector-Gram-Schmidt process to produce orthogonal and orthonormal basis -Inner product spaces- Fourier approximation of continuous functions using inner product spaces.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Solve the system of linear equations, nonlinear equations & calculate the dominant Eigen value.	Apply
CO2: Determine the unknown values from the given set of data & Compute derivatives and integrals.	Apply
CO3: Solve first ordinary differential equation.	Apply
CO4: Apply the concept of vector spaces to electrical network problems.	Apply
CO5: Apply the concept of Inner product spaces in Fourier approximation	Apply

Text Book(s):

T1. Grewal, B.S. and Grewal, J. S., "Numerical Methods in Engineering and Science", Eleventh Edition, Khanna Publishers, New Delhi, 2013.

T2. David C Lay, "Linear Algebra and its Applications', 5th Edition, Pearson Education, 2015.

Reference Book(s):

R1. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", Seventh Edition, Pearson Education Asia, New Delhi, 2006.

R2. Jain M. K., Iyengar, S. R. and Jain, R. K, "Numerical Methods for Scientific and Engineering Computation', New Age Publishers, 2012.

R3. Sastry.S.S "Introductory Methods of Numerical Analysis", 4th Edition, PHI, 2010.

R4. Gilbert Strang, "Linear algebra and its Applications', 4th Edition, Cengage Learning India Private Limited, 2012.

Web References:

1. http://nptel.ac.in/courses/122104018/node2.html
2. http://nptel.ac.in/courses/111105038/

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO .No.	Marks	Total
Continuous Comprehensive Evaluation	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials	1,2,3,4,5	30	10
	Quiz	1,2,3,4,5		
	Assignments	1,2,3,4,5		
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EICN1301		Course Title: Electron Devices and Circuits	
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 3: 0: 0	Credits: 3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Explain the operation of Transistors.
2. Explain the operation of Transistor as amplifiers.
3. Explain the structure and applications of thyristors and special diodes
4. Explain the concept of Feedback amplifiers and oscillators
5. Explain the function of wave shaping circuits and multivibrators

Unit I TRANSISTORS 9 Hours

BJT, JFET, MOSFET- structure, operation, characteristics -Transistor Biasing

Unit II AMPLIFIERS 9 Hours

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response – FET small signal model, Differential Amplifier, Multistage amplifier- Two stage RC coupled Amplifier, Tuned amplifier-Gain and Frequency Response.

Unit III THYRISTORS AND SPECIAL DIODES 9 Hours

UJT ,SCR,TRIAC,DIAC ,IGBT -structure and characteristics, Schottky barrier diode-Varactor diode –Tunnel diode- LASER diode

Unit IV FEEDBACK AMPLIFIERS AND OSCILLATOR 9 Hours

Advantages of negative feedback – voltage / current, series, Shunt feedback –positive feedback –Condition for oscillations, phase shift – Wien bridge, Hartley, Colpitts and Crystal oscillators.

Unit V WAVE SHAPING CIRCUITS and MULTIVIBRATOR 9 Hours

Wave shaping circuits-Differentiator -Integrator- Diode Clipper -Clampers-Multivibrators-Schmitt trigger.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1:Explain the structure, characteristics and biasing of BJT and FET.	Understand
CO2:Determine Frequency Response and gain of BJT, FET and multistage amplifiers.	Understand
CO3: Illustrate the current voltage characteristics of UJT, thyristors and special diodes.	Understand
CO4:Analyze Feedback amplifiers and different oscillators for different frequency	Apply
CO5:Design different wave shaping circuits and multivibrators.	Apply

Text Book(s):

T1. David A. Bell ,"Electronic devices and circuits", Oxford University higher education, 5th Edition,2010.

T2. Robert L.Boylestad, "Electronic Devices and Circuit Theory", 11th Edition, Pearson prentice hall, 2015.

Reference Book(s):

R1. Balbir Kumar, Shail.B.Jain, "Electronic devices and circuits" PHI learning private limited, 2nd Edition, 2014.

R2. Thomas L.Floyd, "Electronic devices" Conventional current version, Pearson prentice hall, 10thEdition, 2017.

R3. J.Millman, C.C.Halkias, and SatyabrathaJit "Electronic Devices and Circuits", Tata McGraw Hill, 2nd Edition, 2008.

R4. Robert L.Boylestad, "Electronic Devices and Circuit Theory", 11th Edition, Pearson prentice hall, 2015.

Web References:

1. https://nptel.ac.in/courses/122106025/
2. https://nptel.ac.in/courses/117103063/

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Assessment pattern:

	Assessment Component	CO .No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

Approved in Academic Council meeting

BOS Convener

BOS Chairman

Course Code:19EICN1302	Course Title: Electrical Machines and Measurements		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Summarize the operation and characteristics of types of DC Machine.
2. Demonstrate the different types of induction motor.
3. Explain the construction and working of meters used to measure current, voltage, Resistance, Inductance and capacitance.
4. Explain the construction and working of measurement techniques for power and energy.
5. Elaborate the construction and working of potentiometer and instrument transformers.

Unit I D.C. MACHINES 9 Hours

Construction of D.C. Machines - Principle of operation of D.C. generator -EMF equation -Various excitation schemes- Characteristics of D.C. generators- Principle of operation of D.C. motor-Types-Torque equation-Characteristics-Starters:3 point and 4 point starters.

Unit II A.C. MACHINES 9 Hours

Three phase Induction motor: principle of operation, Types- Starting methods and Speed control. Single phase induction motors: Double field revolving theory- Types - Capacitor start capacitor run motors.

Unit III TRANSFORMERS AND SPECIAL MACHINES 9 Hours

Transformers: Principle, Construction, EMF Equation and Equivalent Circuit –Instrument Transformer:-C.T and P.T construction, theory and operation. Stepper motor-Servo Motors - BLDC.

Unit IV MEASUREMENT OF ELECTRICAL PARAMETERS 9 Hours

Types of ammeters and voltmeters – PMMC Instruments – Moving Iron Instruments – Dynamometer type Instruments – bridges for measurement of R, L and C - Wheatstone bridge, Kelvin double bridge, Maxwell bridge, Wein bridge, Schering bridge

Unit V POWER AND ENERGY MEASUREMENTS 9 Hours

Electro dynamic type wattmeter – Theory and its errors– LPF wattmeter– Phantom loading –

Measurement of three phase power- 3 wire and 4 wire supply- single phase and three phase energy meter - theory and Adjustments.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Summarize the characteristics of different types of DC Machines and starters.	Understand
CO2: Summarize the characteristics of different types of AC Machines and starters.	Understand
CO3: Explain the principles and operation of transformers and special machines.	Understand
CO4: Select a suitable instrument for measurement of voltage, current, R, L and C	Apply
CO5: Select a suitable method for the measurement of power and energy in single and three phase circuits.	Apply

Text Book(s):

T1. Nagrath, I.J., and Kothari, D.P., “Electrical Machines”, 4th Edition, Tata McGraw - Hill, 2016.

T2. R.B. Northrop, Introduction to Instrumentation and Measurements, 3rd Edition, Taylor & Francis, New Delhi, 2017

T3. J.J. Carr, Elements of Electronic Instrumentation and Measurement, Pearson Education India, New Delhi, 2011 (Ref)

T4. H.S. Kalsi, Electronic Instrumentation, Tata McGraw-Hill, New Delhi, 2010 (Ref)

Reference Book(s):

R1. Theraja, B.L., “A Text book of Electrical Technology”, Vol.II, S.C Chandand Co., New Delhi, 2007. (Text Book)

R2. A.K. Sawhney, A Course in Electrical & Electronic Measurements & Instrumentation, DhanpatRai and Co, New Delhi, 2010 (Text Book)

R3. Bell, A.D., “Electronic Instrumentation and Measurements”, 3rd Edition, Oxford University Press India, 2013.

Web References:

1. https://nptel.ac.in
2. https://qualifygate.com
3. https://www.electrical4u.com

Passed in Board of Studies meeting — Approved in Academic Council meeting

BOS Convener — BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	**CO .No.**	**Marks**	**Total**
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

Approved in Academic Council meeting

BOS Convener

BOS Chairman

Course Code:19EECC2301	Course Title: Digital Electronics (Common to EE and EI)		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week)3: 0: 2	Credits:4	Total Contact Hours:75	Max Marks:100

Pre-requisites

- Fundamental of Instrumentation Engineering

Course Objectives

The course is intended to:

1. Illustrate the number systems, Boolean laws and simplification techniques
2. Design Combinational circuits
3. Design synchronous sequential circuits
4. Design asynchronous sequential circuits
5. Examine the various memory devices, shift registers and logic families

Unit I NUMBER SYSTEM AND BOOLEAN ALGEBRA 9 Hours

Review of Number Systems - Complements: 1's and 2's - Arithmetic operation of Signed binary numbers - Boolean Algebra: Basic theorems, Simplification of Boolean functions, Representation of Boolean function in canonical and standard forms - Simplification of Boolean expressions using K maps and Quine Mccluskey method.

Unit II COMBINATIONAL CIRCUITS 9 Hours

Basic Gates, Universal gate implementation, Design of Adder, Subtractor, Comparators, Code converters, Encoders, Decoders, Multiplexers, De-multiplexers- Function realization using multiplexer.

Unit III SYNCHRONOUS SEQUENTIAL CIRCUITS 9 Hours

Flip Flops: SR, JK, T, D- Level and Edge Triggering- Analysis of Synchronous sequential circuits - Design of Synchronous sequential circuits with state diagram, state table, state reduction and state assignment - Design of counter.

Unit IV ASYNCHRONOUS SEQUENTIAL CIRCUITS 9 Hours

Analysis of Asynchronous Sequential Circuits - Design of Asynchronous sequential circuits with primitive flow table, State Reduction and State Assignment- Races, Cycles and Hazards: Static, Dynamic, Essential, Hazards Elimination.

Unit V MEMORY DEVICES, SHIFT REGISTERS AND LOGIC FAMILIES 9 Hours

Memories: RAM,ROM, PROM, EPROM – FPGA - Shift registers – Ripple counters –

Logic families: TTL, ECL, CMOS.

Laboratory Component 30 Hours

1. Simplification of Boolean Expression using K map and its implementation.
2. Design of full adder/ full subtractor using logic gates
3. Design of encoder/ decoder using logic gates
4. Design of multiplexer using logic gates
5. Design of basic flip flops
6. Design of shift registers

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Illustrate the number systems, Boolean laws and simplification techniques used in digital design	Understand
CO2: Design and realize the combinational circuits using logic gates	Apply
CO3: Design and construct synchronous sequential circuits using basic flip flops	Apply
CO4: Design asynchronous sequential circuits eliminating hazards and races	Apply
CO5: Explain the various memory devices, shift registers and logic families	Understand

Text Book(s):

T1. Morris Mano. M. Michael D Ciletti, “Digital Design”, Pearson Education, 5th Edition, 2012.

T2. John F.Wakerly, Digital Design Principles and Practice, Pearson Education, 5th edition, 2018

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Reference Book(s):

R1. Malvino and Leach, “Digital Principles and Applications”, Tata McGraw Hill, New Delhi, 8th edition, 2014,

R2. S.Salivahanan and S.Arivazhagan, “Digital Circuits and Design”, Oxford University Press, 5th edition, 2018.

R3. A.Anandkumar, Fundamentals of digital circuits, 4th Edition, PHI Learning Pvt.Ltd, 2016

R4. John M.Yarbrough, “Digital Logic, Application & Design”, Thomson, 2010

R5. Donald D. Givone, “Digital Principles and Design”, McGraw Hill Education,2017

Web References:

1.https://nptel.ac.in/courses/117105080/

2. https://nptel.ac.in/courses/117106086/

Course Articulation Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	2	-	-	1	3	1	-	-	-	-
CO2	3	2	1	1	2	-	-	1	3	1	-	-	-	-
CO3	3	2	1	1	2	-	-	1	3	1	-	-	-	-
CO4	3	2	1	1	2	-	-	1	3	1	-	-	-	-
CO5	2	1	-	1	1	-	-	1	3	1	-	-	-	-

High-3; Medium-2; Low-1

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Assessment Types planned for the course Digital Electronics

CO	Assessment Types	Indicators	POs Associated	PO mapping
CO1	CCET	Questions in Tests	PO8,PO10	PO8-1(L-1) PO9-2(M-2) PO10-3(H-3) PO12-1L-1)
	Quiz #	Questions in Tests	PO12	
	Lab	Record/Observation Viva	PO9(2),PO10(2),	
CO2	CCET	Questions in Tests	PO8,PO10	PO8-1(L-1) PO9-2(M-2) PO10-3(H-3) PO12-1L-1)
	Quiz #	Questions in Tests	PO12	
	Lab	Record/Observation Viva	PO9(2),PO10(2),	
CO3	CCET	Questions in Tests	PO8,PO10	PO8-1(L-1) PO9-2(M-2) PO10-3(H-3) PO12-1L-1)
	Quiz #	Questions in Tests	PO12	
	Lab	Record/Observation Viva	PO9(2),PO10(2),	
CO4	CCET	Questions in Tests	PO8,PO10	PO8-1(L-1) PO9-2(M-2) PO10-3(H-3) PO12-1(L-1)
	Lab	Record/Observation Viva	PO9(2),PO10(2),	
	Quiz #	Questions in Tests	PO12	
CO5	CCET	Questions in Tests	PO8,PO10	PO8-1(L-1) PO9-2(M-2) PO10-3(H-3) PO12-1L-1)
	Quiz #	Questions in Tests	PO12	
	Lab	Record/Observation Viva	PO9(2),PO10(2),	

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	20
	CCET II	3,4	50	
	CCET III	5	50	
	Continuous Assessment – Practical	1,2,3,4,5	75	10
	Final Assessment – Practical	1,2,3,4,5	50	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EICN2301		Course Title: Sensors and Transducers	
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 3: 0: 2	Credits:4	Total Contact Hours: 75	Max Marks:100

Pre-requisites

- Fundamentals of Electrical Engineering
- Engineering Physics

Course Objectives

The course is intended to:

1. Summarize the static and dynamic characteristics of Transducers.
2. Explain the principle and application of resistance transducers.
3. Describe the principle and application of variable inductance and capacitance transducers
4. Explain the principle and application of various types of special transducers.
5. Identify the application of different transducers.

Unit I CHARACTERISTICS OF TRANSDUCERS 9 Hours

Units and standards - Classification of errors - Error analysis – Statistical methods – Odds and uncertainty – Classification of transducers – characteristics of transducers – Zero, I and II order transducers - Response to step and impulse inputs.

Unit II RESISTIVE TRANSDUCERS 9 Hours

Principle of operation, construction details, characteristics and applications of potentiometer, strain gauge, resistance thermometer – 3wire & 4 wire RTD, Thermistor, hot-wire anemometer, piezo resistive sensor and humidity sensor.

Unit III INDUCTIVE AND CAPACITIVE TRANSDUCERS 9 Hours

Induction potentiometer – Variable reluctance transducers – EI pick up – Principle of operation, construction details, characteristics and applications of LVDT –Capacitive transducer and types – Capacitor microphone.

Unit IV SPECIAL TRANSDUCERS 9 Hours

Piezoelectric transducer - Hall Effect transducer – Magneto elastic load cell- Digital transducers : linear and rotary type –Fibre optic sensors – magnetometer – Nano sensor – MEMS - Smart Sensor

Unit V APPLICATIONS OF TRANSDUCERS 9 Hours

Strain Gauge: Load Cell – Torque measurement – Accelerometer.Piezo-electric type: Load Cell

– Accelerometer – Seismic instrument.LVDT: Displacement – Accelerometer.Inductive Type: Accelerometer.Resistive and Capacitive type Humidity and Moisture Measurement

List of Experiments **30 Hours**

1. Plot the hysteresis curve for Load cell and strain gauge.
2. Plot the Characteristics of LVDT and Capacitive type transducers.
3. Plot the Characteristics curve and step response curve of RTD.
4. Plot the Characteristics of Piezo electric and Hall Effect transducers.
5. Plot the hysteresis curve for torque sensor.
6. Measurement of Speed using optical transducer

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1.Analyse the static and dynamic characteristics of transducers.	Apply
CO2.Explain the principle and application of resistance transducers.	Understand
CO3.Describe the principle and application of variable inductance and capacitance transducers.	Understand
CO4.Illustrate the concept of special and digital type transducers.	Understand
CO5. Analyse the characteristics experimentally for different transducers.	Apply

Text Book(s):

T1.John P.Bentley, Principles of Measurement Systems, III Edition, Pearson Education, 2015.

T2.Doebelin E.O. and Manik D.N., Measurement Systems – Applications and Design, Special Indian Edition, Tata McGraw Hill Education Pvt. Ltd., 2017.

Reference Book(s):

R1.D. Patranabis, Sensors and Transducers, 2nd edition, Prentice Hall of India, 2013. E.A

R2.Neubert H.K.P., Instrument Transducers – An Introduction to their Performance and Design, Oxford University Press, Cambridge, 2013

R3.W.Bolton, Engineering Science, Elsevier Newnes, 5th Edition, 2006

Web References:

1. nptel.ac.in/courses/112103174
2. http://nptel.ac.in/courses/108105064
3. http://nptel.ac.in/courses/112106140

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO .No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	20
	CCET II	3,4	50	
	CCET III	5	50	
	Continuous Assessment – Practical	1,2,3,4,5	75	10
	Final Assessment – Practical	1,2,3,4,5	50	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EICN3301		Course Title: Electron Devices and Circuits Laboratory	
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 0: 0: 3	Credits:1.5	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Analyze the characteristics of Transistors and Thyristors
2. Analyze the characteristics of transistor amplifiers.
3. Design transistor based voltage regulator and logic gates
4. Analyze different oscillators.
5. Analyze the characteristics of different wave shaping circuits and multivibrator

List of Experiments

1. Analyze the VI Characteristics of BJT.
2. Analyze the VI Characteristics of FET.
3. Analyze the Characteristics of SCR and TRIAC.
4. Analyze the Frequency Response of CE amplifier.
5. Design and verify Series voltage regulator using transistor
6. Design and verify transistor based logic gates.
7. Design and verify Two stage RC coupled amplifier.
8. Design and verify RC Phase shift Oscillator.
9. Design and verify Wave shaping circuits - Clipper /Clamper.
10. Design and verify Astable Multivibrator

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Outcomes:	**Cognitive/ Affective**
At the end of this course, students will be able to:	
CO1:Analyze the characteristics of Transistors and Thyristors using hardware /simulation.	Apply
CO2:Analyze the characteristics of transistor amplifiers using hardware /simulation.	Apply
CO3:Design transistor based voltage regulator and verify using hardware /simulation.	Apply
CO4:Analyze different oscillators using hardware /simulation.	Apply
CO5:Analyze the characteristics of different wave shaping circuits and multivibrator using hardware /simulation.	Apply

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	**CO.No.**	**Marks**	**Scale To**
Continuous Assessment	Each Lab Experiment	1,2,3,4,5	75	75
	Cycle Test 1	1,2,3,4	50	25
	Cycle Test 2	1,2,3,4,5	50	
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EICN3302	Course Title: Electrical Machines and Measurements Laboratory		
Course Category: Professional Core		Course Level: Introductory	
L:T:P(Hours/Week) 0: 0: 3	Credits:1.5	Total Contact Hours:45	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Facilitate the students to study the characteristics of DC shunt generator.
2. Obtain the various load characteristics of D.C motor.
3. Study the load characteristics of induction motor under various load condition
4. Provide practical knowledge on different measuring devices.
5. Measurement of power using different measurement devices.

List of Experiments

1. Open circuit and load characteristic of DC Shunt Generator
2. Load test on DC Shunt Motor and series motor
3. Speed control of DC motor
4. Load test on Single - phase Induction Motor
5. Load test on Three - phase Induction Motor
6. Wheatstone and Kelvin's bridge for measurement of resistance
7. Schering Bridge for capacitance measurement and Maxwell Bridge for inductance measurement.
8. Calibration of Energy meter by Phantom Loading
9. Measurement of power and energy in 3 phase circuits
10. Measurement of current and voltage using CT and PT

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Outcomes:	Cognitive/ Affective
At the end of this course, students will be able to:	
CO1: Analyze the performance characteristics of DC shunt generators by conducting load tests	Apply
CO2: Implement the speed control techniques for DC motor	Apply
CO3: Determine the performance characteristics of induction machine by conducting direct load tests.	Apply
CO4: Design a bridge circuit to measure resistance, inductance and capacitance	Apply
CO5: Measure current, voltage, power and energy using different measurement devices.	Apply

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO .No.	Marks	Scale To
Continuous Assessment	Each Lab Experiment	1,2,3,4,5	75	75
	Cycle Test 1	1,2,3,4	50	25
	Cycle Test 2	1,2,3,4,5	50	
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Semester– IV

Course Code:19MABG1401	Course Title: Probability and Statistics (Common to AU, CE, CS, EC, EE ME and IT)		
Course Category: Basic Science		Course Level: Introductory	
L:T:P(Hours/Week) 3: 1: 0	Credits:4	Total Contact Hours:60	Max Marks:100

Pre-requisites

- Matrices and Calculus
- Ordinary Differential Equation and Complex variables

Course Objectives

The course is intended to:

1. Calculate expectations and variances of random variables
2. Apply the concepts of standard distributions to solve practical problems
3. Calculate the correlation and regression for two variables
4. Test the samples based on hypothesis
5. Analyze the samples based on variance

Unit I PROBABILITY AND RANDOM VARIABLES 9+3 Hours

Axioms of Probability- Conditional Probability- Total Probability -Baye's Theorem- Random Variables- Probability Mass Function- Probability Density Functions- Properties - Moments- Moment generating functions and their properties.

Unit II STANDARD DISTRIBUTIONS 9+3 Hours

Binomial- Poisson- Uniform –Exponential- Normal Distributions and their properties-Functions of a random variable.

Unit III TWO DIMENSIONAL RANDOM VARIABLES 9+3 Hours

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and regression – Transformation of random variables.

Unit IV TESTING OF HYPOTHESES 9+3 Hours

Sampling Distributions- Testing of hypotheses for mean, variance, proportions and differences using Normal, t, Chi-Square and F distributions – Tests for independence of attributes and Goodness of fit.

Unit V DESIGN OF EXPERIMENTS 9+3 Hours

Analysis of Variance (ANOVA)- One way Classification – Completely Randomized Design(CRD) – Two way Classification – Randomized Block Design (RBD) – Latin square.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Calculate expectations and variances of random variables	Apply
CO2: Apply the concepts of standard distributions to solve practical problems	Apply
CO3: Calculate the correlation and regression for two variables	Apply
CO4: Test the samples based on hypothesis	Apply
CO5: Analyze the samples based on variance	Apply

Text Book(s):

T1. Veerajan T, "Probability, Statistics and Random process", 3rd Edition, Tata McGraw-Hill, New Delhi, 2017.

T2. Dr.J.Ravichandran, "Probability and Statistics for Engineers", 1st Edition, Wiley India Pvt.Ltd.,2010.

Reference Book(s):

R1. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, "Probability and Statistics for Engineers and Scientists", 8th Edition Pearson Education, Asia, 2007.

R2. M.R. Spiegel,J. Schiller and R.A. Srinivasan, "Schaum's Outlines Probability and Statistics", Tata McGraw Hill edition, 2004.

R3. Morris DeGroot, Mark Schervish, "Probability and Statistics", Pearson Educational Ltd, 4th Edition, 2014.

R4. Johnson and C.B. Gupta,"Probability and Statistics for Engineers", 7th Edition,Pearson Education, Asia, 2007.

Web References:

1. https://onlinecourses.nptel.ac.in/111105041/
2. https://nptel.ac.in/downloads/111105041/
3. https://nptel.ac.in/courses/111105090/

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Assessment pattern:

	Assessment Component	CO .No.	Marks	Total
Continuous Comprehensive Evaluation	CCET 1	1,2	50	30
	CCET 2	3,4	50	
	Retest	1,2,3,4	50	
	CCET 3	5	50	
	Tutorial	1,2,3,4,5	30	10
	Quiz	1,2,3,4,5		
	Assignment	1,2,3,4,5		
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code :19EICN1401	Course Title : Linear Integrated Circuits		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact hours:45	Max Marks:100

Prerequisites: The student should have undergone the course(s):

- Electronic Devices and Circuits

Course Objectives

The course is intended to:

1. Explain the IC packages and OP-AMP Characteristics
2. Design an amplifier and filter circuits using OPAMP
3. Design a converter circuits using OPAMP
4. Illustrate the internal functional blocks and the applications of special ICs like Timers, VCO, PLL circuits, regulator Circuits.
5. Summarize the special features of analog ICs.

Unit I OPERATIONAL AMPLIFIER AND CHARACTERISTICS 9 Hours

Introduction to Integrated Circuits – Types of IC packages - Thermal Characterization of IC Packages - OPAMP Internal blocks, Ideal OPAMP characteristics, DC characteristics, AC characteristics, Frequency response of OPAMP, Open-loop and closed-loop configurations.

Unit II APPLICATIONS OF OP-AMP 9 Hours

IC 741 - Inverting amplifier, Non Inverting amplifier, Summer, Differential amplifier, Differentiator, Integrator, Instrumentation amplifier, Log and Antilog amplifier, Active Filters: First and Second order active Low and high Pass filters.

Unit III SPECIAL APPLICATIONS OF OP-AMP 9 Hours

Comparators, Zero Crossing Detector - Schmitt Trigger- S/H circuit - I/V and V/I Converter – V/F and F/V Converter ,D/A converter: R-2R ladder and Weighted resistor types - A/D converter: Successive approximation and Flash types.

