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

L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

1st Year 1st Semester

Sl. No.	Category	Course Code	Course Title	Hours per week				Credits
	A. THEORY			L	T	P	Total	
1	Basic Science course	PH101	Physics-I	3	0	0	3	3
2	Basic Science course	M101	Mathematics –I	4	0	0	4	4
3	Humanities and Social Sciences including Management courses	HSMC 101	Professional Communication	2	0	0	2	2
	B. PRACTICAL							
4	Basic Science course	PH191	Physics-I Lab	0	0	3	3	1.5
5	Engineering Science Courses	ME 191	Workshop & Manufacturing Practices Lab	0	0	3	3	1.5
6	PROJECT	PR191	Theme based Project I	0	0	1	1	0.5
7	PROJECT	PR192	Skill Development I: Soft Skill	0	0	1	1	0.5
	C. MANDATORY ACTIVITIES / COURSES							
8	Mandatory Course	MC181	Induction Program	0	0	0	0	2Units
	TOTAL CREDIT							**13.0**

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A. Theory

COURSE NAME: PHYSICS –I
CODE: PH 101
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDIT: 3

Prerequisites: Knowledge of Physics up to 12th standard.

Course Outcomes (COs):

After attending the course students' should be able to

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

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

CO3: apply superposition principle to explain interference and diffraction

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

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

CO-PO Mapping:

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

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Course Content:

Module 1 (5L):-
Waves & Oscillations:-
Simple Harmonic Motion (Recap), superposition of waves, damped harmonic motion-over damped, critically damped and under damped motion, energy decay, logarithmic decrement, force vibration and resonance (amplitude, velocity resonance), sharpness of resonance, quality factor, related numerical problems. 5L

Module 2 (12L):-
Classical Optics:
2.01- Interference of light: Huygens's principle, conditions of sustained interference, classification of interference, Newton's ring (qualitative descriptions of working principles and procedures-no deduction required). Engineering applications, related numerical problems. 4L

2.02- Diffraction of light: Fresnel and Fraunhofer class, Fraunhoffer diffraction of a single slit, double slit, multiple slits, intensity distributions, missing order, Rayleigh criterion (no deduction) and resolving power of grating and microscope (no deduction), related numerical problems. 4L

2.03- Polarization: Definition, Plane of polarization, Plane of vibration, Malus Law, Fundamental concepts of plane, circular & elliptical polarizations (only qualitative idea) with examples, Brewster's law, Double refraction: Ordinary & Extra ordinary rays, positive and negative crystal, Nicol's prism, Numerical problems 4L

Module 3 (8L):-
Quantum Mechanics-I
3.01 Quantum Theory: Inadequacy of classical physics-concept of quantization of energy, particle concept of electromagnetic wave (example: photoelectric and Compton Effect; no derivation required, origin of modified and unmodified lines), wave particle duality; phase velocity and group velocity; de Broglie hypothesis; Davisson and Germer experiment. 4L

3.02 Quantum Mechanics 1: Concept of wave function, physical significance of wave function, probability interpretation; normalization of wave functions; uncertainty principle, relevant numerical problems. Introduction of Schrödinger wave equation (only statement). 4L

Module 4 (3L):-
Solid State Physics-I:
4.01 Crystal Structure: Structure of solids, amorphous and crystalline solids (definition and examples), lattice, basis, unit cell, Fundamental types of lattices –Bravais lattice, simple cubic, fcc and bcc lattices, Miller indices and miller planes, co-ordination number and atomic packing factor, Bragg's equation, applications, numerical problems. 3L

Module 5 (8L):
Modern Optics-I:
5.01- Laser: Concepts of various emission and absorption processes, Einstein A and B coefficients and equations, working principle of laser, metastable state, population inversion, condition necessary for active laser action, optical resonator, illustrations of Ruby laser, He-Ne laser, Semiconductor laser, applications of laser, related numerical problems. 5L

5.02-Fibre optics-Principle and propagation of light in optical fibers (Step index, Graded index, single and multiple modes) - Numerical aperture and Acceptance angle, Basic concept of losses in optical fiber, related numerical problems. 3L

Recommended Text Books for Physics I (PH 101):

Waves & Oscillations:

1. Sound-N. K. Bajaj (TMH)
2. Advanced Acoustics-D. P. Roy Chowdhury (Chayan Publisher)
3. Principles of Acoustics-B.Ghosh (Sridhar Publisher)
4. A text book of sound-M. Ghosh (S. Chand publishers)
5. A text book of Light- K.G. Mazumder & B.Ghoshs, (Book & Allied Publisher)
6. Physics of Oscillations and Waves- R.P. Singh
7. College Physics Vol. II - A.B. Gupta
8. Vibration, Waves and Acoustics- Chattopadhyay and Rakshit

Classical & Modern Optics:

1. A text book of Light- K.G. Mazumder & B.Ghoshs (Book & Allied Publisher)
2. A text book of Light-Brijlal & Subhramanium, (S. Chand publishers)
3. Modern Optics-A. B. Gupta (Book & Allied Publisher)
4. Optics-Ajay Ghatak (TMH)
5. Optics-Hecht
6. Optics-R. Kar, Books Applied Publishers
7. Physical Optics Möler
8. Optics -F.A. Jenkins and H.E White

Quantum Mechanics-I

1. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)
2. Quantum Mechanics-Bagde and Singh (S. Chand Publishers)
3. Perspective of Quantum Mechanics-S. P. Kuilla (New Central Book Agency)
4. Quantum Mechanics-Binayak Datta Roy (S. Chand Publishers)
5. Quantum Mechanics-Bransden (Pearson Education Ltd.)
6. Perspective of Modern Physics-A. Beiser (TMH)
7. Quantum mechanics -A.K. Ghatak and S Lokenathan
8. Modern Physics -E.E. Anderson
9. Physics Volume 2 -Haliday, Resnick & Krane, Published by Wiley India

Solid State Physics-I:

1. Solid state physics-Puri & Babbar (S. Chand publishers)
2. Materials Science & Engineering-Kakani Kakani
3. Solid state physics- S. O. Pillai
4. Introduction to solid state physics-Kittel (TMH)
5. Solid State Physics and Electronics-A. B. Gupta and Nurul Islam (Book & Allied Publisher)
6. Problem in Solid state physics -S.O. Pillai (a. b.)

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Text Books:

1. Refresher courses in physics (Vol. 1, Vol. 2 & Vol. 3)-C. L. Arora (S. Chand Publishers)
2. Basic Engineering Physics-Amal Chakraborty (Chaya Prakashani Pvt. Ltd.)
3. Perspective & Concept of Modern Physics -Arthur Baiser
4. Principles of engineering physics – Md. N Khan and S Panigrahi.
5. Basic Engineering Physics-Sujoy Bhattacharya, Saumen Pal (MG)
6. Engineering Physics (Vol. 1, Vol. 2)-S.P. Kuila (S. Chand Publishers)
7. Engineering Physics-A. S. Vasudeva

Project Domains

1. Study of Superposition of waves: Lissajous figures.

2. Electrical analogue of mechanical vibrations: application to electrical circuit (LC and LCR circuits), Electrical and mechanical impedance, quality factor, complex representation and phasor diagram.

3. Study of N-slit diffractions

4. Optical Fiber & its applications: Study of losses, estimation of numerical aperture in practical problems.

5. Photonic nature of electromagnetic waves

6. Optical Rotation

COURSE NAME: MATHEMATICS-I
COURSE CODE: M 101
CONTACT: 3:1:0
TOTAL CONTACT HOURS: 48
CREDITS: 4

Prerequisite: The students to whom this course will be offered must have the concept of (10+2) standard matrix algebra, calculus, and vector algebra.

Course Outcomes (COs):

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

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

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

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

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

Course Content:

Module I: Matrix Algebra **11L**

Echelon form and Normal (Canonical) form of a matrix; Inverse and rank of a matrix; Consistency and inconsistency of system of linear equations, Solution of system of linear equations; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton theorem.

Module II: Differential Calculus and Infinite Series **10L**

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Concept of sequence and series, Tests for convergence of infinite series: Comparison test, D'Alembert's ratio test, Raabe's test, Cauchy's root test, Leibnitz's Test, Power series; Taylor's series, Series for exponential, trigonometric and logarithm functions.

Module III: Multivariable Calculus (Differentiation) **13L**

Function of several variables, Concept of limit, continuity and differentiability; Partial derivatives, Total derivative and its application; Chain rules, Derivatives of implicit functions Euler's theorem on homogeneous function, Jacobian. Maxima and minima of functions of two variables, Method of Lagrange multipliers.

Module IV: Multivariable Calculus (Integration) **6L**

Line Integral, Double Integral, Triple Integral,Change of order in multiple integrals, Change of variables in multiple integrals.

Module V: Vector Calculus **8L**

Gradient, Directional derivatives, Divergence, Curl, vector line integrals, vector surface integrals, vector volume integrals, Green's theorem, Gauss divergence theorem and Stokes' theorem.

Project Domain:

1. Study on eigenvalues and eigenvectors.
2. Study on convergence of infinite series.
3. Application of partial derivatives.
4. Application of vector calculus
5. Application of integral calculus.

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Text Books:

1. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
5. Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
6. Samanta Guruprasad, A text book of Engineering Mathematics-I, New age International Publishers

Reference Books:

1. Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Apostol, M., Calculus, Volumes 1 and 2 (2nd Edition), Wiley Eastern, 1980.
3. Kumaresan, S., Linear Algebra - A Geometric approach, Prentice Hall of India, 2000.
4. Poole, D., Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
5. Bronson, R., Schaum's Outline of Matrix Operations. 1988.
6. Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 1969

CO-PO Mapping:

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

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COURSE NAME: PROFESSIONAL COMMUNICATION
COURSE CODE: HSMC 101
CONTACT: 2:0:0
TOTAL CONTACT HOURS: 24
CREDITS: 2

Pre-requisites: Basic (10+2) level of knowledge of English grammar, vocabulary reading and writing skills.

Course Outcomes (COs):

After attending the course students' should be able to

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

CO2: analyze communication across cultures and societies.

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

CO4: employ formal communication modes in meetings and reports.

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

Course Content:

Module- 1: Verbal and Non-verbal communication **4L**

1.1: Definition, Relevance and Effective Usage
1.2: Components of Verbal Communication: Written and Oral Communication
1.3: Components of Non-verbal Communication: Kinesics, Proxemics, Chronemics, Haptics Paralanguage
1.4: Barriers to Effective Communication

Module- 2: Social Communication Essentials and Cross-Cultural Communication **6L**

2.1: Communication in Society and the Workplace
2.2: Greetings, Courtesies and Socially Useful Language
2.3: Cultural Contexts: High Context and Low Context Cultures
2.4: Understanding Cultural Nuances and Stereotyping
2.5: Achieving Culturally Neutral Communication in Speech and Writing

Module- 3: Meetings **4L**

3.1: Meetings: Nature and Types
3.2: Conducting Meetings: Organization and Procedures
3.3: Meeting Coordination: Roles of Chairpersons and Members
3.4: Notice and Agenda for a Meeting
3.5: Preparing the Minutes of a Meeting (MOM)

Module- 4: Report Writing **4L**

4.1: Nature and Function of Reports

4.2: Types of Reports
4.3: Researching for a Business Report
4.4: Format, Language and Style
4.5: Report Documentation

Module 5: Employment Communication **6L**

5.1: Writing Business Letters- (Enquiry, Order, Sales, Complaint, Adjustment, Job Application, Offer)
5.2: Preparing a CV or Rẽsumẽ
5.3: Creating a Digital/Online Profile – LinkedIn (Résumé/Video Profile)
5.4: Writing E-mails: types, convention, and etiquette
5.5: Memo, Notices and Circulars
5.6: Writing Technicalities—Paragraphing, Sentence Structure and Punctuation

Text Books &Reference Books:

1. Meenakshi Raman and Sangeetha Sharma. *Technical Communication*. 3rd edition. New Delhi: Oxford University Press, 2015.
2. Mark Ibbotson. *Cambridge English for Engineering*. Cambridge: Cambridge University Press, 2008.
3. Mark Ibbotson. *Professional English in Use: Engineering*. Cambridge: Cambridge UP, 2009.
4. Lesikar et al. *Business Communication: Connecting in a Digital World*. New Delhi: Tata McGraw-Hill, 2014.
5. John Seeley. *Writing Reports*. Oxford: Oxford University Press, 2002.
6. Judith Leigh. *CVs and JobApplications*. Oxford: Oxford University Press, 2002.
7. Judith Leigh. *Organizing and Participating in Meetings*. Oxford: Oxford University Press, 2002.
8. Michael Swan. *Practical English Usage*. Oxford: OUP, 1980.
9. Pickett, Laster and Staples. *Technical English: Writing, Reading & Speaking.* 8th ed. London: Longman, 2001.
10. Diana Booher. *E-writing: 21st Century Tools for Effective Communication*.

Links:

1. Purdue University's Online Writing Lab (OWL)-https://owl.purdue.edu/
2. Business English Pod-https://www.businessenglishpod.com/

CO-PO Mapping

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

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B. Practical

COURSE NAME: PHYSICS I LAB
CODE: PH 191
CONTACT HOURS: 0:0:3
CREDIT: 1.5

Prerequisites: Knowledge of Physics up to 12th standard.

Course Outcomes (COs):

After attending the course students' will be able to

CO1 : demonstrate experiments allied to their theoretical concepts

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

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

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

General idea about Measurements and Errors (One Mandatory):

i) Error estimation using Slide calipers/ Screw-gauge/travelling microscope for one experiment.
ii) Proportional error calculation using Carrey Foster Bridge.

Any 6 to be performed from the following experiments

Experiments on Waves & Oscillations:
1. Study of Torsional oscillation of Torsional pendulum & determination of time using various load of the oscillator.
2. Determination of elastic moduli of different materials (Young's modulus /Rigidity modulus)
3. Determination of Q factor using LCR Circuit.
4. Calibration of an oscillator using Lissajous Figure.

Experiments on Classical Optics:
5. Determination of wavelength of light by Newton's ring method.
6. Determination of wavelength of light by Laser diffraction method.
7. To determine the angle of optical rotation of a polar solution using polarimeter

Experiments on Quantum Physics-I:
8. Determination of Planck's constant using photoelectric cell.
9. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
10. Determination of Stefan's Constant

In addition it is **recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment

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Probable experiments beyond the syllabus:
1. Determination of wavelength of light by Fresnel's bi-prism method (beyond the syllabus).
3. Study of dispersive power of material of a prism.
4. Study of viscosity using Poiseuille's capillary flow method/using Stoke's law.
5. Measurement of nodal and antipodal points along transmission wire and measurement of wavelength.
6. Any other experiment related to the theory**.**

Recommended Text Books for Physics I Lab (PH 291):

Waves & Oscillations:
1. Vibration, Waves and Acoustics- Chattopadhyay and Rakshit

Classical & Modern Optics:
1. A text book of Light- K.G. Mazumder & B.Ghoshs (Book & Allied Publisher)

Quantum Mechanics-I
1. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)

Solid State Physics-I:
1. Solid State Physics and Electronics-A. B. Gupta and Nurul Islam (Book & Allied Publisher)

Text Books:
1. Practical Physics by Chatterjee & Rakshit (Book & Allied Publisher)
2. Practical Physics by K.G. Mazumder (New Central Publishing)
3. Practical Physics by R. K. Kar (Book & Allied Publisher)

CO-PO Mapping:

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

COURSE NAME: WORKSHOP/MANUFACTURING PRACTICES
COURSE CODE: ME191
CONTACT: 0:0:3
CREDITS: 1.5

Prerequisite: Higher Secondary with Mathematics, Physics and Chemistry.

Course Outcomes (COs):

After completion of this course students will be able to

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

CO2: Safely fabricate simple components with their own hands.

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

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

Course Content:

(i) Theoretical discussion & videos: 3P

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2. Fitting operations & power tools
3. Carpentry
4. Welding (arc welding & gas welding), brazing
5. Electrical & Electronics
6. Metal casting
7. CNC machining, Additive manufacturing
8. Plastic moulding& Glass Cutting

(ii) Workshop Practice:

Module 1 - Machine shop 6P

Typical jobs that may be made in this practice module:

i. To make a pin from a mild steel rod in a lathe.

ii. To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.

Module 2 - Fitting shop 6P

Typical jobs that may be made in this practice module:

i. To make a Gauge from MS plate.

Module 3 - Carpentry 6P

Typical jobs that may be made in this practice module:

i. To make wooden joints and/or a pattern or like.

Module 4 - Welding shop (Arc welding 3P + gas welding 3P) 3P

Typical jobs that may be made in this practice module:

i. ARC WELDING (3P): To join two thick (approx 5mm) MS plates by manual metalarcwelding.

ii. GAS WELDING (3P): To join two thin mild steel plates or sheets by gas welding.

Module 5 - Electrical & Electronics 3P

House wiring, soft Soldering

Module 6 – Smithy 3P

Typical jobs that may be made in this practice module:

i. A simple job of making a square rod from a round bar or similar.

For further study (Optional)

Module 7 - Casting **3P**

Typical jobs that may be made in this practice module:
i. One/ two green sand moulds to prepare, and a casting be demonstrated.

Module 8 - Plastic moulding & Glass Cutting **3P**

Typical jobs that may be made in this practice module:
i. For plastic moulding, making at least one simple plastic component should be made.
ii. At least one sample shape on glass should be made using laser cutting machine.

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Text Books:

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGrawHill House, 2017.

Reference Books:

1. Gowri P., Hariharan and A. Suresh Babu, Manufacturing Technology – I, Pearson Education, 2008.
2. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
3. Kalpakjian S. and Steven S. Schmid, Manufacturing Engineering and Technology, 4th edition, Pearson Education India Edition, 2002.
4. Manufacturing Science by A. Ghosh and A.K. Mallick, Wiley Eastern.
5. Principles of Metal Cutting/Principles of Machine Tools by G.C. Sen and A. Bhattacharya, New Central Book Agency, Kolkata.

CO-PO Mapping:

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

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First Year 2nd Semester

Sl. No.	Category	Course Code	Course Title	Hours per week				Credits
	A. THEORY			L	T	P	Total	
1	Basic Science courses	CH 201	Chemistry-I	3	0	0	3	3
2	Basic Science courses	M 201	Mathematics –II	4	0	0	4	4
3	Engineering Science Courses	EE 201	Basic Electrical Engineering	3	0	0	3	3
4	Engineering Science Courses	CS 201	Programming for Problem Solving	3	0	0	3	3
	B. PRACTICAL							
5	Basic Science course	CH 291	Chemistry-I Lab	0	0	3	3	1.5
6	Humanities and Social Sciences including Management courses	HSMC 291	Professional Communication LAB	0	0	2	2	1.0
7	Engineering Science Courses	EE 291	Basic Electrical Engineering Lab	0	0	3	3	1.5
8	Engineering Science Courses	ME 292	Engineering Graphics & Design Lab	0	0	3	3	1.5
9	Engineering Science Courses	CS 291	Programming for Problem Solving Lab	0	0	3	3	1.5
10	PROJECT	PR291	Theme based Project II	0	0	1	1	0.5
11	PROJECT	PR292	Skill Development II: Life Skill	1	0	0	1	0.5
	C. MANDATORY ACTIVITIES / COURSES							
12	Mandatory Course	MC281	NSS/Physical Activities / Meditation & Yoga / Photography	0	0	3	3	3 Units
	TOTAL CREDIT							**21**

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A. Theory

COURSE NAME: CHEMISTRY
COURSE CODE: CH 201
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDITS: 3

Pre requisites: A basic knowledge in 10+2 science with chemistry

Course Outcomes (COs):

After completion of this course students will be able to

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

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

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

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

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

Course Content

Module- I: Inorganic Chemistry **9L**

(i) Atomic structure **5L**

Bohr's theory to hydrogen-like atoms and ions; spectrum of hydrogen atom. Quantum numbers, Introduction to the concept of atomic orbitals, diagrams of s, p and d orbitals, Pauli's exclusion principle, Hund's rule, exchange energy, Aufbau principle and its limitation, introduction to Schrodinger equation.

(ii) Periodic properties **4L**

Modern Periodic table, group trends and periodic trends in physical properties: electron affinity, electronegativity, polarizability, oxidation states, effective nuclear charges, penetration of orbitals, variations of s, p and d orbital energies of atoms.

Module II: Physical Chemistry **8L**

(i) Use of free energy in chemical equilibria **6L**

Thermodynamic functions: internal energy, enthalpy, entropy and free energy. 2nd Law of Thermodynamics, Estimations of entropy and free energies, Free energy and emf, Cell potentials, the Nernst equation and applications.

(ii) Real Gases **2L**

Reason for deviation of real gases from ideal behavior, Equations of state of real gases,Vander Waals' equation, pressure & volume correction, validity, critical state of gas.

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Module III: Organic Chemistry **8L**

(i) Stereochemistry **4L**

Representations of 3 dimensional structures, Chirality, optical activity, isomerism, structural isomerism, stereoisomers, enantiomers, diastereomers, configurations (D,L & cis trans), racemisation.

(ii) Organic reactions **4L**

Concepts of inductive effect, resonance, hyperconjugation, introduction to reactions involving substitution, addition, elimination, oxidation (Baeyer villiger oxidation), reduction (Clemmensen reduction, Wolff-Kishner reduction).

Module IV: Industrial Chemistry **8L**

(i) Water **2L**

Hardness, alkalinity, numerical

(ii) Corrosion. **2L**

Types of corrosion: wet & dry, preventive measures

(iii) Polymers **3L**

Classification of polymers, conducting polymers, biodegradable polymers

(iv) Synthesis of a commonly used drug molecule. **1L**

Paracetamol, Aspirin

Module V: Spectroscopic techniques in Chemistry **3L**

Electromagnetic radiation, Principles of spectroscopy, spectrophotometer, infrared spectroscopy, fingerprint region, functional group region, UV-VIS spectroscopy, ^{1}H Nuclear magnetic resonance spectroscopy, chemical shift.

Textbooks

1. A Text Book of Organic Chemistry, Arun Bahl & Arun Bahl
2. General & Inorganic Chemistry, P.K. Dutt
3. General & Inorganic Chemistry, Vol I, R.P. Sarkar
4. Physical Chemistry, P.C. Rakshit

Reference Books

1. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
2. Fundamentals of Molecular Spectroscopy, by C. N.Banwell
3. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S.Krishnan
4. Physical Chemistry, by P. W.Atkins
5. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Editionhttp://bcs.whfreeman.com/vollhardtschore5e/default.asp

Project Domain

1. Application of Thermodynamics
2. Application of polymers in daily life
3. Nanomaterials and its applications
4. Determination of water quality parameters

5. Electronic storage devices
6. Managing E –wastes
7. Application of chemistry in core engineering
8. Application of spectroscopy in medical field
9. Applications of green chemistry
10. Merits of commercial organic products
11. Bioplastics
12. Any other related topics

CO-PO Mapping

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

COURSE NAME: MATHEMATICS-II
COURSE CODE: M 201
CONTACT: 3:1:0
TOTAL CONTACT HOURS: 48
CREDIT: 4

Prerequisite: The students to whom this course will be offered must have the concept of (10+2) calculus.

Course Outcomes (COs):

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

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

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

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

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

Course Content:

Module I: First Order Ordinary Differential Equations (ODE): 10L

Solution of first order and first degree ODE: Exact ODE, Rules for finding Integrating factors, Linear ODE, Bernoulli's equation, Solution of first order and higher degree ODE: solvable for p, solvable for y solvable for x and Clairaut's equation.

Module II: Second Order Ordinary Differential Equations (ODE): 10L

Solution of second order ODE with constant coefficients: C.F. & P.I., Method of variation of parameters, Cauchy-Euler equations, Solution of simultaneous linear ODEs.

Module III: Laplace Transform (LT): 14L

Improper integrals; Beta and Gamma functions and their properties.
Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property, LT of $t\,f\,(t)$, LT of $\frac{f\,(t)}{t}$, LT of derivatives of $f\,(t)$, LT of integral of $f(t)$, Evaluation of improper integrals using LT, LT of periodic and step functions, Inverse LT: Definition and its properties, Convolution theorem (statement only) and its application to the evaluation of inverse LT, Solution of linear ODE with constant coefficients (initial value problem) using LT.

Module IV: Numerical Methods 14L

Introduction to error analysis, Calculus of finite difference. **Interpolation:** Newton forward and backward interpolation, Lagrange's interpolation, Newton's divided difference interpolation formula. Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule. Numerical solution of ordinary differential equation: Euler method, Modified Euler method, Fourth order Runge-Kutta method.

Project Domains:

1. Mathematical modeling using ODE.
2. Application of ODE.
3. Application of Laplace Transform in different engineering branches.
4. Application of Numerical Methods in different engineering branches.

Text Books:

1. Kreyszig, E., Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Ramana, B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
3. Veerarajan, T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

5. Bali, N.P. and Goyal, M., A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
6. Samanta Guruprasad, A text book of Engineering Mathematics-II, New age International Publishers
7. Mollah, S. A, Numerical Analysis and Computational Procedures, Books and Allied (P) Ltd.

Reference Books:

1. Thomas, G.B. and Finney, R.L., Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Boyce, W. E. and DiPrima, R. C., Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
3. Ross, S. L., Differential Equations, 3rd Ed., Wiley India, 1984.
4. Piskunov, N., Differential and Integral Calculus, Vol. I & Vol. II, Mir Publishers, 1969.
5. Coddington, E. A., An Introduction to Ordinary Differential Equations, Prentice Hall, India, 1995.
6. Dey, Sukhendu, Gupta Sisir, Numerical Methods, MsGraw Hill Education(India) Private Limited.
7. Jain, M. K., Iyengar, S. R. K., Jain, R. K., Numerical Methods, New age International Publishers

CO-PO Mapping:

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

COURSE NAME: BASIC ELECTRICAL ENGINEERING
COURSE CODE: EE201
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDITS: 3

Pre-requisite: Basic 12th standard Physics and Mathematics, Concept of components of electric circuit.

Course Outcomes (COs):

After attending the course students' would be able to

CO1: understand and analyze basic electric circuits

CO2: study the working principles of electrical machines.

CO3: introduce the components of low voltage electrical installations

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

Course Content

Module- I: DC Circuits **8L**

Definition of electric circuit, linear circuit, non-linear circuit, bilateral circuit, unilateral circuit, Dependent source, node, branch, active and passive elements, Kirchhoff's laws, Source equivalence and conversion, Network Theorems - Superposition Theorem, Thevenin's Theorem, Norton Theorem, Maximum Power Transfer Theorem, Star-Delta Conversions.

Module- II: AC Fundamentals **8L**

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module- III: Electrical Machines **10L**

Transformer: Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Rotating Machines - DC Machines: Brief idea on constructional features, classifications, working principle of both motor and generator. Simple problems on Voltage equation. Three-Phase Induction Motor: Basic concept of three phase circuit and production of rotating magnetic field. Working principle of three-phase induction motor and torque-speed characteristics (concept only).

Module- IV: Electrical Installations **3L**

Earthing of Electrical Equipment, ideas of basic components- MCB, MCCB, ELCB, SFU, Megger. Types of Wires and Cables, Earthing.