Unit IV SPECIAL FUNCTION ICs 9 Hours

555 Timer circuit – Functional block, characteristics & applications – 566 voltage controlled oscillator circuit – 565 Phase lock loop and applications, IC voltage regulators: Fixed and Variable regulators – 78XX, 79XX, 317, 723 regulators, Switching regulator.

Unit V APPLICATION SPECIFIC ICs **9 Hours**

Resistor chip – Rectifier ICs –LM35/AD590 Temperature sensor ICs– AD522 Instrumentation Amplifier - TL594 PWM ICs – L293 DC motor driver ICs– ULN2003 Stepper Motor Driver IC

Course Outcomes **At the end of the course students will be able to:**	**Cognitive Level**
CO1: Explain the structure of IC packages and frequency response of OPAMP	Understand
CO2: Design amplifier, differentiator, integrator and filters usingIC741	Apply
CO3: Design a comparator and signal converter circuits usingIC741	Apply
CO4: Describe the internal functional blocks and the applications of special ICs like Timers, PLL circuits and regulator Circuits.	Understand
CO5: Explain the functions of application specific ICs	Understand

Text Books

T1. Ramakant A. Gayakward, 'Op-amps and Linear Integrated Circuits', 4th Edition, Pearson Education, 2016.

T2. Roy Choudhary.D., Sheil B. Jani, 'Linear Integrated Circuits', 4th Edition, New 2018.

Reference Books

R1. David A. Bell, 'Op-amp & Linear ICs', Prentice Hall of India, 2012.

R2. Jacob Millman, Christos C.Halkias, 'Integrated Electronics - Analog and Digital circuits system', Tata McGraw Hill, 2015.

R3. Robert F.Coughlin, Fredrick F.Driscoll, 'Op-amp and Linear ICs', Pearson Education, 4th edition, 2010.

Web References

1. https://onlinecourses.nptel.ac.in/explorer

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Assessment pattern:

	Assessment Component	CO .No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	40
	CCET II	3,4	50	
	CCET III	5	50	
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EICN1402	Course Title: Signals and Systems		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 3: 1 : 0	Credits:4	Total Contact Hours:60	Max Marks:100

Pre-requisites

- Matrices and Calculus
- Ordinary Differential equation and complex Variables

Course Objectives

The course is intended to:

1. Categorize various signals and systems and explain their mathematical representation.
2. Define sampling theorem and the need of signal reconstruction.
3. Realize the need of Fourier Series and Fourier Transform for continuous time signals.
4. Realize the need of Fourier Series and Fourier Transform for Discrete time signals.
5. Implement Z-Transform for discrete systems.

Unit I Classification of Signals and Systems 9 + 3 Hours

Introduction to signals and system, Continuous time(CT) and Discrete Time(DT) signals-Elementary signals, operation on independent and dependent variables, classification of CT and DT signals-periodic and Aperiodic, Deterministic and Random, Energy and Power-Impulse Signals, Time Shifting, Scaling-CT & DT systems-classification of systems-static and dynamic, Linear and Nonlinear, Time variant and Time invariant, causal and Non causal, stable and Unstable.

Unit II Signal Discretization and LTI Systems 9 + 3 Hours

Discretization of signals: Sample and Hold Circuits, Sampling: Sampling theorem, selection of sampling rate, Types of sampling, Aliasing and Quantization, Linear Time Invariant/Linear shift Invariant (LTI/LSI) systems, Linear and Circular Convolution, Overlap add and overlap save methods

Unit III Fourier Representation of Continuous Time Signals 9 + 3 Hours

Fourier Transform – Properties - Fourier representation of continuous time periodic signals-CTFS, Properties, Fourier representation of continuous time Non-periodic signals-CTFT, Properties

Unit IV Fourier Representation of Discrete Time Signals 9 + 3 Hours

Fourier representation of discrete time periodic signals-DTFS, Properties-Fourier representation of discrete time non- periodic signals-DTFT, properties.

Unit V Applications of Z-Transform 9 + 3 Hours

Z-Transform, ROC, Properties, Inverse Z Transform, Applications of Z-Transform

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Classify signals and systems and familiarize their mathematical representation.	Understand
CO2: Describe sampling theorem and signal reconstruction	Understand
CO3: Apply Fourier series and Fourier Transform for continuous time signals	Apply
CO4: Apply Fourier series and Fourier Transform for discrete time signals	Apply
CO5: ApplyZ Transform for discrete systems	Apply

Text Books:

T1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab“ Signals and Systems”, Pearson Education, 2015.

T2. Simon Haykins and Barry Van Veen, “Signals and systems”, John Wiley and sons, 2nd EditionInc, 2018.

Reference Books:

R1. H.P.Hsu,RakeshRanjan, ”Signals and Systems”,Schaum’sOutlines,Tata McGraw Hill,Indian Reprint,2013

R2. Edward W Kamen& Bonnie’s Heck,”Fundamentals of Signals andSystems”,Pearson Education, 2014.

R3. B.P.Lathi,”Principles of Linear Systems and Signals”,2nd Edition,Oxford,2009.

R4. R.E.Zeimer,W.H.Tranter and R.D.Fannin,”Signals and Systems-Continuous and Discrete”,Pearson,2007.

R5. John AlanStuller,”AnIntroductionto signals and systems”,Thomson,2007.

Web References:

1. http://ocw.mit.edu/resources/res-6-007-signals-and-systems-spring-2011
2. http://nptel.ac.in/courses/117104074
3. http://www.nptel.ac.in/courses/117101055
4. https://www.tutorialspoint.com/signals_and_systems

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Passed in Board of Studies meeting

Approved in Academic Council meeting

BOS Convener

BOS Chairman

Assessment pattern

	Assessment Component	CO .No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EICN2401		Course Title: Industrial Instrumentation	
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 3: 0: 2	Credits:4	Total Contact Hours:75	Max Marks:100

Pre-requisites

- Sensors and Transducers
- Physics for Electrical Sciences

Course Objectives

The course is intended to:

1. Explain the various techniques for pressure measurement.
2. Explain non-contact type temperature measuring instruments.
3. Explain various level measurement techniques.
4. Describe working of electrical type flow meters.
5. Explain the principle and working of force, torque and velocity measuring instruments.

Unit I PRESSURE MEASUREMENT 9 Hours

Manometers, different types, Elastic type pressure gauges, Bourdon tube and diaphragms with strain gauge- Capacitive type pressure gauge - Measurement of vacuum - McLeod gauge- Thermal conductivity gauge - lonization gauges - calibration of pressure gauges - Dead weight tester.

Unit II TEMPERATURE MEASUREMENT 9 Hours

Definitions and standards - Primary and secondary fixed points - Bimetallic thermometers - Thermocouples - Laws of thermocouple – Cold Junction Compensation - Radiation fundamentals - Radiation methods of temperature measurement - Total radiation pyrometers - Optical pyrometers - Fiber optic sensor for temperature measurement.– Selection of temperature measuring instrument for given applications

Unit III LEVEL MEASUREMENT 9 Hours

Level measurement – Float gauges - Displacer type –D/P methods - Load cell – Electrical types: Conductivity sensors – Capacitive sensors – Nucleonic gauge - Ultrasonic gauge – Boiler drum level measurement: – Differential pressure and Hydrastep methods - Solid level measurement – RADAR measurement

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit IV FLOW MEASUREMENT 9 Hours

Expression for flow rate through restriction(compressible and incompressible flow) - Orifice plate -Venturi tube – Flow nozzle – Pitot tube – Positive displacement flow meters – Nutatingdisc and Oval gear flow meters – Rotameter - Mass flow meters: Thermal and Coriolis type – Electromagnetic flow meter – Ultrasonic flow meters – Selection of flow meter for given applications

Unit V SPEED, TORQUE, DENSITY, FORCE, VISCOSITY, HUMIDITY AND MOISTURE 9 Hours

Speed& Torque Measurement: Magnetic and Optical Method – Density Measurement: Float, Ultrasonic and Bridge gas type – Viscosity Measurement: Saybolt Viscometer and Rotameter Type – Humidity Measurement: Psychrometer and Hygroscopic Method - Moisture Measurement in Granular, Penetrable and Web type material

List of Experiments 30 Hours

1. Determine the discharge coefficient of Orifice plate and venture meter.
2. Determine the liquid level in an open tank using DPT.
3. Determine the liquid flow measurement using turbine flowmeter.
4. Analyze the error present in the RTD.
5. Determine the air pressure inside the closed tank using piezo electric type measurement.
6. Calibrate the bourdon gauge using Dead weight tester

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1. Summarize the various techniques for pressure measurement.	Understand
CO2. Select a suitable temperature measuring instruments for the given application.	Apply
CO3. Review the various techniques for Level measurement.	Understand
CO4. Select a suitable flow measuring instruments for the given application.	Apply
CO5. Explain the different methods of measurement of speed, torque, viscosity measuring instruments.	Understand

Text Book(s):

T1. Doebellin, E.O.andManikD.N., “Measurement systems Application and Design”, 6th Edition, Tata McGraw Hill Education Pvt.Ltd,2007

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

T2. D. Patranabis, “Principles of industrial instrumentation”, 3rd edition, McGraw Hill Education, 2017.

Reference Book(s):

R1. John P.Bentley, “Principles of Measurement Systems”, 3rdEdition, Pearson Education, 2015.

R2. W.Bolton, “Engineering Science”, Elsevier Newnes, 5th Edition, 2006

R3. B.C. Nakra and K.K.Chaudhary,“Instrumentation, Measurement and Analysis”, McGraw Hill Education India Private Limited, 4thedition,2016

Web References:

1. nptel.ac.in/courses/112103174
2. http://nptel.ac.in/courses/108105064
3. http://nptel.ac.in/courses/112106140

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Assessment pattern

	Assessment Component	CO .No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	20
	CCET II	3,4	50	
	CCET III	5	50	
	Continuous Assessment – Practical	1,2,3,4,5	75	10
	Final Assessment – Practical	1,2,3,4,5	50	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19CSSC2401	Course Title: Data Structures and Algorithms (Common to EE and EI)		
Course Category: Engineering Science		Course Level: Practice	
L:T:P(Hours/Week) 2: 0: 2	Credits:3	Total Contact Hours:60	Max. Marks:100

Pre-requisites

- C Programming

Course Objectives

1. Design linear data structure
2. Implement Tree data structure
3. Implement Graph data structure
4. Demonstrate a familiarity with sorting in data structure
5. Apply suitable algorithm for searching and hashing techniques

Unit I POINTERS **6 Hours**

Data Structures types - Abstract Data Types - List ADT: Array and Linked List Implementation - Stack ADT: Stack Model - Array Implementation of Stack –Queue ADT: Queue Model - Array Implementation of Queue

Unit II NON LINEAR DATA STRUCTURE: TREE **6 Hours**

Tree - Preliminaries - Binary tree - Tree traversal - Applications - Expression tree - Binary search tree – 2-3 Tree

Unit III LINEAR DATA STRUCTURE - LIST **6 Hours**

Representation of graph – Graph Traversals: Depth first and breadth first traversal – Topological sort – Shaortest path algorithms : Dijkstra's algorithms – Minimum Spanning Tree : Prim's and Kruskal's algorithms.

Unit IV SORTING **6 Hours**

Simple Sorting Algorithms – Insertion sort -Shell Sort - Merge Sort – Quick Sort External Sorting.

Unit V SEARCHING AND HASHING **6 Hours**

Linear Search – Binary Search – Hashing: Hash Functions – Separate Chaining – Open Addressing – Linear Probing – Quadratic Probing – Double Hashing.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

List of Exercises **30 Hours**

1.Create a C program to implement Singly Linked list using Linked list implementation

2.Create a C program to implement Stack using array implementation

3.Create a C program to implement Queue using array implementation

4.Develop a C program to implement Binary search tree.

5.Develop a C program to implement Dijkstra's algorithm.

6.Create a C program to implement Merge Sort / Quick Sort / Bubble Sort

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Design Linear data structure such as Linked List, Stack and Queue using C	Apply
CO2: Implement Tree data structure for the given Scenario	Apply
CO3: Implement Tree data structure for the given application	Apply
CO4: Demonstrate a familiarity with sorting in data structures for a real time scenario	Apply
CO5:Apply suitable algorithm for searching and hashing techniques for given application	Apply

Text Book(s):

T1.Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education Asia, New Delhi, 2011.

Reference Book(s):

R1. Sahni, "Data Structures Using C, The McGraw-Hill, New Delhi, 2006.

R2. Michael.T.Goodrich, "Data Structures and Algorithm Analysis in C", Wiley student Edition, New Delhi, 2007

R3. Thomas H.Cormen, Charles E. Leiserson, Ronald L Rivest, Clifford Stein, "Introduction to Algorithms", MIT Press, England, 2009.

Web References:

1. https://www.coursera.org/specializations/data-structures-algorithms
2. http://www.csse.monash.edu.au/~lloyd/tildeAlgDS
3. http://freevideolectures.com/Course/2279/Data-Structures-And-Algorithms

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	**CO. No.**	**Marks**	**Total**
Continuous Assessment	CCET I	1,2	50	20
	CCET II	3,4	50	
	CCET III	5	50	
	Continuous Assessment – Practical	1,2,3,4,5	75	10
	Final Assessment – Practical	1,2,3,4,5	50	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EICN3401	Course Title: Signal Conditioning Laboratory		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 0: 0: 4	Credits: 2	Total Contact Hours:60	Max Marks:100

Pre-requisites

- NIL

Course Objectives

The course is intended to:

1. Develop OPAMP based different amplifier circuits
2. Design an amplifier for sensors
3. Conversion of sensor signal in to voltage, current and digital format
4. Design a signal conditioning circuits for RTD and Thermocouple
5. Design a signal conditioning circuits for optical type sensors

List of Experiments

1. OPAMP based amplifier circuits – Inverting amplifier, Non- Inverting amplifier, Summing amplifier and Differential amplifier.
2. Design of Integrator and differentiator.
3. Design of Voltage to current and frequency to voltage convertor.
4. Design of Flash type ADC
5. Design of R-2R type DAC.
6. Phase Locked Loop using IC 566
7. Design and implement the signal conditioning circuit for RTDusing Instrumentation Amplifier.
8. Design and implement the signal conditioning circuit for LDR.
9. Design and implement the signal conditioning circuit for Thermocouple.
10. Measurement of angular velocity using optical type transducer.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Outcomes:	Cognitive/ Affective
At the end of this course, students will be able to:	
CO1: Identify the suitable amplifier as per the application using IC741	Apply
CO2: Design of amplifier circuit depends on sensor using IC741	Apply
CO3: Develop OPAMP circuits for sensor signal conversion in to voltage, current and digital format	Apply
CO4: Design a signal conditioning circuits for PT100 and J type Thermocouple using IC741	Apply
CO5: Develop a signal conditioning circuits for LDR and IR sensor	Apply

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO .No.	Marks	Scale To
Continuous Assessment	Each Lab Experiment	1,2,3,4,5	75	75
	Cycle Test 1	1,2,3,4	50	25
	Cycle Test 2	1,2,3,4,5	50	
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code: 19PSHG6002		Course Title: Universal Human Values 2 :Understanding Harmony	
Course Category: Humanities		Course Level: Practice	
L:T:P (Hours/Week) 2:1: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- 19SHMG6101-Induction Program (UHV 1)

Course Objectives

The course is intended to:

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
2. Strengthening of self-reflection
3. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
4. Development of commitment and courage to act

Unit IIntroduction to Value Education **6+3 Hours**

Need for the Value Education; Self -exploration as the process for value education ; Continuous Happiness and Prosperity: A look at basic Human Aspirations; Right understanding: Relationship and Physical Facilities ; Happiness and Prosperity: current scenario ; Method to fulfill the Basic human aspirations

Unit II Harmony in Human Being **6+3 Hours**

Human being as a co-existence of self (‘I’) and the material ‘Body’; needs of Self ('I') and 'Body'; The Body as an instrument of ‘I’; Harmony in the self (‘I’); Harmony of the self (‘I’) with body; Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail. Programs to ensure Sanyam and Swasthya.

Unit III Harmony in the Family and Society **6+3 Hours**

Harmony in the Family the basic unit of human interaction; Values in human to human relationship; Trust as the foundational values of relationship; Respect as the right evaluation ;Understanding harmony in the society (society being an extension of family); Vision for the universal human order

Unit IV Harmony in the Nature **6+3 Hours**

Understanding the harmony in the Nature Interconnectedness, self-regulation and mutual fulfillment among the four orders of nature; Existence as Co-existence at all levels; Holistic perception of harmony in existence.

Unit V Harmony on Professional Ethics **6+3 Hours**

Natural acceptance of human values ;Definitiveness of Ethical Human Conduct; Basic for Humanistic Education, Humanistic Constitution and Humanistic Universal Order; Competence in professional ethics ;Case study: holistic technologies, management models and production systems ;Strategy for transition towards value based life and profession

Passed in Board of Studies meeting Approved to Academic council meeting

BOS Convener BOS Chairman

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Outcomes	Affective Level
At the end of this course, students will be able to:	
CO1. Reflect on values, aspiration, relationships and hence identify strengths and weaknesses.	Responding
CO2. Appraise physical, mental and social wellbeing of self and practice techniques to promote wellbeing.	Responding
CO3. Value human relationships in family and society and maintain harmonious relationships.	Valuing
CO4. Respect nature and its existence for survival and sustainable of all life forms and hence practice conservation of nature	Valuing
CO5. Appreciate ethical behaviour as a result of value system in personal and professional situations	Receiving

Text Book(s):

T1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010.

Reference Book(s):

R1.Jeevan Vidya: EkParichaya, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
R2.Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
R3. The story of stuff, Annie Leonard, Free Press, New York 2010.

Web References:

1. https://aktu.ac.in/hvpe/ResourceVideo.aspx
2. http://hvpenotes.blogspot.com/
3. https://nptel.ac.in/courses/109/104/109104068/

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Assessment Pattern

As per AICTE guidelines, the following are the assessment pattern prescribed:

	Assessment component	CO No.	Marks	Total marks weightage
Continuous assessment	Socially relevant project/Group Activities/ Assignments a. One assignment per Module with 20 marks each b. Average of all assignments	1,2,3,4,5	20	75%
	Assessment by faculty mentor a. Based on attendance and engagement		10	
	Self-assessment a. Based on individual behavioral change: Case study of their own		10	
	Assessment by peers a. Based on 2 friends about their behavioral change		10	
EndSemester Examination	Part A – Objective type – 20x1=20 marks Part B – Short answer questions – 15x 2 = 30 marks Part C – Descriptive Type Questions (Either or Pattern) – 5 x 10 = 50 marks	1,2,3,4,5	100	25%
			Total	100%

The overall pass percentage is 50%. In case the student fails, he/she must repeat the course.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code: 19EIPN6401		Course Title: MINI-PROJECT	
Course Category: Project		Course Level: Practice	
L:T:P (Hours/Week) 0: 0: 4	Credits: 2	Total Contact Hours:60	Max. Marks:100

Pre-requisites:

- Nil

Course Objectives:

The course is intended to:

1. Take up any challenging practical problems and find solution by formulating proper methodology.
2. Work collaboratively on a team to successfully complete a design project
3. Effectively communicate the results of projects in a written and oral format

The objective of Mini Project is to enable the student to take up investigative study in the broad field of Electronics and Instrumentation Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include:

1. Survey and study of published literature on the assigned topic.
2. Working out a preliminary Approach to the Problem relating to the assigned topic.
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility.
4. Preparing a Written Report on the Study conducted for presentation to the Department.
5. Final Seminar, as oral Presentation before a departmental committee.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Take up any challenging practical problems and find solution by formulating proper methodology.	Apply
CO2: Work collaboratively on a team to successfully complete a design project	Apply
CO3: Effectively communicate the results of projects in a written and oral format	Apply

Passed in Board of Studies meeting

Approved in Academic Council meeting

. BOS Convener

BOS Chairman

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	3	-	-	-	3	3	3	2
CO2	-	-	3	-	-	-	-	3	3	-	3	3	3	2
CO3	-	-	-	-	-	-	-	3	-	3	-	3	3	2

High-3; Medium-2; Low-1

Passed in Board of Studies meeting

Approved in Academic Council meeting

. BOS Convener

BOS Chairman

Semester– V

Course Code:19EICN1501		Course Title: Control System	
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 3: 1: 0	Credits:4	Total Contact Hours:60	Max Marks:100

Pre-requisites

- Engineering Mathematics – I
- Engineering Mathematics – II

Course Objectives

The course is intended to:

1. Practice the modelling of a physical dynamical system
2. Study time response and specifications of first and second order systems
3. Study frequency response and specifications of first and second order systems
4. Include the system stability
5. Design compensators

Unit I CONTROL SYSTEM MODELING 9+3 Hours

Basic Elements of Control System – Open loop and Closed loop systems - Transfer function, Modelling of Electrical systems, mechanical systems: Translational and rotational systems- Transfer function of armature and field controlled DC motor- Block diagram reduction Techniques – Signal flow graph.

Unit II TIME RESPONSE ANALYSIS 9+3 Hours

Standard test signals - Time response of first order systems - Impulse and Step Response analysis of second order systems – Time Domain specifications - Steady state errors and error constants – Effects of P, PI, PD and PID Controllers on the system's response

Unit III FREQUENCY RESPONSE ANALYSIS 9+3 Hours

Frequency Response – Bode Plot: Gain margin, Phase margin, gain & phase crossover frequency-Polar Plot: Gain margin, Phase margin, - Frequency Domain specifications from the plots – correlation between time domain and frequency domain specifications

Unit IV STABILITY ANALYSIS 9+3 Hours

Stability, Routh -Hurwitz Criterion, Concept of Root Locus Technique, Construction of Root Locus, Effects of adding poles and zeros – Nyquist Stability Criterion

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit V COMPENSATOR DESIGN 9+3 Hours

Performance criteria – Lag, lead and lag-lead networks – Compensator design using bode plots. Compensator Design using simulation.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Model electrical and mechanical systems using transfer function.	Understand
CO2.	Determine the time response and time domain specifications of first order and second order systems	Apply
CO3.	Determine the given first order and second order system with their frequency domain specifications.	Apply
CO4.	Execute the stability of the given system.	Apply
CO5.	Design compensator using bode plot technique	Apply

T1. J. Nagrath and M. Gopal, 'Control Systems Engineering', New Age International Publishers, 6th Edition, 2018.

T2. Benjamin C. Kuo, 'Automatic Control systems', 10 edition Pearson Education, New Delhi, 10th Edition, 2017.

Reference Book(s):

R1. Norman S. Nise, 'Control Systems Engineering', John Wiley, New Delhi,Sixth Edition, 2010.

R2. SamarajitGhosh, 'Control systems Theory and Applications ', Pearson Education, New Delhi, Second Edition 2012.

R3. M. Gopal, 'Control Systems, Principles and Design', Tata McGraw Hill, New Delhi, Fourth Edition 2012.

R4. K. Ogata, 'Modern Control Engineering', Pearson Education India, New Delhi, Fifth Edition 2015.

R5. Richard C.Dort and Robert H.Bishop, "Modern Control Systems ", Pearson Prentice Hall , Thirteenth Edition 2016.

Web References:

1. http://nptel.ac.in/courses/108101037/1
2. https://www.tutorialspoint.com/control_systems/control_systems
3. http://lpsa.swarthmore.edu/Root_Locus/RLocusExamples.html
4. https://in.mathworks.com/help/control/examples/compensator-design-for-systems-

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

Approved in Academic Council meeting

BOS Convener

BOS Chairman

Course Code:19EICN1502		Course Title: Microprocessor and Microcontroller	
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Digital Electronics, Linear Integrated Circuits.

Course Objectives

The course is intended to:

1. Explain the architecture of 8085 microprocessor
2. Write assembly language programs for 8085 microprocessor
3. Explain the function of interfacing devices used with 8085 microprocessor
4. Describe the architecture of 8051 Microcontroller
5. Explain Interfacing techniques using 8051 microcontroller & architecture of PIC microcontroller

Unit I 8085 MICROPROCESSOR 9Hours

Introduction to 8085 Microprocessor: Architecture, Memory interfacing, I/O Devices Interfacing, Timing Diagram, Interrupt structure.

Unit II PROGRAMMING OF 8085 PROCESSOR 9Hours

Addressing modes - Instruction sets: Data transfer instruction set, Arithmetic & Logic Instruction set – Branching & control Instruction set – Assembly language format - Simple Assembly level programs.

Unit III PERIPHERALS INTERFACING 9Hours

Interfacing of 8085 with: Keyboard & display unit [8279 IC] – Parallel peripheral interface [8255] – Interrupt controller interface [8259 PIC] – USART interface [8251] - A/D & D/A converter interfacing with 8085.

Unit IV 8051 MICROCONTROLLER 9Hours

Architecture - Addressing modes and Instruction Sets – Interrupt structure – Timer –I/O ports – Serial communication.

Unit V 8051 INTERFACING ANDPIC ARCHITECTURE 9 Hours

Interfacing of 8051with: Analog Sensors - ADC – DAC - DC motor and Stepper motor.RISC Vs. CISC machines - PIC microcontroller Architecture and Pin details.

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Outcomes		Cognitive Level
At the end of this course, students will be able to:		
CO1.	Summarize the architecture of 8085 microprocessor	Understand
CO2.	Write the assembly language programs for 8085 microprocessor	Apply
CO3.	Understand the function of interfacing devices used with 8085 microprocessor	Understand
CO4.	Understand the architecture of 8051 Microcontroller	Understand
CO5.	Practice the Interfacing techniques using 8051 microcontroller and Illustrate the architecture of PIC microcontroller.	Apply

Text Book(s):

T1. R.S.Gaonkar,"Microprocessor Architecture, Programming and Applications with the 8085", 6th Edition, Prentice Hall, 2013

T2. Kenneth J.Ayala., "The 8051 Microcontroller", 3rd Edition, Thompson Delmar Learning, 2005, New Delhi.

T3. Microcontrollers, principles and applications – Ajit pal – PHI Ltd., - 2012.

Reference Book(s):

R1. Muhammad Ali Mazidi and Janice GilliMazidi, "The 8051 Microcontroller and Embedded Systems", Pearson Education, 2007.

R2. A.K.Rai and K. M. Bhurchandi, "Advanced Microprocessors and peripherals" , 2nd edition, Tata McGraw- Hill, 2006.

R3. John B Peatman, "Design with PIC Microcontrollers", Pearson Education, 1998.

Web References:

1. http://nptel.ac.in/courses/Webcourse-contents/IIT KANPUR/microcontrollers/micro/ui/TOC.htm
2. http://www.nptel.ac.in/downloads/106108100/
3. http://www.ustudy.in/ece/mpmc/u1

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19CSSN2502	Course Title: Object Oriented Programming		
Course Category: Engineering Science		Course Level: Practice	
L:T:P(Hours/Week) 3: 0: 2	Credits:4	Total Contact Hours:75	Max. Marks:100

Pre-requisites

- C Programming

Course Objectives

1. Explain the object-oriented paradigm and C++ programming
2. Describe various control flows and memory management techniques
3. Implement various principles of object orientation
4. Explain file handling techniques with C++ programming
5. Explain the trouble shooting procedures in OOPS

Unit I INTRODUCTION 9 Hours

Object – Oriented Paradigm, elements of object oriented programming – Merits and demerits of OO methodology – C++ fundamentals – data types, operators and expressions – control flow – arrays.

UnitII CONTROL FLOW &DYNAMIC MEMORY MANAGEMENT 9 Hours

Function declaration – Call by value and call by reference – Friend functions – Accessing functions between classes – Dynamic Memory Allocation - Constructors – Destructors – Realloc – Operator Overloading.

UnitIII OOP PRINCIPLES 9 Hours

Inheritance - Types of Inheritance – Polymorphism: Function overloading - Virtual functions - Abstraction - Abstract Class and Virtual base class - Encapsulation and Data Hiding.

Unit IV FILE HANDLING 9 Hours

C++ streams – console streams – console stream classes-formatted and unformatted console I/O operations, manipulators - File streams - classes file modes file pointers and manipulations file I/O.

Unit V TEMPLATES AND EXCEPTION HANDLING 9 Hours

Function and class templates - Exception handling – try-catch-throw paradigm – exception specification – terminate and unexpected functions – Uncaught exception

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

List of Exercises **30 Hours**

1. Write a C++ programs using operators, expressions, control flow and arrays.
2. Write a C++ programs using Constructors, Destructors and Operator Overloading.
3. Write a C++ programs using Inheritance
4. Develop a C++ program using Polymorphism Concepts
5. Write a C++ programs using File Handling Methods
6. Create a C++ programs using Exception handling

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1:	Explain the object-oriented paradigm and C++ programming with their fundamentals	Apply
CO2:	Examine various control flows and memory management techniques	Apply
CO3:	Implement various principles of object orientation	Apply
CO4:	Illustrate handling of files with C++ programming	Apply
CO5:	Summarize the trouble shooting procedures in OOPS	Apply

Text Book(s):

T1. Herbert Schildt, “Complete Reference:C++”, Fourth edition, Tata McGraw Hill, Noida, 2007.

Reference Book(s):

R1. Ira Pohl, “Object oriented programming using C++”, Pearson Education Asia, 2007.

R2. Malik.D.S, “C++ Programming from Problem Analysis to Program Design”, 3rd Edition, Thomson course Technology, New Delhi, 2007.

R3. John.R.Hubbard, "Programming with C++", Schaums outline series, Tata McGraw Hill, New Delhi ,2003.

R4. Herbert Schildt, “The Complete Reference: Java2”, Fifth edition, Tata McGraw Hill, Noida, 2007.

Web References:

1. www.nptel.ac.in/courses

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	**CO. No.**	**Marks**	**Total**
Continuous Assessment	CCET I	1,2	50	20
	CCET II	3,4	50	
	CCET III	5	50	
	Continuous Assessment – Practical	1,2,3,4,5	75	10
	Final Assessment – Practical	1,2,3,4,5	50	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EICN3501	Course Title: Microprocessor and Microcontroller Laboratory		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 0: 0: 3	Credits:1.5	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Digital Electronics Lab, LIC Lab

Course Objectives

The course is intended to:

1. Explain the architecture of 8085 microprocessor
2. Write assembly language programs for 8085 microprocessor
3. Explain the function of interfacing devices used with 8085 microprocessor
4. Describe the architecture of 8051 Microcontroller
5. Explain Interfacing techniques using 8051 microcontroller & architecture of PIC microcontroller

List of Experiments

1. Programming for 8 bit Arithmetic operations using 8085.
2. Programming with control instructions using 8085.
3. Traffic Light Controller using 8085.
4. A/D and D/A interfacing with 8085.
5. Timer interfacing with 8085.
6. Programming for 8 bit Arithmetic operations using 8051
7. Interfacing of Keypad / Display units using 8051
8. Programming & Interfacing of DC motor with 8051
9. Programming &Interfacing of Servo /Stepper motor using 8051
10. 10.Interfacing a temperature sensor and controlling an LED/ Motor using PIC/AT mega/ARM controllers IDE through HLL.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Outcomes:		Cognitive/ Affective
At the end of this course, students will be able to:		
CO1:	Summarize the architecture of 8085 microprocessor	Understand
CO2:	Write assembly language programs for 8085 microprocessor	Apply
CO3:	Explain the function of interfacing devices used with 8085 microprocessor	Apply
CO4:	Describe the 8051 Microcontroller architecture	Understand
CO5:	Practice the Interfacing techniques using 8051 microcontroller and Illustrate the architecture of PIC microcontroller.	Apply

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO .No.	Marks	Scale To
Continuous Assessment	Each Lab Experiment	1,2,3,4,5	75	75
	Cycle Test 1	1,2,3,4	50	25
	Cycle Test 2	1,2,3,4,5	50	
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EICN3502	Course Title: Control System Laboratory		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 0: 0: 3	Credits: 1.5	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Study the dynamics of second order systems.
2. Experiment with different filter circuit designs.
3. Model the System and to analyze the performance.
4. Analyze the stability of a system.
5. Demonstrate the Inverted Pendulum working.

List of Experiments

1. Determine the dynamics of second order system for different damping factor
2. Determine the step and ramp response of Instruments
3. Design a LPF and HPF circuits using MATLAB.
4. Identify the transfer function of DC Motor
5. Identify the transfer function of AC Servo Motor
6. DC Speed Control System
7. Linear System analysis (Time domain analysis) using MATLAB
8. Stability analysis (Bode, Root Locus) of linear time invariant system using MATLAB
9. Stability analysis (Nyquist) of linear time invariant system using MATLAB
10. Study on Inverted Pendulum

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Outcomes:		**Cognitive/ Affective**
At the end of this course, students will be able to:		
CO1:	Conduct the experiment to determine the dynamics of first and second order system.	Apply
CO2:	Conduct the experiment to design the different filter circuits.	Apply
CO3:	Model the Control System to predict their performance	Apply
CO4:	Determinethe stability of linear time invariant system	Apply
CO5:	Demonstrate the operation of Inverted Pendulum	Apply

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	**CO .No.**	**Marks**	**Scale To**
Continuous Assessment	Each Lab Experiment	1,2,3,4,5	75	75
	Cycle Test 1	1,2,3,4	50	25
	Cycle Test 2	1,2,3,4,5	50	
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Semester– VI

Course Code:19EICN1601	Course Title: Process Control		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Engineering Mathematics – II
- Control Systems

Course Objectives

The course is intended to:

1. Explain the mathematical model and dynamic behavior of the process.
2. Outline the characteristics of continuous and discontinuous controllers.
3. Provide knowledge to modes of P/PI/PID controller.
4. Describe the construction and operation of final control elements including converters.
5. Illustrate the control strategies of multi loop processes.

Unit I PROCESS CONTROL 9 Hours

Need for process control – Mathematical model of Flow, Level, Pressure and Thermal processes – Interacting and non-interacting systems – Degrees of freedom – Continuous and batch processes – Self regulation – Servo and regulatory operations-process dynamics– Heat exchanger and CSTR.

Unit II CONTROLLER TUNING 9 Hours

Evaluation criteria –simple performance- ¼ decay ratio-time integral criteria IAE, ISE, ITAE and ¼ decay ratio - Tuning:- Process reaction curve method, Continuous cycling method and Damped oscillation method –selection of controller

Unit III CONTROL ACTIONS 9 Hours

Characteristic of on-off, proportional, single speed floating, integral and derivative controllers – P+I, P+D and P+I+D control modes – Electronic PID controller – Auto/manual transfer - Reset windup

Unit IV FINAL CONTROL ELEMENTS 9 Hours

I/P converter - Pneumatic and electric actuators – Valve Positioner – Control Valves – Characteristic of Control Valves: Inherent and Installed characteristics – Valvebody: Commercial valve bodies – Control valve sizing – Cavitation and flashing – Selection criteria.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit V MULTILOOP CONTROL 9 Hours

Feedback control - feed forward control – Ratio control – Cascade control-selective control – Inferential control – Split-range and introduction to multivariable control – case studies from distillation column and boiler systems

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Explain the mathematical model and dynamic behaviour of the process	Understand
CO2.	Summarize the characteristics of continuous and discontinuous controllers	Understand
CO3.	Select suitable P/PI/PID controller by applying tuning methods and performance criteria	Apply
CO4.	Describe the construction and operation of final control elements including converters	Understand
CO5.	Illustrate the control strategies of multi loop processes	Understand

Text Book(s):

T1. Coughanowr, D.R., “Process Systems Analysis and Control”, McGraw - Hill International Edition, 2004.

T2. Bequette, B.W., “Process Control Modeling, Design and Simulation”, Prentice Hall of India, 2003.

Reference Book(s):

R1. Krishnasamy, K., “Process Control”,New age international,2009

R2. Stephanopoulos, G., “Chemical Process Control - An Introduction to Theory and Practice”,Prentice Hall of India, 2005.

R3. Curtis D. Johnson Process Control Instrumentation Technology, 8th Edition, Pearson, 2016.

R4. Bela.G.Liptak., “Process Control and Optimization”., Instrument Engineers’ Handbook., volume 2, CRC press and ISA, 2005.

R5. Considine, D.M., Process Instruments and Controls Handbook, Second Edition, McGraw, 2008

Web References:

1. http://nptel.ac.in/courses/103105064/

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EICN1602		Course Title: Embedded System Design	
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Digital Electronics
- Microprocessor and Microcontroller

Course Objectives

The course is intended to:

1. Provide knowledge on the basic concepts of embedded systems
2. Provide knowledge on developing the real time models for different application
3. Realize the importance and various features in RTOS
4. Provide knowledge on Embedded IoT concepts
5. Realize the Network Protocols with different applications.

Unit I INTRODUCTION 9 Hours

Embedded System – Classification of Embedded System – Processors in the embedded system – Processor and Memory organization – DMA – Timer and Counting devices – Device drivers and interrupt service mechanism.

Unit II REAL TIME MODELS 9 Hours

State Machine and Concurrent Process model: Types of models – FSM – HCFSM and State chart Language – Program state machine model – Concurrent Process – Communication among process – Synchronization among process – Data flow model.

Unit III REAL TIME OPERATING SYSTEMS 9 Hours

Architecture of the Kernel – Tasks - Tasks states - Task priorities - Various task scheduling methods – Semaphores – Mutex - IPC: Mailboxes, Message Queues, Event Registers, Pipes, and Signals.

Unit IV INTRODUCTION TO IoT 9 Hours

Internet of Things Concepts - Internet of Things Framework – IoT Major Components – Challenges, Advantages and Disadvantages – LED interfacing – Relay interfacing – Sensor interfacing- Temperature sensor, IR sensor, Ultrasonic Sensor - local network- Bluetooth, LPWAN, XBEE- IoT gateway- Interfacing multiple nodes with gateway.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit V IoT NETWORK PROTOCOLS AND APPLICATIONS 9 Hours

IoT Networking Protocols: MQTT -CoAP – Implementation of IoT- Collect data from the devices in the local Network, Send the data to a server, control the device from the server- Applications: remote data logging system – remote Lamp control.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Explain the basic functions, components and importance of Embedded Systems.	Understand
CO2.	Elucidate the Real Time Models based with application examples.	Understand
CO3.	Elaborate the functions of RTOS.	Understand
CO4.	Explain the Embedded IoT concepts.	Understand
CO5.	Illustrate the IoT Network protocols for data processing in IoT.	Understand

Text Book(s):

T1. Rajkamal, “Embedded Systems: Architecture, Programming and Design”, Third Edition, Tata McGraw-Hill, New Delhi, 2017.

T2. Frank Vahid, Tony D. Givargis, John Wiley & Sons, “Embedded System Design-A Unified Hardware/Software Introduction” Wiley India, 2009.

T3. Internet of Things (A Hands-on-Approach), by Vijay Madisetti and ArshdeepBahga, 1st Edition, VPT, 2015

Reference Book(s):

R1. John.B.Peatman, “Design with Microcontrollers”, Pearson Education, 2008

R2. Tammy Noergaard, “Embedded Systems Architecture”, Second Edition, Elsevier, 2012.

R3. Ajay V. Deshmukh, “Microcontrollers Theory and Applications”, Tata McGraw Hill Publishing Company Ltd, 2011

R4. Raj Kamal, “Internet of Things: Architecture and Design Principles” McGraw Hill Education India, 2017.

Web References:

1. http://nptel.ac.in/courses/108102045/
2. http://www.nptelvideos.in/2012/11/embedded-systems.html

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EICN3601	Course Title: Process Control Laboratory		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 0: 0: 3	Credits: 1.5	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Transducer and measurements Laboratory
- System Simulation Instrumentation Laboratory
- Industrial Instrumentation Laboratory

Course Objectives

The course is intended to:

1. Conduct experiment to obtain the mathematical model of the first order and second order system
2. Obtain the response of PID controller for first order and second order processes
3. Design the PID controller for first order and second order processes.
4. Determine the characteristics of control valve and obtain the response of complex control systems.
5. Analyze the closed loop response of various process

List of Experiments

1. Mathematical modelling of Interacting and non-interacting systems
2. Response of P+I+D controller using MATLAB
3. Response of Electronic PID Controller
4. PID Controller tuning with performance criteria using MATLAB
5. Characteristics of control valve with and without positioner
6. Modelling and response of flow/ level control loop
7. Modelling and response of temperature control loop
8. Modelling and response of pressure control loop
9. Response of complex control systems (Ratio control/Cascade)
10. Study of non-linear control loop (conical/spherical)

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Outcomes:		Cognitive/ Affective
At the end of this course, students will be able to:		
CO1:	Conduct experiment to obtain the mathematical model of the first order and second order system	Apply
CO2:	Obtain the response of PID controller for first order and second order processes	Apply
CO3:	Design the PID controller for first order and second order processes.	Apply
CO4:	Determine the characteristics of control valve and obtain the response of complex control systems.	Apply
CO5:	Obtain the closed loop response of various process	Apply

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO .No.	Marks	Scale To
Continuous Assessment	Each Lab Experiment	1,2,3,4,5	75	75
	Cycle Test 1	1,2,3,4	50	25
	Cycle Test 2	1,2,3,4,5	50	
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EICN3602	Course Title: Embedded and IoT Laboratory		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 0: 0: 3	Credits: 1.5	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Microprocessor and Microcontroller Laboratory

Course Objectives

The course is intended to:

1. Demonstrate the configuration of I/O ports, ADC, Timer, PWM and Serial Communication based Operations
2. Demonstrate the utilization of I/O parts for interfacing LCD and Keypad
3. Use Connectivity technologies for data transfer in IoT.
4. Provide an overview on the network protocols for data processing in IoT.
5. Implement simple applications in Home Automation using IoT

List of Experiments

1. Activation of LED and Generating delay for buzzer using timer.
2. Interfacing LCD with microcontroller
3. Interfacing of Matrix keypad and display the data on LCD using microcontroller.
4. Interfacing of temperature sensor and programming of ADC using microcontroller.
5. PWM Generation using microcontroller.
6. Interfacing temperature sensor and ultrasonic sensor (EDGE device)
7. Interfacing relay and control the Lamp (EDGE device)
8. Multi node connection to GATEWAY using local network. (EDGE and FOG devices)
9. Send the data to the server from GATEWAY.(FOG and CLOUD)
10. Control the home appliances (lamp and fan) from server. (EDGE,FOG and CLOUD)

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Outcomes:		Cognitive/ Affective
At the end of this course, students will be able to:		
CO1:	Demonstrate the configuration of I/O ports, ADC, Timer, PWM based Operations	Apply
CO2:	Interface LEDS and keypad with microcontroller	Apply
CO3:	Use Connectivity technologies for data transfer in IoT	Apply
CO4:	Implement protocols and architecture for data processing in IoT	Apply
CO5:	Implement simple applications in Home Automation using IoT.	Apply

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO .No.	Marks	Scale To
Continuous Assessment	Each Lab Experiment	1,2,3,4,5	75	75
	Cycle Test 1	1,2,3,4	50	25
	Cycle Test 2	1,2,3,4,5	50	
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code: 19EIPN6601	Course Title: INNOVATIVE AND CREATIVE PROJECT		
Course Category: Project		Course Level: Practice	
L:T:P (Hours/Week) 0: 0: 4	Credits:2	Total Contact Hours:60	Max. Marks:100

Pre-requisites:

- Nil

Course Objectives:

The course is intended to:

1. Take up any challenging practical problems and find solution by formulating proper methodology.
2. Work collaboratively on a team to successfully complete a design project
3. Effectively communicate the results of projects in a written and oral format

The objective of Innovative and Creative Project is to enable the student to take up investigative study in the broad field of Electronics and Instrumentation Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include:

1. Survey and study of published literature on the assigned topic.
2. Working out a preliminary Approach to the Problem relating to the assigned topic.
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility.
4. Preparing a Written Report on the Study conducted for presentation to the Department.
5. Final Seminar, as oral Presentation before a departmental committee.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Take up any challenging practical problems and find solution by Formulating proper methodology.	Apply
CO2: Work collaboratively on a team to successfully complete a design project	Create
CO3: Effectively communicate the results of projects in a written and oral format	Apply

Passed in Board of Studies meeting

Approved in Academic Council meeting

. BOS Convener

BOS Chairman

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	3	-	-	-	3	3	3	3
CO2	-	-	-	-	-	-	-	3	3	-	3	3	3	3
CO3	-	-	-	-	-	-	-	-	-	3	-	3	3	3

High-3; Medium-2; Low-1

Passed in Board of Studies meeting

Approved in Academic Council meeting

. BOS Convener

BOS Chairman

Semester– VII

Course Code:19EICN1701	Course Title: Introduction to Machine Learning		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- 19MBAC1202-Calculus and Transforms
- 19CSCN4401- Python Programming Laboratory
- Probability and Statistics

Course Objectives

The course is intended to:

1. Describe the types and challenges in Machine learning.
2. Illustrate the machine learning framework
3. Interpret the supervised learning techniques
4. Demonstrate the un-supervised learning methods
5. Construct the Neural network and deep learning models

Unit I **INTRODUCTION** **9 Hours**

Introduction to Machine Learning – Types of Machine Learning systems – Challenges in Machine Learning – Over fitting and Under fitting - Testing and Validating the model – Bias and Variance

Unit II **MACHINE LEARNING FRAMEWORK** **9 Hours**

Problem Formulation – Get the data - analyze and visualize the data – Prepare the data for ML algorithms – sample complexity - Hypothesis space – Model evaluation and Improvement: Cross validation – Grid search – Evaluation Metrics – Kernel functions

Unit III **SUPERVISED LEARNING** **9 Hours**

Linear and Logistic Regression – Eigen Values and Eigen vectors - Naïve Bayes Classifier: Maximum Likely hood, Minimum Description Length – Gradient Descent - Decision Trees – Ensembles of Decision Trees – Support Vector Machine(SVM)

Unit IV **UNSUPERVISED LEARNING** **9 Hours**

Clustering: k-Means clustering- Agglomerative Clustering – DBSCAN- Gaussian Mixtures- precision and recall - Collaborative filtering and Content Filtering

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit V **NEURAL NETWORK AND DEEP LEARNING** **9 Hours**

Biological Neuron – Logical computation with Neuron – Perceptron – Sigmoid and soft max functions - Multi Layer Perceptron(MLP) with Back propagation – Regression MLPs – Classification MLPs – Fine Tuning NN models – Convolutional Neural Network: Architecture of Visual cortex – Convolutional Layers – Stacking Multiple Feature Maps-CNN architectures

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Describe the types and challenges in Machine learning for exploring the machine learning concepts	Understand
CO2.	Illustrate the machine learning framework for implementation of machine learning projects.	Apply
CO3.	Interpret the supervised learning techniques for classification	Apply
CO4.	Demonstrate the un-supervised learning methods for clustering and classification	Apply
CO5.	Construct the Neural network and deep learning models for classification	Apply

Text Book(s):

T1. Aurélien Géron," Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow", Seconf edition, O'Reilly Media, Inc,2019.

T2. Andreas C. Müller and Sarah Guido, " Introduction to Machine Learning with Python A Guide for Data Scientists", First Edition,O'Reilly,2017

Reference Book(s):

R1. Ethem Alpaydin, "Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)", Third Edition, MIT Press, 2014

R2. Jason Bell, —Machine learning – Hands on for Developers and Technical Professionals‖, First Edition, Wiley, 2014

R3. Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", First Edition, Cambridge University Press, 2012

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Web References:

1. https://www.kaggle.com/kanncaa1/machine-learning-tutorial-for-beginners.
2. https://nptel.ac.in/courses/106/106/106106139/
3. https://archive.ics.uci.edu/ml/datasets.php

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EICN1702	Course Title: Industrial Automation System		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Fundamentals of Electrical Engineering
- Digital Principles and Applications

Course Objectives

The course is intended to:

1. Explain architecture of PLC
2. Develop simple PLC programs using ladder logic programming
3. Understand the PLC troubleshooting techniques
4. Describe the concept of SCADA and open SCADA protocols.
5. Explain DCS

Unit I PROGRAMMABLE LOGIC CONTROLLER BASICS 9 Hours

Overview of PLC systems – parts of PLC –Input/ Output modules – power supplies and isolators – Fundamental PLC wiring diagram – relays – switches –transducers – sensors –seal-in circuits.

Unit II PROGRAMMING OF PLC 9 Hours

Fundamentals of logic – Types of PLC – Program scan – Relay logic – PLC programming languages – register basics - timers – counters – Arithmetic functions - comparison functions - Skip and MCR functions - data move systems - PLC Advanced intermediate functions - sequencer functions - matrix functions – Design of interlocks and alarms using PLC – connecting PLC to computer.

Unit III PLC ADVANCED FUNCTIONS AND HMI 9 Hours

Other programming languages – FBD-Structured Text- Analog PLC operation - PLC-PID functions - Networking of PLC - PLC installation - troubleshooting and maintenance - Necessity and Role of HMI in Industrial Automation, Text display - operator panels - Touch panels - Integrated displays (PLC & HMI)

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit IV SCADA 9 Hours

Elements of SCADA system – history of SCADA – remote terminal unit (RTU) –discrete control – analog control – master terminal unit – (MTU) –operator interface. Open SCADA protocol – DNP3 – Case Study: Water Industry Application of DNP3

Unit V DISTRIBUTED CONTROL SYSTEM 9 Hours

Evolution – Different architectures – local control unit – Operator Interface –Displays – Engineering Interface – DCS integration with PLC and computers. Case study: DCS Applications in power plant and Cement plant..

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Describe the architecture of PLC and I/O devices	Understand
CO2.	Solve simple tasks using ladder programming	Apply
CO3.	Explain the development of operator panel for PLC	Understand
CO4.	Summarize the concepts of SCADA.	Understand
CO5.	Illustrate the operation of DCS	Understand

Text Book(s):

T1. Frank D.Petruzella, 'Programmable Logic Controllers', Fourth edition, Tata McGraw Hill, 2010

T2. Clarke, G., Reynders, D. and Wright, E., "Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems", Newnes, 1st Edition, 2004

T3. Michael P. Lukas, 'Distributed Control System', Van Nostrand Reinhold CO, Newyork, 1986

Reference Book(s):

R1. John W. Webb, Ronald A. Reis 'Programmable Logic Controllers and Applications', PHI Learning, Fifth Edition, 2009.