Module- V: Fundamentals of Power Systems **5L**

Generation of power: Block schematic representation of Thermal and nuclear power plants. Renewable energy sources: solar, wind, tidal and geothermal (Block diagram and working only- No Problems). Power transmission: Typical electrical power transmission scheme-need for high voltage transmission-(Derivation is not needed, No Problems). Power Distribution: substation equipments, primary and secondary transmission and distribution systems- feeder, service mains.

Module- VI: Introduction to Control Systems **2L**

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Concept control systems, Objectives of control system, Types of control systems, Real examples of control systems.

Text books:

D. P. Kothari & I. J. Nagrath, Basic Electrical Engineering, TMH.

1. V. Mittle& Arvind Mittal, Basic Electrical Engineering, TMH.
2. Ashfaq Hussain, Basic Electrical Engineering, S. Chand Publication.
3. Chakrabarti, Nath& Chanda, Basic Electrical Engineering, TMH.
4. C.L. Wadhwa, Basic Electrical Engineering, Pearson Education.

Reference books:

1. E. Hughes, ―Electrical and Electronics Technology‖, Pearson, 2010.
2. V. D. Toro, ―Electrical Engineering Fundamentals‖, Prentice Hall India, 1989.

CO-PO Mapping:

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

COURSE NAME: PROGRAMMING FOR PROBLEM SOLVING
COURSE CODE: CS 201
CONTACT: 3:0:0
TOTAL CONTACT HOURS: 36
CREDITS: 3

Prerequisites: Number system, Boolean Algebra

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

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

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

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

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

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

Course Content:

Module-1: Fundamentals of Computer **9L**

History of Computer, Generation of Computer, Classification of Computers, Basic structure of Computer System, Primary & Secondary Memory, Processing Unit, Input & Output devices.

Number System: basic of Binary, Octal, Decimal and Hexadecimal number systems; Representation and interchanging of number in different number systems. Introduction to complements system, Representation of signed and unsigned numbers in singed magnitude singed 1's complement system and signed 2's complement system.

Arithmetic– Addition and Subtraction (using1'scomplementand2'scomplement).

Representation of Characters-ASCII Code

Basics of Compiler, Interpreter and Assembler

Problem solving – Basic concept of Algorithm. Representation of algorithm using flow chart and pseudo code. Some basic examples.

Module-2: Introduction to C Programming **5L**

Overview of Procedural vs Structural language; History of C Programming Language.

Variable and Data Types: The C characterse identifiers

And keywords, data type & sizes, variable names, declaration, statements.

Operators & Expressions: Arithmetic operators,relational operators, logical operators, increment anddecrementoperators,bitwiseoperators,assignmentoperators,conditionaloperators,specialoperators-typeconversion, C expressions, precedence and associativity.

Input and Output: Standard input and output, formatted output–print f,formatted input scan f.

Module-3: Branch and Loop **5L**

Branching: Concept of Statement and Blocks in C, Simple if, if -else, nested if-else and if-else ladder.

Switch Case: break andcontinue; switch-case, concept of goto and labels

Loops - while, for, do while

Module-4: Program Structures **4L**

Function: Basics of Functions, function types, function prototypes, formal and actual parameter, function calling, functions returning values, functions not returning values. Recursion and Recursive Function.

Storage Class in C: Storage Class-auto, external, static and register storage class, scope rules and life time of variables

C pre-processor: Pre-processing directive and macro, parameterized macro.

Module-5: Array and Pointer **7L**

Arrays: One dimensional arrays, Two-dimensional arrays, Passing an array to a function

Pointers: Pointers, Pointer andArray, Pointer and functions.

Strings: Character array and string, array of strings, Passing a string to a function, String related functions, Pointer and String.

Dynamic memory allocation: Malloc, calloc, realloc and free with example.

Module-6: Structures, Unions and Enum **3L**

Basic of structures, arrays of structures, structures and pointers, bit fields. Basics of union and enum, difference between structure and union.

Module-7: File in C **3L**

Files handling- opening and closing a file in different mode, formatted and unformatted files, Command line arguments, f open, f close, f get c, f put c, f print f, f scan f function.

Textbook:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. KanetkarY.-LetusC,BPBPublication,15th Edition

ReferenceBooks:

1. **Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India**
2. K R Venugopal & S R Prasad – MASTERING C, TMH, 2nd Edition

CO–PO Mapping:

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

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B. Practical

COURSE NAME: CHEMISTRY LAB
COURSE CODE: CH 291
CONTACT: 0:0:3
CREDITs: 1.5

Pre-requisite: A basic knowledge in 10+2 science with chemistry.

Course Outcomes (COs):

After attending this course, students would be

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

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

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

CO4: able to synthesize drug and polymer materials.

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

Course Content:

Choice of 10-12 experiments from the following:

1. Determination of surface tension and viscosity
2. Thin layer chromatography
3. Determination of hardness of water
4. Determination of chloride content of water
5. Determination of the rate constant of a reaction
6. Determination of cell constant and conductometric tritration
7. pH metric titrations
8. Synthesis of a polymer/drug
9. Saponification/acid value of an oil
10. Chemical analysis of a salt
    Chemical oscillations- Iodine clock reaction
11. Determination of the partition coefficient of a substance between two immiscible liquids
12. Adsorption of acetic acid by charcoal
13. Estimation of iron in Mohr's salt solution by permanganometry (Redox Titration)
14. Innovative experiments (any one)
    - Synthesis of silver nano-particles
    - Green synthesis

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CO-PO Mapping

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

COURSE NAME: PROFESSIONAL COMMUNICATION LAB
COURSE CODE: HSMC291
Contact: 0:0:2
CREDIT: 1

Pre requisites: Basic knowledge of LSRW skills.

Course Outcomes (COs):

After attending the course students' would be

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

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

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

CO4: Able to analyze communication behaviours.

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

Course Content:

Module- 1: Introduction to the Language Lab

a. The Need for a Language Laboratory
b. Tasks in the Lab
c. Writing a Laboratory Note Book

Module- 2: Active Listening

a. What is Active Listening?
b. Listening Sub-Skills—Predicting, Clarifying, Inferencing, Evaluating, Note-taking
c. Academic Listening vs Business Listening
d. Listening in Business Telephony
e. Study of Contextualized Examples based on Lab Recordings

Module- 3: Speaking

a. Speaking—Accuracy and Fluency Parameters
b. Pronunciation Guide—Basics of Sound Scripting, Stress and Intonation
c. Fluency-focussed activities—JAM, Conversational Role Plays, Speaking using Picture/Audio Visual inputs
d. Accuracy-focussed activities—Identifying Minimal Pairs, Sound Mazes, Open and Closed Pair Drilling, Student Recordings (using software)
e. Group Discussion: Principles and Practice
f. Business Meetings and Sales Talks

Module- 4: Lab Project Work

a. Making a brief Advertisement video (1-2 minutes)
b. Making a brief Business Documentary film (5-7 minutes)
c. Client interaction video (5-7 minutes)
d. Making a short video CV (1-2 minutes)

References:

1. IIT Mumbai, Preparatory Course in English syllabus
2. IIT Mumbai, Introduction to Linguistics syllabus
3. Sasikumar et al. A Course in Listening and Speaking. New Delhi: Foundation Books, 2005.
4. Tony Lynch, Study Listening. Cambridge: Cambridge UP, 2004.

CO-PO Mapping

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

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COURSE NAME: BASIC ELECTRICAL ENGINEERING LABORATORY
COURSE CODE: EE291
CONTACT: 0:0:3
CREDITS: 1.5

Prerequisite: Basic Physics and applied physics, Basic Mathematics, Basic concept of Electric Circuit.

Course Outcomes (COs):

After completion of this course students will be able to

CO1: Identify and use common electrical components.

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

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

List of Experiments

1. Basic safety precautions – earthing, introduction to measuring instruments – Voltmeter, Ammeter, Multimeter, Wattmeter, Real life Resistor, Capacitor, Inductor.
2. Verification of Thevenin's and Norton's Theorem.
3. Verification of Superposition and Maximum Power Transfer Theorem.
4. Characteristics of Fluorescent, Tungsten and Carbon filament lamps.
5. Study of R-L-C series circuit.
6. Three-phase Power measurement with two wattmeter methods.
7. Demonstration of cut-out sections of machines: DC Machine (commutator-brush arrangement), Induction Machine (squirrel cage rotor).
8. Measurement of primary and secondary voltage and current of single-phase transformer – Open Circuit and Short Circuit Test.
9. Starting, Reversing and speed control of DC shunt motor.
10. Torque-Speed characteristics of DC Machine.
11. Torque-Speed characteristics of Three-phase Induction Motor.
12. Test on single-phase Energy Meter.
13. Innovative experiments

CO-PO Mapping

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

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COURSE NAME: ENGINEERING GRAPHICS & DESIGN
COURSE CODE: ME292
CONTACT: 0:0:3
CREDITS: 1.5

Prerequisites: Basic knowledge of geometry

Course Outcomes (COs):

After attending the course students would

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

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

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

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

List of Drawings:

Traditional Engineering Graphics:

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Module 1: Introduction to Engineering Drawing

Principles of Engineering Graphics and their significance, Usage of Drawing instruments, lettering, Conic sections including Rectangular Hyperbola (General method only); Cycloid, Epicycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

Module 2: Orthographic & Isometric Projections

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes on inclined Planes - Auxiliary Planes; Projection of Solids inclined to both the Planes- Auxiliary Views; Isometric Scale, Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa.

Module 3: Sections and Sectional Views of Right Angular Solids

Drawing sectional views of solids for Prism, Cylinder, Pyramid, Cone and project the true shape of the sectioned surface, Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw sectional orthographic views of objects from industry and dwellings (foundation to slab only).

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Computer Graphics:

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modeling; Solid Modeling.

Module 4: Overview of Computer Graphics

Demonstration of CAD software [The Menu System, Toolbars (Standard, Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), Zooming methods, Select and erase objects].

Module 5: CAD Drawing, Customization, Annotations, layering

Set up of drawing page including scale settings, ISO and ANSI standards for dimensioning and tolerancing; Using various methods to draw straight lines, circles, applying dimensions and annotations to drawings; Setting up and use of Layers, changing line lengths (extend/lengthen); Drawing sectional views of solids; Drawing annotation,
CAD modeling of parts and assemblies with animation, Parametric and nonparametric solid, surface and wireframe modeling, Part editing and printing documents.

Module 6: Demonstration of a simple team design project

Illustrating Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; Meshed topologies for engineering analysis and tool-path generation for component manufacture, use of solid-modeling software for creating associative models at the component and assembly levels.

Text Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R, (2014), Engineering Drawing, Charotar Publishing House

2. K. Venugopal, Engineering Drawing + AutoCAD, New Age International publishers

Reference Books:

1. Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House

2. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.

3. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education

4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.

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CO-PO Mapping:

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

COURSENAME: PROGRAMMING FOR PROBLEM SOLVING LAB
COURSE CODE: CS 291
CONTACT: 0:0:3
CREDITS: 1.5

Prerequisites: Number system, Boolean Algebra

Course Outcomes (COs):

After completion of the course students would be able to

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

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

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

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

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

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Applied Electronics & Instrumentation Engineering
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

Course Content:

Module-1: Familiarization with some basic commands of DOS and Linux. File handling and Directory structures, file permissions, creating and editing simple C program in different editor and IDE, compilation and execution of C program. Introduction to Code block.

Module-2: Problem based on

a) Basic data types
b) Different arithmetic operators.
c) Print f( ) and scan f( ) functions.

Module-3: Problem based on conditional statements using

a) if-else statements
b) different relational operators
c) different logical operators

Module-4: Problem based on

a) **for** loop
b) **while** loop
c) **do-while** loop

Module-5: Problem based on

a) How to write a menu driven program using **switch-case** statement
b) How to write a function and passing values to a function
c) How to write a **recursive function.**

Module-6: Problem based on

a) How to use **array (both I-Dand2-D).**
b) How to pass an **array** to a **function.**

Module-7: Problem based on manipulation of strings in different way.

Module-8: Problem based on

a) How to handle compound variables in C
b) How to handle file in C
c) How to use command line argument in C

Textbook:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. KanetkarY.-LetusC,BPBPublication,15thEdition

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. K R Venugopal & S R Prasad – MASTERING C, TMH, 2nd Edition

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CO-PO Mapping:

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

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2nd Year 1st Semester

Sl. No.	Category	Course Code	Course Title	Hours per week				Credits
				L	**T**	**P**	**Total**	
A. THEORY								
1	Basic Science course	M 301	Mathematics III	3	0	0	3	3
2	Engineering Science Courses	EI301	Analog Electronic Circuits	3	0	0	3	3
3	Engineering Science Courses	EI302	Digital Electronic Circuits	3	0	0	3	3
4	Program Core Course	EI303	Circuit Theory and Networks	3	0	0	3	3
5	Program Core Course	EI304	Basic of Measurement Techniques	3	0	0	3	3
6	Humanities and Social Sciences including Management courses	HSMC 303	Universal Human Values 2: Understanding Harmony	3	0	0	3	3
B. PRACTICAL								
7	Engineering Science Courses	M(CS)391	Numerical Method lab	0	0	3	3	1.5
8	Engineering Science Courses	EI391	Analog Electronic circuits Lab	0	0	3	3	1.5
9	Engineering Science Courses	EI392	Digital Electronic Circuits Lab	0	0	3	3	1.5
10	Program Core Course	EI393	Circuit Network Lab	0	0	3	3	1.5
11	PROJECT	PR391	Theme based Project III	0	0	1	1	0.5
12	PROJECT	PR392	Skill Development III: Technical Seminar Presentation	1	0	0	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
13	MC	MC 301	Environmental Science	2	0	3	3	3 Units
	TOTAL CREDIT WITHOUT MOOCS COURSES							25
D.MOOCS COURSES**								
14	MOOCS COURSES	HM301	MOOCS COURSE-I	1	3	1	4	4
TOTAL CREDIT WITH MOOCS COURSES								**29**

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**** MOOCS COURSES for HONOURS/MINOR Degree are Program-specific and to be taken from MOOCS BASKET**

Curriculum for B.Tech
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L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

A. THEORY

Course Name: Mathematics- III
Course Code: M 301
Total Contact Hours: 36
Credit: 3

Prerequisite:

The students to whom this course will be offered must have the concept of (10+2) standard calculus, basic probability and differential equations.

Course Objectives:

The objective of this course is to disseminate the prospective engineers with basic techniques for solving partial differential equations. It also aims to equip the students with concepts and tools of calculus of complex variables, Fourier series and Fourier transform, and probability distribution as an intermediate to the advanced level of applications that they would find useful in their disciplines.

Course Outcomes (COs):
On successful completion of the learning sessions of the course, the learner will be able to:

CO1: Recall the underlying principle and properties of Fourier series, Fourier transform, probability distribution of a random variable, calculus of complex variable, and partial differential equation.
CO2: Exemplify the variables, functions, probability distribution and differential equations and find their distinctive measures using the underlying concept of Fourier series, Fourier transform, probability distribution of a random variable, calculus of complex variable, and partial differential equation.
CO3: Apply Cauchy's integral theorem and the residue theorem to find the value of complex integration, and compute the probability of real world uncertain phenomena by indentifying probability distribution that fits the phenomena.
CO4: Solve partial differential equation using method of separation of variables
CO5: Find the Fourier series and Fourier transform of functions by organizing understandings of underlying principles and also evaluate the integral using Parseval's identity.

Course Content:

MODULE I: ***Fourier series and Fourier Transform: (9 Lectures)***

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Fourier series: Dirichlet's Conditions; Euler's Formula for Fourier Series; Fourier Series for functions of period 2π; Sum of Fourier series (examples); Theorem for the convergence of Fourier series (statement only); Fourier series of a function with its periodic extension; Half range Fourier series: Construction of half range Sine series and half range Cosine Series; Parseval's identity (statement only) and related problems.
Fourier Transform: Fourier Transform, Fourier Cosine Transforms, Fourier Sine Transforms (problems only); Properties of Fourier Transform: Linearity, Shifting, Change of Scale, Modulation (problems only); Fourier Transform of Derivatives (problems only); Convolution Theorem (statement only), Inverse of Fourier Transform (problems only).

MODULE II: ***Probability Distributions: (9 Lectures)***

Random Variable: Discrete and Continuous (definition & examples); Probability Distribution (definition & examples); Probability Mass Function, Probability Density Functionand Distribution Function for a single random variable only (definition, properties & related problems); Expectation, Varianceand Standard Deviation for a single random variable only (definition, properties & related problems); Binomial Distribution, Poisson Distribution, Binomial Approximation to Poisson Distribution and Normal Distribution (problems only), Mean, Variance and Standard Deviation of Binomial, Poisson and Normal Distribution (problems only).

MODULE III: ***Calculus of Complex Variable: (13 Lectures)***

Functions of a Complex Variable (definition and examples); Concept of Limit, Continuity and Differentiability (problems only); Analytic Functions (definition and examples); Cauchy-Riemann Equations (statement only& related problems); Sufficient condition for a function to be analytic (statement only & related problems).
Concept of Simple Curve, Closed Curve, Smooth Curve & Contour; Some elementary properties of complex integrals (problems only); Cauchy's Theorem (statement only & related problems); Cauchy's Integral Formula(statement only & related problems); Cauchy's Integral Formula for the derivative of an analytic function(statement only & related problems); Cauchy's Integral Formula for the successive derivatives of an analytic function (statement only & related problems); Taylor's series and Laurent's series (problems only).
Zero of an Analytic Function and its order (definition & related problems); Singularities of an Analytic Function: Isolated Singularity and Non-isolated Singularity (definition & related problems); Essential Singularities, Poles (Simple Pole and Pole of Order m) and Removable Singularities (definition & related problems); Determination of singularities and their nature (problems only); Residue (definition & examples); Determination of the residue of a given function; Cauchy's Residue theorem (statement only & related problems). Application of Residue.

MODULE IV: Partial Differential Equation (PDE): (5 Lectures)

Solution of PDE: Method of Separation of Variables.
Solution of Initial Value & Boundary Value Problem: One Dimensional Wave Equation, One Dimensional Heat Equation, Two Dimensional Laplace Equation.

Project Domains:

1. Study of physical processes through PDE and ODE.

2. Application of calculus of complex variable in real world engineering problems.
3. Study of uncertainty in real world phenomena using probability distribution.
4. Application of Fourier series and Fourier transform in engineering problems.

Text Books:

1. Herman, R. L. *An Introduction to Fourier Analysis*, Chapman and Hall/CRC, 2016.
2. Grafakos, L. *Classical Fourier Analysis*, Springer, India, Private Ltd.
3. Das, N.G. *Probability and Statistics*; The McGraw Hill Companies.
4. Gupta, S. C. and Kapoor, V. K. *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons.
5. Mathews, J. H. and Howell, R. W. *Complex Analysis for Mathematics & Engineering,* Jones & Bartlett Pub, 2006.
6. Chowdhury, B. *Elements of Complex Analysis*, New Age International, 1993.
7. Raisinghania, M .D. *Advanced Ordinary & Partial Differential. Equation*; S. Chand Publication.
8. Grewal, B. S. *Higher Engineering Mathematics*, Khanna Pub.
9. Kreyszig, E. *Advanced Engineering Mathematics*, John Wiley & Sons, 2006.

Reference Books:

1. Gray, R. M. and Goodman, J. *Fourier Transforms: An Introduction for Engineers*, Springer, US, 1995.
2. Lipschutz & Lipson, *Schaum's Outline in Probability (2ndEd)*, McGraw Hill Education.
3. Spiegel, M. R. *Theory and Problems of Probability and Statistics (Schaum's Outline Series)*, McGraw Hill Book Co.
4. Goon, A.M., Gupta M .K. and Dasgupta, B. *Fundamental of Statistics*, The World Press Pvt. Ltd.
5. Soong, T. T. *Fundamentals of Probability and Statistics for Engineers*, John Wiley & Sons Inc, 2004.
6. Delampady, M. *Probability & Statistics*, Universities Press.
7. Spiegel, M. R. *Theory and Problems of Complex Variables (Schaum's Outline Series)*, McGraw Hill Book Co.
8. Sneddon, I. N. *Elements of Partial Differential Equations,* McGraw Hill Book Co.

CO-PO Mapping:

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Applied Electronics & Instrumentation Engineering
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
M 301.1	3	1	1	-	-	-	-	-	-	-	-	1
M 301.2	3	2	1	-	-	-	-	-	-	-	-	1
M 301.3	3	2	2	-	-	-	-	-	-	-	-	1
M 301.4	3	2	2	-	-	-	-	-	-	-	-	1
M 301.5	3	3	2	3	-	-	-	-	-	-	-	1

CO- PSO Mapping

	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	3	2	1
CO3	2	3	1
CO4	2	3	1
CO5	2	3	1

Course Name: Analog Electronic Circuits
Course Code: EI301
Contact : 3:0:0
Total Contact Hours: 36
Credits: 3
Prerequisite: Concept of basic electronics devices, basic law of circuit analysis

Course Objective:

1. Provide a strong foundation on Linear Circuits.

2. Familiarize students with applications of various IC's.
3. Having a broad coverage in the field that is relevant for engineers to design Linear circuits using Op-amps.
4. Familiarize the conversion of data from Analog to Digital and Digital to Analog.

Course Outcome:

At the end of this course students will be able to

CO1: Explain the characteristics of diodes and transistors

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

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

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

CO5: Design ADC and DAC

Module I: **[4]**

Small signal amplifiers: Introduction to Analog Integrated Circuits, BJT Modeling-hybrid model of transistors; Emitter follower circuits, High frequency model of transistors. FET Small signal analysis - Source follower

Module II: **[9]**

Transistor Amplifiers: RC coupled amplifier, functions of all components, equivalent circuit, derivation of voltage gain, current gain, input impedance and output impedance, frequency response characteristics, lower and upper half frequencies, bandwidth, and concept of wide band amplifier.

Feedback Amplifiers & Oscillators: Feedback concept, Voltage series-shunt, current series-shunt feedback

Configurations, Barkhausen criterion, Colpitts, Hartley's, Phase shift, Wien bridge and crystal oscillators

Module III: **[14]**

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Operational Amplifier: Introduction to Integrated Circuits, Differential Amplifier, Constant current source (current mirror etc.), level shifter, CMRR, Open & Closed loop circuits, importance of feedback loop (positive & negative), Block Diagram of OPAMP, Ideal OPAMP

Applications of Operational Amplifiers: analog adder, subtractor, integrator, differentiator, comparator, Schmitt Trigger. Instrumentation Amplifier, Log & Anti-log amplifiers, Analog multiplier, Precision Rectifier, voltage to current and current to voltage converter, free running Multivibrator , zero crossing detector

Multivibrator – Monostable, Bistable, Astablemultivibrators ; Monostable and astable operation using 555 timer.

Module IV: **[9]**

Large signal Amplifiers: Introduction to power amplifiers (Class A, B, AB)

Power Supply:

Analysis for DC voltage and ripple voltage with C, L-C and C-L-C filters in Rectifier Circuit - Regulated DC power supplies- Line regulation, output resistance and temperature coefficient, Series and Shunt Voltage Regulation – percentage regulation, Fixed output voltage IC regulator 78xx and 79xx series , Adjustable output voltage regulator, LM 337 series power supply ICs , Concept of **Switched** Mode Power Supply`

Text Books:
1. Millman Halkias – Integrated Electronics, McGraw Hill
2. Schilling & Belove—Electronic Circuit: Discrete & Integrated, 3/e, McGraw Hill
3. Ramakant A. Gayakwad —Op- Amps and linear Integrated Circuits, Pub: PHI
4. Boylested&Nashelsky- Electronic Devices and Circuit Theory- Pearson/PHI
5. “Operational Amplifiers and Linear Integrated Circuits” by Robert F. Coughlin, Frederick F. Driscoll

Reference Books:
1. Rashid-Microelectronic Circuits- Analysis and Design- Thomson(Cenege Learning)
2. Linear Integrated Circuits – D. Roy Choudhury &Shail B. Jain
3. Analog Integrated Circuits – J. B. Gupta

CO-PO Mapping:

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

L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

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

CO- PSO Mapping

	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	3	2	1
CO3	2	3	1
CO4	2	2	1
CO5	2	3	1

Course Name: Digital Electronic Circuits
Course Code: EI302

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L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

Contact:3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite: Concept of basic electronics and number system

Course Objective:
1. To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
2. To introduce number systems and codes
3. To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions
4. To give students the basic tools for the analysis and design of combinational circuits and sequential circuits
5. To introduce the concept of memories, programmable logic devices and digital ICs.
6. To acquire the knowledge of Digital-to-Analog Conversion, Analog-to-Digital Conversion.

Course Outcome:
On completion of this Subject/Course the student shall be able to:
CO1: give Interpretation of the fundamental concepts and techniques used in digital electronics.
CO2: apply the concept of various number systems in digital design.
CO3: analyze and design various cost effective combinational and sequential circuits.
CO4: solve real life complex circuit problems by applying knowledge of digital electronics.

Module1:
Introduction:
Digital system, Comparison between Analog and Digital system, Logic level, Element of Digital Logic, Functions of Digital logic.
Data and number systems:
Number system: Binary, Octal and Hexadecimal representation and their conversions.
Number Representation: Signed binary number representation with 1's and 2's complement methods, Fixed point - Floating point
Binary Codes: BCD- Gray code- Excess 3 code- Alpha Numeric codes – Error detecting and correcting codes- properties
Binary Arithmetic: Addition, subtraction, Multiplication, Division, Addition and subtraction by 1's and 2's complement, BCD addition and subtraction [5]

Boolean algebra:
Theorems and operations, Boolean expressions and truth tables, Representation in SOP and POS forms Boolean functions; Min-term and Max-term expansions Minimization of logic expressions by algebraic method, K-map method and Quine- McClauskey method

Various Logic gates- their truth tables and circuits; Design of circuits with universal gates. Exclusive-OR and Exclusive NOR and equivalence operations [6]

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Module II:
Design procedure–Adder: and Subtractor circuit: half and full adder and subtractor, BCD adder and subtractor, controlled inverter.
Convertors: BCD to excess-3 and vice versa, Binary to BCD, Gray to binary and viceversa.
Applications and circuits of Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator and Checker. [7]

Module III:
Sequential Logic:
Basic memory element-S-R, J-K, D and T Flip Flops-Truth table and Excitation table, Conversion of Flip-flop ,Various types of Registers and their design and application, Synchronous and Asynchronous counters, Irregular counter- counter design [5]

Sequential Circuits Design: State diagrams and tables, transition table, excitation table, Examples using flip-flops. Analysis of simple synchronous sequential circuits, construction of state diagram, State Machine-Mealy and Moore machine [5]

Module IV:
Memory Systems: RAM: Static RAM and Dynamic RAM, ROM, EPROM, EEROM
Programmable logic devices: programmable read only memory, programmable logic arrays and programmable array logic, Design using PLA, PAL, PROM [2]

Logic families:
TTL, ECL, MOS and CMOS, their operation and specifications: Logic levels, propagation delay time, power dissipation fan-out and fan-in, noise margin.
Implementation of Logic gate using TTL, MOS [2]
Different types of A/D and D/A:
Conversion techniques: analog-to- digital (successive approximation, Dual slope, flash) and digital-to- analog converters (weighted R, R-2R ladder and current steering logic). Characteristics of ADCs and DACs (resolution, quantization, significant bits, conversion/settling time)
[4]

Text Books:
1. A.Anand Kumar, Fundamentals of Digital Circuits- PHI
2 Morries Mano- Digital Logic Design- PHI
3. R.P.Jain—Modern Digital Electronics
4. Digital Integrated Circuits -- Taub and Schilling .Mcgraw Hill

Reference Books:
1. Digital Fundamental, Floyd-PHI
2. Digital, Principle and Application, Leach Malvino,Mcgraw Hill

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CO-PO Mapping:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO 9	PO1 0	PO11	PO1 2
CO1	3	3	2	2	2	1	1	1	1	1	1	1
CO2	3	2	2	1	1	1	1	1	1	1	1	2
CO3	3	2	2	2	1	1	1	1	1	1	1	1
CO4	2	3	2	2	1	1	1	1	1	1	1	2

CO- PSO Mapping

	PSO1	**PSO2**	**PSO3**
CO1	3	1	1
CO2	2	2	1
CO3	2	3	1
CO4	2	3	1

Course Name : Circuit Theory and Networks
Course Code: EI303
Contact : 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite: Concept of Basic electrical

Course Objectives:

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1. To prepare the students to acquire basic knowledge in the analysis of Electrical Networks
2. To solve electrical network using mesh and nodal analysis by applying network theorems
3. To analyze the transient response of series and parallel circuits and to solve problems in time and frequency domains
4. To understand the concept of resonance in series and parallel circuits.
5. To design various types of filters.