R2. Stuart Boyer A, "Supervisory control and data Acquisition", Second edition,ISA

R3. Romily Bowden, "HART application guide and the OSI communicationfoundation", 1999.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Web References:

1. John W. Webb, Ronald A. Reis 'Programmable Logic Controllers and Applications', PHI Learning, Fifth Edition, 2009.
2. Stuart Boyer A, "Supervisory control and data Acquisition", Second edition,ISA

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EICN3701	Course Title: Industrial Automation Laboratory		
Course Category: Professional Core		Course Level: Practice	
L:T:P(Hours/Week) 0: 0: 3	Credits: 1.5	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Digital Principles and Applications

Course Objectives

The course is intended to:

1. Interface pneumatic devices with PLC
2. Develop PLC programs for automation application
3. Develop PLC and HMI programs for process control applications
4. Develop SCADA based automation for real time process
5. Design LabVIEW based Control system for real time process

List of Experiments

1. Programming of PLC for latching, interlock, logic gates, motor forward reverse and motor starter
2. Interfacing of pneumatic type direction control valves with PLC
3. Programming of PLC for Automatic stamping machine
4. Bottle filling system using PLC
5. PLC programming for Parking system
6. Temperature process control using PLC and HMI
7. Flow process control using PLC and HMI
8. Remote monitoring of Temperature Process using SCADA.
9. SCADA programming to monitor and control multiple processes.
10. Remote monitoring of Process parameters using wireless Transmitters.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Outcomes:		Cognitive/ Affective
At the end of this course, students will be able to:		
CO1:	Interface pneumatic devices with PLC	Apply
CO2:	Develop PLC programs for automation application	Apply
CO3:	Develop PLC and HMI programs for process control applications	Apply
CO4:	Develop SCADA based automation for real time process	Apply
CO5:	Design LabVIEW based Control system for real time process	Apply

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Assessment pattern

	Assessment Component	CO .No.	Marks	Scale To
Continuous Assessment	Each Lab Experiment	1,2,3,4,5	75	75
	Cycle Test 1	1,2,3,4	50	25
	Cycle Test 2	1,2,3,4,5	50	
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code: 19EIPN6801		Course Title: PROJECT	
Course Category: Project		Course Level: Practice	
L:T:P (Hours/Week) 0: 0: 16	Credits:8	Total Contact Hours:240	Max. Marks:100

Pre-requisites:

- Nil

Course Objectives:

The course is intended to:

1. Take up any challenging practical problems and find solution by formulating proper methodology.
2. Work collaboratively on a team to successfully complete a design project
3. Effectively communicate the results of projects in a written and oral format

The objective of Project is to enable the student to take up investigative study in the broad field of Electronics and Instrumentation Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include:

1. Survey and study of published literature on the assigned topic.
2. Working out a preliminary Approach to the Problem relating to the assigned topic.
3. Conducting preliminary Analysis/Modelling/Simulation/Experiment/Design/Feasibility.
4. Preparing a Written Report on the Study conducted for presentation to the Department.
5. Final Seminar, as oral Presentation before a departmental committee.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO1: Take up any challenging practical problems and find solution by Formulating proper methodology.	Apply
CO2: Work collaboratively on a team to successfully complete a design project	Create
CO3: Effectively communicate the results of projects in a written and oral format	Apply

Passed in Board of Studies meeting

Approved in Academic Council meeting

. BOS Convener

BOS Chairman

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	3	-	-	-	3	3	3	3
CO2	-	-	-	-	-	-	-	3	3	-	3	3	3	3
CO3	-	-	-	-	-	-	-	-	-	3	-	3	3	3

High-3; Medium-2; Low-1

Passed in Board of Studies meeting

Approved in Academic Council meeting

. BOS Convener

BOS Chairman

Professional Electives

Course Code:19EIEN1001	Course Title: Industrial Data Communication Networks		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Digital Principles and Applications

Course Objectives

The course is intended to:

1. Enumerate the layers of the OSI model and TCP/IP.
2. Summarize the different types of industrial Ethernet.
3. Describe the different standards of industrial protocol.
4. Explain the different types of field bus technology.
5. Illustrate the wireless communication standards and Satellite networks.

Unit I OSI REFERENCE MODEL 9 Hours

ISO-OSI model – Layers in the OSI model – Peer to Peer Process –TCP/IP Protocol Suite– TCP/IP comparison with OSI model – Types of TCP/IP addressing

Unit II INDUSTRIAL ETHERNET 9 Hours

Introduction – IEEE Standards – Ethernet MAC layer – IEEE 802.2 and Ethernet SNAP – OSI and IEEE 802.3 standard. Ethernet transceivers, Ethernet types, switches and switching hubs, 10 Mbps Ethernet, 100 Mbps Ethernet, Gigabit Ethernet.

Unit III INDUSTRIAL DATA COMMUNICATION PROTOCOL 9 Hours

Serial communication Standards: RS232, 422 and 485 – Protocol Structure Overview – Example Function codes. ASCII based protocol - Modbus protocol – Overview. HART Protocol – Overview – Layers

Unit IV FIELD BUS TRCHNOLOGY 9 Hours

AS-i Bus - Protocol Stack - CAN bus – Overview – Layers - Profibus – Overview – Protocol Stack. FIP and World FIP - Foundation Field Bus – Layers – Error Detection and Diagnostics – Redundancy

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit V **WIRELESS COMMUNICATION** **9 Hours**

Wireless LANs – IEEE 802.11 standard – Blue Tooth Communication - Wireless WANs – Cellular Telephony: 1G, 2G, 3G and 4G/LTEE,5G – Satellite Networks

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Understand industrial data communication protocol and standards	Understand
CO2.	Identify, prevent and troubleshoot industrial data communication problems	Understand
CO3.	Understand the fieldbus configuration in networking	Understand
CO4.	Understand the wired and wireless communications used in Process	Understand
CO5.	Understand industrial data communication protocol and standards	Understand

Text Book(s):

T1. Behrouz A Forouzan, 'Data Communications and Networking', Tata McGraw-Hill, 2013.

T2. William Buchanan, 'Computer Buses- Design and Application', CRC Press, 2000.

Reference Book(s):

R1. Theodore S Rappaport, 'Wireless Communications: Principles and Practice', Prentice Hall PTR, Second Edition, 2010.

R2. Stallings,W., "wireless Communication and networks", second Edition, Prentice Hall of India, 2005.

R3. Steve Mackay, Edwin Wright and Deon Reynders, 'Practical Industrial data Networks: Design, Installation and Trouble Shooting', Elsevier International Projects Ltd., 2004.

R4. Nader. F. Mir, "Computer and Communication Networks", Pearson Prentice Hall Publishers, 2010.

Web References:

1. http://nptel.ac.in/courses/106105082/
2. http://nptel.ac.in/downloads/106105080/
3. http://sine.ni.com/nips/cds/view/p/lang/en/nid/208382

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EIEN1002		Course Title: Digital Signal Processing	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Signals and Systems

Course Objectives

The course is intended to:

1. Apply DFT for the analysis of digital signals & systems.
2. Apply FFT algorithms for computing DFT.
3. Design IIR filters through analog filter design techniques.
4. Design FIR filters directly.
5. Understand basics of digital signal processors [TMS320X Family].

Unit I DISCRETE FOURIER TRANSFORM 9 Hours

Introduction to DTFT – Basic Problems using DTFT - Demerits in DTFT – Introduction to DFT – computational complexity comparison between DTFT & DFT - Properties of DFT - Twiddle factor & Matrix method to calculate DFT -magnitude and phase representations for DFT.

Unit II FAST FOURIER TRANSFORMS 9 Hours

FFT Algorithms –Decimation in time FFT Algorithms (DITFFT), Decimation in frequency FFT Algorithms (DIFFFT), IDFT Using FFT Algorithms.

Unit III IIR FILTER DESIGN 9 Hours

Introduction to Analog and Digital Filter – Analog filter design: Butterworth Filter and Chebyshev Filter – IIR filter design approximation using Impulse Invariance and Bilinear transformation – Frequency transformations from LPF design to HPF, BPF, BRFs - IIR Filter realizations

Unit IV FIR FILTER DESIGN 9 Hours

Introduction to Linear phase FIR filter – Filter design using Fourier series and windowing techniques (Rectangular, Triangular, Hamming, Hanning and Kaiser Windows) - FIR Filter realizations.

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Unit V **DIGITAL SIGNAL PROCESSORS** **9 Hours**

Introduction to programmable DSPs – Overview of TMS320X family - Architecture (TMS320X) – Features – Addressing Formats – Instruction set of TMS320X family processors.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Apply DFT for the analysis of digital signals & systems	Understand
CO2.	Apply FFT algorithms for computing DFT.	Apply
CO3.	Design IIR filters through analog filter design techniques.	Understand
CO4.	Design FIR filters directly.	Apply
CO5.	Understand basics of digital signal processors.	Understand

Text Book(s):

T1. John G. Proakis&Dimitris, G. Manolakis, “Digital Signal Processing – Principles, Algorithms & Applications”, Fourth Edition, Pearson Education / Prentice Hall, 2014.

T2. A.V.Oppenheim, R.W. Schafer and J.R. Buck, “Discrete-Time Signal Processing”, Third Edition, Pearson, 2011

T3. A.AnandKumar ,”Digital Signal Processing”, Second Edition, PHI, 2014.

Reference Book(s):

R1. Emmanuel C..Ifeachor, &Barrie.W.Jervis, “Digital Signal Processing”, Second Edition, Pearson , 2012

R2. Sanjit K. Mitra, “Digital Signal Processing – A Computer Based Approach”, Tata McGraw Hill, 2007

R3. Andreas Antoniou, “Digital Signal Processing”, Tata McGraw Hill, 2006

Web References:

1. http://nptel.ac.in/courses/117102060/
2. http://www.analog.com/en/design-center/landing-pages/001/beginners-guide-to-dsp.html

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	**CO. No.**	**Marks**	**Total**
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

Approved in Academic Council meeting

BOS Convener

BOS Chairman

Course Code:19EIEN1003		Course Title: VLSI Design	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Linear Integrated Circuits
- Digital Electronics

Course Objectives

The course is intended to:

1. Describe the VLSI design flow and fabrication Techniques.
2. Explain the characteristics and operation.
3. Design digital circuits.
4. Develop VHDL programs.
5. Explain the different types of fault and testing principles.

Unit I INTRODUCTION 9 Hours

VLSI Design process: Design specification- design entry – functional simulation – planning, placement and routing – timing simulation, fabricating into chip- CMOS processing technologies - nWell - pWell - Twin tub - Silicon on insulator.

Unit II MOS TRANSISTORS AND INVERTERS 9 Hours

Basic MOS Transistors & Operation: NMOS enhancement transistor - PMOS enhancement transistor - Threshold Voltage-Derivation of Drain Current- Channel length modulation- Body Effect –Trans conductance –MOSFETS as Switches - CMOS Inverter – Latch-up in CMOS Circuit - Power Dissipation in CMOS Circuits.

Unit III LOGIC DESIGN WITH CMOS 9 Hours

Combinational Circuit Design: Logic Gates in Static CMOS - Transistor sizing – Stick diagram, Layout diagrams & Design Rules – Ratioed circuits: Pseudo NMOS – cascade voltage switch logic - Dynamic CMOS logic: domino logic, Dual rail Domino Logic –Transmission gate - pass-transistor circuits - Scaling of MOSFETs & its effects.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit IV VHDL PROGRAMMING FOR SUBSYSTEM DESIGN 9 Hours

Introduction to VHDL: entities, architectures, signals, variables and constants – inertial and transport delay - arrays–operators - functions – procedures – packages and libraries - types of

modelling: Structural, dataflow and behavioral modelling –VHDL Programs for simple adders and multipliers –Test Bench - FPGA: Architecture and Programming Technologies

Unit V TESTING OF DIGITAL CIRCUITS 9 Hours

Need for testing-Failures and fault-Modelling of fault: Stuck at faults-Bridging faults-Break and transistor stuck on/open faults-Delay faults-temporary Faults-design of testability: Ad-hoc testing, scan design, BIST, IDDQ testing, Boundary scan.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Explain the VLSI design flow and CMOS design processes with appropriate fabrication technologies.	Understand
CO2.	Describe MOS transistors and CMOS inverter with relevant characteristics	Understand
CO3.	Design various digital circuits using appropriate CMOS logic styles	Understand
CO4.	Develop VHDL programs for various digital logic circuits using data path elements	Understand
CO5.	Categorize the faults in VLSI circuits using suitable testing methods.	Understand

Text Book(s):

T1. Neil H. E. Weste, David Harris, “CMOS VLSI Design” (4th edition) Pearson Education,

T2. Charles H. Roth, Jr., Lizy K. John, “Digital System design using VHDL”,(3rd edition) Cengage Learning, 2016.

T3. Neil H.E. Weste and Kamran Eshraghian, “Principles of CMOS VLSI Design”, Pearson Education ASIS 2nd Edition, 2011.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Reference Book(s):

R1. John P. Uyemura J.P, “Introduction to VLSI circuits and systems”, John Wiley and Sons, Inc., 2002.

R2. Eugene D. Fabricius , “Introduction to VLSI design” , McGraw-Hill International Edition, 2011

R3. Douglas A. Pucknell and Kamran Eshraghian, "Basic VLSI Design", Prentice Hall of India Publication, 1995.

R4. Wayne Wolf, “ Modern VLSI Design System on chip”, Pearson Education, 2002

R5. P.K.Lala, “Digital Circuit Testing and Testability”, Academic Press, 2002

Web References:

1. http://nptel.ac.in/courses/117106093/
2. http://www.vlsi-expert.com/p/vlsi-basic.html

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EIEN1004		Course Title: Automotive Electronics	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Electronic devices and circuits
- Embedded system design

Course Objectives

The course is intended to:

1. Inculcate knowledge of mechanical system in automotive systems.
2. Understand the electronic system in automobiles.
3. Know the X-by-wire concepts in automobiles.
4. Understand the embedded system applications in automobiles.
5. Disseminate the knowledge of communication protocols used in automobiles.

Unit I AUTOMOTIVE MECHANICAL SYSTEMS 9 Hours

Vehicle Systems: Power Train System (Air System, Fuel System (Carburetor& Diesel Fuel Injection, Ignition System, Exhaust System and other Auxiliary Systems (Cooling, Lubrications & Electrical Systems)), Transmission System (Front, Rear & 4-wheel Drive, Manual, Automatic Transmission, Differential). Braking System (Drum, Disc, Hydraulic, Pneumatic), Steering System (Rack and Pinion, Power Steering).

Unit II ELECTRONICS IN AUTOMOTIVE SYSTEMS 9 Hours

Performance (Speed, Power, and Torque), Control (Emission, Fuel Economy, Drivability, and Safety) & Legislation (Environmental legislation for pollution & Safety Norms). Overview of Chassis subsystem (ABS, TCS, & ESP) – Comfort and safety subsystems (Night Vision, Airbags, Seatbelt Tensioners, Cruise Control-Lane-departure-warning, Parking).

Unit III DRIVE BY WIRE 9 Hours

Challenges and opportunities of X-by-wire: system & design requirements, steer-by-wire, brake-by-wire, suspension-by wire, gas-by-wire, power-by-wire, shift by wire- Future of Automotive Electronics

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit IV EMBEDDED SYSTEM IN AUTOMOTIVE APPLICATIONS 9 Hours

Gasoline / Diesel systems Sensors – Nox sensor, Knock Sensor, MAP Sensor, Oxygen sensor, Throttle Position Sensor- Actuators - Idle speed control valves, Exhaust gas recirculation valves Thermal actuators - Body electronics – Body electronics domain- Central locking and electric windows, Climatic Control - On-Board Diagnostics (OBD). Introduction to electric vehicles- Types of electric vehicles.

Unit V VEHICLE COMMUNICATION PROTOCOLS 9 Hours

SPI, I2C, USB communication protocols - Introduction to CAN, LIN, FLEXRAY, MOST, KWP2000. Introduction to AUTOSAR

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Explain the mechanical systems of automobiles	Understand
CO2.	Describe the electronic system in automobiles	Understand
CO3.	Summarize the X-by-wire concepts in automobile	Understand
CO4.	Outline the embedded system applications in automobiles	Understand
CO5.	Explain the different communication protocols in embedded system for automobile	Understand

Text Book(s):

T1. Robert Bosch GmbH, "Bosch Automotive Handbook", 10th Edition, Wiley Publishers, 2019

T2. William B. Ribbens, “Understanding Automotive Electronics”, 7th Edition, SAMS/Elsevier Publishing, 2012

Reference Book(s):

R1. Robert Bosch Gmbh, Automotive Electrics and Automotive Electronics, Systems and Components, Networking and Hybrid drive, 5th edition, Springer Vieweg, Wiesbaden 2014

R2. Knowles.D, Automotive Electronic and Computer Controlled Ignition Systems, Reston Pub Co,1990

R3. Denton.T , Automobile Electrical and Electronic Systems: Automotive Technology: Vehicle Maintenance and Repair, 2012

R4. JoergSchaeuffele, Thomas Zurawka – Automotive Software Engineering – Principles,

Web References:

1. http://nptel.ac.in/courses/117106093/
2. http://www.vlsi-expert.com/p/vlsi-basic.html

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EIEN1005		Course Title: Image and Video Processing	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Digital Signal Processing

Course Objectives

The course is intended to:

1. Explain the basics of Image processing system.
2. Outline the basics of filtering & Demonstrate image segmentation.
3. Elucidate the Image compressing procedure
4. Explain the basics of video processing.
5. Apply various techniques for video processing.

Unit I Fundamentals of Image processing & Transforms 9 Hours

Basic steps of Image processing system sampling and quantization of an Image – Basic relationship between pixels Image Transforms: 2 – D Discrete Fourier Transform, Discrete Cosine Transform (DCT), Discrete Wavelet transforms

Unit II Image Processing Techniques 9 Hours

Image Enhancement: Spatial Domain methods: Histogram Processing, Fundamentals of Spatial Filtering, Smoothing Spatial filters, Sharpening Spatial filters Frequency Domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, selective filtering Image Segmentation: Segmentation concepts, point, line and Edge detection, Thresholding, region-based segmentation

Unit III Image Compression 9 Hours

Image compression fundamentals – coding Redundancy, spatial and temporal redundancy. Compression models : Lossy and Lossless, Huffmann coding, Arithmetic coding, LZW coding, run length coding, Bit Plane coding, transform coding, predictive coding , wavelet coding, JPEG standards

Unit IV Basic Steps of Video Processing 9 Hours

Analog video, Digital Video, Time varying Image Formation models : 3D motion models, Geometric Image formation, Photometric Image formation, sampling of video signals, filtering operations.

Unit V 2-D Motion Estimation 9 Hours

Optical flow, general methodologies, pixel based motion estimation, Block matching algorithm, Mesh based motion Estimation, global Motion Estimation, Region based motion estimation, multi resolution motion estimation. Waveform based coding, Block based transform coding, predictive coding, Application of motion estimation in video coding.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Apply histogram equalization to images.	Understand
CO2.	Outline the basics of filtering in the frequency domain &Illustrate the image segmentation of images.	Understand
CO3.	Summarize the procedure for compressing images.	Understand
CO4.	Outline the basic steps of video processing	Understand
CO5.	Describe the operation of video processing	Understand

Text Book(s):

T1. R.C. Gonzalez and R.E. Woods, “Digital Image Processing”, Third edition, Prentice Hall,2009.

T2. Yao Wang, JoemOstarmann and Ya-quin Zhang, “Video Processing and Communication”, 1st Edition PHI.

T3. T3.William Bolton, “Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering”, 5th Edition, PHI, 2013.

Reference Book(s):

R1. M. Tekalp,” Digital video Processing”, Prentice Hall International

R2. William K Pratt, “Digital Image Processing”, John Willey, 2001.

R3. A.K. Jain, “Fundamentals of Digital Image Processing”, PHI, New Delhi, 2003.

R4. R.C. Gonzalez, R.E. Woods and S.Eddins, “Digital Image Processing using MATLAB”,

R5. Peter D symes, “Digital Video Compression”, McGraw Hill Professional, 2004.

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Web References:

1. https://nptel.ac.in/courses/117/105/117105079/
2. https://nptel.ac.in/courses/117/105/117105135/
3. https://nptel.ac.in/courses/117/104/117104020/

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EIEN1006		Course Title: Modern Electronic Instrumentation	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Electric Circuits

Course Objectives

The course is intended to:

1. Introduce different types of electronic instruments and their applications.
2. Provide knowledge on various types of cathode ray oscilloscopes, their applications and different types of signal analyzers.
3. Introduce different types of waveform generators and analyzers and their applications.
4. Educate on virtual instrumentation, its applications, programming and DAQ cards and modules.
5. Provide exposure to telemetry, modulation techniques and multiplexing.

Unit I ELECTRONIC INSTRUMENTS 9 Hours

Introduction – DC Voltmeter – AC Voltmeter using rectifiers – True RMS responding voltmeter – Electronic multimeter – Considerations in choosing an analog voltmeter – Digital Voltmeter - Microprocessor based ramp type DVM – Q Meter – Vector Impedance Meter.

Unit II CATHODE RAY OSCILLOSCOPE & SIGNAL ANALYZERS 9 Hours

General purpose cathode ray oscilloscope – Dual trace, dual beam and sampling oscilloscopes– Digital storage oscilloscope – Basic Wave Analyzer – Frequency selective and Heterodyne wave analyzer – Harmonic distortion wave analyzer – Spectrum analyzer.

Unit III WAVEFORM GENERATORS 9 Hours

Standard Signal Wave Generator – AF Sine and Square wave generator – Function Generator – Square wave and pulse wave generators – Sweep Generator – Electronic Counters – Light Emitting Diodes – Liquid Crystal Display – Segmental Displays using LED's – Dot Matrix Displays & 3 Digit Alphanumeric Displays.

Unit IV DATA ACQUISITION SYSTEM 9 Hours

Introduction to DAS – Signal Conditioning of Inputs – Single Channel DAS – Multi Channel DAS – Computer Based DAS – Data Logger – DAS Applications.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit V TELEMETRY 9 Hours

General telemetry system – Landline telemetry systems, voltage, current and position telemetry systems – Radio frequency telemetry – Modulation Techniques in Telemetry System – Multiple Access techniques in Telemetry system

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Describe different types of electronic instruments and their applications.	Understand
CO2.	Explain various types of cathode ray oscilloscopes, their applications and different types of signal analyzers.	Understand
CO3.	Compare different types of waveform generators and analyzers and their applications.	Understand
CO4.	Explain the concept of virtual instrumentation, its applications, programming and DAQ cards and modules.	Understand
CO5.	Explain different types of telemetry system, modulation techniques and multiplexing.	Understand

Text Book(s):

T1. A.D. Helfrick and W.D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, Prentice Hall India Private Ltd., New Delhi, 2015.

T2. H.S. Kalsi, Electronic Instrumentation, 4th edition, Tata McGraw-Hill, New Delhi, 2019.

Reference Book(s):

R1. A.K. Sawhney, A Course in Electrical & Electronic Measurements and Instrumentation, DhanpatRai and Co, New Delhi, 2015.

R2. Jerome J., Virtual Instrumentation using Lab VIEW, Prentice Hall India Private Ltd., New Delhi, 2010.

R3. David A Bell, “Electronic Instrumentation and Measurements”, Ox for University Press, 2013.

R4. PrithwirajPurkait, B Biswas, S Das, C Koley., “Electrical and Electronics Measurements and Instrumentation”, Tata McGraw-Hill, New Delhi, 2017.

R5. J.J. Carr, Elements of Electronic Instrumentation and Measurement, 3rd edition, Pearson Education India, New Delhi, 2011.

R6. M.M.S. Anand, Electronics Instruments and Instrumentation Technology, Prentice Hall India, New Delhi, 2009.
R7. Sanjay Gupta, Virtual Instrumentation using Lab view, Tata McGraw-Hill Education, 2010.

Web References:

1. http://iitg.vlab.co.in/?sub=61&brch=174
2. http://nptel.iitg.ernet.in/couses/Elec_Engg/IIT%20Bombay/Electrical%20and%20Electronic%20Measurements.html

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EIEN1007		Course Title: Fiber Optics and Laser Instrumentation	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Electric Circuits

Course Objectives

The course is intended to:

1. Introduce different types of electronic instruments and their applications.
2. Provide knowledge on various types of cathode ray oscilloscopes, their applications and different types of signal analyzers.
3. Introduce different types of waveform generators and analyzers and their applications.
4. Educate on virtual instrumentation, its applications, programming and DAQ cards and modules.
5. Provide exposure to telemetry, modulation techniques and multiplexing.

Unit I OPTICAL FIBRES AND THEIR PROPERTIES 9 Hours

Principles of light propagation through a fibre - Different types of fibres and their properties, fibre characteristics – Absorption losses – Scattering losses – Dispersion – Connectors and splicers – Fibre termination – Optical sources – Optical detectors.

Unit II INDUSTRIAL APPLICATION OF OPTICAL FIBRES 9 Hours

Fibre optic sensors – Fibre optic instrumentation system – Different types of modulators – Interferometric method of measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain.

Unit III LASER FUNDAMENTALS 9 Hours

Fundamental characteristics of lasers – Three level and four level lasers – Properties of laser – Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers – Gas lasers, solid lasers, liquid lasers, semiconductor lasers..

Unit IV INDUSTRIAL APPLICATION OF LASERS 9 Hours

Laser for measurement of distance, length, velocity, acceleration, current, voltage and Atmospheric effect – Material processing – Laser heating, welding, melting and trimming of material – Removal and vaporization.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit V HOLOGRAM AND MEDICAL APPLICATIONS 9 Hours

Holography – Basic principle - Methods – Holographic interferometry and application, Holography for non-destructive testing – Holographic components – Medical applications of lasers, laser and tissue interactive – Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynecology and oncology.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Understand the principle, transmission, dispersion and attenuation characteristics of optical fibers	Understand
CO2.	Apply the gained knowledge on optical fibers for its use as communication medium and as sensor as well which have important applications in production, manufacturing industrial and biomedical applications.	Understand
CO3.	Understand laser theory and laser generation system.	Understand
CO4.	Apply laser theory for the specific Industrial applications.	Understand
CO5.	Apply laser theory for the specific medical application.	Understand

Text Book(s):

T1. J.M. Senior, Optical Fibre Communication – Principles and Practice, Prentice Hall of India,1985

T2. J. Wilson and J.F.B. Hawkes, Introduction to Opto Electronics, Prentice Hall of India, 2001.

T3. Eric Udd, William B., and Spillman, Jr., Fiber Optic Sensors: An Introduction for Engineers and Scientists, John Wiley and Sons, 2011

Reference Book(s):

R1. G. Keiser, Optical Fibre Communication, McGraw Hill, 1995..