To relate various two port parameters and transform them.

Course Outcome:

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

CO1: Solve complex circuit problems by applying knowledge of circuit theorems.
CO2: Analyze dynamic performance of the networks using Laplace Transform.
CO3: Find out resonance of different circuits.
CO4: Analyze two port networks using A,B,C,D and Z,Y Parameter Model.
CO5: Design different types of filters.

Module1:
Introduction: Continuous & Discrete, Fixed & Time varying, Linear and Nonlinear, Lumped and Distributed, Passive and Active networks and systems. Independent & Dependent sources, Source Transformation, Star-Delta conversion [4]
Network equations: Kirchoff's Voltage Law & Current Law, Formulation of network equations, Loop variable analysis, Supermesh Analysis, Node variable analysis, Supernode Analysis
Network theorem: Superposition, Thevenin's, Norton's,Maximum power transfer, Compensation & Reciprocity theorem. Millman's theorem and its application. Solution of Problems with DC & AC sources. [5]

Module II:
Laplace transforms: Concept of complex frequency, properties of Laplace Transform, Initial Value Theorem and Final Value Theorem, Concept of Convolution theorem and its application, Transformation of step, ramp, impulse, exponential, damped and undamped sine & cosine functions. Laplace Transform of Gate function & its application. Laplace transform of Periodic function. Inverse Laplace Transform, application of Laplace Transform in circuit analysis. [5]

Circuit Transients: Impulse, Step & Sinusoidal response of RL, RC, and RLC circuits. Transient analysis of different electrical circuits with and without initial conditions using AC & DC source. Solutions of Problems with DC & AC sources [5]

Module III:

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L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

Two port network analysis: Open circuit Impedance & Short circuit Admittance parameters, Transmission parameters, Hybrid parameters and their inter relations. Condition of Reciprocity & symmetry. Interconnection of two port networks. Solution of Problems with DC & AC sources. [5]

Resonant Circuits: Series and Parallel Resonance, Impedance and Admittance Characteristics, Quality Factor, Half-Power Points, Bandwidth, Solution of problems [3]

Module IV:
Graph of Network: Concept of Tree, Branch, Tree link, junctions, Incident matrix, Tie-set matrix and loop currents, Cut-set matrix and node pair potentials, duality of networks, solution of problems. [4]

Coupled circuits: Magnetic coupling, Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Modeling of coupled circuits, Solution of problems. [3]

Filter Circuits: Analysis of Low pass, High pass, Band pass, Band reject, All pass filters (first and second order only) using operational amplifier. Solution of Problems [2]

Text Books:
1. Network Analysis, M.E.Van Valkenburg (Prentice H all)
2. Engineering Circuit Analysis, W.H.Hayt, J.E.Kenmerly, S.M.Durbin,(TMH)
3. Network and Systems, D.Roychowdhury,(New Age International)

Reference Books:
1. Network and Systems, Ashfaq Husain,(Khanna Book Publisher)
2. Modern Netwok Analysis, F.M.Reza&S.Seely, McGraw Hill.
3.Circuits and Networks: Analysis and Synthesis Paperback , A. Sudhakar, Shyammohan S. Palli (TMH)
4. Network Analysis And Synthesis, C L Wadhwa, ,(New Age International)

CO-PO Mapping:

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

Curriculum for B.Tech
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L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO- PSO Mapping

	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	3	2	1
CO3	3	2	1
CO4	2	2	1
C05	2	3	1

Course Name: Basic of Measurement Techniques
Course Code: EI304
Contact : 3:0:0
Total Contact Hours: 36
Credits: 3
Prerequisite:knowledge of basic mathematics and physics

Course objective:

1. To provide students a brief knowledge of measurements and measuring instruments related to engineering.

2. To provide extensive knowledge about standards and units of measurements, calibration, and standardization of various instruments.

3. To determine various types of errors in measurements

4. To understand design aspects and performance criteria of measuring instruments.

5. To familiarize the students with how different types of electrical and electronics meters work and their construction and applications.

Course Outcome:

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

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Applied Electronics & Instrumentation Engineering
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

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

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

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

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

Module 1: **6**

Introduction, Definition, the significance of measurement and instruments, General concepts and terminology of measurement systems, Static & dynamic characteristics of instruments.Standard, Calibration.

Module II: **10**

Errors in measurement –Types of errors, Limiting errors with examples.
Statistical error analysis, mean, median, mode, average, estimates, distribution, probable error, standard deviation, a test of normal distribution, chi-squared test curve fitting (a) method of sequential differences (b) method of extended differences, and (c) method of least squares

Reliability: definition on the basis of Gaussian and normal distribution function, MTTF, Bath Tub curve, operating life and cumulative failure analysis.

Module III: **10**

General features – Construction and principle of operation of moving coil, moving iron, Dynamometer, Thermal, Rectifier, and Electrostatic type instruments. Deflecting, controlling, and damping torques, an extension of instrument ranges using shunts, multipliers, and instrument transformers

Module IV: **10**

Different types of instruments:
Voltmeters:Multirange, range extension,.
Ammeters: Shunt and thermocouple type ammeter.
Ohmmeters: Series type, shunt type,
Multimeter for voltage, current, and resistance measurements.
Digital multimeters: Block diagram and specifications.
Cathode Ray Oscilloscope: Construction features of cathode ray tube, c application of CRO for different electrical measurements: amplitude-frequency and phase of sine wave, Lissajous figure.

Curriculum for B.Tech
Under Autonomy
Applied Electronics & Instrumentation Engineering
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

Text Books:

1. Golding E.W. &Widdis F.C.: Electrical Measuring Instruments & Measurements; Wheeler

2. H.S. Kalsi, Electronic Instrumentation, Tata McGraw Hill

3. Sawhney A K: A course in Electrical & Electronic Measurements & Instruments, Dhanpat Rai & Co.

4. Helfrick A.D. & Cooper W.D.: Modern Electronic Instrumentation & Measuring Instruments; Wheeler

5. Bell, David: Electronic Instrumentation & Measurement, Reston Publishers

6. D.C. Patranabis, Principles of Electronic Instrumentation, PHI

7. A. K. Ghosh, Introduction to Measurements and Instrumentation

Reference Books:

1. Harris, F. K. – Electrical Measurements, Wiley.

2. Reissland M.U.: Electrical Measurement, New Age International

CO-PO Mapping:

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

CO- PSO Mapping

	PSO1	**PSO2**	**PSO3**
CO1	3	2	1
CO2	3	2	1

CO3	3	2	1
CO4	2	3	1

Paper name: Universal Human Values 2: Understanding Harmony
Paper code: HSMC403
Credits: 3,
The course has 28 lectures and 14 practice sessions in 5 modules

Prerequisites: Universal Human Values 1 (desirable)

Course Objective: The objective of the course is four fold:

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

Course outcomes:

By the end of the course,

CO1-To understand family, society and nature and build awareness of themselves
CO2-To develop the knowledge how to become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
CO3: To understand human values, human relationship and human society that help them to become more sensitive to their commitment.
CO4: To develop critical ability in handling problems and design sustainable solutions.
CO5: To applythe concepts for solving day to day real life problems by understanding self.

Course Content:

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I

2. Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration

3. Continuous Happiness and Prosperity- A look at basic Human Aspirations

4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority

5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario

6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking

Module 2: Understanding Harmony in the Human Being - Harmony in Myself

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'

8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility

9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)

10. Understanding the characteristics and activities of 'I' and harmony in 'I'

11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail

12. Programs to ensureSanyam and Health. Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease

Module 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship

14. Understanding the meaning of Trust; Difference between intention and competence

15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship

16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals

17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

18. Understanding the harmony in the Nature

19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature

20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space

21. Holistic perception of harmony at all levels of existence. Include practice sessions to discuss human being as cause of imbalance in nature (film “Home” can be used), pollution, depletion of resources and role of technology etc.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

22. Natural acceptance of human values

23. Definitiveness of Ethical Human Conduct

24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order

25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.

26. Case studies of typical holistic technologies, management models and production systems

27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations

28. Sum up. Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.

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Text Book:

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

Reference Books

1. JeevanVidya: EkParichaya, ANagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

CO-PO Mapping:

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

CO- PSO Mapping

	PSO1	**PSO2**	**PSO3**
CO1	3	2	2
CO2	3	2	2

CO3	3	2	2
CO4	2	3	1

B. PRACTICAL

Subject Name: Numerical Methods Lab
CODE: M(CS) 391
Credit: 2.5
Total Contact hour: 30

Prerequisite: Any introductory course on programming language (example. C/ Matlab).

Course Objective: The purpose of this course is to provide basic programming skills for solving the problems in numerical methods.

Course Outcomes (COs):
On successful completion of the learning sessions of the course, the learner will be able to:

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

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

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

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

Course Content:

1.Assignments on Newton forward /backward, Lagrange's interpolation.

2.Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.

3.Assignments on numerical solution of a system of linear equations using Gauss elimination, Tridiagonal matrix algorithm, Gauss-Seidel iterations. LU Factorization method.

4.Assignments on numerical solution of Algebraic Equation by Bisection method, Regula-Falsi method, Secant Method, Newton-Raphson method

5.Assignments on ordinary differential equation: Euler's method, Euler's modified method, Runge-Kutta methods, Taylor series method and Predictor-Corrector method.

Implementation of numerical methods on computer through C/C++ and commercial Software Packages: Matlab / Scilab / Labview / Mathematica/NAG (Numerical Algorithms Group)/Python.

CO-PO Mapping:

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

CO- PSO Mapping

	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	2	3	1
CO3	2	3	1
CO4	2	3	1

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Course Name: Analog Electronics Circuits Lab
Course Code : EI391
Contact :0:0:3
Credits : 1.5

Course Objective:

1. Understand the scope of modern electronics.
2. Describe models of basic components.
3. Design and construct simple electronic circuits to perform a specific function, e.g.,designing of amplifiers, ADC etc.
4. Understand capabilities and limitations and make decisions regarding their best utilization in a specific situation.

Course Outcome:

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

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

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

CO3: Explore the operation and advantages of operational amplifiers.

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

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

List of Experiment:

1. Study of ripple and regulation characteristics of full wave rectifier with and without capacitor filter

2. Construction of a R-C coupled amplifier & study of its input impedance, output impedance and frequency response

3. Study of timer circuit using NE555 & configuration for monostable & astable multivibrator

4. Study a linear voltage regulator using regulator IC chip

5. Construction of analog adder and subtractor using opamp

6. Construction of integrator and differentiator using opamp

7. Construction of precision rectifier using opamp

8. Construction of a simple function generator using opamp

9. Construction of a Schmitt trigger circuit using opamp

10. Design and testing of Wien bridge oscillator

11. Study and analysis of Instrumentation Amplifier

12. Innovative Experiment

CO-PO Mapping:

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

CO- PSO Mapping

	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	2	3	1
CO3	3	3	1
CO4	2	3	1
CO5	2	3	1

Curriculum for B.Tech
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Course Name: Digital Electronic Circuits Lab
Course Code: EI392
Contact: 0:0:3
Credits: 1.5

Course Objective:

1. To reinforce learning through hands-on experience with design, construction, and implementation of digital circuits.
2. To train students with all the equipment which will help in improving the basic knowledge

Course Outcome:

On completion of this course students will be able to:

CO1: operate laboratory equipment.

CO2: design digital circuits

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

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

List of Experiment:

1. Realization of basic gates using Universal logic gates

2. Code conversion circuits- BCD to Excess-3 & vice-versa

3. 4-bit parity generator & comparator circuits

4. Construction of simple Decoder & Multiplexer circuits using logic gates

5. Design of combinational circuit for BCD to decimal conversion to drive 7segment display using multiplexer

6. Construction of simple arithmetic circuits-Adder, Subtractor.

7. Realization of RS-JK & D flip-flops using Universal logic gates.

8. Realization of Universal Register using JK flip-flops & logic gates.

9. Realization of Universal Register using multiplexer & flip-flops.

10. Realization of Asynchronous and Synchronous Up/Down counter.

11. Design of Sequential Counter with irregular sequences.

12. Realization of Ring counters.

13. Innovative Experiment.

CO-PO Mapping:

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

CO- PSO Mapping

	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	2	3	1
CO3	3	3	1
CO4	2	3	1

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Course Name: Circuit Network Lab
Course Code: EI393
Contact: 0:0:3
Credits : 1.5

Course Objective:

1. To acquaint students with the simulation software such as MATLAB to carry out design experiments as it is a key analysis software of engineering design
2. To generate different signals and transform tose to s- domain using MATLAB
3. To verify various network theorem and other network aspects using SIMULINK.
4. To provide basic laboratory experience with analyzing the frequency response of different filters using simulation software.

Course Outcome:

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

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

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

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

CO4:Determine frequency response of different filters using simulation software

List of Experiments:

1. Introduction to MATLAB

2. Generation of Periodic, Exponential, Sinusoidal, Damped sinusoidal, Step, Impulse, Ramp signals using MATLAB in both discrete and analog form

3. Verification of Network Theorems using simulation software

4. Determination of Laplace transform and inverse Laplace transformation using MATLAB

5. Transient response in R-L and R-C Network: Simulation/hardware

6. Transient response in R-L-C Series circuits Network: Simulation and hardware.

7. Determination of Impedance (Z) and Admittance(Y) parameters of two port network

8. Frequency response of LP and HP filters: Hardware

9. Frequency response of BP and BR filters

10. Evaluation of convolution integral for periodic & non-periodic signal using MATLAB

11. Innovative Experiment

CO-PO Mapping:

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

CO- PSO Mapping

	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	3	2	1
CO3	3	2	1
CO4	3	2	1

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C. MANDATORY ACTIVITIES / COURSES

Course Name: Environmental Science
Course Code: MC301
Contact: 3:0:0
Total Contact Hours: 22
Credits: 3units

Pre-requisite: Basic knowledge of Chemistry & Mathematics

Course Objective:
1. Be able to understand the natural environment and its relationships with human activities.
2. Be able to apply the fundamental knowledge of science and engineering to assess environmental and health risk.
3. Be able to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues.
4. Be able to solve scientific problem-solving related to air, water, and noise& land pollution.

Course Outcome:
After completion of this subject students will be able to:
CO1 : Study the mathematics and calculations of population growth, material balance and sustainable development.
CO2 : Study the components and diversity of eco system.
CO3 : Study the fundamental knowledge of air pollution, calculations of earth's surface temperature, atmospheric window and lapse rate.
CO4: Acquire fundamental knowledge of water pollution and its consequences knowledge and calculations regarding BOD, COD.
CO5: Understand the basic concepts regarding noise and musical sound, decibel unit and its relation with sound intensity, reasons and consequences of noise pollution.
CO6: Understand the concepts of land pollution and its remedies.
1.General

1.1 Natural Resources: Forest Resource, water resource, mineral resource, energy resources (renewable, non-renewable, potentially renewable)

1.2 Population Growth: Exponential Growth, logistic growth, Maximum sustainable yield
1.3 Disaster Management: Types of disasters (Natural & Man-made), Floods, Earthquake, Tsunamis, Cyclones, landslides (cause, effect & control)
1.4 Ecology & Ecosystem: Elements of ecology, definition of ecosystem- components types and function, Food chain & Foodweb, Structure and function of the following ecosystem: Forest ecosystem, Grassland

ecosystem, Desert ecosystem, Aquatic ecosystems **1.5 Environmental Management**: Environmental impact assessment, Environmental laws and protection act of India, Different international environmental agreement.

2. Air pollution and control
2.1Sources of Pollutants: point sources, nonpoint sources and manmade sources primary & secondary pollutant
2.2 Types of air pollutants: primary & secondary pollutant ; Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur,particulate,PAN, Smog (Photochemical smog and London smog),
2.3Effects on human health & climate: Greenhouse effect, Global Warming, Acid rain, Ozone Layer Depletion
2.4 Air pollution and meteorology: Ambient Lapse Rate, Adiabatic Lapse Rate, Atmospheric stability & Temperature inversion
2.5 control of air pollution (ESP, cyclone separator, bag house, catalytic converter, scrubber (ventury)

3. Water Pollution
3.1 Classification of water (Ground & surface water)
3.2 Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, heavy metals, pesticides, volatile organic compounds.
3.3 Surface water quality parameters: pH, DO, 5 day BOD test, BOD reaction rate constants, COD. Numerical related to BOD
Lake: Eutrophication [Definition, source and effect].
3.4Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only),ground water pollution (Arsenic & Fluoride; sources, effects, control)
3.5 Quality of Boiler fed water: DO, hardness , alkalinity, TDS and Chloride
3.6 Layout of waste water treatment plant (scheme only).

4. Land Pollution
4.1 Types of Solid Waste: Municipal, industrial, commercial, agricultural, domestic, hazardous solid wastes (bio-medical), E-waste
4.2 Solid waste disposal method: Open dumping, Land filling, incineration, composting, recycling (Advantages and disadvantages).

5. Noise Pollution 1. A Textbook of Environmental Studies, ShashiChawla. Tata McGraw Hill Education Private Limited
5.1 Definition of noise, effect of noise pollution on human health,
5.2 Average Noise level of some common noise sources
5.3 Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L10 (18 hr Index).
5.4 Noise pollution control.

Text Book:
1. A Textbook of Environmental Studies, ShashiChawla. Tata McGraw Hill Education Private Limited
References Books:

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2. Environmental Studies, Dr. J P Sharma, University Science Press
3. Environmental Engineering, J K Das Mohapatra, Vikas Publication.

CO-PO Mapping:

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10	P11	P12
MC301 .1	2	2	1	1	1	2	3	1	1	1	1	1
MC301 .2	2	2	2	1	1	1	3	1	1	1	1	1
MC301.3	2	2	2	1	1	1	3	1	1	1	1	1
MC301.4	2	2	2	1	1	1	3	1	1	1	1	1
MC301.5	2	2	1	1	1	1	2	1	1	1	1	1
MC301.6	2	2	1	1	1	1	3	1	1	1	1	1

CO- PSO Mapping

	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	2	3	1
CO3	2	3	1
CO4	2	3	1
CO5	2	2	1
CO6	2	2	1

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2nd Year 2nd Semester

Sl. No.	Category	Course Code	Course Title	Hours per week				Credits
				L	T	P	Total	
A. THEORY								
1	Basic Science course	PH (EIE) 401	Physics-II	3	0	0	3	3
2	PC	EI401	Sensors and Transducers	3	0	0	3	3
3	PC	EI402	Microprocessors and Computer Architecture	3	0	0	3	3
4	PC	EI403	Digital Signal Processing	3	0	0	3	3
5	PC	EI404	Electrical & Electronic Measurement & Instrumentation	3	0	0	3	3
6	Humanities and Social Sciences including Management courses	HSMC 402	Gender Culture and Development	2	0	0	2	2
B. PRACTICAL								
7	Basic Science course	PH (EIE) 491	Physics-II lab	0	0	2	2	1
8	PC	EI491	Sensors and Transducers Lab	0	0	3	3	1.5
9	PC	EI492	Microprocessors and Microcontrollers Lab	0	0	3	3	1.5
10	PC	EI493	Digital Signal Processing Lab	0	0	3	3	1.5
11	PC	EI494	Electrical & Electronic Measurement & Instrumentation Lab	0	0	3	3	1.5
12	PROJECT	PR 491	Theme based Project IV	0	0	1	1	0.5
13	PROJECT	PR492	Skill Development IV: Soft Skill & Aptitude-I	1	0	0	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
14	MC	MC 481	Environmental Protection Initiatives	2	0	0	3	3 Units
	TOTAL CREDIT WITHOUT MOOCS COURSES							25.0
D.MOOCS COURSES								
15	MOOCS COURSES	HM401	MOOCS COURSE-II	3	1	0	4	4
TOTAL CREDIT WITH MOOCS COURSES								**29.0**

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**** MOOCS COURSES for HONOURS/MINOR Degree are Program-specific and to be taken from MOOCS BASKET**

A. THEORY

Physics-II (Gr-B/Gr-A)

Code: PH (EIE) 401

Contacts: 3L

Credit: 3

Total no. of lectures: 36L

Prerequisite:

Knowledge of Physics up B.Tech 1st year Physics-I course

Course Objective:

The Physics-II course will provide the exposure to the physics of materials that are applied in digital circuitry, storage devices; exposure to the physics of quantum logic gate operation and quantum computation; an insight into the science & technology of next generation; foundations of electromagnetic theory and communication systems; concept of fundamental particles and associated applications in semiconductors

Course Outcome

After completion of this course student will be able to

CO1: To understand and explain electrostatics, magnetostatics and electromagnetic theory, operator formalism in Quantum Mechanics, materials at the low-dimensions and fundamental particles.

CO2: Apply the knowledge of Schrödinger equation in problems of junction diode, tunnel diode and study of energy band structures in metals, semiconductors and insulators. Also to apply Magnetism and semiconductors in data storage, Electromagnetic theory in communication and networking, Poisson's equations in various electronic systems and Fermi levels in intrinsic and extrinsic semiconductors.

CO3: Analyze which type of magnetic materials to be used for data storage purpose, Role of quantum confinement in inducing novel feature of a nano material. And Change in electric and magnetic fields in various symmetrical bodies.

CO4: To evaluate role of nuclear power as an alternative energy resource.

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Course Content:

Module 1: Electric and Magnetic properties of materials (10L)

Module 1.01: Insulating materials:

Dielectric Material: Concept of Polarization, the relation between **D, E** and **P**, Polarizability, Electronic (derivation of polarizability), Ionic, Orientation & Space charge polarization (no derivation), behavior of Dielectric under alternating field (qualitative discussion only), Dielectric losses, Local electric field at an atom: Lorentz field, Lorentz relation; Dielectric constant and polarizability – Clausius-Mossotti equation (with derivation) ;. ferroelctric and piezoelectrics (Qualitative study). 5L

Module 1.02: Magnetic materials and storage devices:

Magnetic Field & Magnetization M, relation between **B, H, M**. Bohr magneton, susceptibility, Diamagnetism- & Paramagnetism - Curie law (qualitative discussion), Ferromagnetism– Curie Temperature, Weiss molecular field theory (qualitative) & Curie-Weiss law, concept of θ_p , Hysteresis, Hard ferromagnets, Comparison and applications of permanent magnets (storage devices) and Soft ferromagnets (Permalloys, Ferrites etc.) **5L**

Module 2: Quantum Mechanics-II (8L)

Formulation of quantum mechanics and Basic postulates- superposition principle, orthogonality of wave function, expectation value; operator correspondence, Commutator. Measurements in Quantum Mechanics- Eigen value, Eigen function, Schrödinger's equation as energy eigen value equation. 4L

Application of Schrödinger equation – Particle in an infinite square well potential (1-D and 3-D potential well; Discussion on degenerate levels), 1D finite barrier problem and concept of quantum tunnelling (solve only $E<V_0$). 4L

Module 3: Statistical Mechanics: (4L)

Concept of energy levels and energy states, phasespace, microstates, macrostates and thermodynamic probability, MB, BE, FD, statistics (Qualitative discussions)- physical significance, conception of bosons, fermions, classical limits of quantum statistics, Fermi distribution at zero & non-zero temperature, Concept of Fermi level. 4L

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Module 4: Elements of solid state physics (6L)

Module 4.01: Free electron theory (qualitative) - Electronic conduction in solids : Drude's theory, B Wiedemann Frantz Law, Idea of quantization of energy-Sommerfeld theory. 3L

Module 4.02: Band theory of solids: Bloch Theorem-statement only, Kronig-Penny model (qualitative treatment)- Energy-band (E-k) diagram, allowed and forbidden energy bands. 3L

Module 5: Physics of Nanomaterials (4L)

Reduction of dimensionality, properties of nanomaterials, Quantum wells (two dimensional), Quantum wires (one dimensional), Quantum dots (zero dimensional); Quantum size effect and Quantum confinement. Carbon allotropes. Application of nanomaterials (CNT, grapheme, electronic, environment, medical). 4L

Module 6: Nuclear energy as future energy (4L)

Nuclear Binding Energy, Liquid drop model, Concept of Nuclear Fission, Nuclear Fusion & Energy output , Nuclear Reactor. 4L

Books

1. Insulating Materials: Principles, Materials, Applications, Margit Pfundstein , Roland Gellert , Martin Spitzner & Alexander Rudolphi: Birkhauser Verlag AG; 1

2. High Voltage and Electrical Insulation Engineering, Ravindra Arora, Wolfgang Mosch: Online ISBN: 9780470947906 DOI: 10.1002/9780470947906 Series Editor(s): Mohamed E. El-Hawary

3. Physics-II, Sujay Kumar Bhattacharya and Soumen Pal, McGraw Hill Education Private Limited

4. Advanced Engineering Physics, S. P. Kuila, New Central Book Agency (P) Ltd.

5. Introduction to Quantum Mechanics-S. N. Ghoshal (Calcutta Book House)

6. Quantum Mechanics- Bagde Singh (S. Chand Publishers)

7. Principles of Engineering Physics Vol 1 and Vol 2; by Md. N. Khan and S. Panigrahi, Pub: Cambridge Univ. press

8. Advanced Quantum Mechanics-J. J. Sakurai (TMH)

9. Quantum Computation and Quantum Information(10th Anniversary Edition)- Nielsen & Chuang (Cambridge University Press)

9.Fundamental of Statistical Mechanics: B Laud

10.Introduction to statistical mechanics : .Pathria

11.Fundamental of Statistical and Thermal Physics: .F. Reif Advanced Engineering Physics-S. P. Kuila New Central Book Agency (P)Ltd.

12. Electricity and Magnetism (In Si Units): Berkeley Physics Course - Vol.2, Edward M Purcell

13. Introduction to Electrodynamics-Griffiths David J.

14. The Feynman Lectures on Physics. 2 (2nd ed.)., Feynman, Richard P Addison-Wesley.

ISBN 978-0-8053-9065-0

4. Solid State Physics, A. J. Dekker, McMillan

15.Nanostructure and Nanomaterials, B.K. Parthasarathy

16.Introduction to Nanotechnology, B.K. Parthasarathy

17.Essentials of Nanotechnology, Rishabh Anand

18.Nanomaterials Handbook (Advanced Materials and Technologies)-YuryGogotsi (Editor) 1. Nuclear Physics, Irvin Keplan

19. Nuclear Physics, J. Pearson, University of Manchester, 2008

20. Nuclear and Particle Physics, Jenny Thomas - University College London , 2000.

21. Solid State Physics, S.O. Pillai.

CO-PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PH (EIE) 401**.1**	3	1	-	-	-	-	-	-	-	-	-	1
PH (EIE) 401**.2**	3	2	-	-	-	-	-	-	-	-	-	2
PH (EIE) 401**.3**	2	3	-	-	-	-	-	-	-	-	-	1
PH (EIE) 401**.4**	1	2	3	2	-	-	-	-	-	-	-	1

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PH (EIE) 401	2.25	2	3	2	-	-	-	-	-	-	-	1.66

CO- PSO Mapping

	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	3	2	1
CO3	2	3	1
CO4	3	2	1

Course Name: Sensors and Transducers
Code: EI401
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Course Objective:

1. To deal with various types of Sensors & Transducers and their working principle.
2. To deal with Resistive, Capacitive and Inductive transducers.
3. To deal with some of the miscellaneous transducers.
4. To know the overview of different advance sensors.

Course Outcome:

Students should be able to

CO1: Illustrate the fundamental principles of various types of sensors.

CO2: Illustrate the different types of transducers available.

CO3: Employ appropriate sensors to perform engineering tasks and scientific research.

CO4: Design of different Sensors.

CO5: Reorganize the basics of modern sensors

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Module I:

Introduction & Characteristics of Transducers

Introduction to sensors and transducers, Measurement system, Principles of sensing & transduction, Classification of sensors, Static characteristics, Dynamic characteristics: Zero, first order and second order measurement system, Response to impulse, step, ramp and sinusoidal inputs, sensitivity calculation, error estimation.

Resistive Sensing Element

Potentiometer: Loading effect, Strain gauge: theory, types, temperature compensation, applications: force, velocity and torque measurements.

Inductive Sensing Element

Self-inductive transducer, Mutual inductive transducers, Variable Reluctance type, Linear Variable Differential Transformer (LVDT): construction, Characteristic Curve, application: LVDT Accelerometer, LVDT displacement sensors

Module II:

Capacitive Sensing Element

Capacitive transducer: Variable Area Type, Variable distance type , Variable Permittivity type, calculation of sensitivities, applications.

Piezoelectric & Piezoresistive Sensing Element

Piezoelectric effects, charge and voltage coefficients, crystal model, materials, natural and synthetic types – their comparison, force and stress sensing, piezoelectric accelerometer, piezoresistive sensor.

Tachometers: Stroboscopes, Encoders, seismic accelerometer, Measurement of vibration, Proximity switches, Load cells: pneumatic, piezoelectric, elastic and magneto-elastic types - their mounting.**08L**

Module III:

Optical Sensors

Light Dependent Resistor, Optocoupler, Photodiode, Phototransistor, Photomultiplier tube, solar cell.

Magnetic Sensors

Sensors based on Villari effect for assessment of force, torque, rpm meters,Hall effect and Hall drive, performance characteristics

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Radioactive sensors

Gieger counter, proportional counter, Scintillation detection, Ionization chamber .

Module IV

Miscellaneous Sensors

IC temperature Sensor, Electrochemical Gas sensors, Fibre optic sensors- Thick film technology-MEMS sensors- Nano sensors- Sensors for intelligent systems- Introduction to Smart sensors and Sensor network.**08L**

Text Books:

1. Patranabis. D, "Sensors and Transducers", Prentice Hall of India, 1999.
2. John Brignell,"Intelligent Sensor Systems", CRC Press; 2nd Revised edition edition,1996

Reference Books:

1. Doebelin. E.A, "Measurement Systems – Applications and Design", Tata McGraw Hill, New York, 2000.
2. John. P, Bentley, "Principles of Measurement Systems", III Edition, Pearson Education, 2000.
3. Murthy.D.V.S, "Transducers and Instrumentation", Prentice Hall of India, 2001.
4. Sawhney. A.K, "A Course in Electrical and Electronics Measurements and Instrumentation", 18th Edition, DhanpatRai& Company Private Limited, 2007.

CO-PO Mapping:

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

CO- PSO Mapping

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L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	3	2	1
CO3	2	3	1
CO4	3	2	1
CO5	3	3	1

Course Name: Microprocessors and Computer Architecture
Code: EI402
Contact : 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite: Concept of Digital electronics

Course Objective:

1. To understand the architectures of 8085
2. To familiarize with the assembly level programming technique.
3. To familiarize the technique for interfacing memory and peripheral devices to microprocessors, including several specific standard I/O devices.
4. To be able to design a microprocessor /microcontroller-based system.

Course Outcome:

On completion of this course, students will be capable of

CO1: Apply the knowledge of the internal architecture 8085
CO2: construct and analyze assembly language program in 8085 to solve various complex engineering problems
CO3: Applying the knowledge of interfacing circuits to some real-time applications
CO4: Design memory devices using memory chips and utilize the knowledge in memory-based devices used in academics and industry.

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Module I: 8L

Introduction to microprocessors: Overview of 8085, Internal architecture, Pin Diagram description. Software instruction set and Assembly Language Programming. Addressing Modes.

Module II: 10L

Instruction cycle, machine cycle, Timing diagrams. Interrupts: Introduction, Interrupt vector table, Interrupt service routine, Design of programs using interrupts. DMA operation. Stack and Stack Handling, Call and subroutine, Counter and Time delay generation.

Module III: 10L

Hardware Interfacing: Interfacing memory, Interfacing I/O devices. Programmable peripheral devices (PPI) – Intel 8255, Programmable interval timer – Intel 8254, Programmable Keyboard/Display Controller- Intel 8279, A/D and D/A converters and interfacing of the same.

Module IV: 8L

General organization of a digital computer, Architecture classification, Parallel computers classification, Harvard architecture, Von Neumann architecture, Pipelining, pipeline hazards, Multiprocessors, Array processors.

Text/Reference Book:

1. Microprocessor architecture, programming and applications with 8085/8085A, Wiley eastern Ltd, 1989 by Ramesh S. Gaonkar.
2. Intel Corp: The 8085 / 8085A. Microprocessor Book – Intel marketing communication, Wiley inter science publications, 1980.
3. Fundamental of Microprocessor and Microcontrollers, Dhanpat Rai Publications, By B.Ram
4. Computer Architecture & Organization, McGraw Hill, by J.P.Hayes.
5. Computer System Architecture, Pearson, by M. Mano.
6. Computer Architecture – A Quantitative Approach, John Hennessy and David A Patterson.

CO-PO Mapping:

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

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CO- PSO Mapping

	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	3	2	1
CO3	2	3	1
CO4	2	3	1

Course Name:Digital Signal Processing
Code: EI403
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisite: Analog Electronics circuit, Signals & Systems, Analog Filters

Course Objective:

1. To develop the knowledge on signals used in digital signal processing.
2. To impart the knowledge of the principles of discrete-time signal analysis to perform various signal operations
3. Apply the principles of Fourier transform analysis to describe the frequency characteristics of discrete-time signals and systems
4. To study various sampling techniques and different types of filters
5. To learn the use of computer programming tools to create, analyze process and visualize signals and to plot and interpret magnitude and phase of LTI system frequency responses
6. To understand the architecture of a digital signal processor and some programming issues in fixed-point digital signal processor in real-time implementation.

Course Outcome:

The students will be able to:

CO1: Apply the knowledge about continuous and discrete time signals

CO2: Understand the Fourier Transform, and examine the process of Quantization and the effects of finite register length

CO3: Understand and implement DFTs on long data sets such as speech signals and images.

CO4: Develop different types of FIR & IIR filter structures and their implementations

CO5: Use of FFTs for efficient implementation of linear convolution

CO6: Excel in fields such as speech processing, audio signal processing, digital image processing, video and audio compression.

Course Content:

Module I:

LTI systems: **[8L]**

Concept of signals & systems, digital signal processing and its relevance to digital communication.Definition, representation, impulse response, derivation for the output sequence, concept of convolution, graphical, analytical and overlap-add methods to compute convolution supported with examples and exercise, properties of convolution, interconnection of LTI systems with physical interpretations, stability and causality conditions, recursive and non-recursive systems.

Module II:

Discrete Time Fourier Transform(DTFT): **[2L]**

Concept of frequency in discrete and continuous domain and their relationship (radian and radian/sec), freq. response in the discrete domain. Discrete system's response to sinusoidal/complex inputs (DTFT), Representation of LTI systems in complex frequency domain.

Discrete Fourier Transform: **[8L]**

Concept and relations for DFT/IDFT; Relation between DTFT & DFT; Twiddle factors and their properties; DFT/DFT as linear transformation and matrices ; Computation of DFT/IDFT by matrix method; Properties of DFT – periodicity, linearity, time reversal, circular time & frequency shift, symmetry, circular symmetry, duality, multiplication of two DFTs, circulation convolution, circular correlation ; Computation of circular convolution by graphical; Linear filtering using DFT, aliasing error, filtering of long data sequences- Overlap-Save and Overlap-Add methods.

Fast Fourier Transforms: **[4L]**

Radix-2 algorithm, decimation-in-time, decimation-in-frequency algorithm, signal flow graph, Butterflies, computations in one place, bit reversal, examples for DIT & DIF FFT Butterfly computations and exercises.

Module III:

Filter design: **[6L]**

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Basic concepts of IIR and FIR filters, difference equations, design of Butterworth IIR analog filter using impulse invariant and bilinear transform. Concept of Chebyshev filters and comparison with Butterworth filter. Design of linear phase FIR filters -no. of taps, rectangular, Hamming and Blackman windows. Effect of quantization. Some examples on practical filters.

Multirate Digital Signal Processing: **[2L]**

Introduction to multirate digital signal processing, sampling rate conversion, multistage interpolator & decimator, digital filter banks.

Module IV:

Digital Signal Processor: **[6L]**

Elementary idea about the architecture and important instruction sets of TMS320C 5416/6713 processor, writing of small programs.

Text Books :

1. Digital Signal Processing–Principles,Algorithms and Applications, J.G.Proakis& D.G.Manolakis, Pearson Ed.
2. Digital Signal processing – A Computer Based Approach, S.K.Mitra, TMH Publishing Co.
3. Digital Signal Processing Signals, Systems and Filters, A. Antoniou, TMH Publishing Co.
4. Digital Signal processing – A.V. Oppenheim,R.W.Schafer, Prentice Hall
5. Discrete-time Signal processing – A.V. Oppenheim,R.W.Schafer, John R. Buck, Prentice Hall

Reference Books :

1. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).
2. Digital Signal Processing, S.Salivahanan, A.Vallabraj& C. Gnanapriya, TMH Publishing Co.
3. Digital Signal Processing; A Hands on Approach, C. Schuler &M.Chugani, TMH Publishing Co.
4. Digital Signal Processing,A. NagoorKani, TMH Education
5. Digital Signal Processing S. Poornachandra& B. Sasikala, MH Education
6. Digital Signal Processing; Spectral Computation and Filter Design Chi-Tsong Chen, Oxford University Press
7. Texas Instruments DSP Processor user manuals and application notes.
8. Digital Signal Processing: A MATLAB-Based Approach, V.K.Ingle and J.G.Proakis, Cengage Learning
9. Modern Digital Signal Processing,V. Udayashankara, PHI Learning

CO-PO Mapping

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

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CO2	3	1	1	1	1	1	1	1	1	1	1	1
CO3	3	1	1	1	1	2	1	1	1	1	1	1
CO4	2	1	3	1	1	1	1	1	1	1	1	1
CO5	2	1	1	1	3	1	1	1	1	1	1	1
CO6	3	1	2	1	1	2	1	1	1	1	1	1

CO- PSO Mapping

	PSO1	**PSO2**	**PSO3**
CO1	3	2	1
CO2	3	2	1
CO3	3	2	1
CO4	2	3	1
CO5	2	3	1
CO6	3	2	1

Course Name: Electrical & Electronic Measurement & Instrumentation
Code: EI404
Contact : 3:0:0
Total Contact Hours : 36
Credits: 3

Course objective:

1. To familiarize the students how different types of electrical and electronics meters work and their construction and applications.
2. To provide an extensive knowledge about standards and units of measurements.
3. To provide knowledge for the calibration and standardization of various instruments.
4. To provide students with opportunities to develop basic skills in the design of measuring equipments.
5. To familiarize the students with the available software for virtual instrumentation.

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Course Outcome:

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

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

CO2: Calibrate and standardize the instruments applying the knowledge of calibration .

CO3: Design measuring instruments on a requirement basis.

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

Course Content:

Module I: **8**

Measurement of low, medium and high resistances, Kelvins double bridge, multimeters, megger.
Measurement of Capacitance: De Sauty's bridge & Schering bridge (AC Bridge)
Measurement of Inductance: Maxwell's inductance capacitance bridge (AC Bridge), Anderson Bridge
(*each bridge should cover: Bridge balance equation, Magnitude and phase balance of AC bridges, Phasor Diagram),

Module II: 8

Localization of cable faults using Murray and Varley loop methods. D.C. and A.C. potentiometers, Measurement of high voltage.
Wattmeter and Energy meter
Instrument transformers

Module III: **10**

Building blocks of Electronic Instruments:PLL including VCO: Block diagram, circuit diagram, operation, Charge amplifier, Current Mirror , Voltage to frequency and frequency to voltage converters
Analogue Electronic Instruments: Introduction,
True RMS voltmeter, Digital Voltmeter,
Q meter

Module IV:

Oscilloscopes and its applications: Oscilloscope Time Base, Triggering, Oscilloscope Controls, Oscilloscope Probes, Digital Storage Oscilloscope 5
Spectrum Analyzer
Interference and Noises
Introduction to Virtual Instrumentation

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Text Books:

1. Golding E.W. & Widdis F.C. : Electrical Measuring Instruments & Measurements ; Wheeler

2. Sawhney A K : A course in Electrical & Electronic Measurements & Instruments, Dhanpat Rai & Co.

3. Helfrick A.D. & Cooper W.D. : Modern Electronic Instrumentation & Measuring Instruments; Wheeler

4. Bell, David : Electronic Instrumentation & Measurement, Reston Publishers

5. D.C. Patranabis, Principles of Electronic Instrumentation, PHI

6. A. K. Ghosh, Introduction to Measurements and Instrumentation

Reference Books:

1. Harris, F. K. – Electrical Measurements, Wiley.

2. H.S. Kalsi, Electronic Instrumentation, Tata McGraw Hill

3. Reissland M.U.: Electrical Measurement, New Age International

CO-PO Mapping:

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

CO- PSO Mapping

	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	3	2	1
CO3	2	3	1
CO4	3	2	1

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Course Name: Gender Culture and Development
Code: HSMC 402
Credits: 2
No. of lectures: 24

Course objectives:

This course offers an introduction to Gender Studies, an interdisciplinary field that asks critical questions about the meanings of sex and gender in society.

Course Outcomes:

CO1: To understand the key issues, questions related to Gender studies.

CO2: To understand gender-based violence and discrimination.

CO3: To examine the concepts of gender, gender based violence and rights.

CO4: To analyse the impact of gender based violence on education, health and development.

Course Content

MODULE 1: Introduction -3L

Definition of Gender • Basic Gender Concepts and Terminology • Exploring Attitudes towards Gender • Social Construction of Gender

MODULE 2:Gender Roles and Relations-6L

• Types of Gender Roles • Gender Roles and Relationships Matrix •Gender Division of Labour – Mode of Production Gender-based Division and Valuation of Labour

MODULE 3:Gender Development Issues -6L

• Identifying Gender Issues • Gender Sensitive Language • Gender, Governance and Sustainable Development • Gender and Human Rights • Gender and Mainstreaming

MODULE 4:Gender-based Violence -5L

• The concept of violence • Types of Gender-based violence •the relationship between gender, development and violence • Gender-based violence from a human rights perspective

MODULE 5: Gender and Culture-4L

• Gender and Film • Gender and Electronic Media • Gender and Advertisement • Gender and Popular Literature

Reference:

1. IAWS, Feminist Approaches to Economic Theories A Report, IAWS, New Delhi, 1995.

2. PromillaKapur (ed), Empowering Indian Women, Publication Division, Government of India, New Delhi, 2000.

3. Kaila H.L, Women, Work and the Family, Rawat Publications, Jaipur, 2005.

4. Malcom Harper, Profit for the Poor – Cases in Microfinance, Oxford and IBH Publishing House, New Delhi, 1998.

5. Sheela Varghese, Employment of Women in the unorganized manufacturing sector, University Book House Private Limited, Jaipur, 2003.

6. Balakrishnan A., Rural Landless women Labourers – Problems and Prospects, Kalpaz Publications, New Delhi, 2005.

CO-PO Mapping:

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

CO- PSO Mapping

	PSO1	PSO2	PSO3
CO1	1	1	3
CO2	1	2	3
CO3	1	2	3
CO4	1	1	1

B. Practical

Curriculum for B.Tech
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L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

Course Name: Physics II Lab

Code: PH (EIE)491

Total Contact Hours: 0:0:3

Credit: 1.5

Pre requisites: Knowledge of Physics up B. Tech. 1st year Physics-I course

Course Objective:

The Physics-II course will provide

A.exposure to the physics of materials that are applied in electrical engineering

B. an insight into the science & technology of next generation and related technicalities through quantum mechanics

C. advanced materials for electrical engineering

D. concept of fundamental particles and associated applications in semiconductors

At the end of the course students' will be able to
CO1 : demonstrate experiments allied to their theoretical concepts
CO2 : conduct experiments using semiconductors , dielectric and ferroelectrics
CO3 : classify various types of magnetic materials
CO4 : participate as an individual, and as a member or leader in groups in laboratory sessions actively
CO5 : analyze experimental data from graphical representations , and to communicate effectively them in Laboratory reports including innovative experiments

Experiments on Module 1: Electric and Magnetic properties of materials (8L)

1. Study of dipolar magnetic field behavior.
2. Study of hysteresis curve of a ferromagnetic material using CRO.
3. Use of paramagnetic resonance and determination of Lande-g factor using ESR setup.
4. Measurement of Curie temperature of the given sample.
5. Determination of dielectric constant of given sample (frequency dependent)/Measurement of losses in a dielectric using LCR circuits.

Experiments on Module 2: Quantum Mechanics-II (6L)

6. Determination of Stefan's radiation constant.
7. To study current-voltage characteristics, load response, areal characteristics and spectral response of photo voltaic solar cells & measurement of maximum workable power.
8. Measurement of specific charge of electron using CRT.

Experiments on Module 4: Solid state physics (9L)

9. Determination of band gap of a semiconductor.
10. Determination of Hall co-efficient of a semiconductor and measurement of Magneto resistance of a given semiconductor
11. Study of I-V characteristics of a LED.

12. Study of Intensity-Resistance characteristics of a LDR.

In addition to regular 7 experiments it is **recommended that each student should carry out at least one experiment beyond the syllabus/one experiment as Innovative experiment.

Probable experiments beyond the syllabus:

1. Determination of thermal conductivity of a bad conductor by Lees and Chorlton's method.
2. Determination of thermal conductivity of a good conductor by Searle's mothod.
3. Study of transducer property: Determination of the thermo-electric power at a certain temperature of the given thermocouple.

CO-PO Mapping:

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

CO- PSO Mapping

	PSO1	**PSO2**	**PSO3**
CO1	1	1	3
CO2	1	2	3
CO3	1	2	3
CO4	1	1	1
CO5	2	2	1

Course Name: Sensors and Transducers Lab
Code: EI491

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

L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

Contact: 0:0:3

Credits: 1.5

Course Objective:

1. To identify suitable instruments for the specific physical parameter measurement.
2. To operate Resistive, Capacitive and Inductive transducers.
3. To recommend the transducers for specific physical parameter measurement.
4. To characterize specific transducers.

Course Outcome:

The students will be able to:

CO1: Illustrate the working of transducers and various transducers used for the measurement of various physical variables.

CO2: Analyze the characteristics of the transducers.

CO3: Design sensor based on the real time application.

CO4: Estimate the design specifications of different transducers.

List Of Experiment:

1. Displacement measurement by using a capacitive transducer.
2. Pressure and displacement measurement by using LVDT.
3. Study of a load cell with tensile and compressive load.
4. Torque measurement Strain gauge transducer.
5. Speed measurement using magnetic proximity sensor.
6. Speed measurement using a Stroboscope.
7. Study of the characteristics of a LDR.
8. Pressure measurement using Piezo-electric transducer
9. Study of the Characteristics of Hall-effect transducer
10. Innovative experiment

CO-PO Mapping:

CO	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1 1	PO1 2
CO1	3	2	1	1	1	1	1	1	1	1	1	1

Curriculum for B.Tech
Under Autonomy
Applied Electronics & Instrumentation Engineering
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

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

CO- PSO Mapping

	PSO1	**PSO2**	**PSO3**
CO1	3	2	1
CO2	3	2	1
CO3	2	3	1
CO4	2	2	1

Course Name: Microprocessors Lab
Code : EI492
Contact :0:0: 3
Credits: 1.5

Course Objective:

1. To enable the students to analyze microprocessors.

2. To grow programming concepts using microprocessors.
3. To make students able to write programs, interface with peripherals and implement them in projects.
4. To be able to choose suitable microprocessors for any design and implementation.
5. To be able to interface microprocessors with peripherals devices.

Course Outcome:

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

CO1: write microprocessor and microcontroller-based programs to solve any given problem statement.
CO2: design microprocessor-based systems for real-time applications.
CO3: reconstruct microprocessor based memory interfacing as per the requirements.
CO4: Understand the concepts related to I/O interfacing

Curriculum for B.Tech
Under Autonomy
Applied Electronics & Instrumentation Engineering
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

List of Experiments:

1. Familiarization with 8085 trainer kit components.

2. Program development using basic instruction set (data transfer, Load/ Sore, Arithmetic, Logical) using 8085 trainer kit such as

a) Addition and subtraction

b) Copying and shifting a block of memory

c) Packing and unpacking of BCD numbers

d) Addition of BCD numbers

e) Binary to ASCII conversions

f) String matching

g) Multiplication of two numbers

h) Sorting of an array of numbers

3. Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit, write a subroutine for the delay, reading switch state & glowing LEDs accordingly, finding out the frequency of a pulse train, etc.

4.Interfacing with I/O Modules

5. Innovative experiment

CO-PO Mapping:

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

CO- PSO Mapping

Curriculum for B.Tech
Under Autonomy
Applied Electronics & Instrumentation Engineering
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	3	2	1
CO3	3	3	1
CO4	3	2	1

Course Name: Digital Signal Processing Lab
Code: EI493
Contact: 0:0:3
Credits: 1.5

Course Objective:

1. To implement simulation and development of basic signal processing algorithms.
2. To study the standardized environments such as MATLAB and general-purpose DSP development kits.
3. To analyze and Observe Magnitude and phase characteristics of different signals.
4. The experiments implement fundamental concepts of digital signal processing like sampling and aliasing, internal arithmetic operations, digital filter design and implementation, signal generation.
5. Students will try to learn about the knowledge on different algorithms associated with filtering of long data sequences.

Course Outcome:

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

CO1: Understand various signals generation.

CO2: Compute the system output using convolution method with MATLAB Software package.

CO3: Analyze and Observe Magnitude and phase characteristics of different signals.

CO4: Calculate DFT, FFT, IDFT using MATLAB.

CO5: Analyze Magnitude and phase characteristics (Frequency response Characteristics) of digital LP,HP& FIR Butterworth filters.

CO6: Develop and Implement DSP algorithms in software using a Computer language such as C with TMS320C6713 floating point Processor.

Experiments:

1. Sampled sinusoidal signal, various sequences and different arithmetic operations using MATLAB.
2. Convolution of two sequences using graphical methods and using commands- verification of the properties of convolution.
3. Z-transform of various sequences – verification of the properties of Z-transform.
4. Twiddle factors – verification of the properties.
5. DFTs / IDFTs using matrix multiplication and also using commands.
6. Circular convolution of two sequences using graphical methods and using commands, Differentiation between linear and circular convolutions.
7. Verifications of the different algorithms associated with filtering of long data sequences and Overlap –add and Overlap-save methods.
8. Implementation of FFT of given sequence.
9. Implementation of LP & HP FIR filters for a given sequence.
10. Hardware Laboratory :
    Writing & execution of small programs related to arithmetic operations and

    Convolution using Assembly Language of TMS320C 5416/6713 Processor

11. Innovative Experiment

CO-PO Mapping:

CO	PO1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO1 1	PO1 2
CO 1	3	2	-	-	-	-	-	-	-	-	-	1
CO 2	1	2	-	3	-	-	-	-	-	-	-	1
CO 3	1	2	-	-	-	-	-	-	3	-	-	1
CO 4	1	2	-	-	-	-	-	-	-	3	-	1
CO	1	2	-	3	-	-	-	-	-	-	-	1

Curriculum for B.Tech
Under Autonomy
Applied Electronics & Instrumentation Engineering
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

5												
CO 6	2	2	-	2	-	-	-	-	1	-	-	1

CO- PSO Mapping

	PSO1	**PSO2**	**PSO3**
CO1	3	2	1
CO2	3	2	1
CO3	2	2	1
CO4	2	2	1
CO5	2	2	1
CO6	2	2	1

Course Name: Electrical & Electronic Measurement & Instrumentation Lab
Code: EI494
Contact: 0:0:3
Credits: 1.5

Course objective:

1. To understand how different types of bridge circuits are to be operated

2. To understand about different types of static and dynamic characteristics.

3. To understand the operation of VCO and PLL

4. To understand the operation of Digital Storage Oscilloscope

5. To familiarize the calibration procedure of different electrical meters

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

L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

Course outcome:

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

CO1: Apply the knowledge for calibration of different electrical meters.

CO2: Relate different static and dynamic characteristics of a measuring instrumentfor a typical application.

CO3: Analyze the measured data statistically.

CO4: Reconstruct a given signal using the knowledge of Digital Storage Oscilloscope.

List of Experiment:

1. Measure the resistivity of material using Kelvin Double Bridge
2. Measurement of Capacitance by De Sauty Bridge
3. Calibrate dynamometer type Wattmeter by potentiometer
4. Calibrate A.C. energy meter.
5. Measurement of Power using Instrument transformer
6. Study of Static Characteristics of a Measuring Instrument
7. Study of Dynamic Characteristics of a Measuring Instrument
8. Realization of a V-to-I & I-to-V converter.
9. Statistical analysis of errors in measurement.
10. Study of VCO (Voltage controlled oscillator) & PLL (Phase Locked Loop).
11. Analysis of various waveforms and spectrum using Spectrum Analyser.
12. Familiarization with Digital Storage Oscilloscope.
13. Innovative experiment

CO-PO Mapping:

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

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

L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO- PSO Mapping

	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	3	2	1
CO3	2	2	1
CO4	2	2	1

C. MANDATORY ACTIVITIES / COURSES

Course Name: Environmental protection initiatives
Code: MC481
Credits: 0
Total lectures: 36
Course Objective

- To illustrate the concepts of Environmental Protection in an active learning environment.
- To analyze the quality of air, water and soil in the nearby areas.
- To illustrate some popular techniques for scientific problem-solving related to air, water, noise & land pollution.
- To obtain knowledge about environment and its sustainability.