R2. M. Arumugam, Optical Fibre Communication and Sensors, Anuradha Agencies, 2002.

R3. John F. Ready, Industrial Applications of Lasers, Academic Press, Digitized in 2008.

Web References:

1. http://iitg.vlab.co.in/?sub=61&brch=174
2. http://nptel.iitg.ernet.in/couses/Elec_Engg/IIT%20Bombay/Electrical%20and%20Electronic

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

Approved in Academic Council meeting

BOS Convener

BOS Chairman

Course Code:19EIEN1008		Course Title: Smart and Wireless Instrumentation	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Industrial Instrumentation
- Microprocessor and Microcontroller

Course Objectives

The course is intended to:

1. Provide knowledge on various sensors.
2. Provide knowledge on the project development procedure with communicating devices.
3. Introduce various power harvesting methodologies and power management techniques in WSN.
4. Provide introduction to configure, receive, test and transmit the data using GUI.
5. Provide knowledge on the hardware and software involved in developing the project.

Unit I SENSORS FUNDAMENTAL 9 Hours

Sensor Classification -Sensors Parameters - Thermal Sensors-Humidity Sensors-Capacitive Sensors-Planar Inter digital Sensors - Planar Electromagnetic Sensors- Light Sensing Technology - Moisture Sensing Technology - Carbon Dioxide (CO2) Sensing Technology – Smart Sensors - TEDS.

Unit II WIRELESS SENSORS AND SENSORS NETWORK 9 Hours

Frequency of Wireless Communication - Development of Wireless Sensor Network Based Project - Wireless Sensor Based on Microcontroller and Communicating device like Zigbee and Bluetooth - ISA 100, Wireless HART.

Unit III POWER SUPPLIES FOR SENSORS 9 Hours

Power Sources-Energy Harvesting-Solar and Lead Acid Batteries-RF Energy Harvesting-Energy Harvesting from Vibration-Thermal Energy Harvesting-Energy Management Techniques-Calculation for Battery Selection.

Unit IV SOFTWARE DESIGN FOR DATA RECEPTION AND ANALYSIS 9 Hours

Brief Description of API Mode Data Transmission-Testing the Communication between Coordinator and Remote XBee-Design and Development of Graphical User Interface for Receiving Sensor Data Using LabVIEW/C++.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit V WIRELESS SENSOR AND INSTRUMENT APPLICATIONS 9 Hours

A Brief Review of Signal Processing Techniques for Structural Health Monitoring - WSN Based Physiological Parameters Monitoring System-Intelligent Sensing System for Emotion Recognition-WSN Based Smart Power Monitoring System.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Explain the classification of sensors with its operation.	Understand
CO2.	Describe the project development procedure with communicating devices like Zigbee, ISA100, Wireless HART.	Understand
CO3.	Analyze the power harvesting methodologies and power management techniques in WSN.	Understand
CO4.	Illustrate the steps to configure, receive, test and transmit the data using GUI.	Understand
CO5.	Elucidate the hardware and software involved in developing the project for applications like structural health, physiological, smart power and emotion monitoring.	Understand

Text Book(s):

T1. Subhas Chandra Mukhopadhyay “Smart Sensors, Measurement and Instrumentation”, Springer Heidelberg New York Dordrecht London, 2013

T2. HalitEren, “Wireless Sensors and Instruments: Networks, Design, and Applications”, CRC Press, Taylor and Francis Group, 2006.

Reference Book(s):

R1. UvaisQidwai “Smart Instrumentation: A Data Flow Approach to Interfacing” Chapman & Hall; 1 edition December 2013.

Web References:

1. http://nptel.ac.in/courses/112103174
2. http://nptel.ac.in/courses/108105064
3. http://nptel.ac.in/courses/112106140

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EIEN1009		Course Title: Bio Medical Instrumentation	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Transducer Engineering

Course Objectives

The course is intended to:

1. Explain the basic physiology and biomedical applications of different types of transducers.
2. Explain the different Electro Physiological Measurements.
3. Explain the different non electrical parameter measurements on human body.
4. Explain the concept of modern methods of imaging techniques.
5. Explain the concept of medical assisting and therapeutic equipment.

Unit I PHYSIOLOGY AND TRANSDUCERS 9 Hours

Cell and its structure – Action and resting – Potential propagation of action potential – Sodium pump –Nervous system – CNS – PNS – Nerve cell –Synapse – Cardio pulmonary system – Physiology of heart and lungs –Circulation and respiration – Transducers– Piezoelectric, ultrasonic, resistive, capacitive, inductive transducers – selection criteria.

Unit II ELECTRO – PHYSIOLOGICAL MEASUREMENTS 9 Hours

Basic components of a biomedical system – Electrodes – Micro, needle and surface electrodes – Amplifiers – Preamplifiers, differential amplifiers, chopper amplifiers – Isolation amplifier. ECG – PCG – EEG – EMG – ERG – Lead systems and recording methods – Typical Waveforms.

Unit III NON-ELECTRICAL PARAMETER MEASUREMENTS 9 Hours

Measurement of blood pressure – Cardiac output – Cardiac rate –Respiratory rate – Gas volume –- pH of blood, GSR measurements – Plethysmography.

Unit IV MEDICAL IMAGING AND PMS 9 Hours

X-ray machine - Computer tomography – MRI – Ultrasonography – Endoscopy – Thermography – Different types of biotelemetry systems and patient monitoring – Electrical safety.

Unit V ASSISTING AND THERAPEUTIC EQUIPMENTS 9 Hours

Pacemakers – Defibrillators – Ventilators – Nerve and muscle stimulators –Diathermy – Heart Lung machine – Audio meters – Dialyzers.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Explain the basic physiology and biomedical applications of different types of transducers.	Understand
CO2.	Explain the different Electro Physiological Measurements.	Understand
CO3.	Explain the different non electrical parameter measurements on human body.	Understand
CO4.	Explain the concept of modern methods of imaging techniques.	Understand
CO5.	Explain the concept of medical assisting and therapeutic equipment.	Understand

Text Book(s):

T1. Khandpur R.S, “Handbook of Biomedical Instrumentation”, Tata McGraw-Hill, 3rd Edition, New Delhi, 2014.

T2. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Prentice Hall of India, New Delhi, 2007.

Reference Book(s):

R1. John G. Webster, “Medical Instrumentation Application and Design”, John Wiley and sons, 4th Edition New York, 2009.

R2. Joseph J. Carr and John M. Brown,” Introduction to Biomedical Equipment Technology”, John Wiley and sons, 4th Edition, New York, 2000.

R3. Duane Knudson,” Fundamentals of Biomechanics”, Springer, 2003.

R4. Ed. Joseph D. Bronzino, “The Biomedical Engineering Hand Book”, 2nd Edition, Boca Raton, CRC Press LLC, 2000

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Web References:

1. http://www.mtu.edu/biomedical/research/biosensors/
2. http://www.eecs.umich.edu/courses/bme458

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EIEN1010		Course Title: Analytical Instrumentation	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Engineering Chemistry

Course Objectives

The course is intended to:

1. Explain the concepts and application of various spectrophotometers.
2. Describe Nuclear magnetic resonance, types of mass spectrometers and electron microscope.
3. Compare different types of chromatography.
4. Summarize the working and characteristics of different analyzers.
5. Illustrate the measuring techniques for Pollutant gases from industries.

Unit I COLORIMETRY AND SPECTROPHOTOMETRY 9 Hours

Spectral methods of analysis– Beer-Lambert law – Colorimeters – UV-Visible spectrophotometers – Single and double beam instruments – Sources and detectors – IR Spectrophotometers – Types – Attenuated total reflectance flame photometers – Atomic absorption spectrophotometers – Sources and detectors – FTIR spectrophotometers – Flame emission photometers – Fluorescence spectrophotometer.

Unit II NUCLEAR MAGNETIC RESONANCE AND MICROSCOPIC TECHNIQUES 9 Hours

NMR – Basic principles – NMR spectrometer – Applications - Electron spin Resonance spectroscopy – Basic principles, Instrumentation and applications. Scanning Electron Microscope (SEM) - Basic principles, Instrumentation and applications. Transmission Electron Microscope (TEM) – Basic principles – Instrumentation and applications. Mass spectrometers – Different types – Applications.

Unit III CHROMATOGRAPHY 9 Hours

Different techniques – Techniques by chromatographic bed shape- Column chromatography Planer Chromatography - Paper Chromatography - Thin layer Chromatography-Applications – Techniques by physical state of mobile phase - Gas chromatography – Detectors – High-pressure liquid chromatographs – detectors - Applications - Techniques by separation mechanism Ion exchange chromatography-size-exclusion chromatography – Applications.

Unit IV pH METERS AND DISSOLVED COMPONENT ANALYZERS 9 Hours

Principle of pH measurement, glass electrodes, hydrogen electrodes, reference electrodes, selective ion electrodes, ammonia electrodes, biosensors, dissolved oxygen analyzer – Sodium analyzer – Silicon analyzer.

Unit V INDUSTRIAL GAS ANALYZERS AND POLLUTION MONITORING INSTRUMENTS 9 Hours

Types of gas analyzers – Oxygen, NO2 and H2S types, IR analyzers, thermal conductivity analyzers, analysis based on ionization of gases. Air pollution due to carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide estimation - Dust and smoke measurements.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Explain the concepts and application of various spectrophotometers	Understand
CO2.	Describe Nuclear magnetic resonance, types of mass spectrometers and electron microscope.	Understand
CO3.	Contrast the different types of chromatography based on construction and working principle	Understand
CO4.	Summarise the working and characteristics of different analyzers	Understand
CO5.	Illustrate the measuring techniques for Pollutant gases from industries	Understand

Text Book(s):

T1. R.S. Khandpur, Handbook of Analytical Instruments, Tata McGraw Hill publishing Co. Ltd., 2nd edition, 2006.

T2. G.W. Ewing, Instrumental Methods of Analysis, McGraw Hill, 2004.

T3. H.H.Willard, L.L.Merritt, J.A.Dean, F.A.Settle, Instrumental methods of analysis, CBS publishing & distribution, 1995.

Reference Book(s):

R1. Braun, R.D., Introduction to Instrumental Analysis, McGraw – Hill, Singapore, 2006.

R2. Liptak, B.G., Process Measurement and Analysis, CRC Press, 2005.

Web References:

1. www.nptel.ac.in

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

Approved in Academic Council meeting

BOS Convener

BOS Chairman

Course Code:19EIEN1011		Course Title: Automobile and Aircraft Instrumentation	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Engineering Chemistry

Course Objectives

The course is intended to:

1. Provide the knowledge on Automobile measuring devices
2. Provide the knowledge on sensors and actuators used in Automobiles
3. Understand the instrumentation for emission system
4. Provide the knowledge on gyroscopic theory for aircraft
5. Impart the knowledge on Aircraft Navigation system

Unit I MEASURING DEVICES IN AUTOMOBILES 9 Hours

Selection of measuring instrument, requirements of measurement such as precision, accuracy, errors, sensitivity, readability and reliability – Devices to measure temperature and pressure of the working fluid, coolant, air and fuel flow into the engine - Indicating and integrating instruments – Vibrometer, Accelerometer, vibration and pressure pick-ups, vibration test methods and counters.

Unit II SENSORS AND ACTUATORS 9 Hours

Introduction to basic sensor arrangement – types of sensors – Oxygen sensors, crank angle position sensors – Fuel metering / vehicle speed sensor and detonation sensor – Altitude sensor – Flow sensors – Throttle position sensors – Solenoids, stepper motors, relays – Electronic dash board systems – GPS.

Unit III INSTRUMENTATION FOR EMISSION MEASUREMENT 9 Hours

Test procedures – NDIR analyzers – Flame ionization detectors – Chemiluminescent analyzers – Gas chromatograph – Smoke meters – Emission – Standards.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit IV FLIGHT INSTRUMENTATION AND GYROSCOPIC INSTRUMENTS **9 Hours**

Classification of aircraft instruments – Instrument displays, panels, cockpit layout – Altimeters – Airspeed indicators – Machmeters – Accelerometers – Gyroscopic theory – Directional gyro indictor – Artificial horizon – Turn and slip indicators.

Unit V AIRCRAFT COMPUTER SYSTEMS **9 Hours**

Terrestrial magnetism – Aircraft magnetism- Direct reading magnetic components – Compass errors – Gyromagnetic compass – Performance margin indicators – Safe take off indicators - Aircraft take off monitoring systems – Autopilot and navigation systems.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Contrast between different automobile measuring devices	Understand
CO2.	Summarize different sensors and actuators used in automobiles	Understand
CO3.	Explain the instruments used for emission measurement	Understand
CO4.	Describe on gyroscopic theory for aircraft	Understand
CO5.	Recognize the aircraft navigation system	Understand

Text Book(s):

T1. Riddens.B, “Understanding Automotive Electronics”, 5th Edition, Butterworth, Heinemann Woburn, 2008

T2. Robert C. Nelson, “Flight stability and Automatic control”, 2nd Edition, McGraw Hill International, 1998.

Reference Book(s):

R1. Springer and Patterson, “Engine Emission”, Plenum Press, 2000.

R2. Pallett E.H.J, “Aircraft Instruments – Principles and Applications”, Pitman and sons, 2001.

Web References:

1. www.nptel.ac.in

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EIEN1012		Course Title: Agricultural Instrumentation	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Explain the concept of soil properties
2. Understand the importance of sensors used in agricultural systems.
3. Explain the importance of instrumentation in irrigation
4. Understand the automation scheme for green house
5. Implement the automation techniques in agriculture

Unit I Basics of Soil science 9 Hours

Engineering properties of soil pH, conductivity, resistivity, temperature, soil moisture and salinity, ion concentration measurement, method of soil analysis, Instrumentation for environmental conditioning of seed germination and growth.

Unit II Sensors 9 Hours

Necessity of sensors in agriculture instrumentation, sonic anemometers, hygrometers, fine wire thermocouples, open & close path gas analysers, remote sensing and biosensors in agriculture: infrared & UV bio sensor methods in agriculture, agro-metrological instrumentation weather stations.

Unit III Instrumentation for Irrigation 9 Hours

Water distribution & management control, Auto drip & sprinkler irrigation systems, irrigation canal management systems, upstream & downstream control concept, SCADA for DAM parameters & control.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit IV Greenhouse Parameters and Instrumentation 9 Hours

Flow diagram of sugar plant, sensors & instrumentation set up, Flow diagram of fermenter & control (batch process), flow diagram of dairy industry & instrumentation set up for it, juice extraction control process & instrumentation set up.

Unit V Agricultural Automation 9 Hours

Automation in earth moving equipments& farm equipments, application of SCADA & PLC in packing industry and cold storage systems, implementation of hydraulic, pneumatic & electronics control circuits in harvesters cotton pickers. classification of pumps: pump characteristics, pump selection & installation.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Explain about concept of soil properties.	Understand
CO2.	Describe the different sensors used in agricultural instrumentation	Understand
CO3.	Explain the Water distribution & management using irrigation system.	Understand
CO4.	Illustrate the concept of greenhouse automation system.	Understand
CO5.	Expalin automation techniques by evaluating agricultural parameter	Understand

Text Book(s):

T1. Industrial Instrumentation by D. Patranabis, Tata Mcgraw Hill pub

T2. Mineral Processing Technology by Wills B.A., Pergamon Press, 4th Ed

T3. G.S. Sawhney —Non-Conventional Energy Resources, PHI Learning Private Limited, 1st ed., 2012

Reference Book(s):

R1. Agricultural Engineering; RadheyLal: Saroj Publication

R2. Principle of Farm Machinery, R.A Kepner, Roy Bainer;: CBS Publication

Web References:

1. http://nptel.ac.in/video.php

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EIEN1013	Course Title: Instrumentation System Design		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Understand the basic concepts and standards of Instrumentation system
2. Develop Signal Conditioning circuit for Temperature Sensor
3. Explain the concepts the Control system design
4. Design Electronic PID controllers for Process Control Applications.
5. Design a Microcontroller based Instrumentation system for measuring and controlling.

Unit I Instrumentation Basic Concepts 9 Hours

Calibrating and testing standards for Instruments and transducer – NEMA, DIN, BIS and ANSI standards – P&I symbols: SAMA & ISA, P&I diagram for flow, pressure, level and temperature process.

Unit II Signal Conditioning for Transducers 9 Hours

Analog Signal Conditioning: Overview of bridge circuits and OP-AMP based amplifiers – Design consideration for thermocouple and RTD – Digital Signal Conditioning: Overview of ADCs and DACs – Analog and Digital Conversions – Hardware structure of DAS.

Unit III Control System Instrumentation 9 Hours

Standard Instrumentation Signal levels – Sensor Transmitter – Transmission lines – Steps in Control System design – Selection of Controlled, Manipulated and Measured variable – Process safety – Process alarms – Safety interlocks System (SIS) – Interlocks and Automatic shutdown systems.

Unit IV Analog Controllers 9 Hours

Electronic Controllers – Error detector – Single Mode: Design of Two Position and Three Position Control, Proportional, Integral, and Derivative modes – Composite Controller modes: Design of PI, PD, PID.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit V Microcontroller Based Instrumentation 9 Hours

Case study – Temperature Monitoring and control: Temperature IC Sensor, Signal Conditioning – ADC – Interface of Microcontroller – DAC – Driver circuit for Heater – PID algorithm and Programming for temperature control.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Explain the basic concepts of Instrumentation system	Understand
CO2.	Design Signal Conditioning circuit (Analog and Digital) for Temperature Sensor	Apply
CO3.	Summarize the concepts of Control system design	Understand
CO4.	Design Analog PID controllers for Process Control Applications.	Apply
CO5.	Design a Microcontroller based Instrumentation system for measuring and controlling.	Apply

Text Book(s):

T1. Dale E. Seborg, Thomas F.Edger, Process dynamics and Control, 2nd Edition, Willey,

T2. C. D. Johnson, Process Control Instrumentation Technology, 8th Ed, PHI, 2014 education

Reference Book(s):

R1. Instrumentation Engineers Handbook- Process measurement volume I and Process control volume II, by B.G.Liptak, Chilton Book Company, 2001

R2. Process Instrumentation and control handbook by Considine D. M., McGraw Hill pub.

Web References:

1. http://nptel.ac.in/video.php

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EIEN1014		Course Title: Thermal and Fluid Mechanics	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Explain the fundamentals of fluid mechanics thermodynamics
2. Understand basic concepts into various fluid and thermal applications
3. Understand the mechanics of fluids and its properties
4. Describe the transport of mass, momentum and energy
5. Explain the conservation laws of flow through pipes and hydraulic machines.

Unit I BASIC CONCEPTS AND LAWS OF THERMODYNAMICS 9 Hours

Classical approach: Thermodynamic systems – Control volume – System and surroundings – Universe – Properties – State–Process – Cycle – Equilibrium – Work and heat transfer – Point and path functions – First law of thermodynamics for open and closed systems – First law applied to a control volume – SFEE equations [steady flow energy equation] – Second law of thermodynamics– Heat engines – Refrigerators and heat pumps – Carnot cycle – Carnot theorem (Qualitative).

Unit II IC ENGINES & STEAM TURBINE 9 Hours

Air standard cycles: Otto, diesel and dual cycles and comparison of efficiency – Application of IC engines. Formation of steam – Properties of steam – Use of steam tables and charts – Steam power cycle (Rankine) – Steam turbines: Impulse and reaction principle.

Unit III COMPRESSORS, REFRIGERATION AND AIR CONDITIONING 9 Hours

Positive displacement compressors – Reciprocating compressors – Indicated power – Clearance volume – Various efficiencies – Clearance ratio – Volume rate – Conditions for perfect and imperfect inter cooling – Multi stage with inter cooling (Qualitative) – Construction and working principle of centrifugal and axial flow compressors.

Refrigeration – Various methods of producing refrigerating effects (RE) – Vapour compression cycle: P–H and T–S diagram – Saturation cycles – Air–conditioning systems, Types of air

conditioning systems – Selection criteria for a particular application.

Unit IV FLUID PROPERTIES & FLOW THROUGH PIPES 9 Hours

Dimensions. Properties of fluids – Specific gravity, specific weight, viscosity, compressibility, vapour pressure and gas laws – capillarity and surface tension. Flow characteristics – concepts of system and control volume. Application of control volume to continuity equation, Momentum Equation, Darcy – Weisbach equation. Friction factor. Minor losses. Flow through pipes in series and in parallel.

Unit V TURBINE & PUMPS 9 Hours

Homologous units – Specific speed. Theory of turbo machines. Euler"s equation. Hydraulic efficiency. Velocity components at the entry and exit of the rotor – Velocity triangle for single stage radial flow and axial flow machines – Centrifugal pumps, turbines, performance curves for pumps and turbines. Reciprocating pumps – Indicator diagrams, Work saved by air vessels – Rotary pumps – Classification. Working and performance curves

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Expose the fundamentals of fluid mechanics thermodynamics and to be able to use it in accounting for the bulk behavior of the sample physical systems	Understand
CO2.	Integrate the basic concepts into various fluid and thermal applications like pumps, turbines, IC engines, steam boiler, steam turbine, compressors, refrigeration and air conditioning.	Understand
CO3.	Understand the mechanics of fluids through by understanding the properties of fluids.	Understand
CO4.	Understand the transport of mass, momentum and energy	Understand
CO5.	Explain the conservation laws of flow through pipes and hydraulic machines.	Understand

Text Book(s):

T1. Khurmi. R.S.& Gupta. J.K., "Thermal Engineering", S.Chand& Co. Ltd., 2012.

T2. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", Laxmi Publications (P) Ltd., New Delhi, 2010

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Reference Book(s):

R1. Rogers and Mayhew, “Engineering Thermodynamics – Work and Heat Transfer”, Pearson Education Pvt. Ltd., 2006.

R2. Eastop and McConkey, “Applied Thermodynamics”, Pearson Education Pvt. Ltd, 2002.

R3. Nag. P.K., “Engineering Thermodynamics” Tata McGraw Hill, 2003.

R4. Rajput, B.K. Sankaar, “Thermal Engineering”, S.Chand& Co. Ltd., 2003.

R5. Kumar. K.L., “Engineering Fluid Mechanics” Eurasia Publishing House (P) Ltd., 7th edition, 1995.

Web References:

1. http://nptel.ac.in/video.php

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EIEN1015		Course Title: Power Electronics and Drives	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Electron Devices
- Electrical Machines and Measurements

Course Objectives

The course is intended to:

1. Summarize the characteristics of various power semiconductor devices.
2. Analyze the performance of AC/DC rectifier and DC/DC converter circuits.
3. Describe the various PWM techniques of Inverter and AC/AC converter circuits.
4. Demonstrate the speed control methods of D.C and A.C drives
5. Explain the concept of special Electric Drives

Unit I POWER SEMI-CONDUCTOR DEVICES 9 Hours

Study of switching devices: Diode, SCR, TRIAC, MOSFET, IGBT-Static and Dynamic characteristics –Turn ON and OFF characteristics - protection circuit.

Unit II DC POWER CONVERTER 9 Hours

Single phase and three phase controlled rectifiers (half and full converters) with R and RL load -estimation of rms load voltage, current and input power factor - Effect of source inductance - Dual Converter.

Unit III AC POWER CONVERTER 9 Hours

Inverters: voltage source inverters (120 and180 degree mode) - current source inverters - Harmonic reduction.AC voltage controller: Single phase R and RL load. Cycloconverter: Three phase to single phase and three phase to three phase cycloconverter.

Unit IV CONTROL OF DC &AC DRIVES 9 Hours

Selection of drives – Factors influencing the choice of drive – Braking methods –Chopper fed drives – Four quadrant drives –. Voltage control, V/F control of induction motor – VSI and CSI fed drives – Open loop and closed loop control of drives.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit V CONTROL OF SPECIAL DRIVES 9 Hours

Stepper motor: Driver circuit – Digital Implementation- BLDC motor: Principle of operation- Types - Control of BLDC motor -Microprocessor and DSP based control schemes -Sensor less Control- servomotor: AC and DC control.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Classify the characteristics of various power semiconductor devices.	Understand
CO2.	Design AC/DC rectifier and DC/DC converter circuits.	Apply
CO3.	Compare the different PWM techniques of Inverter and AC/AC converter circuits.	Understand
CO4.	Illustrate different speed control methods in D.C and A.C drives using thyristor based control schemes.	Understand
CO5.	Explain Microprocessor based control of Electric Drives	Understand

Text Book(s):

T1. Muhammad H. Rashid, "Power Electronics: Circuits, Devices and Applications", Pearson Education, 3rd Edition, 2013.

T2. M.D.Singh and K.B.Khanchandani, “Power Electronics”, Tata McGraw-Hill, New Delhi,

T3. E.G.Janardanan, ‘Special Electrical Machines’, Prentice Hall of India, 2014.

Reference Book(s):

R1. Ned Mohan, T.M.Undeland, W.P.Robbins, "Power Electronics: Converters, applications and design", 3rd Edition, John wiley and Sons, 2006.

R2. Bimal K Bose, “Modern Power Electronics& AC Drives”, PHI Learning PVT. LTD New Delhi,2002.

R3. R. Krishnan, ‘Electric Motor and Drives: Modelling Analysis and Control’, Pearson Education, 2001.

Web References:

1. http://www.nptel.ac.in/courses
2. https://onlinelibrary.wiley.com/doi/book/10.1002/9780470547113

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EIEN1016	Course Title: Non-Linear Control System		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Control Systems

Course Objectives

The course is intended to:

1. Understand different nonlinearities and analyse the stability of nonlinear system using phase plane analysis.
2. Derive describing functions for static nonlinearities and predict the stability.
3. Infer the stability properties of nonlinear systems.
4. Acquire knowledge of state feedback and state observer based nonlinear control system design.
5. Describe sliding mode controller

Unit I PHASE PLANE ANALYSIS 9 Hours

Features of linear and non-linear systems - Common physical non-linearities – Methods of linearising non-linear systems - Concept of phase portraits – Singular points – Limit cycles – Construction of phase portraits – Phase plane analysis of linear and non-linear systems – Isocline method.

Unit II DESCRIBING FUNCTION ANALYSIS 9 Hours

Basic concepts, derivation of describing functions for common non-linearities – Describing function analysis of non-linear systems – Conditions for stability – Stability of oscillations.

Unit III STABILITY ANALYSIS 9 Hours

Introduction – Liapunov's stability concept – Liapunov's direct method – Lure's transformation – Aizerman's and Kalman's conjecture – Popov's criterion – Circle criterion.

Unit IV STATE FEEDBACK AND STATE OBSERVERS 9 Hours

State Feedback - Gain Matrix - Pole Placement design using State feedback system – State observer Full order Observer-Reduced order observer – Design of state observer system.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit V SLIDING MODE CONTROL 9 Hours

Variable structure systems - Basic concepts - Sliding modes in variable structure system conditions for existence of sliding regions – Case Study - Sliding mode approach to speed control of dc motors.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Explain the non-linear system behaviour by phase plane method	Understand
CO2.	Describe the stability and existence of periodic solutions of nonlinear system through describing functions.	Understand
CO3.	Apply the stability properties of non-linear system using Liapunov's direct and indirect methods.	Apply
CO4.	Design the non-linear controller using state feedback and state observer	Apply
CO5.	Design sliding motor controller for given system	Apply

Text Book(s):

T1. M.Gopal, 'Modern control system theory', New Age International Publishers, Second Edition,2005

T2. Ogata, 'Modern control Design with Matlab and Simulink', John Wiley, New Delhi, 2002

Reference Book(s):

R1. Gene F. Franklin, J. David Powell and Abbasemami-Naeini, "Feedback Control of Dynamic Systems", Fourth edition, Pearson Education, Low price edition.2008

R2. J. Nagrath and M. Gopal, 'Control Systems Engineering', New Age International Publishers, 2010.

R3. VadimUtkin, JurgenGuldner, Jingxin Shi, "Sliding Mode Control in Electromechanical System", Taylor and Francis, 1999.

R4. George J. Thaler, 'Automatic Control Systems', Jaico Publishers, 1993.

Web References:

1. http://www.nptel.ac.in/courses

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	**CO. No.**	**Marks**	**Total**
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EIEN1017	Course Title: Digital Control Engineering		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Control Systems

Course Objectives

The course is intended to:

1. Study the importance of sample data control system.
2. Give adequate knowledge about signal processing in digital control.
3. Study the importance of modeling of discrete systems and stability analysis of discrete data system.
4. Study the importance of state space representation for discrete data system.
5. Introduce the design concept for digital controllers.

Unit I INTRODUCTION 9 Hours

Introduction to digital control – Sampling Process – Sample and Hold Circuit – Zero and First Order hold – Z-Transform – Inverse Z- Transform – Region of convergence – Initial and Final Value Theorem.

Unit II PULSE TRANSFER FUNCTION AND TIME RESPONSE 9 Hours

Block diagram reduction methods – Reduction Rules- Multi-loop – MIMO Systems – Signal Flow Graph- steady state error – error transfer functions- Error Constants-Time-Domain Analysis of Second Order Systems-Time Response

Unit III STABILITY ANALYSIS 9 Hours

Introduction-Jury Stability Test- Schur-Cohn stability Test- Bilinear transformation- Stability by Pole Location – Root locus method- Bode Plot- Nyquist Plot

Unit IV STATE VARIABLE ANALYSIS 9 Hours

Review of state space techniques to continuous data systems, state space representation of discrete time systems- Transfer function from state space model-various canonical forms-conversion of transfer function model to state space model-characteristics equation- solution to discrete state equations

Unit V STATE FEEDBACK CONTROLLER DESIGN 9 Hours

Controllability and Observability - Response between sampling instants using state variable approach-Pole placement using state feedback. Dynamic output feedback- Effects of finite word length on controllability and closed loop pole placement.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Analyze signals in both time domain and Z domain.	Apply
CO2.	Solve the problems on discrete systems.	Apply
CO3.	Analyze the real time problems using discrete data system.	Apply
CO4.	Distinguish the conventional and state variable approaches.	Apply
CO5.	Design the discrete-date control systems.	Apply

Text Book(s):

T1. Gopal M, “Digital Control and State Variable Methods”, Tata McGraw-Hill Publishing Company Limited, New Delhi, India, Second Edition, 2012.
T2. Katsuhiko Ogata, "Modern Control Engineering", Prentice Hall of India Private Ltd., New

Reference Book(s):

R1. Nagrath I J and Gopal M, "Control Systems Engineering", New Age International Publisher, New Delhi, 2010.
R2. Nise S Norman, “Control Systems Engineering”, John Wiley & Sons, Inc, Delhi, Third edition, 2010.
R3. Benjamin C Kuo, “Automatic Control Systems”,John Wiley & Sons, Inc., Delhi, 2009.
R4. Thomas Kailath, “Linear Systems”, Prentice Hall, 1980.

Web References:

1. www.gcebargur.ac.in
2. www.goodreads.com/59581
3. nptel.ac.in/courses/108103008/25
4. web.mit.edu/2.14/StateSpace.pdf
5. www.nptelvideos.in/control-engineering.htm

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EIEN1018	Course Title: Fluid Power System		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Understand the principles of fluid power system
2. Illustrate the construction and working of hydraulic system and its components.
3. Explain the working of valves, actuators and industrial hydraulic circuits
4. Understand the working of components in pneumatic system
5. Explain the pneumatic DCVs and pneumatic circuits

Unit I FLUID POWER PRINCIPLES AND FUNDAMENTALS 9 Hours

Introduction to Fluid power - Types of fluid power systems - Hydraulic system components - Pneumatic system components - Application of Pascal's Law in hydraulics-Advantages of fluid power system -Applications of Fluid power system -Properties of hydraulic fluids - Types of fluids.

Unit II HYDRAULIC SYSTEM AND COMPONENTS 9 Hours

Pumping theory - Pump classification - Construction and working of gear pumps, Vane pumps, Piston pumps - Construction and working of linear actuators - Special cylinder - Rotary actuator – Construction and operation of direction control valves (DCV), Pressure control valve, Flow control valve – Construction and operation of accumulators, Intensifiers

.

Unit III HYDRAULIC CIRCUITS 9 Hours

Hydraulic symbols - Hydraulic circuits using 4/2 and 4/3 DCVs – Electro Hydraulic circuits - Speed control circuits - Sequencing circuit - Regenerative circuit - Accumulator circuit – Application of intensifier - Hydraulic circuit for Grinding Machine - Hydraulic braking in Automobiles.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit IV PNEUMATIC SYSTEM AND COMPONENTS 9 Hours

Properties of air – Compressor - Types of compressor - Construction and operation of air filter, air regulator and air lubricator - Pneumatic symbols - Pneumatic linear actuator - Rotary actuator - Constriction and working of pneumatic direction control valves and Flow controls valve.

Unit V PNEUMATIC CIRCUITS 9 Hours

Pneumatic circuits for single acting cylinder and Double acting cylinder using 3/2, 5/2 and 5/3 DCVs – Electro Pneumatic circuits - Cascade method for two Cylinders - Hydro-Pneumatic circuit - Material handling system circuit.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Explain the principles of fluid power system	Understand
CO2.	Describe the construction and working of hydraulic system and its components.	Understand
CO3.	Illustrate the working of valves, switches, actuators and industrial hydraulic circuits	Understand
CO4.	Summarize the working of components in pneumatic system	Understand
CO5.	Describe the pneumatic DCVs, pneumatic circuits and application	Understand

Text Book(s):

T1. Anthony Esposito, “Fluid Power with Applications”, 7th edition, Pearson education, 2014

T2. Srinivasan, R., “Hydraulic and Pneumatic Controls”, 2nd edition, Vijay Nicole Imprints,

Reference Book(s):

R1. Andrew Parr,”Hydraulics& Pneumatics”, Jaico Publishing House, 2014.

R2. Majumdar, “Oil Hydraulics: Principles and Maintenance”, Tata McGraw Hill, 2004.

R3. Majumdar, “Pneumatic system: Principles and Maintenance”, Tata McGraw Hill, 2014

Web References:

1. www.nptel.ac.in

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EIEC1001		Course Title: Robotics and Automation	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Control Systems

Course Objectives

The course is intended to:

1. Describe the anatomy of Robot
2. Explain the sources used to rum the Robot
3. Analyze kinematics and dynamic of robot
4. Develop the program to smooth run of Robot
5. Understand Robot operation used in various Industry application

Unit I Basic Concepts 9 Hours

Automation and Robotics – Asimov's laws of Robotics – Robot Anatomy – Basic components of Robot System – classification of Robots by configuration – Robot Motion – Precision of movements – End effectors.

Unit II Power Sources, Sensors and Drive system 9 Hours

Actuators – Hydraulic, Pneumatic and Electric drives – Mechanical power transmission system: Bearings, Gears, Belt and Chains – Sensors: Position, Velocity, tactile sensors, Proximity and range sensor – Machine vision: Sensing and digitizing, Image processing and application

Unit III Kinematics and Dynamics 9 Hours

Solution for direct and inverse kinematic problem – Robot dynamics – Jacobian work envelops – Robot trajectories – Manipulator path control – Robot cycle time analysis.

Unit IV Robot Programming 9 Hours

Methods of Robot programming – lead through programming methods – Robot program as a path in space – Motion interpolation – Wait, signal and delay commands – Branching – Capabilities and limitations – Robot programming examples for pick and place application using VAL.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit V Case studies **9 Hours**

Robots in manufacturing and non-manufacturing application – Robot Cell layout – Selection of Robot – Applications – Material handling, Processing operation, assembly and inspection.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Explain the various parts of robotics and its automation	Understand
CO2.	Identify the sensors and systems for developing a robot	Understand
CO3.	Derive kinematics and dynamic equation for functioning the robot	Understand
CO4.	Program a Robot using lead through methods.	Understand
CO5.	Describe the operations of Robot used in industrial automation	Understand

Text Book(s):

T1. MikellP.Groover, Nichols G.Ordy, "Industrial Robotics, Technology, Programming and Applications" McGraw hill, 2005

T2. Fu K.S, Gonzalez and Lee C.S.G, "Robotics Control, Sensing, vision and Intelligence",

Reference Book(s):

R1. Deb.S.R, "Robotics Technology and Flexible Machine Design", Tata McGraw Hill, 2012

Web References:

1. www.nptel.ac.in

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EIEN1020		Course Title: Power Plant Instrumentation	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Industrial Instrumentation
- Process Control

Course Objectives

The course is intended to:

1. Introduce the concept of different power generation techniques
2. Describe the various measurements in power plants
3. Apply the different control schemes in boiler side
4. Apply the different control schemes in furnace side
5. Illustrate the different control schemes in turbine

Unit I OVERVIEW OF POWER GENERATION 9 Hours

Survey of methods of power generation – hydro, thermal, nuclear, solar and wind power – Importance of instrumentation in power generation – Thermal power plant – Building blocks – Boiler Accessories– sub critical and supercritical boilers – Condensers – Cooling towers.

Unit II MEASUREMENTS & ANALYSERS IN POWER PLANTS 9 Hours

Measurement of feed water flow, air flow, steam flow and coal flow – Drum level measurement – Steam pressure and temperature measurement – Turbine speed and vibration measurement – Flue gas analyzer – Fuel composition analyzer.

Unit III BOILER CONTROL - I 9 Hours

Combustion of fuel and excess air – Firing rate demand – Steam temperature control – Control of deaerator – Drum level control: Single, two and three element control – Furnace draft control – implosion – flue gas dew point control – Trimming of combustion air – Soot blowing.

Unit IV BOILER CONTROL - II 9 Hours

Burners for liquid and solid fuels – Burner management system – Furnace safety interlocks – Coal pulverizer control – Combustion control for liquid and solid fuel fired boilers – air/fuel ratio control – fluidized bed boiler.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit V CONTROL OF TURBINE 9 Hours

Turbine - Types of steam turbines: impulse turbine, reaction turbine and compounding turbines – Turbine governing system – Automatic Load Frequency Control – Turbine oil system – Oil pressure drop relay – Oil cooling system.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Explain overview of different methods of power generation and boiler process	Understand
CO2.	Illustrate the various measurements involved in power generation plants.	Understand
CO3.	Apply the different control schemes in boiler side	Apply
CO4.	Apply the different control schemes in furnace side.	Apply
CO5.	Elucidate the different control schemes to monitor turbine parameters.	Understand

Text Book(s):

T1. Sam Dukelow, Control of Boilers, Second Edition, Instrument Society of America, 1991.

T2. Rajput R.K., A Text book of Power plant Engineering. Fifth Edition, Lakshmi Publications, 2013

Reference Book(s):

R1. Everett Woodruff , Herbert Lammers, Thomas Lammers, Steam Plant Operation,9th Edition McGraw Hill, 2012

R2. Krishnaswamy.K and Ponnibala.M., Power Plant Instrumentation, PHI Learning Pvt.Ltd., New Delhi, 2011

R3. Liptak B.G., Instrumentation in Process Industries, Chilton Book Company, 2005

R4. Jain R.K., Mechanical and Industrial Measurements, Khanna Publishers, New Delhi, 1999.

R5. P.K.Nag, Powerplant Engineering, Tata McGraw-Hill Education, 3rd edition, 2007

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Web References:

1. \ www.nptel.ac.in

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EIEN1021		Course Title: Instrumentation in Process Industries	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Engineering Chemistry
- Process Control
- Logic and Distributed Control System

Course Objectives

The course is intended to:

1. Explain about Petroleum production and the various equipment involved in the petrochemical industries.
2. Describe the chemical reactors and heat exchangers.
3. Illustrate the performance of the pumps and various control loops in Petrochemical Industry.
4. Explain about the Cement manufacturing process.
5. Elaborate the various instrumentation and control loops in Cement industry.

Unit I INTRODUCTION TO PETROLEUM 9 Hours

Petroleum exploration – production and refining – constituents of crude oil – P &I diagram of petroleum refinery – atmospheric distillation of crude oil – vacuum distillation process – thermal conversion process – control of distillation column – temperature control.

Unit II CHEMICAL REACTORS AND HEAT EXCHANGERS 9 Hours

Temperature control– pressure control – control of dryers – batch dryers – atmospheric and vacuum – continuous dryers – liquid to liquid heat exchangers – steam heaters – condensers – reboilers and vaporizers – evaporators– types of evaporators.

Unit III EFFLUENT AND WATER TREATMENT CONTROL 9 Hours

Centrifugal pump – On– Off control – pressure control – flow control – throttling control , rotary pumps – On– Off control – pressure control, reciprocating pump – On– Off control and throttling control – chemical oxidation – chemical reduction – naturalization – precipitation – biological control.

Unit IV INTRODUCTION TO CEMENT AND BINDING MATERIALS 9 Hours

History of binding materials and Cement-Classification of Cement Binders- Lime as Binder, cement and its importance in construction- Cement and its Raw Mill Composition- History of Cement manufacturing process- material composition of cement- various unit operation of cement manufacture- the present status and future of cement industry in India.

Unit V INSTRUMENTATION AND CONTROL IN CEMENT KILNS – CONVEYOR BELT INSTRUMENTATION 9 Hours

Automatic bagging and bottling – preheater – kiln feed control – kiln speed control – kiln draught control – combustion control – cooler control.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Explain about Petroleum production and the various equipments involved in the petrochemical industries.	Understand
CO2.	Describe the distillation column, reactor, heat exchangers and evaporators.	Understand
CO3.	Illustrate the performance of the pumps and various control loops in Petrochemical Industry.	Understand
CO4.	Familiarize with the Cement manufacturing process	Understand
CO5.	Explain the various instrumentation and control loops in Cement Industry.	Understand

Text Book(s):

T1. Dr. Ram Prasad, “Petroleum Refining Technology”, Khanna Publisher, 1stEdition, 2000.

T2. Liptak B.G, “Instrument Engineers Handbook”, Volume III, 2006.

T3. Waddams A.L., Chemicals from Petroleum, Butter and Janner Ltd., 1968

T4. F M Lea, Arnold, London “Chemistry of Cement and Concrete” 3rd Edition, 1970

Reference Book(s):

R1. Liptak. B. G, “Process Control” , Third edition , Chilton Book Company, Pennsylvania, 1995.

R2. Considine. D. M, “Process/Industrial Instruments and control Handbook”, McGraw Hill, 4th edition,1993.

R3. Robert. H, Perry, Green. D.W, and J.O. Maloney, Perry's – “Chemical Engineers Handbook”, McGraw Hill Inc, New York, 7th edition, 1998.

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Web References:

1. ∨ www.nptel.ac.in
2. www.scribd.com/doc/2336259/ABB-Oil-Gas-production-Hand-Book.
3. Norms for limestone exploration for cement manufacture: NCCBM

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

Approved in Academic Council meeting

BOS Convener

BOS Chairman

Course Code:19EIEN1022		Course Title: Industrial safety and standards	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Industrial Data Communication Networks

Course Objectives

The course is intended to:

1. Summarize basics of industrial safety.
2. Identify preventive and periodic maintenance.
3. To make review on the instruments used for measurement of basic process parameters like level, flow, pressure and temperature.
4. To explore the various types of analyzers used in industrial applications.
5. To make aware of basic concepts of safety instrumented system, standards.

Unit I BASICS OF INDUSTRIAL SAFETY 9 Hours

Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, Safety color codes. Fire prevention and firefighting, equipment and methods.

Unit II PERIODIC AND PREVENTIVE MAINTENANCE 9 Hours

Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, Definition, need, steps and advantages of preventive maintenance. Repair cycle concept and importance.

Unit III STANDARDS ORGANIZATION 9 Hours

Standards: Introduction, International and National Standards organization, IEC, ISO, IEEE, ISA, API, BIS, DIN and ANSI − API: Process Measurement and Instrumentation (APIRP551), recommended practice for installation of the instruments – flow, level, temperature, pressure - Process Instrument and Control (API RP554): performance requirements and considerations for the selection, specification, installation and testing of process instrumentation and control systems

Unit IV ISA STANDARDS 9 Hours

Documentation of Measurement and Control− Instruments and System (ISA 5): 5.1, 5.2, 5.3,

5.4, 5.5, 5.6, 5.7 − General Requirement for Electrical Equipment in Hazardous Location (ISA 12): 12.2, 12.4, 12.24, 12.29. Instrument Specification Forms (ISA20) − Measurement Transducers (ISA37)

Unit V ISA STANDARDS - CONTROL VALVE AND ACTUATOR 9 Hours

Control Valve Standards (ISA75): 75.01, 75.04, 75.05, 75.13, 75.14, 75.23, 75.24, 75.26. − Valve Actuator (ISA 96): 96.01, 96.02, 96.03, 96.04

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Ability to summarize basics of industrial safety.	Understand
CO2.	Ability to identify preventive and periodic maintenance.	Understand
CO3.	Ability to understand the role of standards organization.	Understand
CO4.	Ability to interpret and follow different standards while carrying out installation of sensors, transmitters, Industrial automation systems, PLC programming, documentation, equipment selection in hazardous area and instrument specification forms	Understand
CO5.	Ability to understand and follow different standards while performing control valve sizing, actuator sizing and orifice sizing etc.,	Understand

Text Book(s):

T1. Garg H P, Maintenance Engineering, S. Chand and Company, 1987.

T2. Higgins & Morrow, Maintenance Engineering Handbook, 8th Edition,2008.

T3. William Bolton, “Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering”, 5th Edition, PHI, 2013.

T4. ISA standard 75, “Control Valve Standards”, ISA, North Carolina, USA.

Reference Book(s):

R1. Audels, Pump-hydraulic Compressors, Mcgrew Hill Publication, 1978.

R2. Hans F. Winterkom, Foundation Engineering Handbook, Chapman & Hall London, 2013.

Web References:

1. https://nptel.ac.in/courses/117/105/117105079/
2. https://nptel.ac.in/courses/117/105/117105135/
3. https://nptel.ac.in/courses/117/104/117104020/

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	**CO. No.**	**Marks**	**Total**
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EIEN1023		Course Title: Industrial Internet of Things	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Embedded systems

Course Objectives

The course is intended to:

1. Indicate the various industrial revolutions and need for industry 4.0
2. Illustrate the design architecture and components of IoT.
3. Provide knowledge on communication protocols used IoT based solutions
4. Realize the opportunities, challenges brought about by Industry 4.0 and how organizations and individuals should prepare to reap the benefits
5. Demonstrate the application of IIoT

Unit I Introduction to IIoT 9 Hours

The Various Industrial Revolutions - Digitalisation and the Networked Economy -Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0- Comparison of Industry 4.0 Factory and Today's Factory - Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation

Unit II IoT building blocks 9 Hours

IoT Architecture, WoT and M2M - Physical & Logical IoT design Basics - IoT Enabling Technologies - IoT Levels and templates

System Design of Connected Devices: Embedded Devices, Embedded Hardware, Connected Sensors and Actuators, Controllers, Battery Life Conservation and designing with Energy Efficient Devices, SoCs, Single Chip Controllers with integrated Processing and Network Core with Hardware Crypto Engines.

Unit III IoT Communication protocols 9 Hours

Understanding Internet Protocols: Simplified OSI Model, Network Topologies, Standards, Types of Internet Networking - Ethernet, WiFi, Local Networking, Bluetooth, Bluetooth Low Energy (BLE), Zigbee, 6LoWPAN, Sub 1 GHz, RFID,NFC, Proprietary Protocols, Simplicity, Networking Design - Push, Pull and Polling, Network APIs.

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Unit IV Advanced design and challenges 9 Hours

IOT Specific Challenges and Opportunities- Advances Design Concepts for IOT - Software UX Design Considerations, Machine Learning and Predictive Analysis, Interactions, Inter-usability and Inter-operability considerations, Understanding Security in IOT Design, Design requirements of IOT Security Issues and challenges, Privacy, Overview of Social Engineering.

Unit V Case study 9 Hours

Smart Manufacturing – IIoT in oil and gas industry - Smart Cities- Precision healthcare- Precision mining.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Describe various industrial revolutions and role of industry4.0	Understand
CO2.	Summarize various components required to build IoT based application	Understand
CO3.	Explain the communication protocols suitable for IOT	Understand
CO4.	Describe the opportunities, challenges brought about by Industry 4.0 and how organisations and individuals should prepare to reap the benefits	Understand
CO5.	Appreciate the smartness in Smart Factories, Smart cities, smart products and other smart services	Understand

Text Book(s):

T1. Foundational Elements of an IOT Solution - The Edge, Cloud and Application

T2. Designing Connected Products, 1st Edition, Elizabeth Goodman, Alfred Lui, Martin Charlier, Ann Light, Claire Rowland

Reference Book(s):

R1. The Internet of Things (A Look at Real World Use Cases and Concerns), Kindle Edition, 2016, Lucas Darnell

R2. From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence: By Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand,

R3. Vijay Madisetti, ArshdeepBahga, “Internet of Things: A Hands-On Approach”

R4. Internet of Things (A Hands-on-Approach), by Vijay Madisetti and ArshdeepBahga, 1st

Web References:

1. https://nptel.ac.in/courses/117/105/117105079/
2. https://nptel.ac.in/courses/117/105/117105135/
3. https://nptel.ac.in/courses/117/104/117104020/

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

SOFTWARE ENGINEERING

Course Code:19CSEC1001		Course Title: Programming using JAVA	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites The student should have undergone the course(s):

- C Programming
- Data Structures and Algorithms

Course Objectives

The course is intended to:

1. Describe the distinct properties and features of Java.
2. Implement name spaces, concurrency and handle exceptional conditions.
3. Employ Java standard library functions.
4. Apply Java utility, input/output functions and file manipulators.
5. Develop Java applications using user interfaces and database connectivity.

Unit I Introduction 9 Hours

Overview of Java – Data types, operators, control flows –Class fundamentals, objects and constructors –Method overloading- argument passing, Returning objects, recursion – Method Overriding and Dynamic Method dispatch- Abstract class.

Unit II Packages, Exceptions and Threads 9 Hours

Packages and access protection – Interfaces and extending interfaces – Exception fundamentals and types – Try, catch, throw, throws and finally; Chained Exceptions – Thread model, Creating threads and thread priorities – Synchronization –Inter thread communication.

Unit III JAVA Utilities 9 Hours

String Handling –String Buffer class and functions – Library Functions – Math – Process – Clone – System Functions.

Unit IV Collections and I/O Streams 9 Hours

Collections – Classes and Interfaces – Iterators and User defined collections – String Tokenizer – Java I/O classes and Interfaces - Streams – Byte Streams - Character Streams – File concepts.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit V Exploring Swing **9 Hours**

Java Swing – Features –Components and Containers – Event handling – Exploring Swing – Menus – Java Database Connectivity.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Describe the distinct properties and features of Java.	Understand
CO2: Implement name spaces, concurrency and handle exceptional conditions inprograms.	Apply
CO3: Employ Java standard library functions for solving complex problems.	Apply
CO4: Apply Java utility, input/output functions and file manipulators	Apply
CO5: Develop Java applications using user interfaces and database connectivity	Apply

Text Book(s):

T1. Herbert Schildt, “Java the Complete Reference”, Mcgraw Hill EducationNinth Edition, 2014

T2. Mahmoud Parsian, “JDBC Metada, MySQL and Oracle Recipes: A Problem-Solution Approach”, Apress Publications, 2006

Reference Book(s):

R1. Bart Baesens, Aimee Backiel, SeppeVandenBrocke, “Beginning JavaProgramming: The Object Oriented Approach”, John Wiley & Sons, 2015.