Course Outcome

CO1:Ability to measure and analyze the different water quality parameters as recommended by WHO.

CO.2: Ability to analyze air quality any suggest suitable measures for its improvement.

CO 3: Ability to calculate Carbon foot prints and provides solutions accordingly.

CO.4: Able to apply different statistical tools for environment management and environmental protection acts.

CO.5:Acquire skills for scientific problem-solving related to air, water, noise & land pollution.

Choice of 10-12 experiments/activities from the following:

1. Measurement of pH and conductance of waterand soil samples collected from different sources and analysis of their quality.

2. Measurement of alkalinity of water & soil samples collected from different sources and analysis of their quality.
3. Measurement of Dissolved Oxygen in water collected from different sources by Winkler's Method and analysis of its quality for aquatic animals.
4. Measure of Chemical Oxygen Demand of different waste water sample using potassium dichromate and its analysis.
5. Estimation of Chloride and Sulphate present in different waste water sample and study of their effect on plant and animal life.
6. Measurement of TDS & TSS of different drinking water sample and their comparative study.
7. Enumerating the presence of pathogenic bacteria in water sample.
8. Plantation of tree
9. Study of construction and functioning of a Biogas plant.
10. Study of Environmental Impact Assessment
11. Analysis of the Carbon Footprint and study of its Environmental Impact Factors
12. Analysis of an automobile and study of its emission per day.
13. Case Study on Air pollution in a city.

CO-PO Mapping

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

CO- PSO Mapping

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

L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	3	2	1
CO3	2	2	1
CO4	2	2	1
CO5	2	2	2

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

L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

3rd Year 1st Semester

Sl. No.	Category	Course Code	Course Title	Hours per week				Credits
				L	**T**	**P**	**Total**	
A. THEORY								
1	Humanities and Social Sciences including Management courses	HSMC 505	Principles of Management	2	0	0	2	2
2	PC	EI501	Industrial Instrumentation	3	0	0	3	3
3	PC	EI502	Analog and Digital Communication	3	0	0	3	3
4	PC	EI503	Control theory	3	0	0	3	3
5	PE	EI504	A. Power Plant Instrumentation B. Virtual Instrumentation C. Advanced microprocessor and microcontroller	3	0	0	3	3
B. PRACTICAL								
7	PC	EI591	Industrial Instrumentation Lab	0	0	3	3	1.5
8	PC	EI592	Analog and Digital Communication Lab	0	0	3	3	1.5
9	PC	EI593	Control theory Lab	0	0	3	3	1.5
10	PE	EI594	A. Power Plant Instrumentation Lab B. Virtual Instrumentation Lab C. Advanced microprocessor and microcontroller Lab	0	0	3	3	1.5
11	PROJECT	PR 591	Minor Project I	0	0	3	3	1
12	PROJECT	PR 592	Skill Development V: Soft Skill & Aptitude-II	1	0	0	1	0.5
C. MANDATORY ACTIVITIES / COURSES								

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L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

14	MC	MC 501	Constitution of India	3	0	0	3	3Units
	TOTAL CREDIT WITHOUT MOOCS COURSES							21.5
D. MOOCS COURSES**								
15	MOOCS COURSES	HM501	MOOCS COURSE-III	3	1	0	4	4
TOTAL CREDIT WITH MOOCS COURSES								**25.5**

**** MOOCS COURSES for HONOURS/MINOR Degree are Program specific and to be taken from MOOCS BASKET**

Curriculum for B. Tech
Under Autonomy
Applied Electronics & Instrumentation Engineering
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

A. THEORY

Paper name: Principles of Management
Paper Code:HSMC 505
Credits: 2
No. of lectures: 24

Course Objective:
1. To understand and apply management principles to a manufacturing organization.

2. To understand concepts of work-study, method study, and Quality control method to improve the performance of any organization.

.

Course outcome:
On completion of the course, students will be able to
CO1: To recall and identify the relevance of management concepts.

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

CO3: To compare the management theories and models critically to solve real-life problems in an organization.
CO4: To apply principles of management in order to execute the role as a manager in an organization.

Course Content:

Module-1: Management Concepts: Definition, roles, functions, and importance of Management, Evolution of Management thought-contribution made by Taylor ,Fayol, Gilbreth, Elton Mayo,McGregor, Maslow **(4L)**

Module - 2: Planning and Control: Planning: Nature and importance of planning, -types of planning, Levels of planning - The Planning Process. –
MBO, SWOTanalysis, McKinsey's7S Approach.
Organizing for decision making: Nature of organizing, a span of control, Organisational structure –line and staff authority.
Basic control process -control as a feedback system – Feed Forward Control –
Requirements for effective control – control **(4L)**

Module - 3:Group dynamics: Types of groups, characteristics, objectives of Group Dynamics.

Leadership: Definition, styles & functions of leadership, qualities for good leadership, Theories of leadership **(4L)**

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Module – 4: Work Study and work measurement: Definition of work-study**,** Method Study Steps, Tools and Techniques used in the Method Study and Work Measurement Time Study: Aim & Objectives, Use of stopwatch procedure in making Time Study. Performance rating, allowances, and its types. Calculation of Standard Time. Work sampling **(4L)**

Module - 5:Marketing Management: Functions of Marketing, Product Planning, and development, PromotionalStrategy (**2L)**

Module - 6: Quality management: Quality definition, Statistical quality control, acceptance sampling , Control Charts –Mean chart, range chart,cchart,p chart, np chart, Zero Defects, Quality circles, Kaizen & Six Sigma, ISO -9000 Implementation steps, Total quality management **(6L)**

Text Books:

1. Essentials of Management, by Harold Koontz & Heinz Weihrich Tata McGraw
2. Production and Operations Management-K.Aswathapa,K.Shridhara Bhat, Himalayan Publishing House

References:

1. Organizational Behavior, by Stephen Robbins Pearson Education, New Delhi
2. New era Management, Daft, 11th Edition, Cengage Learning
3. Principles of Marketing, Kotlar Philip and Armstrong Gary, Pearson publication

CO-PO Mapping:

CO Codes	PO 1	PO 2	PO 3	P O4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	2	1	1	2	1	1	1	1	3	1	3	2
CO2	1	1	1	1	1	2	1	3	3	1	3	3
CO3	2	1	1	2	1	1	1	1	2	1	3	3
CO4	3	1	1	1	1	2	1	2	3	1	3	1

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	1	3
CO2	2	1	2
CO3	2	1	2
CO4	2	2	2

Curriculum for B. Tech
Under Autonomy
Applied Electronics & Instrumentation Engineering
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

Course Name: Industrial Instrumentation
Course Code: EI501
Contact: 3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisites: Knowledge of Sensor & Transducer, Measurement process.

Course Objectives:

1. To understand the importance of different industrial instruments.
2. To understand the working principle of different measuring instruments.
3. To measure different physical parameters like pressure, temperature, flow rate, level etc.
4. To install the different instruments.

Course Outcomes:

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

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

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

CO4: Able to install the instruments.

Module I: Measurement of Pressure and Vacuum: [6L]
Manometers – U tube, Inclined Tube and Well type Manometers, Characteristics of Elastic Pressure Sensor, Bourdon Tube Pressure Gauge, Diaphragm, Bellows, Capsule Gauge, Differential Pressure Gauge, Pressure Switch, DP transmitters, McLeod Gauge, thermal conductivity gauge, ionization gauge.

Module II: Flow rate Measurement: [11L]

Types of Flow, Reynolds's number, Bernoulli's Equation, Calibration of flow meters,
Head type flow measurement – analysis and calculation - orifice, venturi, pitot tube, flow nozzle,
Variable Area Flowmeters – Glass and metal tube rotameters,
Mass flow meters : Coriolis, Thermal, Impeller type,
Electromagnetic type, Ultrasonic type, Positive displacement type

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Module III: Level Measurement: [5L]
Gauge glass, Bi-Colour, Magnetic and Reflex Level Gauge, Float and displacers type instruments, Hydrostatic type level measurement, Capacitive type level instrument, Ultrasonic and Microwave type level instruments

Module IV: Temperature Measurement: [9L]
Temperature scale, Thermometers: Liquid, vapour and gas filled: construction details and comparison, Bimetal elements, Thermostats,
RTD: review of materials, construction, types; measuring circuits, ranges, errors and minimization of errors,
Thermocouples: types, thermoelectric power, circuits, ranges, errors, cold junction compensation, compensating cables, Linearization techniques of thermocouples, Thermopile, thermowell. Thermistors,
Radiation Thermometer sensors: spectral and other characteristics, Pyrometers.

Module V: [5L]
Installation of pressure measuring instruments and Temperature elements
Pneumatic Instrumentation : Flapper nozzle system - pneumatic force balance and motion balance system , Pneumatic Transmitter.
Hazardous Area Instrumentation: Basic Concept

Text Books:

1. D. Patranabis, 'Principles of industrial Instrumentation', TMH, New Delhi, 2nd Ed
2. S.K.Singh:'Industrial instrumentation And Control' TMH, New Delhi, Third edition,
3. Arun Kumar Ghosh: 'Introduction to Measurement & Instrumentation', PHI, New Delhi, 4th edition.

Reference Books:

1. K.Krishnaswamy, S.Vijayachitra: 'Industrial Instrumentation',New age International Publishers, 2nd edition.
2. B. G. Liptak: 'Instrument Engineers Handbook', vol-I and vol-II, Chilton Book Co. Philadelphia
3. Ernest O. Doeblin, 'Measurement Systems – Application and Design', Tata-McGraw Hill
4. S.K.Sen, 'Measurement Techniques in Industrial Instrumentation',New Age International.

CO-PO Mapping:

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

Curriculum for B. Tech
Under Autonomy
Applied Electronics & Instrumentation Engineering
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	2	3
CO2	2	1	1
CO3	2	3	2
CO4	2	2	2

Course Name: Analog & Digital Communication Theory
Course Code: EI502
Contact:3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisites: Signals and Systems, Analog and digital electronic circuits

Course Objectives:

1. To understand the building blocks of the communication system.
2. To prepare the mathematical background for communication signal analysis.
3. To understand and analyze the signal flow in a communication system.
4. To analyze the error performance of a communication system in presence of noise and other interferences.
5. To understand the concept of spread spectrum communication system.

Course Outcomes:

CO1: Able to analyze the performance of a baseband and pass band communication system in terms of error rate and spectral efficiency.
CO2: Able to perform the time and frequency domain analysis of the signals in a communication system.
CO3: Able to select the blocks in a design of communication system.
CO4: Able to analyze Performance of spread spectrum communication system.

Curriculum for B. Tech
Under Autonomy
Applied Electronics & Instrumentation Engineering
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

Module I: Elements of communication system: [10L]

The basic elements of a communication system, Concept of transmitter and receiver, origin of noise and its effects in a communication system, the Concept and effects of SNR and its importance in system design.
Linear (AM) modulation, Generation, and demodulation of AM wave. Concept of DSBSC, SSBSC, and a brief discussion of VSBSC. Concept of QAM.
Basic principle of nonlinear (FM, PM) modulation and their relations. Generation and demodulation of FM waves.

Module II: Sampling and Pulse Modulation techniques: [8L]

Sampling theorem, sampling rate, impulse sampling, natural &flat-topped sampling, reconstruction of the signal from samples, Concept of Aliasing, and anti-aliasing filter.
Quantization noise, Uniform quantization, Non-uniform quantization, A-law, and μ-law.
A/D and D/A conversion techniques, Concept of Bitrate, Baud rate, M-ary encoding.
Analog pulse modulation-PAM, PWM, PPM.
Fundamentals of PCM, Block diagram of PCM, the basic concept of Delta modulation, Adaptive delta modulation.
Introduction to DPCM.
Different types of multiplexing: TDM, FDM.

Module III: Digital Transmission: [8L]

The basic concept of Digital communication, comparative study of digital communication and analog communication.
Encoding, coding efficiency. Line coding & its desirable properties, Different types of line coding: NRZ & RZ, AMI, Manchester coding and their spectra.
Baseband pulse transmission, optimum filter, Matched filter, and correlation filter, Inter Symbol Interference (ISI), Eye pattern, Signal power in the binary digital signal.

Module IV: Digital carrier modulation & demodulation technique: [6L]
Introduction to the digital modulation techniques- ASK. FSK, PSK, BPSK, QPSK, M-ary PSK and their comparisons.
Basic concept of spread spectrum modulation and CDMA.

Module V: Introduction to coding theory: [4L]
Introduction, Measurement of Information and its unit, Entropy, Mutual information, Information rate, Basic principle of error control & error correction coding.

Text Books:

1. Modern Digital and Analog Communication Systems, B.P. Lathi, Oxford University press
2. Communication Systems (Analog and Digital), Dr. Sanjay Sharma, S. K. Kataria& Sons

3. Analog communication system, P. Chakrabarti, Dhanpat Rai & Co.
4. Principle of digital communication, P. Chakrabarti, Dhanpat Rai & Co.

Reference Books:

1. Digital and Analog communication Systems, Leon W Couch II, Pearson, Education Asia.
2. An Introduction to Analog and Digital communication, Simon Haykin, Wiley India.
3. Principles of Communication Systems, Taub and Schilling, Tata McGraw-Hill Education

CO-PO Mapping:

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

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	2	3
CO2	2	2	1
CO3	2	1	2
CO4	2	2	1

Course Name: Control Engineering
Course Code: EI503
Contact:3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisites:

Electrical measurement systems, basic laws of mathematics, and formulation of integral and differential equations.

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Course Objectives:

1. To construct the model of a physical dynamical system by a linear time-invariant ordinary differential equation.
2. To analyze the under-damped, over-damped, and critically damped cases of a second-order system in the time domain.
3. To illustrate the effects of poles and zeros location in the s-plane on the transient and steady-statebehavior of a system.
4. To determine the system stability in the frequency domain.
5. To explain the effects of Lead, Lag, and Lag-Lead compensator on second-orderSystems.

Course Outcomes:

CO1: Apply Laplace transform and state-space techniques to model dynamic systems.
CO2: Demonstrate an understanding of the fundamentals of control systems.
CO3: Determine the time-domain responses of first and second-order systems.
CO4:Analyze the system behavior in the frequency domain & the system stability using a compensator.

Module I:
Mathematical Model of Physical System & Analysis in Time Domain (12L)

Introduction to Elementary control concepts:-Brief introduction, Applications area. Open-loop and close loop systems and their comparison. Mathematical Model of Physical Systems:- Introduction, Differential equation representation of physical systems, Transfer function concepts, Block diagram algebra, Signal flow graphs:- Mason's gain formula. Time Response Analysis: - Introduction, Review of standard test signals-Step, Ramp, Impulse, sinusoid.Time response of the first-ordersystems, Design specifications of first-order systems, Time response of second-order systems, Design specifications of second-order systems.

Module II: Stability Analysis of System in Time Domain (10L)

Stability Analysis in Time Domain: The concept of stability, Assessment of stability from pole positions, Necessary conditions for stability, Routh Stability Criterion, Relative stability analysis, Illustrative examples. Root Locus Technique: Introduction, The root locus concept, Root locus construction rules, Root contours, Advantages & limitations, Relative stability analysis using root locus.

Module III: Stability Analysis of System in Frequency Domain (11L)

Frequency Response Analysis: Introduction, Performance Indices, the Frequency response of second-order systems, Polar plots, Bode plots, All pass systems, Minimum-phase and Non-minimum-phase systems,

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Assessment of relative stability – Gain Margin and Phase Margin, examples. Stability Analysis in Frequency Domain: Introduction, A brief review of Principle of Argument, Nyquist stability criterion, Illustrative examples. Introduction to Design: The design problem, Concepts of cascade and feedback compensation, Realization of basic compensators- Lead, Lag, Lag-Lead compensator. State variables: Concepts of state, state variables and state model, State models of linear continuous-time systems, Concept on Controllability and Observability.

TextBooks:

1. Modern Control. Engineering. Fifth Edition. Katsuhiko Ogata.
2. CONTROL SYSTEMS: ENGINEERING, 5th Edition [I. J. Nagrath, M. Gopal].
3. Automatic Control Systems [Farid Golnaraghi, Benjamin C. Kuo].
4. NagoorKani. Edition, 2. Publisher, RBA Publications.
5. Automatic Control Engineering, 5th Edition by Raven, Francis H at Bibliography.
6. Control Engineering: Theory and Practice [M. N. Bandyopadhyay].

Reference books:

1. Book. Modern Control Engineering. Marcel Dekker, Inc. New York, NY, USA ©2001.
2. Classical Feedback Control by B. Lurie and P. Enright.
3. Control Systems Engineering: Analysis and Design" by Norman S Nise.
4. 2. Control Systems, Ambikapathy, Khanna Book Publishing Co. (P) Ltd., Delhi.

CO-PO Mapping:

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

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	2	3
CO2	2	2	1
CO3	2	2	3
CO4	2	2	2

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Course Name: Power Plant Instrumentation
Course Code: EI504A
Contacts: 3:0:0
Credits: 3
Total Contact Hours: 36

Module I: General Concepts

Power Plants of different types: Setups, energy conversions and measurement

requirements, examples of Thermal, Hydel, and Nuclear plants. Thermal power plant and system instrumentation.

Module II: Instrumentation for

1) Turbines
2) Condensers
3) Generators
4) Coal handling
5) Water treatment
6) Feed water, combustion air, and flue gases

Module III: Control

Boiler Control - Steam pressure control, combustion control, Furnace Draft control, Steam temperature control, Feedwater control, Datalogger and computer control, supervisory control, and monitoring system. Instrumentation for safety interlocks - protective gears, emergency measures, Alarm systems, and Analysis, etc. Pollution measurement, monitoring, and control.

Module IV:

Data handling-processing, logging, acquisition, accounting, display and storage. Instrumentation for Generator and Busbar coupling.

Introduction to power plant modeling/simulation

Text Books:

1. Principles of Industrial Instrumentation, D. Patranabis, TMH New Delhi

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Reference Books:

1. Electric Power Engineering Handbook – Edited by L. L. Grigsby.

2. Instrument Engineers Handbook, B. G. Liptak, Chilton Book Co., Philadelphia

CO-PO Mapping:

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

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	2	3
CO2	2	2	1
CO3	2	3	1
CO4	1	2	2

Course Name: Virtual Instrumentation
Course Code: EI504B
Contacts: 3:0:0
Credits: 3
Total Contact Hours: 36
Course Outcomes:

Prerequisites:

Sensors and Transducers, Process Instrumentation, Programming Languages, Communication Engineering

Course Objectives:

1. To introduce the concept of virtual instrumentation.
2. To develop basic VI programs using loops, case structures etc. including its applications in image, signal processing, and motion control.

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Applied Electronics & Instrumentation Engineering
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

Course Outcomes:

After the successful completion of the course the students will be able to:
CO1: To explainthe working of LabVIEW.
CO2: To Understand the various types of structures used in LabVIEW.
CO3: To analyze and design different types of programs based on data acquisition.
CO4: To apply the knowledge of LabVIEW for signal processing, image processing, etc.

ModuleI:

Review of Virtual Instrumentation: Historical perspective, Block diagram, and Architecture of Virtual Instruments Data, Review of measurement systems- analog systems, digital systems
Flow Techniques: Graphical programming in the data flow, Comparison with conventional programming.**[8L]**

Module II:

Virtual instrumentation in LabVIEW: Introduction (Front Panel, Block Diagram), Data Types, Operators, Instructions, Graphs, Plots**[10L]**

Module III:

VI Programming Techniques: VIs and sub-VIs, Loops and Charts, Arrays, Clusters and graphs, Case and sequence structures, Formula nodes, Local and global variables, Strings and file I/O. Virtual Instrument projects**[10L]**

ModuleIV:

Data Acquisition Basics: ADC, DAC, DIO, Counters, and timers**.**
Data acquisition boards – Serial ports: RS-232, USB; Parallel ports: IEEE-1284, GPIB standard IEEE-488.2 , System buses, Interface buses: PCMCIA, VXI, SCXl, PXI, etc.**[8L]**

Text Books:

1. Johnson, G., LabVIEW Graphical Programming, McGraw−Hill (2006).
2. Wells, L.K. and Travis, J., LabVIEW for Everyone, Prentice Hall Inc. (1996).
3. Gupta, S. and Gupta, J.P., PC Interfacing for Data Acquisition and Process Control, Instrument Society of America (1988)

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Reference Books:

1. Jeffrey Travis, Jim Kring, LabVIEW for Everyone: Graphical Programming Made Easy and Fun
2. Nitesh Pradhan, Let Us LabVIEW: Part 1, Notion Press
3. 2. Nitesh Pradhan, Let Us LabVIEW: Part 2, Notion Press

CO-PO mapping:

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

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	2	3
CO2	2	2	1
CO3	1	1	2
CO4	2	3	2

Course Name: ADVANCED MICROPROCESSORS AND MICROCONTROLLERS
Course Code: EI504C
Contacts: 3:0:0
Credits: 3
Total Contact Hours: 36
Prerequisites: Digital logics, programming instructions.

Course Objectives:

1. To understand 8085/8086 microprocessors and 8051 microcontrollers with their internal architecture and various addressing modes.
2. To gather knowledge about various instructions and programs
3. To communicate various real-time applications
4. To know the advanced systems based on microprocessors and microcontrollers.

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Course Outcomes:

On completion of this course, students will be capable of

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

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

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

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

Module I:

Intel 8086/8088 Microprocessor: Architecture, Clock Generator, Resetting the microprocessor, Wait for State Inserting, Bus Buffering, Interrupts, and Assembly Language Programming and Addressing Modes. **[8L]**

Module II:

Interfacing Memory: Classification of Memory, Address decoding (using logic gates, decoders, and PAL), Interfacing Static RAM (6116 – 2K, 6264 – 8K), Interfacing EPROM (2764 – 8K, 27256 – 32K), Designing Memory Modules (higher capacity say 512K) using memory chips (say 8K). Interfacing I/O Devices. **[9L]**

Module III:

Interfacing and assembly language monitor program for Key Board (one dimensional, two dimensional) and 7-segment display, Stepper Motor through 8255A, Data transfer between two microprocessor-based systems through 8255.

8237 DMA controller and interfacing with 8086 up **[10L]**

Programmable communication interface- Intel 8251 USART. Programmable InterruController- 8259A.

Module IV:
Introduction to single-chip microcontrollers: Intel MCS-51 family features, 8051/8031 architecture, pin configuration, I/O ports, and Memory organization. Instruction set and basic assembly language programming.

Interrupts, Timer/Counter, and Serial Communication.

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MCS-51 applications: Square wave and pulse wave generation, LED, A/D Converter, and D/A Converter interfacing to 8051. Introduction to PIC microcontroller.

[9L]

Text Books:

1. Douglas V. Hall – Microprocessors & Interfacing, Tata McGraw-Hill
2. Ray &Bhurchandi – Advanced Microprocessors & Peripherals, Tata McGraw-Hill
3. Walter A. Tribel – The 8088 and 8086 Microprocessors, Pearson Education

Reference Books:

1. Barry B. Brey – The Intel Microprocessors, PHI/Pearson Ed. Asia
2. Muhammed Ali Mazidi and Janice GillispieMazidi – The 8051 Microcontroller and Embedded Systems, Pearson Education Inc.
3. Ajay V Deshmukh – Microcontrollers Theory and Applications, Tata McGraw-Hill Kenneth J. Ayala – The 8086 Microprocessor, Cengage Learning.

CO-PO Mapping:

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

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	2	3
CO2	1	2	1
CO3	2	2	2
CO4	1	3	2

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B. PRACTICAL

Course Name: Industrial Instrumentation Lab
Course Code: EI591
Contact: 0:0:3
Credits: 1.5
Course Objectives:

1. To understand the importance of calibration of different industrial instruments.
2. To measure different physical parameters like pressure, temperature, flow rate, level etc
3. To understand the working principle of different measuring instruments
4. To choose the suitable instrument for desired measuring parameter.

Course Outcomes:

CO1: Able to calibrate different instruments.
CO2: Able to measure different industrial parameters like pressure, temperature, flow, level, etc.
CO3: Able to understand the working principle of different instruments
CO4: Able to choose the suitable instrument for desired measuring parameter.

List of Experiments:

1. Calibration of Pressure Gauge using Dead Weight Tester
2. Study of Thermocouple characteristics and Measurement of Temperature.
3. Study of Thermistor characteristics and Measurement of Temperature.
4. Study of RTD characteristics and Measurement of Temperature.
5. Measurement of temperature using AD590
6. Measurements of flow rate and velocity of fluid flow by the head type flow meter.
7. Measurements of flow rate and velocity of fluid flow by Variable Area type flow meter
8. Measurement of the level using capacitive type level instrument.
9. Measurement of moisture using a moisture analyzer
10. Measurement of viscosity
11. Innovative Experiment

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L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO-PO Mapping:

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

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	2	3
CO2	2	1	3
CO3	2	2	2
CO4	1	2	1

Course Name: Analog & Digital Communication Lab
Course Code : EI592
Contact :0:0:3
Credits : 1.5

Course Objectives:

The course objectives are to enable the students to

1. Understand the fundamental concepts of communication systems.
2. Understand and compare different analog modulation schemes.
3. Understand and compare different digital modulation schemes.
4. Understand the design tradeoffs and performance of communications systems.
5. Learn about practical communication systems

Course Outcomes:

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

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

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

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

List of Experiments: -

1. Observation of modulation index in Amplitude modulation and construction of envelope for different values of modulation index.
2. Observation and generation of Double Side Band Suppressed Carrier (DSB-SC) signal.
3. Observation and generation of Single Side Band Suppressed Carrier (SSB-SC) signal.
4. Observation of Frequency Modulation & Demodulation and calculation of modulation index.
5. Generation of Time Division Multiplexing (TDM) & Demultiplexing interlacing several sampled signals using PAM.
6. To interpret Pulse Amplitude Modulation (PAM) and demodulation for various modulating voltages.
7. Generation of Pulse Width Modulation (PWM) and demodulation for various modulating voltages.
8. To analyze an FSK modulation system and interpret the modulated and demodulated waveforms.
9. Innovative Experiment

CO-PO mapping:

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

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	2	3
CO2	2	1	1
CO3	2	3	2
CO4	2	2	2

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Course Name: Control Engineering Laboratory
Course Code: EI593
Contact :0:0:3
Credits: 1.5

Course Objectives:

1. Will have strong knowledgeof MATLAB software.
2. They get the basic knowledge of the practical control system.
3. To get the Design applications of the control system.
4. They get the knowledge of stability analysis of different control systems.

Course Outcomes:

The students will be able to:

CO1. Apply to formulate transfer function for given control system problems.
CO2. Demonstrate an understanding of the fundamentals of control systems.
CO3. Determine the time response of the given control system model.
CO4. Analyze the system behavior through Root Locus, Bode plots & Nyquist plots for a given control system model.