R2. Daniel Liang, “Introduction to Java Programming, Comprehensive Version”, Pearson Education, 9th Edition, 2014.

R3. James M Slack, Programming and Problem solving with JAVA, ThomsonLearning, 2002.

R4. C Thomas Wu, An Introduction to Object Oriented programming with Java, Tata McGrawHill, 2005.

R5. Cay S. Horstmann and Gary Cornell, “Core Java: Volume I – Fundamentals”, 8th Edition, Sun Microsystems Press, 2008.

Web References:

1. https://docs.oracle.com/javase/tutorial/java/index.html
2. http://javabeginnerstutorial.com/core-java/
3. http://www.w3schools.in/java/

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Articulation Matrix

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	PSO 1	PSO2
CO1	2	1	-	-	-	-	-	1	-	1	-	-	1	-
CO2	3	2	1	1	-	-	-	1	-	1	-	-	1	-
CO3	3	2	1	1	-	-	-	1	-	1	-	-	1	-
CO4	3	2	1	1	-	-	-	1	-	1	-	-	1	-
CO5	3	2	1	1	-	-	-	1	-	1	-	-	1	-

High-3; Medium-2;Low-1

Assessment pattern:

	Assessment Component	**CO .No.**	**Marks**	**Total**
Continuous Assessment	CCET 1	1,2	50	30
	CCET 2	3,4	50	
	CCET 3	5	50	
	Tutorial/ Quiz/ Assignment	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

Approved in Academic Council meeting

BOS Convener

BOS Chairman

Course Code:19CSEC1002		Course Title :Data Mining And Analytics	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites: The student should have undergone the course(s):

- C Programming
- Data Structures and Algorithms

Course Objectives

The course is intended to:

1. Select the appropriate pre-processing technique.
2. Relate the techniques of association rule.
3. Evaluate the classification algorithms.
4. Apply the clustering algorithms.
5. Analyze the requirements for a big data analytics.

Unit I Data Preprocessing **9 Hours**

Data Mining Overview – Data Objects and Attribute Types – Data Visualization. Data Pre-processing: Data Cleaning – Data Integration – Data Reduction – Data Transformation and Data Discretization.

Unit II Association **9 Hours**

Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and Methods –Basic Concepts – Frequent Item set Mining Methods – Pattern Evaluation Methods. Advanced Pattern Mining: Pattern Mining: A Road Map – Pattern Mining in Multilevel, Multidimensional Space.

Unit III Classification **9 Hours**

Basic Concepts: Decision Tree Induction – Bayes Classification Methods – Rule Based Classification – Model Evaluation and Selection – Techniques to Improve Classification Accuracy.

Unit IV Clustering **9 Hours**

Cluster Analysis: Partitioning Methods – Hierarchical Methods – Density Based Methods – Grid Based Methods – Evaluation of Clustering.

Unit V Introduction to Big Data **9 Hours**

Introduction to Big Data: Classification of Digital Data – Characteristics, Evolution and Definition of Big data - Challenges with Big Data – Traditional Business Intelligence (BI) vs Big Data – The Big Data Technology Landscape: Hadoop. Introduction to Hadoop: Hadoop Overview – Hadoop Distributors - Hadoop Distributed File System.

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO 1. Choose the appropriate pre-processing technique to solve the given problem.	Apply
CO 2. Apply the techniques of association rule to real world data.	Apply
CO 3. Evaluate the classification algorithms with respect to their accuracy.	Apply
CO 4. Apply the clustering algorithms to group the real world data.	Apply
CO 5. Analyze the requirements for a big data analytics system for the organization.	Apply

Text Book(s):

T1. Jiawei Han, MichelineKamber, Jian Pei, "Data Mining: Concepts and Techniques", 3rd Edition, Elsevier, 2012.

T2. SeemaAcharya, SubhashiniChellappan, "Big Data and Analytics", 1st Edition, Wiley India, 2015.

Reference Book(s):

R1. Jure Leskovec, AnandRajaraman, Jeffery David Ullman, "Mining of Massive Datasets", 2nd Edition, Cambridge University Press, 2014.

R2. Ian H.Witten, Eibe Frank, Mark A.Hall, "Data Mining: Practical Machine Learning Tools and Techniques", 3rd Edition, Elsevier, 2011.

R3. EMC Education Services, "Data Science and Big Data Analytics", Wiley, 2015.

R4. DT Editorial Services, "Black Book- Big Data (Covers Hadoop 2, MapReduce, Hive, Yarn, PIG, R, Data visualization)", Dream tech Press edition 2016

R5. G. K. Gupta, "Introduction to Data Mining with Case Studies", Eastern Economy Edition, Prentice Hall of India, 2006.

Web References:

1. http://hanj.cs.illinois.edu/bk3/bk3_slidesindex.html
2. http://www.mmds.org/
3. http://www.kdnuggets.com/tutorials/index.html

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Articulation Matrix

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	PSO 1	PSO 2
CO1	3	2	1	1	-	-	-	1	-	1	-	-	1	-
CO2	3	2	1	1	-	-	-	1	-	1	-	-	1	1
CO3	3	2	1	1	-	-	-	1	-	1	-	-	1	-
CO4	3	2	1	1	-	-	-	1	-	1	-	-	1	1
CO5	3	2	1	1	-	-	-	1	-	1	-	-	1	-

High-3; Medium-2;Low-1

Assessment pattern:

	Assessment Component	**CO .No.**	**Marks**	**Total**
Continuous Assessment	CCET 1	1,2	50	30
	CCET 2	3,4	50	
	CCET 3	5	50	
	Tutorial/ Quiz/ Assignment	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

Approved in Academic Council meeting

BOS Convener

BOS Chairman

Course Code:19CSEC1003		Course Title: Software Testing	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites The student should have undergone the course(s):

- C Programming
- Data Structures and Algorithms

Course Objectives

The course is intended to:

1. Describe the software testing principles and its characteristics.
2. Choose the appropriate testing for software development.
3. Design Test cases suitable for a software development in various domains.
4. Justify the importance of planning, documenting and validating the test plan.
5. Illustrate the need for automatic testing tools.

Unit I Testing Fundamentals **9 Hours**

Introduction to testing as Engineering Activity –Testing Fundamentals: Basic Definitions- Testing principles-Tester's role –Defects, Hypotheses and Tests.

Unit II Levels of Testing **9 Hours**

The need for levels of Testing- Unit Test: Functions, Procedures, Classes, and Methods as Units- Unit Test: The Need for Preparation- Unit Test Planning- Designing the Unit Tests- Running the Unit Tests and Recording Results- Integration Test: Goals- Integration Strategies for Procedures and Functions- Integration Strategies for Classes- Designing Integration Tests- Integration Test Planning- System Test: The Different Types- Regression Testing- Alpha, Beta, and Acceptance Tests.

Unit III Designing Test Cases **9 Hours**

Test case design strategies-Using Black Box approach to Test Case design-Random Testing – Equivalence class partitioning –Boundary value Analysis-Cause effect testing and state transition testing-Error Guessing - Using White Box Approach to Test case design – Test Adequacy Criteria –Coverage and Control Flow Graphs – Covering Code Logic – Paths – Additional test design approaches- code complexity testing – Evaluating Test Adequacy Criteria.

Unit IV Test Management **9 Hours**

Test Planning: Preparing a plan – scope management – deciding test strategy – responsibilities –resource requirements – test deliverables –testing tasks – Test management: standards – infrastructure management- People management – product release - Test Process – Test Reporting.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit V Test Automation **9 Hours**

Test Automation – Terms – Skills required – Scope of automation- Design and Architecture for Automation – Process Model – Selecting Test tools – automation for extreme Programming- Test Metrics and Measurements.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Describe the software testing principles and its characteristics.	Understand
CO2:Choose the appropriate testing during the phases of software development.	Apply
CO3:Design Test cases suitable for a software development in various domains.	Apply
CO4:Justify the importance of planning, documenting and validating thetest plan.	Apply
CO5:Illustrate the need for automatic testing tools.	Apply

Text Book(s):

T1.Ilene Burnstein,"Practical Software Testing: A Process-Oriented Approach", Springer International Edition, 2013

T2.Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson Education, 2006.

Reference Book(s):

R1.Ron Patton, "Software Testing", Sams Publishing, Pearson Education, 2nd Edition, 2009

R2.Boris Bezier, "Software Testing Techniques",Dreamtech,2nd Edition, Reprint 2009

R3.Aditya P. Mathur, "Foundations of Software Testing: Fundamental Algorithms and Techniques",Pearson Education, 2008.

R4.Edward Kit," Software Testing in the Real World – Improving the Process", Pearson Education, 1995.

R5.RenuRajani, Pradeep Oak, "Software Testing – Effective Methods, Tools and Techniques", Tata McGraw Hill, 2004.

Web References:

1. 1.http://nptel.ac.in/courses/106105150/
2. Lecturehttps://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-00-introduction-to-computer-science-and-programming-fall-2008/video-lectures/lecture-11/
3. http://www.testingtools.com/

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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	PS O1	PSO2
CO 1	2	1	-	-	-	-	-	1	-	1	-	-	1	1
CO 2	3	2	1	1	-	-	-	1	-	1	-	-	1	1
CO 3	3	2	1	1	-	-	-	1	-	1	-	-	1	1
CO 4	3	2	1	1	-	-	-	1	-	1	-	-	1	1
CO 5	3	2	1	1	-	-	-	1	-	1	-	-	1	1

High-3; Medium-2;Low-1

Assessment pattern:

	Assessment Component	CO .No.	Marks	Total
Continuous Assessment	CCET 1	1,2	50	30
	CCET 2	3,4	50	
	CCET 3	5	50	
	Tutorial/ Quiz/ Assignment	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

Approved in Academic Council meeting

BOS Convener

BOS Chairman

Course Code:19CSEC1004		Course Title: Database Management System Concepts	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week)3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites: The student should have undergone the course(s):

- C Programming
- Data Structures and Algorithms

Course Objectives

The course is intended to:

1. Construct the Entity Relationship Model.
2. Convert ER diagram to relational database schema.
3. Relate the normalization technique to obtain the relational database design.
4. Choose a query evaluation and optimization technique.
5. Execute the online transactions and control concurrency.

Unit I An Overview of Database Systems 9 Hours

Introduction – Database system applications, Database versus file systems, View of data, Data models, Database languages, Database users and administrators, Database system structure, Entity – Relationship Model – Basic concepts, Constraints, Keys, Design issues, ER diagram, Weak entity sets, Design of an ER database schema.

Unit II Data Models 9 Hours

Relational model - Structure of relational databases – The relational algebra –Tuple relational calculus, Domain relational calculus, SQL – Background, Basic structure, Set operations, Aggregate functions, Null values, Nested sub queries, Views, Joined relations, DDL, Embedded SQL, Dynamic SQL, Integrity and security – Domain constraints, Referential integrity, Assertions, Triggers.

Unit III Relational Databases Design 9Hours

Relational database design – First normal form, Second normal form - Pitfalls in relational database design, Functional dependencies, Decomposition, Desirable properties of decomposition, BCNF, Third normal form, Fourth normal form.

Unit IV Indexing and Querying 9 Hours

Indexing and hashing – Basic concepts, Ordered indices, B+ tree index files, B tree index files – Static hashing, Dynamic hashing, Comparison of ordered indexing and hashing, Multiple key access - Query Processing – Overview, Measures of query cost, Selection operation, Sorting, Join operation - Query Optimization – Overview, Estimating statistics of expression results, Transformation of relational expressions

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Unit V Transaction and Concurrency Control **9 Hours**

Transactions – Transaction concept, Transaction state, Implementation of atomicity and durability, Concurrent executions, Serializability, Recoverability, Testing for serializability - Concurrency control – Lock based protocols, Timestamp based protocols, Validation based protocols, Multiple granularity, Multiversion schemes.

Course Outcomes	**Cognitive Level**
At the end of this course, students will be able to:	
CO1: Construct the Entity Relationship Model for obtaining the structure of a database	Apply
CO2: Convert ER diagram to relational database schema	Apply
CO3: Apply the normalization technique to obtain the relational database design.	Apply
CO4: Select a query evaluation and optimization technique for a given query.	Apply
CO5: Implement online transactions and control concurrency	Apply

Text Book(s):

T1. Silberschatz, Korth, Sudarshan, "Database System Concepts", 6th Edition, McGrawHill International Edition, New Delhi 2010

T2. Date C.J., Kannan A, Swaminathan S, "An introduction to database systems", 8th Edition, Pearson Education, New Delhi, 2009.

Reference Book(s):

R1. Elmasri, R., Navathe, S.B., "Fundamentals of database systems", 6th Edition, Pearson Education, New Delhi, 2010.

R2. Raghu Ramakrishnan, Johannes Gehrke. "Database Management Systems", 3rd Edition, McGrawHill International Edition, New Delhi 2007.

R3. Bipin C Desai, "An Introduction to Database Systems", Eleventh Edition, Galgotia Publications Pvt. Ltd., New Delhi, 2001.

R4. Bipin C Desai, "An Introduction to Database Systems", 11th Edition, Galgotia Publications Pvt. Ltd., New Delhi, 2001.

R5. JefreyD.Ulman and Jenifer Widom, "A First Course in Database Systems", 3rd Edition, Prentice-Hall, New Delhi, 2007.

R6. C.J.Date, A.Kannan and S.Swamynathan, "An Introduction to Database Systems", 8th Edition, Pearson Education, 2006.

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Web References:

1.https://onlinecourses.nptel.ac.in/noc16_ma05

2. http://codex.cs.yale.edu/avi/db-book/db6/slide-dir/

3. www.nptelvideos.in/2012/11/database-management-system.html

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2
CO 1	3	2	1	1	-	-	-	1	-	1	-	-	1	-
CO 2	3	2	1	1	-	-	-	1	-	1	-	-	1	-
CO 3	3	2	1	1	-	-	-	1	-	1	-	-	1	-
CO 4	3	2	1	1	-	-	-	1	-	1	-	-	1	-
CO 5	3	2	1	1	-	-	-	1	-	1	-	-	1	-

High-3; Medium-2;Low-1

Assessment pattern:

	Assessment Component	**CO .No.**	**Marks**	**Total**
Continuous Assessment	CCET 1	1,2	50	30
	CCET 2	3,4	50	
	CCET 3	5	50	
	Tutorial/ Quiz/ Assignment	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19CSEN1001		Course Title: Introduction to Python Programming	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites The student should have undergone the course(s):

- C Programming
- Data Structures and Algorithms

Course Objectives

The course is intended to:

6. Identify various syntax and operators in python programming.
7. Illustrate control flow, library functions and file operations.
8. Implement object oriented features in python.
9. Apply database connectivity technique.
10. Design user interfaces.

Unit I Programming Constructs **9 Hours**

Basics: Data Types – Declaring variables - Usage of Operators- Special functions - Python standards in Coding. Sequential Statements - Control statements - Performing Iterations – Strings - Tuples-Sets - Dictionary.

Unit II Functions **9 Hours**

Functions: Defining & Calling function- Passing arguments to functions: Mutable & Immutable Data Types - Different types of arguments-Recursion-Scope of variables. Standard Library: Math, String, List, Date & Time Modules. Files: Open- Close- Write- Read.

Unit III OOP in python **9 Hours**

Classes - Objects – Modifiers - Method Invocation – Inheritance – Polymorphism - Packages - Scopes and Namespaces - Interface - Exception Handling.

Unit IV Database Programming **9 Hours**

DBM files - Pickled objects - Shelve files - Object Oriented Database - SQL Database interfaces

Unit V GUI Programming **9 Hours**

GUI basics-Working with TKinter library- Adding widgets-Binding Events- Message and Entry- Check and Radio button- Menus and list-Canvas

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Outcomes	Cognitive Level
At the end of this course, students will be able to:	
CO6: Identify various syntax and operators in python programming for writing simpleprograms.	Apply
CO7: Illustrate control flow, library functions and file operations using user-defined and pre-defined functions.	Apply
CO8: Implement object oriented features in python for writing reusable codes.	Apply
CO9: Apply database connectivity technique for real time applications.	Apply
CO10: Design user interfaces using python based GUI components	Apply

Text Book(s):

T1. Peter Wentworth, Jeffrey Elkner, Allen B. Downey, and Chris Meyers, "How to ThinkLike a Computer Scientist: Learning with Python", 3rd Edition, O'Reilly, 2014.

T2. MarkLutz,"Powerful Object Oriented Programming Python", 4th Edition, O'Reilly2012.

Reference Book(s):

R1. Mark Lutz, "Learning Python, Powerful OOPs", O'Reilly, 2011.

R2. Zelle, John M, "Python Programming: An Introduction to Computer Science", Franklin Beedle& Associates, 2003.

R3. Budd, Timothy, "Exploring Python", McGraw-Hill Science, 2009.

R4. Matplotlib for Python Developers: Effective techniques for data visualization with Python, 2nd Edition, Kindle Edition.

Web References:

1. 1.Python tutorial URL:https://docs.python.org/3/tutorial/
2. Advanced Python URL:https://www.learnpython.org/
3. Python basic tutorial URL:www.pyschools.com/
4. 4.Data Visualization https://www.datacamp.com/courses/introduction-to-data-visualization-with-python/

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2;Low-1

Assessment Pattern:

	Assessment Component	**CO. No.**	**Marks**	**Total**
Continuous Assessment	CCET I	1,2	50	20
	CCET II	3,4	50	
	CCET III	5	50	
	Continuous Assessment – Practical	1,2,3,4,5	75	10
	Final Assessment – Practical	1,2,3,4,5	50	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EEEC1004	Course Title: Disaster Management		
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Communication Skills - I
- Communication Skills - II

Course Objectives

The course is intended to:

1. Understand the natural and manmade disasters
2. Illustrate the environment hazards and level of toxicology
3. Describe the causes and effects of Earthquake and Tsunami formation
4. Elucidate the causes and effects of Cyclone formation
5. Explain about modern technological tools in disaster management

Unit I IINTRODUCTION 9 Hours

Disaster- Disaster management- Disaster prevention and preparedness measures-Types of Disaster – Causal factor of Disaster – Natural, Manmade, creeping disaster-Disaster in the Indian context various measures – Disaster related policy goals – United Nations Development Program (UNDP) – United Nations Disaster Relief Organization (UNDRO) – Govt. of India.

Unit II ENVIRONMENTAL DISASTER 9 Hours

Environmental hazards – Typology – Assessment and response – the strategies– the scale of disaster – Vulnerability – Disaster trends – Paradigms towards a balanced view – Chemical hazards and Toxicology – Biological hazards –Hazard caused by world climate change – Risk analysis – other technological disasters.

Unit III EARTHQUAKE AND TSUNAMI 9 Hours

Earthquake – Causes of earthquake – Earthquake scales – Measures of earth –quake – Magnitude and Intensity – Earthquake Recurrence hazard assessment –Seismic zoning – Earthquake disaster mitigation – Component research focus –Forecasting techniques and Risk analysis – Tsunami – Causes of Tsunami –Effects of Tsunami – Tsunami warning system – Tsunami warning system in India – International status of Tsunami warning and communication system –Tsunami warning centers – Pacific Tsunami Warning Center (PTWC) – Pacific Tsunami Warning System (PTWS) components – Institutional arrangements and design criteria for Tsunami mitigation.

Unit IV CYCLONE 9 Hours

Tropical cyclone - Warning system – Protection of buildings from cyclones - Precaution before and during cyclones – Tropical cyclone warning strategy in India – Cyclone related problems – aerial survey – Management strategy – risk reduction by public awareness and education.

Unit V APPLICATION OF TECHNOLOGY IN DIASTER MANAGEMENT 9 Hours

Hazard map – Multi hazard mapping – Application of satellites in Disaster Management – Application of remote sensing in forecasting and disaster relief –Use of digital image processing in disaster management – GIS in disaster management – Spatial data – GIS data base design – Convention mapping concepts and Coordinate system – Methods of spatial Interpolation in GIS.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Distinguish the natural and manmade disasters	Understand
CO2.	Explain the environment hazards and level of toxicology	Understand
CO3.	Explain the causes and effects of Earthquake and Tsunami formation	Understand
CO4.	Elucidate the causes and effects of Cyclone formation	Understand
CO5.	Describe about modern technological tools in disaster management	Understand

Text Book(s):

T1. PardeepSahni, Madhavimalalgoda and Ariyabandu, “Disaster risk reduction in south Asia”, PHI 2010.

T2. AmitaSinhal, “Understanding earthquake disasters” TMH, 2010.

Reference Book(s):

R1. Jeff Groman, “The atlas of Natural Disasters”, Friedman/Fairfax publishing, 2002

R2. 3.Jaikrishna and Chandrasekar, Elements of Earthquake Engineering, 2007

Web References:

1. www.nptel.ac.in

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19MEEC1014		Course Title: Engineering Economics and Cost Analysis	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Engineering Mathematics - I
- Engineering Mathematics - II

Course Objectives

The course is intended to:

1. Explain different cost and calculate the breakeven point for a given business situation
2. Understand different interest formulae and their application in decision making process.
3. Evaluate present value, future value and annual worth analysis on one or more economic alternatives.
4. Determine the economic value of an asset and develop a better replacement policy for a given equipment.
5. Evaluate the depreciation of equipment per period.

Unit I INTRODUCTION TO ECONOMICS 9 Hours

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics - Elements of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis- V ratio, Elementary economic Analysis

Unit II VALUE ENGINEERING 9 Hours

Make or buy decision, Value engineering – Function, aims, and Value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor-Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods with problems.

Unit III CASH FLOW 9 Hours

Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost

dominated cash flow diagram), rate of return method, Examples in all the methods.

Unit IV REPLACEMENT AND MAINTENANCE ANALYSIS 9 Hours

Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

Unit V DEPRECIATION 9 Hours

Depreciation- Straight line method of depreciation, declining balance method of depreciation- Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation- Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset. Case study

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Categorize different cost and calculate the breakeven point for a given business situation	Understand
CO2.	Apply different interest formulae and their application in decision making process.	Apply
CO3.	Evaluate present value, future value and annual worth analysis on one or more economic alternatives.	Evaluate
CO4.	Determine the economic value of an asset and develop a better replacement policy for a given equipment.	Understand
CO5.	Evaluate the depreciation of equipment per period.	Evaluate

Text Book(s):

T1. Panneerselvam R, “Engineering Economics”, Prentice Hall of India Ltd, NewDelhi, 2014

T2. Chan S.Park, “Contemporary Engineering Economics”, Prentice Hall of India, 2010.

Reference Book(s):

R1. Donald.G. Newman, Jerome.P.Lavelle, “Engineering Economics and analysis” Engg. Press, Texas, 2010.

R2. Degarmo, E.P., Sullivan, W.G and Canada, J.R, “Engineering Economy”, Macmillan, New York, 2010.

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Web References:

1. www.nptel.ac.in

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

Approved in Academic Council meeting

BOS Convener

BOS Chairman

Course Code:19MEEC1015		Course Title: Principles of Management	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Communication Skills - I
- Communication Skills - II

Course Objectives

The course is intended to:

1. Describe the overview of management
2. Explain the planning process, policy and decision making
3. Explain the human resource structure and policy
4. Explain the motivational theories for management
5. Explain the control techniques for operations

Unit I OVERVIEWOFMANAGEMENT 9 Hours

Organization – Management – Role of managers – Evolution of Management thought – Organization and the environmental factors – Managing globally – Strategies for International Business.

Unit II PLANNING 9 Hours

Nature and Purpose planning – Planning process – Types of plans – Objectives – Managing by objective (MBO) Strategies – Types of strategies – Policies – Decision Making – Types of decision –Decision Making Process - Rational Decision making Process – Decision Making under different conditions

Unit III ORGANISING 9 Hours

Nature and purpose of organizing – Organization structure – Formal and informal groups / organization – Line and Staff authority – Departmentation – Span of Control – Centralization and Decentralization – Delegation of authority – Staffing – Selection and Recruitment – Orientation Career Development – Career stages – Training – Performance Appraisal.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit IV DIRECTING 9 Hours

Creativity and Innovation – Motivation and Satisfaction – Motivation Theories Leadership – Leadership theories – Communication – Hurdles to effective communication – Organization Culture – Elements and types of culture – Managing cultural diversity.

Unit V CONTROLLING 9 Hours

Process of controlling – Types of control – Budgetary and non-budgetary control techniques – Managing Productivity – Cost Control – Purchase Control – Maintenance Control – Quality Control – Planning operations.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Describe the overview of management	Understand
CO2.	Explain the planning process, policy and decision making	Understand
CO3.	Explain the human resource structure and policy	Understand
CO4.	Explain the motivational theories for management	Understand
CO5.	Explain the control techniques for operations	Understand

Text Book(s):

T1. Stephen P. Robbins and Mary Coulter, “Management”, Prentice Hall of India, 8th edition, 2009.

T2. 2.Charles W.L Hill, Steven L McShane, “Principles of Management”, Mcgraw Hill Education, 2007.

Reference Book(s):

R1. Hellriegel, Slocum & Jackson, “Management – A Competency Based Approach”, Thomson South Western, 10th edition,2007.

R2. Harold Koontz, Heinz Weihrich and mark V Cannice, “Management – A global & Entrepreneurial Perspective”, Tata Mcgraw Hill, 12th edition, 2007..

R3. Andrew J. Dubrin, “Essentials of Management”, Thomson Southwestern, 7th edition, 2007.