List of Experiments:

1. Familiarization with MATLAB & SIMULINK control system toolbox.

2. Study of impulse, step, ramp & sinusoidal response for first and second-ordersystems with unity feedback and calculation of parameters for different system designs.

4. Modelling of a first-order system and its response analysis.

5. Modelling of a second-order system and its response analysis.

6. Simulation of the impulse response for types 0, 1, and 2 with unity feedback using MATLAB.

7. Determination of root-locus, using MATLAB toolbox for a given second-order transfer function and analysis of results.

8. Bode plot, using MATLAB toolbox for a given second-order transfer function and analysis of result.

9. Nyquist plot using MATLAB toolbox for a given second-order transfer function and analysis of result.

10. Study of position control system (AC/DC).

11. Innovative Experiment

TextBooks:

1: B. C. Kuo "Automatic Control Systems" 8th edition– by 2003– John Wiley and son's.,
2: I. J. Nagrath and M. Gopal, "Control Systems Engineering" New Age International (P) Limited, Publishers, 2nd edition.

Reference Books:

1: Katsuhiko Ogata "Modern Control Engineering" Prentice Hall of India Pvt. Ltd., 3rd Edition, 1998.
2: N.K.Sinha, "Control Systems" New Age International (P) Limited Publishers, 3rd Edition, 1998.
3: NISE "Control Systems Engg." 5th Edition – John wiley
4: Narciso F. Macia George J. Thaler, "Modeling & Control of Dynamic Systems" Thomson Publishers

CO-PO Mapping:

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

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	1	3
CO2	2	2	1
CO3	2	2	3
CO4	2	2	2

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L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

Course Name: POWER PLANT INSTRUMENTATION LABORATORY
Course Code: EI594A
Contacts: 0:0:3
Credit: 1.5
Course Objectives:

1. The objective of this course is to provide the student with basic skills useful in identifying the concepts of
2. automated machines and equipment and describe the terms and phrases associated with industrial
3. automation.

Course Outcomes:

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

CO1: understand the operational functions of PLC, DCS, and SCADA.
CO2: analyze Industrial Networking, Networking protocols, and topologies.
CO3: demonstrate competence in maintaining and troubleshooting technology, detecting more serious problems, generating workable solutions to correct deviations, and recognizing when to get additional help.
CO4: analyze the automation technologies in different types of plants.

List of Experiments:

1. Simulation Experiments
2. Single Element and Three Element Drum Level Control
3. Combustion Control
4. Steam Temperature Control
5. Boiler Management System and Boiler Start-up

Text Books:

1. Process Automation Handbook: A Guide to Theory and Practice. J LOVE, Springer 2007
2. Overview of Industrial Process Automation, KLS Sharma, Elsevier, 2011
3. Automation Made Easy, P. G. Martin & H. Gregory, ISA, 2009

Reference Books:

1. Industrial Automation, Circuit Design, and components, D W Pessin
2. Serial Networked Field Instrumentation, JR Jordan, Wiley Series - Measurement Science and Technology

3. Springer Handbook of Automation

CO-PO Mapping:

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

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	2	2	3
CO2	2	1	3
CO3	2	3	2
CO4	2	1	2

Course Name: Virtual Instrumentation Lab
Course Code: EI594B
Contact: 0:0:3
Credits: 1.5

Course Objectives:

The Course Objectives are:
1. To develop basic VI programming skills
2. To develop the skills for the application of VI programs in signal processing and control systems.

Course Outcomes:

On completion of this course students will be able to:
CO1: Operate LabVIEW software.
CO2: Explore the various programming techniques of LabVIEW software
CO3: Design different types of programs based on data acquisition systems and control systems
CO4: Apply knowledge of VI into different real-time applications,

List of Experiments:

1. To familiarize with an array, Charts, and graphs in LabVIEW

2. To study the various loops available in LabVIEW
3. To study the Case and sequence structures in LabVIEW
4. To familiarize with the applications of Formula Node in LabVIEW in solving complex mathematical formulas
4. To measure and plot temperature using LabVIEW with DAQ cards
5. To measure strain and load using LabVIEW with DAQ cards
6. To design a temperature control Loop using LabVIEW with DAQ cards
7. To deploy a LabVIEW interface with an embedded board (Arduino or Raspberry Pi) and study its response.
8. To design a program of Signal Generation using DAQ Cards in the Labview platform.
9. To design a simple PID controller using LabVIEW
10. Innovative Experiment.

CO-PO mapping:

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

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	2	3
CO2	1	2	1
CO3	1	3	2
CO4	2	3	2

Course Name: Advanced Microprocessors and Microcontrollers Lab
Course Code: EI594C
Contact: 0:0:3
Credits: 1.5

Course Objectives:

1. To understand 8085/8086 microprocessors and 8051 microcontrollers with their internal architecture and various addressing modes.
2. To gather knowledge about various instructions and programs
3. To communicate various real-time applications
4. To know the advanced systems based on microprocessors and microcontrollers.

Curriculum for B. Tech
Under Autonomy
Applied Electronics & Instrumentation Engineering
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Course Outcomes

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

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

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

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

List of Experiments:

1. Familiarization with 8086/88 trainer kit components.
2. a) Study of prewritten programs on trainer kit using the basic instruction set (data transfer, Load/Store, Arithmetic, Logical)
b) Assignments based on the above.

3. a) Familiarization with 8086/88 simulator on PC.
b) Study of prewritten programs using basic instruction set (data transfer, Load/ Store, Arithmetic, Logical) on the simulator.
c) Assignments based on above

4. PROGRAMMING USING KIT/SIMULATOR FOR Table lookup
i) Copying a block of memory
ii) Shifting a block of memory
iii) Packing and unpacking of BCD numbers
iv) Addition of BCD numbers
v) Binary to ASCII conversion
vi) String Matching
vii) Sorting etc.

5. Program using subroutine calls and IN/OUT instructions using 8255 PPI on the trainer kit e.g., subroutine for delay, reading switch state & glowing LEDs accordingly, finding out the frequency of a pulse train etc

6. INTERFACING WITH I/O MODULES:
i) ADC
ii) Speed control of mini DC motor using DAC

iii) Temperature sensor and display temperature
iv) Relay
v) Keyboard through 8279 and 8255A
vi) Multi-digit Display with multiplexing through 8255A & 8279
vii) Stepper motor

7. Study of 8051 Micro controller kit and writing programs for the following tasks using the kit

a) Table look up
b) Basic arithmetic and logical operations
c) Interfacing of Keyboard and stepper motor

Text Books:

1. Douglas V. Hall – Microprocessors & Interfacing, Tata McGraw-Hill
2. Ray &Bhurchandi – Advanced Microprocessors & Peripherals, Tata McGraw-Hill
3. Walter A. Tribel – The 8088 and 8086 Microprocessors, Pearson Education
4. Barry B. Brey – The Intel Microprocessors, PHI/Pearson Ed. Asia

Reference Books:

1. Muhammed Ali Mazidi and Janice GillispieMazidi – The 8051 Microcontroller and Embedded Systems, Pearson Education Inc.
2. Ajay V Deshmukh – Microcontrollers Theory and Applications, Tata McGraw-Hill Kenneth J. Ayala – The 8086 Microprocessor, Cengage Learning

CO-PO mapping:

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

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L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	2	3
CO2	2	2	1
CO3	2	1	2
CO4	2	2	3

C. MANDATORY ACTIVITIES / COURSES

Course Name: Constitution of India
Course Code: MC501
Contact: 3:0:0
Total Contact Hours: 32

Prerequisite: NA

Course Outcome:

Student will be able to:

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

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

CO3: Create understanding of their Surroundings, Society, Social problems and their suitable solutions.

CO4: Familiarize with distribution of powers and functions of Local Self Government.

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

Course content:
1. Meaning of the constitution law and constitutionalism (2L)
2. Historical perspective of the Constitution of India (2L)
3. Salient features and characteristics of the Constitution of India (1L)
4. Scheme of the fundamental rights (2L)
5. The scheme of the Fundamental Duties and its legal status (2L)
6. The Directive Principles of State Policy – Its importance and implementation (2L)
7. Federal structure and distribution of legislative and financial powers between the

Union and the States (3L)
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India (2L)
9. Amendment of the Constitutional Powers and Procedure (2L)
10. The historical perspectives of the constitutional amendments in India (2L)
11. Emergency Provisions: National Emergency, President Rule, Financial Emergency (3L)
12. Local Self Government – Constitutional Scheme in India (3L)
13. Scheme of the Fundamental Right to Equality (2L)
14. Scheme of the Fundamental Right to certain Freedom under Article 19 (2L)
15. Scope of the Right to Life and Personal Liberty under Article 21. (2L)

Text Books:

1. Introduction to Constitution of India, D.D. Basu, Lexis Nexus
2. The Constitution of India, PM Bhakshi, Universal Law

CO-PO Mapping:

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

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	2	3
CO2	2	2	1
CO3	2	1	2
CO4	2	2	3
CO5	2	1	3

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

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3rd Year 2nd Semester

Sl. No.	Category	Course Code	Course Title	Hours per week				Credits
				L	**T**	**P**	**Total**	
A. THEORY								
1	Humanities and Social Sciences including Management courses	HSMC 604	Economics for Engineers	2	0	0	2	2
2	PC	EI601	Process control-I	3	0	0	3	3
3	PC	EI602	Biomedical Instrumentation	3	0	0	3	3
4	PE	EI603	A.Robotics Engineering B.Advanced Sensors C.Embedded System	3	0	0	3	3
5	PE	EI604	A. Non-Destructive Testing B.Optoelectronics and Fibre optics C. Soft Computing	3	0	0	3	3
6	OE	EI605	A.Data Structures & Algorithms B.Database Management System/ C.Software Engineering	3	0	0	3	3
B. PRACTICAL								
7	PC	EI691	Process Control Lab	0	0	3	3	1.5
9	PC	EI692	Biomedical Instrumentation Lab	0	0	3	3	1.5
10	PE	EI693	A.Robotics Engineering Lab B.Advanced Sensors Lab C. Embedded System Lab	0	0	3	3	1.5
11	OE	EI695	A.Data Structures & Algorithms Lab B.Database Management System Lab C.Software Engineering Lab	0	0	3	3	1.5

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12	PROJECT	PR 691	Minor Project II	0	0	3	2	1
13	PROJECT	PR 692	Skill Development VI: Soft Skill & Aptitude-III	1	0	0	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
14	MC	MC601	Intellectual Property Right	3	0	0	3	3Units
	TOTAL CREDIT WITHOUT MOOCS COURSES							**24.5**
D.MOOCS COURSES**								
15	MOOCS COURSES	HM601	MOOCS COURSE-IV	3	1	0	4	4
TOTAL CREDIT WITH MOOCS COURSES								**28.5**

**** MOOCS COURSES for HONOURS/MINOR Degree are Program-specific and to be taken from MOOCS BASKET**

Curriculum for B. Tech
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A. THEORY

Paper name: Economics for Engineers
Paper Code: HSMC 604
Credits: 2
No. of lectures: 24

Course Objective:

•To develop decision-making skills using basic economic principles

•To educate the students in evaluating various Business Projects

Course Outcome:

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

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

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

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

Course Content:

Module – 1: Introduction 1L

Economics- Nature, Scope, Uses, Micro Economics and Macro Economics.

Module – 2 Theory of Demand and Supply 3L

Concept of Demand, Determinants of demand, Individual and Market Demand, Law of demand and its Exception; Concept of Supply, Shift in Demand and Supply Curve, Movement along the demand and supply curve, Determinants of equilibrium price and quantity, Elasticity of Demand and Supply.

Module – 3 Theory of Production and Costs 7L

Concept of the Production function, types of the Production function, Laws of return to scale and variable Proportion, Basic understanding of different markets, Determination of equilibrium price under perfect competition& monopoly in short-run and long run; Price Discrimination.

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Module-4 Macroeconomic Aggregates and Concepts 3L

Concepts of National Income, GDP, GNP, Concept of Business Cycle.

Module -5 Inflation 2L

Concept, Causes, and Remedies of Inflation and Unemployment, the basic concept of Philips Curve

Module-6 –Theory of Investment 3LBasic concept of Investment, Business Fixed Investment, Accelerator Theory, Tobin's q.

Module -7 Accounting 3L

The basic concept of Journal, Preparation of Income Statement and Balance Sheet

Module – 8 Cost Volume Profit Analysis 2L

Contribution, P/V Ratio, Break-Even Point, Margin of Safety, Short term decision making: Make or Buy, Shut-down point, Export Pricing, Opportunity, and Sunk cost.

Text Books:

1. Economics, by Lipsey and Chrystal, Oxford University Press
2. Modern Accountancy, vol.-I-, by Hanif &Mukherjee, TataMgrowHill

References:

1. Modern Economic Theory, by K.K. Dewett, S.Chand
2. Principles of Economics, by H.L. Ahuja, S. Chand
3. Engineering Economics,byR.PaneerSeelvan, PHI
4. Economics for Engineers, by Dr. Shantanu Chakraborty &Dr. Nilanjanasingharoy, Law Point Pub
5. Macro Economics, by Mankiw, Macmillan Learning

CO-PO Mapping:

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

Curriculum for B. Tech
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L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	2	1
CO2	2	1	1
CO3	2	3	2
CO4	2	2	2

Course Name: Process Control-1
Course Code: EI601
Contact: 3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite: Knowledge of Control Theory

Course Objectives:

This course helps the student

1. To have knowledge on basic process control loop & characteristics
2. To understand the different controller modes
3. To know about methods of tuning of controllers
4. To have a knowledge of the final control element & different actuators
5. To apply the knowledge of Cascade, Ratio, Feedforward control to control a complex process
6. To provide knowledge levels needed for PLC programming and functioning.

Course Outcomes:

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

CO1: Design a controller by applying the knowledge of different control action
CO2: Calculate controller parameters by applying different tuning methods
CO3: Describe different advanced control strategy
CO4: State the operation and use of the final control element
CO5: Develop ladder logic programs and understand the basics of DCS

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Module I: [10L]

General Review of Process, Process Control, and Automation. Servo and Regulatory Control, Basic process Control loop block diagram. Characteristic parameters of a process – Process Quantity, Process Potential, Process Resistance, Process Capacitance, Process Lag, Self Regulation Characteristics and functions of different modes of control actions: Schemes and analysis of On-Off, Multistep, Floating, Time Proportional, Proportional, Integral, Derivative, PI, PD & PID control Electronic PID controller design, Pneumatic Controllers - a brief analysis

Module II:[5L]

Process Reaction Curves, Controllability - using (i) deviation reduction factors (ii) gain-bandwidth product, State Controllability, Tuning of Controllers: both Closed and Open-loop methods (Ziegler – Nichols, Cohen – Coon, PRC method and 3-C method of parameter adjustment)

Module III:[12L]

Different control strategies - schemes, brief analysis, and uses
(i) Ratio control
(ii)Cascade control
(iii)Feedforward control
(iv)Multivariable control
Final Control Element: Actuators (Pneumatic Actuators, Electrical Actuators) and Control Valves (Globe, Ball, Butterfly, Gate, Pinch), Different Parts, Fail Position, Valve characteristics, Cv, Single & Double Seated Valves, Valve sizing, Valve selection, Cavitation, Flashing, Noise
Control Valve Accessories – Air Filter Regulator, I/P Converter
A brief study of Safety Valves and Solenoid valves

Module IV:[9L]

Introduction to Programmable Logic Controllers (PLCs) – Basic Architecture and Functions; Input-Output Modules and Interfacing; CPU and Memory; Relays, Timers, Counters and their uses; PLC Programming and Applications.
Introduction to DCS: overview, block diagram

Text Books:

1. D. Patranabis, Principles of Process Control, TMH, New Delhi, 2nd Ed.
2. D. P. Eckman, Automatic Process control, John Wiley, New York

3. Surekha Bhanot, Process Control Principal & Application, Oxford
4. B. W. Bequette, Process Control – Modeling, Design and Simulation, PHI

Reference Books:

1. D. R. Coughanowr, Process Systems Analysis and Control, McGraw Hill
2. G. Stephanopoulos, Chemical process Control, PHI
3. C. D. Johnson, Process Control Instrumentation Technology, PHI
4. B. G. Liptak, Instrument Engineers Handbook, Chilton Book Co., Philadelphia

CO-PO Mapping:

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

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	2	3
CO2	2	1	1
CO3	2	3	2
CO4	2	2	2

Course Name: Biomedical Instrumentation
Course Code: EI602
Contact:3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite: Sensors & Transducers, Signal Processing

Course Objectives:

1. To understand the various systems of the human physiology and signals of biological origin obtained from various systems,
2. To analyse various biosensors, transducers and bio-potential electrodes used to acquire various bio-potentials.

3.To understand various methods of measurement of blood pressure, blood flow, heart sounds and pacemaker
4. To familiarize with various amplifiers for measuring biopotentials.
5. To acquire knowledge about Electrical safety of medical devices and their protective measures.

Course Outcomes:

After completion of this course, the students will be able to
CO1: Able to understand the detailed physiology of various human anatomical systems.
CO2: Able to identify proper transducer for acquisition of a particular bioelectric potential.
CO3: Able to analyse various biological conditions from the measured bioelectric potentials.
CO4: Able to design biotelemetry systems for acquiring bioelectric potentials from long distance.

Module I: Physiology of various anatomical systems: [6L]
Introduction to the physiology of cardiac, nervous, muscular and respiratory systems

Module II: Bioelectric potential and measuring transducers: [8L]
Bioelectric potentials: Definitions, types, range, basic characteristics. resting and action potential
Different types of transducers and electrodes: construction, selection for acquiring various bio-potentials

Module III: Measurements on cardiovascular and respiratory system [12L]
Blood pressure - characteristics of blood flow - Heart sounds - ECG - Measurement of blood pressure, blood flow, heart sounds and Cardiac pace-maker: types and its detail instrumentation.

Module IV: Electrical activities in brain and muscles: [2L]
Electromyography and Electroencephalograph: characteristics, measurements and signal analysis.

Module V: Medical Imaging Techniques [4L]
Ultrasound imaging and IR Imaging: image acquisition technique and analysis, MRI

Module VI: Biotelemetry [2L]
Transmission and Reception aspects of Biological signals over long distances.

Module VII: Measurement Errors and safety issues [2L]
Errors in bio-potential measurement, types and methods to minimize errors
Electrical- Safety codes and standards, basic approaches to protection against shock, power
distribution protection, equipment protection

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Text Books:

1. Cromwell L – Biomedical Instrumentation and Measurement, Pearson
2. Khandpur R.S., Hand book of Biomedical Instrumentation, Tata McGraw Hill
3. Webster J S – Medical Instrumentation – Application and Design

Reference Books:

4. Astor B R – Introduction to Biomedical Instrumentation and Measurement, McMillan.
5. Chatterjee Miller – Biomedical Instrumentation, Cengage Learning

CO-PO Mapping:

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

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	2	2	3
CO2	1	1	1
CO3	1	2	2
CO4	2	2	2

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Course Name: ROBOTICS ENGINEERING
Course Code: EI603A
Contact:3:0:0
Credits: 3
Total Contact Hours: 36

Course Objectives:

1. Impart knowledge about basic mathematics related to industrial robots for their control.
2. Design and application of robotics & automation in modern Industries.

Course Outcomes:

CO1: Perform kinematic and dynamic analyses with simulation. Design control laws for a simple robot.
CO2: Integrate mechanical and electrical hardware for a real prototype of the robotic device.
CO3:Select a robotic system for a given industrial application.
CO4: Use of robots in domestic applications.

Module I: Introduction to Robotics: [6L]

Types and components of a robot, Classification of robots, Robotic kinematics systems; Concept of mechanisms and manipulators, Definition of Degrees of Freedom

Module II: Introduction to Robot Kinematics and Dynamics: [8L]

Concept of Kinematic Modeling: Translation and Rotation Representation, Coordinate transformation, Forward and inverse kinematics, Jacobian, Singularity, and Statics, Denavit–Hartenberg parameters, Concept of Dynamic Modeling such as Forward and inverse dynamics, Equations of motion by using Euler-Lagrange formulation and Newton Euler formulation.

Module III: Robotic Sensors and Actuators: [5L]

Robotic Sensor: Contact and Proximity, Position, Velocity, Force, Tactile, etc. Introduction to Cameras, calibration techniques, Geometry of the Image formation, Different transforms such as Euclidean or Projective transformations, Different types of vision applications in robotics.

Actuators: Electric, Pneumatic, and Hydraulic actuators, Parameters for selection of actuators, Transmission Gears, Timing Belts and Bearings.

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Module IV: Robot Control: [7L]

Basics of control: open loop and closed loop, Definition of transfer functions, Control mechanisms, P, PD, PID, Linear, and Non-linear controls.

Module V: Embedded Systems for Robotics and control hardware interfacing mechanisms: [6L]

Embedded Systems, Microprocessors and Microcontroller Architecture and interfacing with robotic sensors, actuators and other components, Programming techniques for Industrial robot.

Module VI: Artificial Intelligence in Robotics [4L]

Applications in unmanned systems, examples: defense, medical, industries, etc. Robotics and Automation for Industrial benefits, Robot safety, and social robotics

Text Books:

1. Introduction to Robotics: J. Craig, Pearson
2. Robot Dynamics and Control, Spong&Vidyasagar, McGraw Hill
3. Robotics Engineering: R. Klafter, PHI
4. Robotics: Subir K Saha, McGraw-Hill
5. Industrial Robotics: M. P. Groover, AshishDutta, McGraw Hill

Reference Books:

1. Richard Paul, Robot Manipulators: Mathematics, Programming, and Control, MIT Press, 1981
2. Robert Shilling, Fundamentals of Robotics, Prentice-Hall, 2003
3. Laxmidhar Behera and Indrani Kar, “Intelligent Systems and Control”, Oxford University Press, Nov 2009.
4. M. Felix Orlando, Laxmidhar Behera, TomayoTamei, Tomohiro Shibata, Ashish Dutta, and Anupam Saxena," On Redundancy Resolution of the Human Thumb, Index and Middle Fingers in Cooperative Object Translation," Robotica, vol. 35, pp. 1992-2017, 2016.

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CO-PO Mapping:

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

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	2	3
CO2	2	1	1
CO3	2	3	2
CO4	2	2	2

Course Name: Advanced Sensors
Course Code: EI603B
Contact: 3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite:

Students should have Knowledge of Sensor & Transducer; Fabrication techniques.

Course Objectives:

1. To understand the basics of sensors, actuators, and theiroperating principle.
2. To educate the students on different types of microfabrication techniques for designing and developing sensors (Several applications from Electronics to Biomedical will be covered).
3. To explain the working of various types of electrochemical sensors and actuators.
4. To provide information about interfacing of sensors and signal conditioning circuits to establish any control system or monitoring system.
5. To provide an understanding of characteristic parameters to evaluate sensor performance.

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Course Outcomes:

Students will be able to

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

Course Content:

Module I: Sensor Signal conditioning & Reliability [12L]

Design techniques of signal conditioning for different sensors
Sensor reliability, reliability models and testing, aging tests, failure mechanisms, and their evaluation, stability studies

Module II: Micro Sensor & MEMS: Introduction & Application [12L]

Historical Development of Microelectronics, Evolution of Microsensors, Evolution of MEMS, Emergence of Micromachines, Sensor Systems, Sensors types and classification, Mechanical Sensors, Acoustic Sensors, Magnetic Sensors, Thermal Sensors, Optical sensors Chemical Sensors, Radiation Sensors and Biosensors. Microsensors, Sensors based on surface-acoustic wave devices. Review of Fabrication Techniques (Lithography, PVD, CVD, RIE), Applications.

Module III: Smart Sensors [12L]

Importance and Adoption of Smart Sensors, Architecture of Smart Sensors: Important components, their features, Fabrication of Sensor and Smart Sensor: Electrode fabrication: Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapour, Anodization, Sol-gel, Interface Electronic Circuit for Smart Sensors and Challenges for Interfacing the Smart Sensor, Usefulness of Silicon Technology in Smart Sensor and Future scope of research in smart sensor

Text Books:

1. Triethy HL - Transducers in Electronic and Mechanical Design, Mercel Dekker 1986
2. D. Patranabis – Sensor and Transducers (2e) Prentice Hall, New Delhi, 2003
3. Silicon Sensors – Middlehoek S and Audel S. A. – Academic Press, London 1989
4. Chemical Sensors – Edmonds T. E. (Ed); Blackie – London, 1988
5. Problems and possibilities of oxidic and organic semiconductor gas sensors, G. Heiland and D. Kohl, Sensors and actuators, Volume 8, Issue 3, November 1985, Pages 227-233.
6. Thick-film sensors: an overview, Maria Prudenziati, and Bruno Morten, Sensors and Actuators, Volume 10, Issues 1–2,10 September 1986, Pages 65-82.

7. The use of polymer materials as sensitive elements in physical and chemical sensors, F.J. Gutierrez Monreal, Claudio M. Mari,Sensors and Actuators, Volume 12, Issue 2, August–September 1987, Pages 129-144.

Reference Books:

1. Principles of Measurement systems John P. Bentley, Third edition 2000, Pearson Education Asia pvt. Ltd.
2. Understanding Smart Sensors, Randy Frank, Second edition, Artech House sensors library.
3.SensorsHandbook,SabrieSoloman,McGraw-Hill,1999
4. Sensors, Nanoscience, Biomedical engineering and instruments, Richard C. Dorf, CRC Press, Taylor and Francis group USA

CO-PO Mapping:

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

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	2	3
CO2	2	2	1
CO3	2	2	2
CO4	2	1	3

Course Name: Embedded System Design
Course Code: EI603C
Contact: 3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite: Knowledge of microprocessor and microcontroller.

Course Objectives:

1. An ability to design a system, component, or process to meet desired needs within realistic constraints.
2. Ability to understand microcontroller, microcomputer, embedded system.
3. Understand different components of a micro-controller and their interactions.

4. To become familiar with the programming environment used to develop embedded systems.
5. Understand key concepts of embedded systems like IO, timers, interrupts, interaction with peripheral devices
6. Learn debugging techniques for an embedded system

Course Outcomes:

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

CO1: Understand the architecture and classifications of different embedded systems and the related programming knowledge.
CO2: Understand the concepts of embedded systems like I/O, timers, interrupts, interaction with peripheral devices
CO3: Choose case-specific debugging technique for an embedded system.
CO4: Design various real time systems using embedded systems.

Module I: **[5L]**

Introduction to the Embedded System: Embedded system Vs General computing systems, Purpose of Embedded systems, classifications of embedded systems, fundamentals of embedded processor and microcontrollers, CISC vs. RISC, ASIC.

Module II: **[9L]**

Serial and parallel communication: devices and protocols, wireless communication: devices and protocols, parallel communication network using ISA, PCI, PCT-X, Internet embedded system network protocols, USB, Bluetooth.

Module III: **[5L]**

Program Modeling Concepts; Fundamental issues in Hardware-software co-design, Unified Modeling Language (UML), Hardware Software trade-offs DFG model, state machine programming model, model for the multiprocessor system.