Web References:

1. http://www.managementstudyguide.com/all-subjects.htm

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EIEN1024		Course Title: Introduction to Total Quality Management	
Course Category: Professional Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Engineering Mathematics - I
- Engineering Mathematics - II

Course Objectives

The course is intended to:

1. Understand the breakeven point for a given business situation
2. Explain the application in decision making process.
3. Understand annual worth analysis on one or more economic alternatives.
4. Elucidate asset and develop a better replacement policy for a given equipment.
5. Evaluate the depreciation of equipment per period.

Unit I INTRODUCTION TO ECONOMICS 9 Hours

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics - Elements of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis- V ratio, Elementary economic Analysis

Unit II VALUE ENGINEERING 9 Hours

Make or buy decision, Value engineering – Function, aims, and Value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor-Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods with problems.

Unit III CASH FLOW 9 Hours

Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

Unit IV REPLACEMENT AND MAINTENANCE ANALYSIS 9 Hours

Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

Unit V DEPRECIATION 9 Hours

Depreciation- Straight line method of depreciation, declining balance method of depreciation- Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation- Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset. Case stud

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Categorize different cost and calculate the breakeven point for a given business situation	Understand
CO2.	Apply different interest formulae and their application in decision making process.	Apply
CO3.	Evaluate present value, future value and annual worth analysis on one or more economic alternatives.	Evaluate
CO4.	Determine the economic value of an asset and develop a better replacement policy for a given equipment.	Understand
CO5.	Evaluate the depreciation of equipment per period.	Understand

Text Book(s):

T1. Panneerselvam R, “Engineering Economics”, Prentice Hall of India Ltd, NewDelhi, 2014

T2. Chan S.Park, “Contemporary Engineering Economics”, Prentice Hall of India, 2010.

Reference Book(s):

R1. Donald.G. Newman, Jerome.P.Lavelle, “Engineering Economics and analysis” Engg. Press, Texas, 2010.

R2. Degarmo, E.P., Sullivan, W.G and Canada, J.R, “Engineering Economy”, Macmillan, New

R3. Grant.E.L.,Ireson.W.G., and Leavenworth, R.S, “Principles of Engineering Economy”, Ronald Press, New York,1990.

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Web References:

1. https://en.wikipedia.org/wiki/Engineering_economics
2. https://en.wikipedia.org/wiki/Cost%E2%80%93benefit_analysis

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

Approved in Academic Council meeting

BOS Convener

BOS Chairman

Open Electives

Course Code: 19EIOC1001	Course Title: Industrial Measurement Systems		
Course Category: Open Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Summarize the types, static and dynamic characteristics of Transducers.
2. Explain the principle of various types of special transducers.
3. Explain the various techniques for pressure and temperature measurement.
4. Describe the different systems for load, speed and torque measurement.
5. Explain the various techniques for flow measurement.

Unit I Transducers 9 Hours

Block diagram of measurement system - Units and standards - Classification of errors – Classification of transducers – Static and Dynamic characteristics of transducers – Concept of Resistive, Capacitive and Inductive transducer.

Unit II Special Transducers 9 Hours

Piezoelectric transducer – Strain gauge - Hall Effect transducer – Magneto elastic load cell - Digital transducers : linear and rotary type – Fibre optic sensors – magnetometer – Nano sensor – MEMS - Smart Sensor

Unit III Pressure and Temperature Measurement 9 Hours

Elastic type pressure gauges, Bourdon tube and diaphragms with strain gauge- Capacitive type pressure gauge - Measurement of vacuum - -Thermal conductivity gauge - lonization gauges - Resistance Thermometer – 3 wire & 4 wire RTD - Bimetallic thermometers – Thermocouples - Optical pyrometers - Fiber optic sensor for temperature measurement.

Unit IV Level, Load and Speed Measurement 9 Hours

Float gauges - Displacer type –D/P methods - Boiler drum level measurement: – Capacitive sensors – Nucleonic gauge - Ultrasonic gauge –RADAR measurement – Speed & Torque Measurement: Magnetic and Optical Method – Strain gauge type load cell, torque sensor, accelerometer.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit V Flow Measurement 9 Hours

Expression for flow rate through restriction - Orifice plate -Venturi tube – Flow nozzle –– Positive displacement flow meters – Nutating disc and Oval gear flow meters – Rotameter - Mass flow meters: Thermal and Coriolis type – Electromagnetic flow meter – Ultrasonic flow meters.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Summarize the types, static and dynamic characteristics of Transducers.	Understand
CO2.	Explain the principle of various types of special transducers.	Understand
CO3.	Select a suitable pressure and temperature measuring instruments for the given application.	Understand
CO4.	Explain the different methods of measurement of Load, speed, torque, measuring instruments.	Understand
CO5.	Select a suitable flow measuring instruments for the given application.	Understand

Text Book(s):

T1. John P. Bentley, Principles of Measurement Systems, III Edition, Pearson Education, 2015.

T2. Doebelin E.O. and Manik D.N., Measurement Systems – Applications and Design, Special Indian Edition, Tata McGraw Hill Education Pvt. Ltd., 2017.

Reference Book(s)

R1. D. Patranabis, Sensors and Transducers, 2nd edition, Prentice Hall of India, 2013.

R2. B.C. Nakra and K.K.Chaudhary, “Instrumentation, Measurement and Analysis”, McGraw Hill Education India Private Limited, 4th edition,2016

R3. W.Bolton, Engineering Science, Elsevier Newnes, 5th Edition, 2006

Web References:

1. nptel.ac.in/courses/112103174
2. http://nptel.ac.in/courses/108105064
3. http://nptel.ac.in/courses/112106140

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

Approved in Academic Council meeting

BOS Convener

BOS Chairman

Course Code: 19EIOC1002	Course Title: Electronics System Design		
Course Category: Open Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Provide knowledge about special diode from PN junction diodes.
2. To learn the construction and characteristics of BJT.
3. To learn the construction and characteristics of Op-amp.
4. To understand the working of 555 timer IC and Voltage regulator IC.
5. To learn the system architecture using existing product design.

Unit I Basic Diodes 9 Hours

PN junction –forward and reverse bias conditions-ideal diode, practical diode-V-I characteristics of a diode- diode specifications – Diode equivalent circuits -zener diode- Schottky Diode-Light Emitting Diodes-Photo diodes- Diode numbers and Lead identification-Diode testing.

Unit II Bipolar junction transistor 9 Hours

Bipolar junction transistor and its types- NPN and PNP Transistor – Transistor operation – Configuration of BJT – Input and output characteristics of CE, CB and CC configurations- Transistor as a switch – Transistor specifications- lead identification – package types- transistor testing.

Unit III Operational Amplifier 9 Hours

Introduction to Integrated Circuits – Types of IC packages - OPAMP Internal blocks, Ideal OPAMP characteristics,IC741 - Inverting amplifier, Non Inverting amplifier- design of Comparators, Zero Crossing Detector- Voltage follower.

Unit IV special function IC 9 Hours

Timer IC555, Implementing a MonostableMultivibrator and AstableMulti vibrator -voltage regulator IC78XX, IC79xx, IC317- Application using IC555 and voltage regulator.

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit V System Design Techniques 9 Hours

LED interfacing – Relay interfacing using transistor driver circuit- Opto-isolator- LCD interfacing, stepper motor interfacing, DC motor interfacing- Design Methodologies, Requirement Analysis, Specification, System Analysis and Architecture Design.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Differentiate special diode from PN junction diodes.	Understand
CO2.	Explain the construction and characteristics of BJT.	Understand
CO3.	Explain the construction and characteristics of Op-amp.	Understand
CO4.	Describe the working of 555 timer IC and Voltage regulator IC.	Understand
CO5.	Describe the system architecture using existing product design.	Understand

Text Book(s):

T1. V.Jegatheesan, K.VInothkumar and R Saravanakumar, “Basics of electrical and Electronics Engineering”, Wiley India, 1st Edition, 2011.

T2. Muhammad Ali Mazidi, RolinD.Mckinlay, Danny Causery, “PIC Microcontroller and Embedded systems using assembly and C PIC18”, 2nd edition, Micro Digital Ed, 2016.

Reference Book(s):

R1. Wayne Wolf, “Computers as Components: Principles of Embedded Computing System Design”, Morgan Kaufman Publishers, First Indian Reprint 2001

R2. John B Peatman, “Designing with PIC Micro Controller”, 1 st Edition, Pearson, 2003

R3. MykePredko, ”Programming and Customizing the PIC Microcontroller” 3rd edition Tata McGraw Hill Publishing Company Ltd, 2011

Web References:

1. NPTEL Video: https://www.youtube.com/watch?v=WUYAjxnwjU4
2. 2.https://www.youtube.com/watch?v=z3VEZPwl5gA&list=PLE7VH8RC_N3bpVn-e8QzOAHziEgmjQ2qE&index=3

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

Approved in Academic Council meeting

BOS Convener

BOS Chairman

Course Code:19EIOC1003		Course Title: Industrial Internet of Things	
Course Category: Open Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Embedded systems

Course Objectives

The course is intended to:

1. Indicate the various industrial revolutions and need for industry 4.0
2. Illustrate the design architecture and components of IoT.
3. Provide knowledge on communication protocols used IoT based solutions
4. Realize the opportunities, challenges brought about by Industry 4.0 and how organisations and individuals should prepare to reap the benefits
5. Demonstrate the application of IIoT

Unit I Introduction to IIoT 9 Hours

The Various Industrial Revolutions - Digitalisation and the Networked Economy -Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0- Comparison of Industry 4.0 Factory and Today's Factory - Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation

Unit II IoT building blocks 9 Hours

IoT Architecture, WoT and M2M - Physical & Logical IoT design Basics - IoT Enabling Technologies - IoT Levels and templates

System Design of Connected Devices: Embedded Devices, Embedded Hardware, Connected Sensors and Actuators, Controllers, Battery Life Conservation and designing with Energy Efficient Devices, SoCs, Single Chip Controllers with integrated Processing and Network Core with Hardware Crypto Engines.

Unit III IoT Communication protocols 9 Hours

Understanding Internet Protocols: Simplified OSI Model, Network Topologies, Standards, Types of Internet Networking - Ethernet, WiFi, Local Networking, Bluetooth, Bluetooth Low Energy (BLE), Zigbee, 6LoWPAN, Sub 1 GHz, RFID,NFC, Proprietary Protocols, Simplicity, Networking Design - Push, Pull and Polling, Network APIs

Unit IV Advanced design and challenges 9 Hours

IOT Specific Challenges and Opportunities- Advances Design Concepts for IOT - Software UX Design Considerations, Machine Learning and Predictive Analysis, Interactions, Inter-usability and Inter-operability considerations, Understanding Security in IOT Design, Design requirements of IOT Security Issues and challenges, Privacy, Overview of Social Engineering.

Unit V Case study 9 Hours

Smart Manufacturing – IIoT in oil and gas industry - Smart Cities- Precision healthcare- Precision mining

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Describe various industrial revolutions and role of industry4.0	Understand
CO2.	Analyse various components required to build IoT based application	Understand
CO3.	Analyse the communication protocols suitable for IOT	Understand
CO4.	Describe the opportunities, challenges brought about by Industry 4.0 and how organisations and individuals should prepare to reap the benefits	Understand
CO5.	Appreciate the smartness in Smart Factories, Smart cities, smart products and other smart services	Understand

Text Book(s):

T1 Foundational Elements of an IOT Solution - The Edge, Cloud and Application Development, Joe Biron& Jonathan Follett, Oreilly, First Edition, March 2016

T2 Designing Connected Products, 1st Edition, Elizabeth Goodman, Alfred Lui, Martin Charlier, Ann Light, Claire Rowland

Reference Book(s):

R1 The Internet of Things (A Look at Real World Use Cases and Concerns), Kindle Edition, 2016, Lucas Darnell

R2 From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence: By Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand,

R3 Vijay Madisetti, ArshdeepBahga, “Internet of Things: A Hands-On Approach”

R4. Internet of Things (A Hands-on-Approach), by Vijay Madisetti and ArshdeepBahga, 1st

Web References:

1. https://nptel.ac.in/courses/117/105/117105079/
2. https://nptel.ac.in/courses/117/105/117105135/
3. https://nptel.ac.in/courses/117/104/117104020/

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

Approved in Academic Council meeting

BOS Convener

BOS Chairman

Course Code: 19EIOC1004	Course Title: Smart Sensor Technology		
Course Category: Professional Core		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Explain the structure of Smart Sensors
2. Describe the data acquisition through the sensor
3. Elucidate the communication used for smart sensor
4. Illustrate the wireless communication technology used for smart sensor
5. Provide knowledge on inbuilt sensors in Smart devices

Unit I INTRODUCTION TO SMART SENSORS 9 Hours

Mechanical to Electronic transition in Sensing – Nature of Sensor – Integration of Micromachining and Microelectronics - Evolution of Smart Sensors - Components of Smart Sensors – General Architecture of Smart Sensors

Unit II DATA ACQUISITION THROUGH SENSOR 9 Hours

Amplification and Signal Conditioning: Instrumentation amplifier – Sleep mode Circuitry - Rail to Rail operational amplifier - 4-20ma Signal transmitter – Digital conversion: sampling, Quantizing and encoding – MCU control and sensor interface – Techniques and system integration: Linearization – PWM Control – Auto zero and Auto range – Diagnostics – Reducing EMC and RFI

Unit III COMMUNICATION FOR SMART SENSOR 9 Hours

Overview of Communication Organization and standards – Automotive protocols: CAN – LIN – Media Oriented Systems Transport – Flex ray - Industrial usage of CAN – MCU with integrated CAN – LonTalk Protocol – MI bus – Other aspects of Network communications

Unit IV WIRELESS SENSING 9 Hours

Introduction of RF and Spread spectrum – Wireless data and communication – Zigbee – ANT+ - 6LoWPAN – NFC – Zwave – Dust networks – RF Sensing: Surface acoustic waves - RADAR – LIDAR – GPS – Remote emission sensing – Intelligent transportation system - RFID - Telemetry.

Unit V SMART SENSOR DEVICES 9 Hours

Case Study: Sensors in Mobile phones: Accelerometer, Gyroscope, Touch sensor, Proximity Sensor, Ambient light sensor, Hall sensor and Finger print sensor – Sensors in Automotive vehicles: Air flow sensor, Engine speed sensor, Manifold Absolute Pressure Sensor, Spark Knock Sensor, Fuel Temperature Sensor and Voltage Sensor - Sensors in Wearables: Electro-chemical Bio Sensor, Wearable electrodes, Strain, temperature and pressure sensors

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Explicate the Structure of Smart Sensors and build the sensor	Understand
CO2.	Describe the data acquisition from sensor to other devices	Understand
CO3.	Summarize the various communication protocol used for data processing	Understand
CO4.	Elucidate wireless technology used in sensor system	Understand
CO5.	Explain the sensors used in various smart devices	Understand

Text Book(s):

T1. Randy Frank “Understanding Smart Sensors” 3rd Edition, CRC Press, 2014

T2. Krzysztof Iniewski “Smart Sensors for Industrial applications” CRC Press, 2013

Reference Book(s):

R1. Kevin Yallup, Krzysztof Iniewski “Technologies for Smart Sensors and Smart fusion” CRC Press, 2014

R2. Gerard Meijer, Kofi Makinwa, MichielPertijs “Smart Sensor Systems: Emerging Technologies and applications” John wiley and Sons Ltd, 2014

R3. S.C.Mukhopadhyay, G.S.Gupta “Smart Sensors and Sensing Technology” Springer, 2008

Web References:

1. https://new.abb.com/motors-generators/service/advanced-services/smart-sensor
2. https://www.intersil.com/en/applications/industrial/smart-sensor.html
3. http://www.smartsensors.com/

Course Articulation Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
CO1	1	1		1	1			1	1	1				
CO2	1	1		1	1			1	1	1				
CO3	1	1		1	1			1	1	1				
CO4	1	1		1	1			1	1	1				
CO5	1	1		1	1			1	1	1				

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	**CO. No.**	**Marks**	**Total**
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Course Code:19EIOC1005		Course Title: Factory Automation	
Course Category: Open Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Understand the hydraulics, electro hydraulics and its circuits
2. Understand the pneumatics, electro pneumatics and its circuits
3. Design an automation system with suitable sensors
4. Explain Industrial based controller and developing S/W solution for the specific automation system
5. Explain the electrical drives and sensors with PLC using SCADA & IoT.

Unit I Hydraulics 9 Hours

Basics of Hydraulics - Components of hydraulics - Types of valves – DCVs - operations - hydraulic Circuits – Electro hydraulics - Solenoids - Relays - Electrical logic circuits - Applications of electro hydraulics – simulation on hydraulic circuits.

Unit II Pneumatics 9 Hours

Basics of Pneumatics - Components of Pneumatics - Types of valves - DCVs - operations - Pneumatic circuits – Electro pneumatics - Electrical Logic circuit – Relay ladder logic - Applications of electro pneumatics – simulation on pneumatic circuits.

Unit III Sensorics 9 Hours

Introduction to sensorics - Types of Proximity sensors (Inductive, Capacitive, Magnetic, Photo electric and ultrasonic)- construction, principle of operation and Applications – Advanced Sensor for Industry application

Unit IV PLC and HMI 9 Hours

Over view of Automation System – Introduction to PLC - Architectural evolution - Role of PLC in Automation - Ladder Logic - Basics of digital logic - Latching - Selections of PLC - HMI Screen Development for various applications – Interfacing PLC and HMI - Automation system interconnect between HMI and PLC.

Unit V SCADA and IoT **9 Hours**

Remote panel development: Data acquisition between PLC and SCADA system – Remote panel development – Screen development – Real monitoring and control through PLC and SCADA - IoT Architecture, and M2M - Physical & Logical IoT design Basics - IoT Enabling Technologies - IoT Levels and templates.

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Expertise on hydraulics, electro hydraulics and its circuits	Understand
CO2.	Expertise on pneumatics, electro pneumatics and its circuits	Understand
CO3.	Explain an automation system with suitable sensors	Understand
CO4.	Understanding of Industrial based controller and developing S/W solution for the specific automation system	Understand
CO5.	Interfacing of electrical drives and sensors with PLC using SCADA & IoT.	Understand

Text Book(s):

T1. Esposito Anthony, “Fluid Power with Applications”, Pearson Education Inc., New York,
T2. Frank D Petruzella, “Programmable Logic Controllers” , Tata Mcgraw hill, 4th edition,

Reference Book(s):

R1. T3.W. Bolton, “Mechatronics”, Person Education Inc., 2010

Web References:

1. https://new.abb.com/motors-generators/service/advanced-services/smart-sensor
2. https://www.intersil.com/en/applications/industrial/smart-sensor.html
3. http://www.smartsensors.com/

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EIOC1006	Course Title: Internet of Medical Things		
Course Category: Open Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Interpret the role of biomedical engineering in society
2. Demonstrate the principles of various diagnostic devices.
3. Identify the importance of Biotelemetry devices.
4. Provide knowledge on role of IoT in portable medical devices
5. Understand about various sensors and peripherals in wearable IoTs

Unit I FUNDAMENTALS OF MEDICAL INSTRUMENTATION 9 Hours

Evolution of modern healthcare system - Role of Biomedical engineers in various domain - Recent Advances in Biomedical Engineering - Professional status of biomedical engineering-Professional Societies - Intelligent Medical Instrumentation Systems - Implantable Medical Devices

Unit II DIAGNOSTIC IMAGING 9 Hours

X-ray computed tomography - Nuclear Medical Imaging Systems-Magnetic Resonance Imaging – Ultrasonic Imaging Systems – Thermal Imaging Systems.

Unit III BIOMEDICAL TELEMETRY 9 Hours

Biotelemetry - Single Channel Telemetry Systems - Multi-Channel Wireless Telemetry Systems - Multi-Patient Telemetry - Implantable Telemetry Systems - Biotelemetry Application On Wimax Networks - Transmission Of Analog Physiological Signals Over Telephone.

Unit IV INTERNET OF HEALTH THINGS (IOHT) 9 Hours

Introduction to IoHT – IoT enabled technology in health care – Applications and services of IoHT – Topologies – Prototype for forthcoming systems in IoHT – Wearable health care system – Challenges of IoHT - Security requirements & Challenges of IoHT - Various technologies to revolutionize the services of healthcare in IoT – Future trends

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Unit V WEARABLE DEVICES 9 Hours

Introduction to Sensors and Wearable hardware – Wearable devices in Medical field – Monitoring used for wearable health devices – wearable health device technologies for different body parts – Applications – Challenges

Course Outcomes		**Cognitive Level**
At the end of this course, students will be able to:		
CO1.	Understand the role of biomedical engineering in society	Understand
CO2.	Understand the principles of various diagnostic devices.	Understand
CO3.	Identify the importance of Biotelemetry devices.	Understand
CO4.	Obtain knowledge on role of IoT in portable medical devices	Understand
CO5.	Identify various sensors and peripherals in wearable IoTs	Understand

Text Book(s):

T1. Enderle, John D, Bronzino, Joseph D, Blanchard, Susan M- Introduction to

T2. R. S. Khandpur, Handbook of Biomedical Instrumentation, McGraw-Hill Publishing

T3. Chakraborty, C., Banerjee, A., Kolekar, M.H., Garg, L., Chakraborty, B. (Eds.), Internet of Things for Healthcare Technologies, Springer, 2021

Reference Book(s):

R1. Manuel Cardona, Vijender Kumar Solanki, Cecilia E. GarcíaCena, Internet of Medical Things

R2. Paradigm of Wearable Devices, Routledge, taylor&francis group, 2021

R3. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, Biomedical Instrumentation and Measurement, Prentice Hall of India, New Delhi,2nd edition, 2002.

R4. John G Webster, Medical Instrumentation: Application and Design, John Wiley andsons, New York,4thedition,2010. Daniel A Vallero, Biomedical ethics for Engineers, Elsevier

Web References:

1. https://www.accessengineeringlibrary.com/content/book/9789339205430
2. https://www.elsevier.com/books/introduction-to-biomedical-engineering/enderle/978-0-12-374979-6

Passed in Board of Studies meeting Approved in Academic Council meeting

BOS Convener BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Code:19EIOC1007		Course Title: Virtual Instrumentation	
Course Category: Open Elective		Course Level: Mastery	
L:T:P(Hours/Week) 3: 0: 0	Credits:3	Total Contact Hours:45	Max Marks:100

Pre-requisites

- Nil

Course Objectives

The course is intended to:

1. Discuss the importance of virtual instrumentation
2. Develop virtual instruments
3. Apply the concept of Arrays, Strings and File I/O tasks
4. Select suitable Data acquisition system interfaces
5. Examine DAQ hardware's and LabVIEW

Unit I GRAPHICAL SYSTEM DESIGN 9 Hours

Graphical System Design Model – Virtual Instrumentation – Virtual Instrument and Traditional Instrument – Hardware and software in virtual instrumentation – Virtual instrumentation for test, control and Design – Conventional and Graphical programming

Unit II LabVIEW BASICS I 9 Hours

Front Panel and Block Diagram – Tools, Controls and Functions palette. Modular programming – Sub VI. Structures – FOR, WHILE Loops, Case, Sequence, event structures, Formula node.

Unit III LabVIEW BASICS II 9 Hours

Arrays, Clusters, Strings, File I/O, Time and Dialog controls, Waveform chart, Graph, XY Graph and operations Report generation, Web Publishing tool.

Unit IV DATA ACQUISITION SYSTEM 9 Hours

Instrument control: GPIB – VISA – Instrument drivers – Serial Port communication. Data Acquisition: Review of Transducers and signal conditioning, DAQ hardware – AI, AO, DIO. DAQ Assistant and configuration.

Unit V LabVIEW APPLICATIONS 9 Hours

LabVIEW RT, Process control applications, Physical applications, Speed control, Data visualization, Imaging and Sound. Level, flow, temperature process, biomedical application - Pulse rate

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Outcomes		Cognitive Level
At the end of this course, students will be able to:		
CO1.	Discuss the importance of virtual instrumentation using LabVIEW	Understand
CO2.	Develop virtual instruments using LabVIEW graphical programming tools	Understand
CO3.	Apply the concept of Arrays, Strings and File I/O tasks in Data acquisition	Understand
CO4.	Select suitable Data acquisition system interfaces based on the requirement	Understand
CO5.	Examine DAQ hardware's and LabVIEW in various real time environments	Understand

Text Book(s):

T1. Jovitha Jerome, 'Virtual Instrumentation using LabVIEW' PHI Learning Private Limited, New Delhi, Second Printing, 2011.

T2. Gary W Johnson, Richard Jennings, 'LabVIEW Graphical Programming' Fourth Edition, McGraw Hill, 2006

Reference Book(s):

R1. Sanjay Gupta, Joseph John, 'Virtual Instrumentation using LabVIEW' Tata McGraw Hill, 5th Reprint, 2010

R2. 2.Robert H Bishop. 'Learning with LabVIEW 2009' Pearson Education, 2010

Web References:

1. http://www.av.it.pt/conftele2009/Papers/125.pdf
2. https://www.researchgate.net/publication/3420671_What_is_virtual_ instrumentation
3. http://www.ni.com/pdf/manuals/374629c.pdf

Passed in Board of Studies meeting

BOS Convener

Approved in Academic Council meeting

BOS Chairman

Course Articulation Matrix

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

High-3; Medium-2; Low-1

Assessment pattern

	Assessment Component	CO. No.	Marks	Total
Continuous Assessment	CCET I	1,2	50	30
	CCET II	3,4	50	
	CCET III	5	50	
	Tutorials / Quiz / Assignments	1,2,3,4,5	30	10
End Semester Examination	ESE	1,2,3,4,5	100	60
Total				100

Passed in Board of Studies meeting

Approved in Academic Council meeting

BOS Convener

BOS Chairman