Module IV: **[5L]**

Real-Time Operating Systems: Operating system basics, Tasks, Process and Threads, Multiprocessing and multitasking, task communication, task synchronization, qualities of good RTOS.

Module V: **[12L]**

PIC microcontroller: introduction, architecture, comparison of PIC with other CISC and RISC-based systems and microprocessors, assembly language programming, addressing modes, instruction set, Interfacing with

various sensors and actuators using PIC microcontroller. Programming concepts and embedded programming, embedded architecture.

Text Books:

1. Introduction to Embedded Systems: Shibu K. V. (TMH)
2. Embedded System Design – A unified hardware and software introduction: F. Vahid (John Wiley)
3. Embedded Systems: Rajkamal (TMH)
4. Embedded Systems: L. B. Das (Pearson)

Reference Books:

1. Embedded System Design: S. Heath (Elsevier)
2. Embedded microcontroller and processor design: G. Osborn (Pearson)
3. Programming PIC microcontrollers with PIC basic by chuck helebuyck
4. PIC microcontrollers-programming in basic by Milan verle

CO-PO mapping:

COs for Course	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
CO1	3	1	2	1	2	3	3	3	3	3	1	1
CO2	2	1	3	1	3	3	2	3	3	3	2	2
CO3	2	2	3	1	2	3	3	2	3	1	1	2
CO4	3	2	2	3	3	3	3	3	1	3	1	2

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	2	2	3
CO2	2	1	1
CO3	1	2	2
CO4	2	2	2

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Course Name: Non-Destructive Testing and Ultrasonic Instrumentation
Course Code: EI604A
Contact:3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisites: Ultrasonic sensor basics and knowledge of nondestructive methods.

Course Objectives:

1. The objective is to impart in-depth knowledge on the various Non-Destructive Evaluation and Testing methods, theory, and their industrial applications.
2. This course Non-Destructive Testing and Ultrasonic Instrumentation helps the student
3. To introduce the basic principles, techniques, equipment, applications, and limitations of NDT methods
4. To enable the selection of appropriate NDT methods
5. To identify advantages and limitations of nondestructive testing methods

Course Outcomes:

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

CO1.Understand the concept of non-destructive testing
CO2.Describe the various types of NDT tests carried out on components
CO3.Analyze the different types of tests carried out on components and surfaces.
CO4.Understand the properties of materials suitable for NDT.

Module I: **[8L]**

Introduction and importance of NDT. General Principles and Basic Elements of NDT,
Overview of the Non-Destructive Testing Methods
Surface feature inspection and testing: General, Visual, Chemical, and Mechanical
Optical - laser probe, holography

Module II: **[6L]**

Magnetic - magnetization, flux, and Electro potential, Electrical resistivity,
Electromagnetic - eddy current techniques, Penetrant, Radiation backscatter

Module III: **[8L]**

Sub-surface (Internal feature inspection and Testing: Thermal - temperature sensing, Electrical resistivity

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X rays - refraction / diffraction and fluorescence, Gamma rays - radiography. IQI (image quality indicator), Xerography,
Image intensification methods, Electron microscopic techniques. ISO specifications and other certifications.

Module IV: **[8L]**

Ultrasonic waves, Basic principle of propagation , Principle of Ultrasonic Test, Their Advantages and limitations
Ultrasonic Test methods: Echo, Transit time, Resonance, Direct contact, and immersion types
longitudinal and shear wave methods, acoustic emission methods
Ultrasonic surface wave probing

Module V: **[6L]**

Ultrasonic methods of measuring thickness, depth, flow, level, etc. Various parameters affecting ultrasonic testing and measurements, their remedy

Text Books:

1. Mclutive p (Ed) – NDT Handbook, American Society for NDT, 1989.
2. Hull B and John V – Non-Destructive Testing, FI BS/McMillan.
3. Krantkramer - Ultrasonic Testing of materials, Springer 2005
4. Handbook of Nondestructive Testing, McGraw Hill, 1998

Reference Books:

1. J. M. Farley and R. W. Nichols – Non-Destructive Testing, Proceedings of the 4th European Conference, London; UK, September 1987, Pergmon Press.
2. Balder Raj, T. Jayakumar and M. Thavasimuthu – Practical Non-Destructive Testing, 2nd Edition, Narosa.

CO-PO Mapping:

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

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CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	2	3
CO2	1	3	1
CO3	2	2	2
CO4	1	2	2

Course Name: Optoelectronics andFibre Optic Sensors
Course Code: EI604B
Contact: 3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite: Knowledge of optics and semiconductor physics

Course Objectives:

1. To make the learners understand the different aspects of optoelectronic sources
2. To make the learners understand the different aspects of optoelectronic detectors
3. To make the learners understand the different aspects of optical fiber
4. To make the learners understand the application and advantages of different fiber optic sensors

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

CO1: compare double heterojunction LED, surface emitter LED, edge emitter LED, superluminescent LED, and semiconductor-based LASER (p-n junction laser, double heterojunction laser, stripe geometry) as optoelectronic sources based on working principles and applications
CO2: compare optoelectronic detectors (p-n photodiode, p-i-n photodiode, avalanche photodiode, Schottky photodiode, heterojunction diode, phototransistor, LDR, photovoltaic cells, photoemissive cells) based on detector parameters, which are responsivity, efficiency, and working principle
CO3: select a suitable optical fiber for an engineering application, based on the number of modes required, distance to be covered and V-parameter
CO4: justify the selection of intensity-modulated fiber optic sensors, phase-modulated fiber optic sensors, and spectrally modulated fiber optic sensors for engineering applications, which are a measurement of temperature, pressure, displacement, and liquid level. Justify optical fiber as a communication channel,

Module I: Optoelectronic sources and laser (8L)

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Optoelectronics: Characteristics of optical emission, electro-luminescence, optical emission from p-n junction, direct bandgap, and indirect bandgap materials.
LED: spontaneous emission, power and efficiency calculation, materials of LED, the structure of LED and its characteristics, double heterojunction LED, surface emitter LED, edge emitter LED, superluminescent LED.

Laser: Einstein relations, population inversion, 3- and 4-energy level systems, optical pumping, modes of laser, lasing materials-gaseous, liquid, and solid.
Semiconductor-based lasers – p-n junction laser, double heterojunction laser, stripe geometry.
Holography.

Module II: Optoelectronic detectors (8L)
Optical detection principle, quantum efficiency, responsivity.
Photo diode: p-n photodiode, p-i-n photodiode, avalanche photo diode, Schottky photodiode, hetero junction diode, phototransistor
LDR, photovoltaic cells, photo emissive cells - types, materials, construction, response.
Opto-couplers – components, characteristics, noise figures, applications

Module III: Optical fiber and fiber optics (8L)
Fiber optics: Optical fiber – materials, construction, step index and graded index fibres, ray propagation. Modes in optical fibres, intermodal dispersion. Single mode and multimode fiber, attenuation, and dispersion in single mode and multimode optical fibers
Active fiber
Optical fiber coupling- splices and connectors

Module IV: Fiber optic sensors (12L)
Fiber-optic sensors: advantages, intrinsic and extrinsic sensors
Classification- intensity modulated sensors, phase modulated sensors, spectrally modulated sensors.
Fibre optic sensors for Industrial applications: temperature, displacement, pressure, and liquid-level sensors.
Fiber optic interferometer- Mach –Zahnder interferometer, Sagnac interferometer

Fiber optic communication
Introduction, a block diagram of basic fiber optic communication system, advantages and disadvantages, introduction to the repeater, comparison of WDM and OFDM

Text Books:

1. P. Bhattacharjee, *Semiconductor Optoelectronic Devices*, PHI
2. John Wilson and John Hawkes, *Optoelectronics- An Introduction*, PHI

Reference Books:

1. John M. Senior, *Optical Fibre Communications*, PHI
2. R.P. Khare, *Fiber Optics and Optoelectronics*, Oxford

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CO-PO Mapping:

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

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	2	3
CO2	2	2	1
CO3	1	3	2
CO4	1	2	2

Course Name: Soft Computing
Course Code: EI604C
Contact:3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite: Knowledge of set theory, nervous system, and biological evolution

Course Objectives:

1. To make the learners understand the advantages of soft computing techniques
2. To make the learners understand the different aspects of fuzzy logic and fuzzy reasoning
3. To make the learners understand the different aspects of artificial neural networks
4. To make the learners understand the different aspects of the genetic algorithm

Course Outcomes:

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

CO1: justify the use of fuzzy logic for decision making in presence of uncertainty
CO2: design a fuzzy logic control system for a continuous-time plant with single i/p-single o/p
CO3: compare the supervised and unsupervised learning techniques in artificial neural networks
CO4: explain the operation of genetic algorithm-based optimization technique

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Module I: Soft Computing and Fuzzy logic (10L)

Soft-computing-definition, an advantage over conventional computing, areas of application
Fuzzy Sets, membership function and membership value, linguistic variable
Fuzzy operators, T- Norms and S- Norms
Fuzzy relations, implications, cylindrical extensions, projection
Fuzzification and defuzzification

Module II: Fuzzy reasoning and fuzzy logic control (12L)

Fuzzy extension principle, compositional rule of inference, approximate reasoning (fuzzy reasoning)
Different Fuzzy models-Mamdani's model, Sugeno's model (T-S-K model)
Fuzzy logic control system, fuzzy PID controller

Module III: Genetic algorithm (5L)

Genetic Algorithm (GA)- basic concept, components-chromosome, and gene, GA operators, methods of selection, elitism
Fuzzy-GA system

Module IV: Artificial neural networks (9L)

Artificial neural network (ANN)- basic concept, areas of application, McCulloch and Pitts model, perceptron, the realization of logic gates, training of ANN, Supervised and unsupervised learning- techniques and comparison
Neuro-fuzzy system

Text Books:

1. D.Dirankov, H. Hellendoorn, and M.Reinfrank, *An Introduction to Fuzzy logic control,*Narosa
2. S.Rajasekaran and G.A.V. Pai, *Neural Networks, Fuzzy logic and Genetic Algorithm: Synthesys and Applications*, Pearson Education
3. J.S.R.Jang, C.T. Sun and, E.Mizutani,*Neuro-fuzzy and soft Computing*, Pearson Education

Reference Books:

1. T.J.Ross, *Fuzzy Logic with Engineering Applications*, Wiley (India)
2. Simon Haykin, *Neural Networks- A Comprehensive Foundation*, Prentice Hall
3. B.Yegnanarayana, *Artificial Neural Networks*, PHI

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CO-PO Mapping:

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

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	2	3
CO2	2	1	3
CO3	1	2	2
CO4	1	2	2

Course Name: Data Structures & Algorithms
Course Code: EI605A
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:

1. Familiarity with the fundamentals of C or other programming languages
2. A solid background in mathematics, including probability, set theory.

Course Objectives:

- To learn the basics of abstract data types.
- To learn the principles of linear and nonlinear data structures.
- To build an application using sorting and searching.

Course Outcomes:

On completion of the course, students will be able to

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1. Differentiate how the choices of data structure & algorithm methods impact the performance of the program.
2. Solve problems based upon different data structures& also write programs.
3. Identify appropriate data structure & algorithmic methods in solving problems.
4. Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing
5. Compare and contrast the benefits of dynamic and static data structures implementations.

Module I: Linear Data Structure [10L]

Introduction (2L):
Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type.
Algorithms and programs, basic idea of pseudo-code (1L)
Algorithm efficiency and analysis, time and space analysis of algorithms – order notations (1L)

Array (2L):
Different representations – row major, column major (1L)
Sparse matrix - its implementation and usage, Array representation of polynomials (1L)

Linked List (6L):
Singly linked list – operations, Doubly linked list – operations (4L)
Circular linked list – operations, Linked list representation of polynomial and applications (2L)

Module II: Linear Data Structure [6L]

Stack and Queue (4L):
Stack and its implementations (using array and linked list) (1L)
Applications (infix to Postfix, Postfix Evaluation) (1L)
Queue, circular queue, de-queue (1L)
Implementation of queue- linear and circular (using array and linked list) (1L)

Recursion (2L):
Principles of recursion - use of stack, tail recursion. (1L)
Applications - The Tower of Hanoi(1L)

Module III: Nonlinear Data structures [12L]

Trees (8L):
Basic terminologies, forest, tree representation (using array and linked list) (1L)
Binary trees - binary tree traversal (pre-, in-, post- order) (1L)
Threaded binary tree (1L)
Binary search tree- operations (creation, insertion, deletion, searching) (1L)

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Concept of Max-Heap and Min-Heap (creation, deletion) (1L)
Height balanced binary tree – AVL tree (insertion with examples only) (1L)
Height balanced binary tree – AVL tree (deletion with examples only) (1L)
m –Way Search Tree, B Tree – operations (insertion, deletion with examples only) (1L)
Graphs (4L):
Graph theory review (1L)
Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) - concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, and forward-edge) (2L)
Minimal spanning tree – Prim's algorithm, Kruskal's algorithm (basic idea of greedy methods) (1L)

Module IV: Searching, Sorting [8L]

Sorting Algorithms (4L):
Bubble sort, Insertion sort, Selection sort – with notion of complexity (1L)
Quick sort, Merge sort – with complexity (2L)
Radix sort – with complexity (1L)
Searching (2L):
Sequential search – with complexity (1L)
Binary search, Interpolation Search– with complexity (1L)
Hashing (2L):
Introduction to Hashing and Hashing functions (1L)
Collision resolution techniques (1L)

Text books:

1. Data Structures Through 'C' Language by Samiran Chattopadhyay, Debabrata Ghosh Dastidar, Matangini Chattopadhyay, Edition: 2001, BPB Publications
2. Fundamentals of Data Structures of C by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed 2nd Edition, Universities Press

Reference books:

1. Data Structures, Algorithms, and Software Principles in C by Thomas A. Standish, 1 Edition, Pearson
2. Data Structures by S. Lipschutz, Special Indian Edition, Tata McGraw Hill Education (India) Private Limited
3. Data Structures and Program Design In C by Robert L. Kruse, Bruce P. Leung 2nd Edition, Pearson
4. Data Structures in C by Aaron M. Tenenbaum, 1St Edition, Pearson

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CO-PO Mapping

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

CO-PSO Mapping:

Cos	**PO1**	**PO2**	**PO3**
CO1	3	2	3
CO2	1	2	1
CO3	1	3	2
CO4	2	2	2

Course Name: Database Management System
Course Code: EI605B
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:
1. Logic of programming language
2. Basic concepts of data structure and algorithms

Course Objectives:
1. To learn the data models, conceptualize and depict a database system
2. To design system using E-R diagram.
3. To learn SQL & relational database design.
4. To understand the internal storage structures using different file and indexing techniques.
5. To know the concepts of transaction processing, concurrency control techniques and recovery procedure**.**

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Course Outcomes:

On completion of the course students will be able to

CO1: Apply the knowledge of Entity Relationship (E-R) diagram for an application.
CO2: Create a normalized relational database model
CO3: Analyze real world queries to generate reports from it.
CO4: Determine whether the transaction satisfies the ACID properties.
CO5: Create and maintain the database of an organization.

Course Content

Module 1:

Introduction [3L]
Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.

Module 2:

Entity-Relationship and Relational Database Model [9L]
Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features, case study on E-R Model. Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications Of the Database.

Module 3:

SQL and Integrity Constraints [6L]
Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.

Module 4:

Relational Database Design [6L]
Functional Dependency, Different anomalies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Normalization using multi-valued dependencies, 4NF, 5NF , Case Study

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Module 5:

Internals of RDBMS [6L]
Physical data structures, Query optimization: join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock base protocols; two phase locking, Dead Lock handling

Module 6:

File Organization & Index Structures [6L]
File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes

Text Books:

1. Henry F. Korth and Silberschatz Abraham, "Database System Concepts", Mc.Graw Hill.
2. ElmasriRamez and NovatheShamkant, "Fundamentals of Database Systems", Benjamin Cummings Publishing. Company.
3. Jain: Advanced Database Management System CyberTech
4. Date C. J., "Introduction to Database Management", Vol. I, II, III, Addison Wesley.
5. "Fundamentals of Database Systems", RamezElmasri, ShamkantB.Navathe, Addison Wesley Publishing Edition

Reference Books:

1. "Database Management Systems", Arun K.Majumdar, Pritimay Bhattacharya, Tata McGraw Hill
2. Ramakrishnan: Database Management System , McGraw-Hill
3. Gray Jim and Reuter Address, "Transaction Processing : Concepts and Techniques", Moragan Kauffman Publishers.
4. Ullman JD., "Principles of Database Systems", Galgottia Publication.

CO-PO Mapping:

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

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CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	2	3
CO2	1	1	1
CO3	2	3	2
CO4	2	2	2
CO5	2	1	1

Course Name: Software Engineering
Course Code: EI605C
Contact Hours: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:
1. An understanding of basic computer software
2. Object Oriented programming skills.

Course Objectives:

1. To develop basic Knowledge in Software Engineering including software Engineering layered architecture, software process models for software development.
2. To design software requirements and specifications of documents.
3. To understand project planning, scheduling, cost estimation, risk management.
4. To describe data models, object models, context models, behavioral models and coding style and testing issues.
5. To know about the quality checking mechanism for software process and product.

Course Outcomes:

CO1: To identify, formulate, and solve software engineering problems, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements
CO2: To analyze, elicit and specify software requirements through a productive working relationship with various stakeholders of the project

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

CO4: To develop the code from the design and effectively apply relevant standards and perform testing, and quality management and practice.
CO5: To identify modern engineering tools necessary for software project management, time management and software reuse, and an ability to engage in life-long learning.

Module I[10L]

Software Engineering–Characteristics, Components,Application,Definitions,Software Process models-Waterfall Model, Prototype model, Spiral., Software Project Planning-Feasibility Analysis, Technical Feasibility, Cost-Benefit Analysis, Basics of estimation : COCOMO (Basic, intermediate, Complete) model

Module II [8L]

System Analysis: Principle of Structure Analysis, Requirement Analysis, DFD, Entity Relationship Diagram, Data Dictionary, Data Modeling, Software Requirements Specification
Software Design Aspects: Objectives, Principles, Concepts, HLD and LLD, Top-Down and Bottom-Up design; Decision tree, decision table and structured English, Structure chart, Transform analysis Functional Vs. Object-Oriented approach.

Module III[10L]

Coding & Documentation–Structured Programming, Modular Programming, Module Relationship- Coupling, Cohesion, Object Oriented Programming, Information Hiding, Reuse, System Documentation.
Testing– Levels of Testing, Integration Testing, System Testing**.**
Test Cases-White Box and Black Box testing Software Quality, Quality Assurance, Software Maintenance, Software Configuration Management.

Module IV [8L]

Software Project Management – Project Scheduling, Staffing, Quality Assurance, Risk Management: Reactive vs. Proactive Risk strategies, Software risks, Risk identification, Risk projection, Risk refinement Project Monitoring.

Text Books:

1. Software Engineering: A practitioner's approach–Pressman(TMH)
2. Software Engineering-Pankaj Jalote (Wiley-India)
3. Software Engineering-Rajib Mall(PHI)

Reference Books:

1. Software Engineering–Agarwal and Agarwal(PHI)

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Applied Electronics & Instrumentation Engineering
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CO-PO Mapping:

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

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	2	3
CO2	2	1	1
CO3	1	3	2
CO4	2	3	2

B. PRACTICAL

Course Name: Process Control Laboratory
Course Code: EI691
Contact :0:0:3
Credits: 1.5

Course Objectives:

This course helps the student

1. To have knowledge on basic process control loop & characteristics
2. To understand the different controller modes
3. To know about methods of tuning of controllers
4. To have a knowledge of the final control element & different actuators
5. To apply the knowledge of Cascade, Ratio, Feedforward control to control a complex process
6. To provide knowledge levels needed for PLC programming and functioning.

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Course Outcomes:

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

CO1: Recognize & explain basic process control loop elements via hands on experiment.

CO2: Control different process variable (flow, pressure, level & temperature) using different controller mode.

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

CO4 :Control & monitor different process variable through DCS.

List of Experiments :

1. Study of Flow, Level, Pressure, Temperature processes and construction of the P&I diagrams in accordance with ISA guidelines/standards

2. Study of a Temperature Control Loop having Furnace, suitable final control element, Temperature transmitter, conventional PID controller/Control System, and data logger/recorder

3.Study of a Pressure Control Loop having Pressure source, Pressure Transmitter, Motorized/Pneumatic control valve, and conventional PID controller/Control System

4. Study of a Flow Control Loop having suitable Flow meter, Motorized/ Pneumatic control valve, and conventional PID controller/Control System

5.Study of a Level Control Loop having Level Transmitter, Motorized/ Pneumatic control valve, and conventional PID controller/Control System

6.Study of a typical Air Duct Flow Monitoring and Control

7. PLC Programming

8. Study of a PC based Automation Software / Simulation Software

9. Configuring the DCS for Temp./Flow/Pressure processes.

10. Innovative Experiment

CO-PO mapping:

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

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CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	2	3
CO2	2	1	1
CO3	1	3	2
CO4	2	3	2

Course Name: Biomedical Instrumentation Laboratory
Course Code: EI692
Contact:0:0:3
Credits: 1.5

Course Objectives:

1. To understand the various systems of human physiology and signals of biological origin obtained from various systems,
2. To analyse various biosensors, transducers and bio-potential electrodes used to acquire various bio-potentials.
3. To understand various methods of measurement of blood pressure, blood flow, heart sounds and pacemaker
4. To familiarize with various amplifiers for measuring biopotentials.
5. To acquire knowledge about the Electrical safety of medical devices and their protective measures.

Course Outcomes:

After completion of this course, the students will be able to
CO1: Able to understand the detailed physiology of various human anatomical systems.
CO2: Able to identify proper transducer for the acquisition of particular bioelectric potential.
CO3: Able to analyze various biological conditions from the measured bioelectric potentials.
CO4: Able to design biotelemetry systems for acquiring bioelectric potentials from long distances.

List of Experiments:

1. Determination of bio signals using Proteus.

2. Blood pressure measurement.

3. ECG signal analysis of Human heart using MATLAB.

4. EMG signal analysis of Human muscle using MATLAB.

5. EEG signal analysis of Human brain using MATLAB.

6. EOG signal analysis of Human eyes using MATLAB.

7. ECG detection using Biotelemetry system.

8. Action and Resting Potential measurement using external stimulation process.

9. Electrode-tissue interface process realization.

Text Books:

1. Cromwell L – Biomedical Instrumentation and Measurement, Pearson
2. Khandpur R.S., Handbook of Biomedical Instrumentation, Tata McGraw Hill
3. Webster J S – Medical Instrumentation – Application and Design

Reference Books:

1. Astor B R – Introduction to Biomedical Instrumentation and Measurement, McMillan.
2. Chatterjee Miller – Biomedical Instrumentation, Cengage Learning

CO-PO Mapping:

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

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	2	3
CO2	2	1	1
CO3	1	2	2
CO4	2	1	2

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Course Name: Robotics Engineering Laboratory
Course Code : EI693A
Contact :0:0:3
Credits : 1.5

Course Objectives:

1. Will have a strong knowledge on MATLAB software..
2. They get the basic knowledge on practical control system.
3. To get the Design applications of control system.
4. They get the knowledge of stability analysis of different control systems.

Course Outcomes:

The students will be able to:

CO1. Apply formulate transfer function for given control system problems.
CO2. Demonstrate an understanding of the fundamentals of control systems.
CO3. Determine time response of given control system model.
CO4. Analyze the system behavior through Root Locus, Bode plots & Nyquist plot fora given control system model.

List of Experiments:

1. Study components of an industrial robot (PUMA, KUKA, FANUC, MTAB, UR , Etc) and its DH parameters.
2. Forward kinematics and validation using a software (RoboAnalyser/MATLAB).
3.Inverse kinematics of an industrial robot and validation using any open source software.
4.Industrial Robot programming using VAL II or its equivalent.
5.Microcontroller lab – programming (8051 and upper level microcontroller).
6.Integration of assorted sensors (IR, Potentiometer, strain gages etc.), micro controllers and ROS (Robot Operating System) in a robotic system. (mainly MATLAB)
7.Control experiment using available hardware or software. (mainlyMATLAB).
8.The use of open source computer vision programming tools such as MATLAB, Python, open CV.
9.Research related experiment in AI, multi agent system, unmanned systems control using ROS, etc.
10. Innovative Experiment

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Text Books:

1. Introduction to Robotics: J. Craig, Pearson
2. Robot Dynamics and Control, Spong&Vidyasagar, McGraw Hill
3. Robotics Engineering: R. Klafter, PHI
4. Robotics: Subir K Saha, McGrawHill
5. Industrial Robotics: M. P. Groover, AshishDutta, McGraw Hill

Reference Books:

1. Richard Paul, Robot Manipulators: Mathematics, Programming and Control, MIT Press, 1981
2. Robert Shilling, Fundamentals of Robotics, Prentice-Hall , 2003
3. Laxmidhar Behera and Indrani Kar, "Intelligent Systems and Control", Oxford University Press, Nov 2009.
4. M. Felix Orlando, Laxmidhar Behera, TomayoTamei, Tomohiro Shibata, Ashish Dutta and Anupam Saxena," On Redundancy Resolution of the Human Thumb, Index and Middle Fingers in Cooperative Object Translation," Robotica, vol. 35, pp. 1992-2017, 2016

CO-PO Mapping:

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

CO-PSO Mapping:

Cos	**PO1**	**PO2**	**PO3**
CO1	3	2	3
CO2	1	1	1
CO3	2	2	2
CO4	2	2	2

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Course Name: Advanced Sensor Laboratory
Course Code: EI693B
Contact: 0:0:3
Credit: 1.5

Course Objectives:

1. To understand basics of sensors, actuators and their operating principle.
2. To educate the students on different types of microfabrication techniques for designing and developing sensors (Several applications from Electronics to Biomedical will be covered).
3. To explain working of various types of electrochemical sensors and actuators.
4. To provide information about interfacing of sensors and signal conditioning circuits to establish any control system or monitoring system.
5. To provide an understanding on characteristic parameters to evaluate sensor performance.

Course Outcomes:

Students will be able to

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

List of Experiments:

1. PCB design implementation using lithography.
2. Sensor design using simulation in Proteus software.
3. Smart sensor design in pressure measurement.
4. Smart sensor design in level measurement.
5. Smart sensor design in flow measurement.
6. Smart sensor design in temperature measurement.
7. Smart sensor design in industrial automation.
8. Smart sensor design in robotics.
9. Smart sensor design in biomedical applications like pulse oximeter, blood sugar level measurement.

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CO-PO Mapping:

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

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	2	3
CO2	1	1	1
CO3	2	2	2
CO4	2	2	3

Course Name: Embedded Systems Design Laboratory
Course Code: EI693C
Contact: 0:0:3
Credit: 1.5

Course Objectives:

1. An ability to design a system, component, or process to meet desired needs within realistic constraints.
2. Ability to understand microcontroller, microcomputer, embedded system.
3. Understand different components of a micro-controller and their interactions.
4. To become familiar with the programming environment used to develop embedded systems.
5. Understand key concepts of embedded systems like IO, timers, interrupts, interaction with peripheral devices
6. Learn debugging techniques for an embedded system

Course Outcomes:

CO1: Familiarization with PIC Microcontroller, ARM Microcontroller, FPGA, and their interfacing.
CO2: Design of different types real-time projects with digital controllers.
CO3: Program ARM microcontroller to perform various tasks.
CO4: Understand the key concepts of embedded systems such as I/O, timers, interrupts and interaction with peripheral devices.

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List of Experiments:

1. **PIC-based experiment (Any Five)**

a. Familiarization of PIC kit.
b. Interface and control a LED, LCD, Keyboard, ADC& DAC using PIC.
c. Connect two PIC kit and transfer data serially.
d. Design a Digital watch based on PIC.
e. Control a stepper motor and display temperature from a temperature sensor on a LCD.

2. **ARM based experiment (Any Four)**

a. Familiarization with ARM evaluation system
b. Familiarization with Raspberry Pi
c. Interfacing with a real-time clock using a serial port to display time.
d. Interface a Keyboard and display the keystrokes on a LCD, LED.
e. Familiarization of image processing using ARM

3. **FPGA based experiment**

a. Design a 3 to 8 decoder circuit.
b. Design an UP/DOWN counter and display the count on a 7-segment display.
c. Designing an ALU and verify with mathematical operations.
d. Innovative Project.

CO-PO Mapping:

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

CO-PSO Mapping:

Cos	PO1	PO2	PO3
CO1	3	2	3
CO2	2	1	1
CO3	2	3	2
CO4	2	2	2

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Name of the Paper: Data Structures & Algorithms Laboratory
Paper Code: EI694A
Contact Hours: 0:0:3
Credit s: 1.5

Course Objectives:

1. To write and execute programs in C to solve problems using data structures such as arrays, linked lists, stacks, queues, trees, graphs, hash tables and search trees.
2. To write and execute write programs in C to implement various sorting and searching methods.

Course Outcomes:

CO1: Choose appropriate data structure as applied to specified problem definition.
CO2: Handle operations like searching, insertion, deletion, traversing mechanism on various data structures.
CO3: Have practical knowledge on the applications of data structures.
CO4: Able to store, manipulate and arrange data in an efficient manner.

List of Experiments:

1. Write a C program to implement Single Link List
2. Write a C program to implement Double Link List
3. Write a C program to implement Single Circular Link List
4. Write a C program to implement Double Circular Link List
5. Write a C program to implement Polynomial addition and Polynomial multiplication using Linked List.
6. Write a C program to convert a given infix expression into its postfix Equivalent.
7. Write C programs to implement a queue ADT using i) array and ii) doubly linked list respectively.
8. Write a C program to implement Binary Search Tree (BST).
9. Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
   Insertion sort
   Merge sort
10. Write C programs for implementing the following sorting methods to arrange a list of integers in ascending order:
    Quick sort
    Selection sort
11. Write C programs for implementing the following searching methods:
    Linear Search
    Binary Search

12. Write a C program to implement all the functions of a dictionary (ADT) using hashing.
13. Write C programs for implementing the following graph traversal algorithms:
    Depth first search
    Breadth first search
14. Innovative Experiment

Text Books:

1. Data Structures using C, R. Thareja, 2nd Edition, Oxford University Press.
2. Data Structures Using C E. Balagurusamy, Mcgraw Hill

Reference Books:

1. Data Structures in C by Aaron M. Tenenbaum, 1st Edition, Pearson
2. Data Structures Through 'C' Language by Samiran Chattopadhyay, Debabrata Ghosh Dastidar, Matangini Chattopadhyay, Edition: 2001, BPB Publications
3. Data structures using C, A.K.Sharma, 2nd Edition, Pearson
4. Fundamentals of Data Structures of C by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed 2nd Edition, Universities Press

CO-PO Mapping:

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

CO-PSO Mapping:

Cos	**PO1**	**PO2**	**PO3**
CO1	3	2	3
CO2	1	1	1
CO3	1	3	2
CO4	2	2	3

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Course Name: Database Management System Laboratory
Course Code: EI694B
Contact: 0:0:3
Credits: 1.5

Course Objectives:

1. To learn the data models, conceptualize and depict a database system
2. To learn the fundamental concepts of SQL queries.
3. To understand the concept of designing a database with the necessary attributes.
4. To know the methodology of Accessing, Modifying, and Updating data & information from the relational databases
5. To learn database design as well as to design user interface and how to connect with database.

Course Outcomes:

On completion of the course, students will be able to

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

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

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

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

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

Module1: [6L]

Structured Query Language
Creating Database
Creating a Database
Creating a Table Specifying Relational Data Types
Specifying Constraints Creating Indexes

Module2: [3L]

Table and Record Handling
INSERT statement

Using SELECT and INSERT together
DELETE, UPDATE, TRUNCATE statements
DROP, ALTER statements

Module3: [6L]

Retrieving Data from a Database
The SELECT statement
Using the WHERE clause
Using Logical Operators in the WHERE clause
Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING Clause Using Aggregate Functions
Combining Tables Using JOINS
Sub-queries

Module 4: [3L]

Database Management
Creating Views
Creating Column Aliases
Creating Database Users
Using GRANT and REVOKE

Module 5:[6L]

PL/SQL

Module 6:[6L]

Database design using E-R model and Normalization

Module 7:[6L]

Design and implementation of some on line system [Library Management System]

Text Books:

1. SQL, PL/SQL by Ivan Bayross, BPB Publications
2. Oracle PL/SQL Programming, 6th Edition - O'Reilly Media By Steven Feuerstein, Bill Pribyl

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Reference Books:

a. "Database System Concepts" by Abraham Silberschatz and S Sudarshan

CO-PO Mapping

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

CO-PSO Mapping:

Cos	**PO1**	**PO2**	**PO3**
CO1	3	2	3
CO2	2	1	1
CO3	2	3	2
CO4	2	2	2

Name of the Paper: Software Engineering Lab
Paper Code: EI694C
Contact Hours: 0:0:3
Credits: 1.5

Course Objectives:

- To learn software development skills through various stages of the software life cycle.
- To ensure the quality of software through software development with the various protocol-basedenvironments.

Course Outcomes:

CO1: To handle software development models through rational methods.
CO2: To prepare SRS document, design document, test cases, and software configuration management and risk management related document.
CO3: To develop function-oriented and object-oriented software design using tools like a rational rose.
CO4: To perform unit testing and integration testing
CO5: To apply various white box and black box testing techniques

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Assignments to be given from the following

1. Preparation of requirement document for standard application problems in a standard format. (e.g. Library Management System, Railway Reservation System, Hospital Management System, University Admission system) .DFD of standard application problems.
2. Project Schedule preparation. Software Requirement Analysis: Describe the individual Phases/ modules of the project, Identify deliverables.
3. Use Case diagram, Class Diagram, Sequence Diagram, Activity Diagram and prepare Software Design Document using tools like Rational Rose.(For standard application problems)
4. Software Development and Debugging. Estimation of project size using Function Point(FP) for calculation.
5. Design Test Script/Test Plan(both Black box and White Box approach)
6. Compute Process and Product Metrics (e.g Defect Density, Defect Age, Productivity, Cost etc.) Cost Estimation models. COCOMO
7. Innovative Experiment

Text Books:
1. Software Engineering: A practitioner's approach–Pressman(TMH)

Reference Books:
1. Software Engineering-Pankaj Jalote (Wiley-India)

CO-PO Mapping:

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

CO-PSO Mapping:

Cos	**PO1**	**PO2**	**PO3**
CO1	3	2	3
CO2	2	1	1
CO3	2	3	2
CO4	2	2	2

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C. MANDATORY ACTIVITIES / COURSES

Intellectual Property Rights
Code: MC 601
Contact: 3:0:0
Credits: 3 units

Course Objective

1. Introduce students to different aspects of Intellectual Property Rights and its application in business, their relationship with business environment.
2. Introduce studentsregarding the general principles of IPR, Concept and Theories, Criticisms of Intellectual Property Rights.
3. Acquaint with International Regime Relating to IPR, Indian position of the Patent Law (1970), Procedure for granting a patent, Indian position of the Copyright Law, 1957, Copyright Law, Indian position of the Trademark Act, 1999, Historical development of the concept of trademark and trademark law.
4. To judge the effect of IPR especially of patents on emerging issues like public health, climate, Domain Name Disputes and Cybersquatting, Bio piracy etc. and the ways to tackle this problem,

Course Outcome

After completion of this course student will able to

CO-1: Explain and describe various aspects of IPR including trademark, patent, and copyright.
CO-2: Select, interpret and use different techniques related to IPR specific issues
CO-3: Adopt methods commensurate with National & International Standard.
CO-4: Understand the impact of IPR on emerging issues like public health, climate change, domain name related disputes etc.

Module-1

Introduction to Intellectual Property Rights, Concept and Theories, Kinds of Intellectual Property Rights, Economic analysis of Intellectual Property Rights, Need for Private Rights versus Public Interests, Advantages and Disadvantages of IPR, International Regime Relating to IPR, TRIPS and other Treaties (WIPO,WTO, GATTS)

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Module-2

Patent Act 1970 – amendments of 1999, 2000, 2002 and 2005 Patentable subject matter, Patentability criteria, non-patentable inventions, pharmaceutical products and process and patent protection Software Patents Patenting of Micro-organism.Rights of patentee, Procedure for granting a patent and obtaining patents.

Module-3

Copyright and Neighbouring Rights Concept and Principles,Copyright Act, 1957, Terms of Copyright conditions for grant of copyright, extent of rights exception to copyright protection, fair use provision, assignment and licensing, Copyright in Literary, Dramatic and MusicalWorks, Sound Recording, Cinematograph Films, Copyright in Computer Programme, Author Special Rights, Right of Broadcasting and performers.

Module-4

Introduction to Trademarks, Need for Protection, Kinds of trademarks, Concept of Well-known trademark, Registration of trademark, Grounds of refusal of registration, Absolute ground Relative ground Procedure of registration of trademark.

Module-5

Public health and Intellectual Property Rights, TRIPS: Flexibilities and access to medicine, IPR and Climate change-Patents and Biotechnology.

Module-6
Implications on intellectual property Rights: International & National legal preparedness, Application of copyright Act 1957, Scope of protection of computer program,Applications of patents to computer technology.

Module-7

Competition Policy and Law. IPRs and IPRs Policy. Framing the Competition-IPRs Relationship.

Text & References:

- B.L. Wadera, Patents, trademarks, copyright, Designs and Geographical Judications.
- Ganguli (Tata Megraw), Intellectual Property Rights
- Brinkhof (Edited), Patent Cases, Wolters Kluwer
- Prof. Willem Hoyng& Frank Eijsvogels, Global Patent Litigation, Strategy
- Hilarry Pearson and Clifford Miller, Commercial Exploitation of Intellectual Property,
- Dr. H. K. Saharay, Textbook on Competition Law, Universal Publications

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CO-PO Mapping:

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

CO-PSO Mapping:

Cos	**PO1**	**PO2**	**PO3**
CO1	3	2	3
CO2	2	1	1
CO3	2	3	1
CO4	2	2	1

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4th Year 1st Semester

Sl No	Course Code	Paper Code	Theory	Contact Hours /Week				Credit Points
				L	T	P	Total	
A. THEORY								
1	PE	EI701	A. Telemetry & Remote Control B. Analytical Instrumentation C. Digital Image Processing	3	0	0	3	3
2	PE	EI702	A. Process Control II B. Introduction to MEMS C. Artificial Intelligence	3	0	0	3	3
3	OE	EI703	A. Power Electronics B. Industrial Drives C. Non-conventional Energy Sources	3	0	0	3	3
4	OE	EI704	A. Satellite Communication B. Wireless Sensor Network C. Quantum Computing	3	0	0	3	3
B. PRACTICAL								
5	PE	EI 791	A. Telemetry &Remote Control Lab B. Analytical Instrumentation Lab C. Digital Image Processing Lab	0	0	0	3	1.5

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6	PROJECT	PR791	Major Project-I	0	0	0	4	2
7	PROJECT	PR792*	Industrial Training / Internship	0	0	0	0	1
8	PROJECT	PR 793	Skill Development VII: Seminar & Group Discussion	1	0	0	1	0.5
C. MANDATORY ACTIVITIES / COURSES								
9	MC	MC 781	Entrepreneurship & Innovation Skill	0	0	3	3	3 Units
TOTAL CREDIT WITHOUT MOOCS COURSES								**17**
D.MOOCS COURSES**								
10	MOOCS COURSES	HM701	MOOCS COURSE-V	3	1	0	4	4
TOTAL CREDIT WITH MOOCS COURSES								**21**

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A. THEORY

Telemetry & Remote Control
Code: EI701A
Contact: 3:0:0
Credits: 3
Total contact hours: 36

Prerequisite:
To understand this course, the learner must have ideas of Laplace transformation & Fourier transformation, digital and analog electronics, digital and analog communication, Fiber Optics, Modulation, and Multiplexing techniques.

Course Objective:

1. To understand the concepts of the telemetry system
2. To understand the concepts of remote sensing,
3. To enable selection and design of remote sensing and telemetry systems

Course Outcome:

Students will be able to

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

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

CO3: Understand the concepts and applications of satellite Telemetry

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

Module I

Basic Concept: Telemetry:-its purpose and application potential, basic schemes-pneumatic, current, voltage, frequency; Wired and wireless types. Concepts of Information transfer, Noise and its distribution; Probability function. Bit error rate. 5

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Module II

Different Multiplexing & Demultiplexing techniques: FDM and TDM, CDM, WDM
Multiple accessing techniques: TDMA, FDMA, CDMA, WDMA
TDM Systems: their circuits, scanning techniques; TDM-PAM, PAM-PM Systems, Synchronization, TDM-PCM System 6

Modem Protocols, Modems & Modem protocols, Synchronous protocols.
Wave Propagation: Aspects of wave propagation; Space and Surface waves 4

Module III

Satellite Communication: Basic concepts of Satellite Communications, Orbital parameters, Types of Satellite orbits
Satellite Communication: TT and C services, subsystems, the earth station,
Multiple access schemes: FDMA, TDMA, and CDMA.
Satellite Navigational System, Direct Broadcast Satellites (DBS)- Direct To Home Broadcast (DTH), Digital Audio Broadcast (DAB) 9

Module IV

Concepts of Fiber-optic Communication- the Fiber as transmission medium, Interconnections, Repeaters, Sources, Detectors 3
Remote Control: Communication based processing control system, pipelines, operational security systems components, pipeline control, power system control 5

Text Books:

1. D. Patranabis, Telemetry principles, TMH, New Delhi
2. E. L. Gruenberg, Handbook of Telemetry and Remote control, Mc Graw Hill

Reference Books:

1. Modern Digital and Analog Communication Systems - B. P. Lathi, Oxford University Press
2. Swobada G – Telecontrol Method and Application of Telemetering and Remote Control, Von Nostrand, 1971
3. Lillesand, M.T. and Ralph, W., Remote Sensing and Image Interpreation, John Wiley (2004) 6th ed

CO-PO Mapping

	PO 1	PO2	PO 3	PO 4	PO5	PO 6	PO 7	P O8	PO 9	P1 0	P1 1	P 12	PS O1
CO1	1	1	2	2	1	1	1	1	1	1	1	1	3
CO2	1	1	1	3	1	1	1	1	1	1	1	1	3
CO3	1	2	1	1	2	1	1	1	1	1	1	2	2
CO4	1	1	1	3	-1	1	1	1	1	1	1	1	3

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CO- PSO Mapping

	PSO1	PSO2	PSO3
CO1	3	1	3
CO2	3	1	3
CO3	3	1	3
CO4	3	1	3

Course Name: Analytical Instrumentation
Course Code: EI701B
Contact: 3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite: Knowledge of measurement methods of various process parameters

Course Objective:

1. To elaborate the physical properties of samples like pH, viscosity, humidity, and moisture
2. To analyze various methods to identify the compositions of various media
3. To explain the function and importance of analyzer sample systems.
4. To describe the operating principles of numerous types of analytical instruments and analyzers.

Course Outcome:

After completion of the course, the students will be

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

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

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

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

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Module I: Introduction to Analytical Instrumentation [8]

Measurement of Humidity: dry & wet psychrometer, hair hygrometer, Electrolysis type hygrometer
Moisture: electrical conductivity type, capacitive method type, IR method
Viscosity: Saybolt's viscometer, rotameter type viscometer, Searle's rotating cylinder type
Density: pressure head type, buoyancy effect type, radioactive type, photoelectric type, displacer type
Gas Analysis: a) Thermal conductivity method
b) Heat of Reaction method.
Oxygen Analysis: a) Magneto Dynamic instrument (Pauling cell)
b) Thermomagnetic type or Hotwire type instrument.
c) Zirconia oxygen analyzer.

Module II: Liquid analysis [9]

a) Electrodes-Ion selective, Molecular selective types- their variations.
b) pH analysis: pH electrodes, circuit for pH measurement and applications.
c) Conductivity cells – standards, circuits.
d) Polarography- apparatus, circuits, and techniques-pulse polarography, applications
e) Colorimetry

Module III: Spectroscopic Methods [12]

Introduction, Laws relating to the absorption of radiation, Molecular Absorption Spectroscopy in UV & VIS ranges: sources, wavelength selectors, sample container, detectors
Spectrophotometers (Single beam & Dual-beam arrangement)
Atomic Absorption & Emission spectroscopy: Atomizers, sources, single & dual-beam arrangement.
Atomic X-Ray spectrometry: Absorption & diffraction phenomena, sources, detectors, techniques. IR Spectroscopy: sources, monochromators, detectors. IR Spectrometer, FT-IR spectrometers.
Introduction to NMR

Module IV: Chromatography [7]

Introduction, basic definitions, some relationships. Gas chromatography: basic parts, columns, detectors, techniques. LC: types, HPLC: basic parts, sample injection system, column, detectors, Applications.

Text Books:

1. Principles of Industrial Instrumentation- D.C. Patranabis, Publisher: Tata McGraw Hill
Analytical Instrumentation- B.G. Liptak
2. Principles of Instrumental Analysis- Skoog, Holler, Nieman, Publisher: Thomson Brooks/Cole

Reference Books:

1. Introduction to Instrumental Analysis- Robert D. Braun, Publisher: Pharma Book Syndicate
2. Handbook of Analytical Instruments- R.S. Khandpur, Publisher: Tata McGraw Hill

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CO-PO mapping:

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

CO-PSO matrix,

	PSO1	PSO2	PSO3
CO1	3	1	3
CO2	3	1	3
CO3	3	1	3
CO4	3	1	3

Course Name: Digital Image Processing
Course Code: EI701C
Contact: 3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite: Digital Signal Processing, Signals, And Systems

Course Objective:

1. To learn basic concepts of digital filter and transform techniques for image processing and feature extraction.
2. To know the overview of common heuristic algorithms for Image Processing.
3. To learn about digital image processing sampling and quantization techniques.

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Course Outcome:

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

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

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

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

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

Module 1:

Digital Image Processing Systems: Introduction to the human eye, Image formation techniques in the human eye, Brightness adaptation and discrimination techniques, Image sensing, and acquisition, storage, Processing, Communication techniques. Image sampling and quantization techniques. Spatial and Tonal resolutions, pixels. [4]

Module 2:

Image Transforms (implementation): Introduction to Discrete Fourier transform, DFT and 2-D DFT, Properties of 2-D DFT, FFT, IFFT, Twiddle factor, Walsh transform, Hadamard transform, Discrete sine and cosine transform, Slant transform, Optimum transform: Karhunen - Loeve (Hotelling) transform. [7]

Module 3:

Image Enhancement in the Spatial and Frequency Domain: Gray level transformations, Histogram processing, Arithmetic, and logical operations, Spatial filtering: Introduction, Smoothing (low pass) and sharpening (high pass) filters. Frequency domain filters: Homomorphic filtering. Basic MATLAB codes to demonstrate the image enhancement and filtering techniques. [5]

Module 4:

Image Data Compression: Fundamentals, Redundancies: Coding, Inter pixel Psycho-visual, fidelity criteria, Image compression techniques, Error-free compression, Lossy compression, Image compression standards:

Binary image and Continuous tone Still Image compression standards, Video compression standards. [7]

Module 5:

Morphological Image Processing: Introduction, algebraic and logical operations, Dilation, Erosion, Opening, closing, Hit or miss transformation, thickening, thinning, skeletonization. Morphological algorithms on binary Images. Morphological algorithm operations on gray-scale Images.
[6]

Module 6:

Image Segmentation, Representation, and Description: Detection of discontinuities, Edge linking and Boundary detection, Thresholding Region-based segmentation, Image Representation schemes, Boundary descriptors, and Regional descriptors. Basic MATLAB codes to demonstrate the different edge detection techniques. [7]

Text Books:

1. Digital Image Processing, R. C Gonzalez and R. Woods, Indian reprint: Pearson publication, 2001

2. Digital Image Processing, Anil K. Jain, Prentice-Hall, India

3. Digital Image Processing, Sanjay Sharma, S. K. Kataria& Sons

Reference Books:

1. Digital Image Processing, W. K. Pratt, 2nd Edition, John Wiley & Sons

2. Digital Image Processing and Analysis, B. Chanda & D. Dutta Majumder, Prentice-Hall, India

3. Image Processing - Theory, Algorithms &Architecture, M. A. Sid-Ahmed, McGraw-Hill

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CO-PO matrix of course:

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

CO-PSO matrix,

	PSO1	PSO2	PSO3
CO1	3	1	3
CO2	3	1	3
CO3	3	1	3
CO4	3	1	3
CO5	3	1	3

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PROCESS CONTROL- II
Code: EI702A
Contacts: 3:0:0
Credits: 3
Total contact hours: 36

Prerequisite: Knowledge of continuous-time control system, process control, fuzzy logic (preferred)

Course Objective:

1. To make the learners able to solve z-transform and inverse z-transform problems
2. To make the learners able to mathematically model and analyze performance and stability of linear discrete-time control system in z-domain using Jury's test
3. To make the learners understand the basic advantages and disadvantages, the basic block diagrams, the functioning, and the areas of applications of DCS, SCADA, and Fuzzy Logic Control (FLC) system.
4. To make the learners understand the techniques of rolling mill control and pH control

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

CO1: carry out the discretization and reconstruction of a given signal by using an ideal sampler and zero-order hold, respectively
CO2: carry out z-transform and inverse z-transform for given functions
CO3: carry out mathematical modeling, stability analysis, and time response analysis of a linear time-invariant discrete-time control system
CO4: design digital PID controller and deadbeat controller for linear time-invariant single i/p-single o/p system
CO5: explain the functionality of DCS in a process plant, including control, communication, protocols, and network topology
CO6: compare the fuzzy logic control system with a conventional control system

Course content:

Module I: Signal discretization, signal reconstruction, z-transform (10L)
Digital control system with the continuous process and digital controller, advantages & limitations of digital control system

Signal discretization - Sampling of a continuous signal, sampling as impulse modulation, sampled spectra & aliasing, sampling theorem

Signal reconstruction – zero-order hold and first-order hold

Mapping between s-plane and z-plane.

z-transform- advantage of z-transform, z-transform of discrete-time signals, z-transform theorems, modified z-transform, inverse z-transform, limitations of z-transform

Representation of digital control system – Linear Difference Equations, Pulse Transfer Function.

Analysis of a discrete-time single input-single output system by Z-transform techniques

Stability studies for discrete-time control systems – Jury's stability criteria
w - plane transforms for discrete-time systems

Module II: Digital controllers (4L)
Designing a digital controller, physical realizability

Digital control algorithms:-
(a) Digital PID controller
(b) Dead beat control
(c) Dahlin's algorithm

Module III: DCS (12L)
DCS – basic components and their functions.
HMI– operator& engineering interface, functions, and requirements.
Communication – ISO/OSI reference model; data highway and Fieldbus; HART
Network access protocols – TDMA, CSMA/CD, token passing, Master-Slave
Transmission media – twisted pair, co-axial, optical fiber ;
Network topology – mesh, ring, star, bus ;
Redundancy – processor, bus, and input-output level

Module IV: SCADA (4L)
Introduction to SCADA, the evolution of SCADA- the different generations, basic architecture, comparison of SCADA and DCS, RTU in SCADA, areas of application

Module V: Fuzzy logic control (4L)
Fuzzy logic control –fuzzy set, membership function, linguistic variable, fuzzy operators, fuzzy reasoning, defuzzification, Mamdani's model, Sugeno's model

Module V: Case studies (2L)
Case studies- rolling mill control (system with time delay), pH control (nonlinear system)

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Text Books:

1. B.C.Kuo, *Digital Control System*, Oxford

Reference Books:

1. George Stephanopoulos, *Chemical Process Control*, PHI
2. M. Gopal, *Digital Control System*, New Age
3. K. Ogata, *Discrete-Time Control Systems*, Pearson Education Inc
4. D.Dirankov, H.Hellendoorn, M.Reinfrank, *Introduction. to Fuzzy Control*, Narosa
5. B. G. Liptak(ed.), *Instrument Engineers' Handbookvol-2*, CRC Press

CO-PO matrix,

	PO1	PO2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	P10	P11	P12
CO1	3	1	3	1	1	1	1	1	1	1	1	1
CO2	3	1	3	1	1	1	1	1	1	1	1	1
CO3	3	1	3	1	3	1	1	1	1	1	1	1
CO4	3	1	3	1	3	1	1	1	1	1	1	1
CO5	3	1	3	1	3	1	1	1	2	1	1	2
CO6	3	1	1	1	3	1	1	1	1	1	1	2

CO-PSO matrix,

	PSO1	PSO2	PSO3
CO1	3	1	3
CO2	3	1	3
CO3	3	1	3
CO4	3	1	3
CO5	3	1	3
CO6	3	1	1

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Introduction to MEMS
Code:EI702B
Contact:3:0:0
Credits: 3
Total Contact Hours: 36

Course Outcomes:

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

1. Understanding the working principles of MEMS and NEMS devices.
2. Understanding the micromachining Techniques
3. Design and model MEM devices.
4. Analyzing the application areas.

Module I: **[6L]**

Introduction and Historical Background of MEMS, Scaling Effects. Micro/Nano Sensors, Application areas.

Module II: **[14L]**

Actuators and Systems overview: Case studies. Review of Basic MEMS fabrication modules: Oxidation, Deposition Techniques, Lithography (LIGA), and Etching. Micromachining: Surface Micromachining, sacrificial layer processes, Stiction; Bulk Micromachining, Isotropic Etching, and Anisotropic Etching, Wafer Bonding.

Module III: **[8L]**
Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hooke's law, Poisson effect, Linear Thermal Expansion, Bending; Energy methods,

Module IV: **[8L]**

Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems.

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Text Books:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, 2012.

2. S. E.Lyshevski, Nano-and Micro-Electromechanical Systems: Fundamentals of Nano-and Microengineering (Vol. 8). CRC Press, (2005).

Reference Books:

1. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001.
2. M. Madou, Fundamentals of Microfabrication, CRC Press, 1997.
3. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, 1998.
4. M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and Gyroscopes, Elsevier, New York, 2000.

CO-PO Mapping:

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

CO-PSO matrix

	PSO1	PSO2	PSO3
CO1	3	1	3
CO2	2	1	3
CO3	2	2	3
CO4	3	1	3

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Course Name: Artificial Intelligence
Course Code:EI702C
Contact:3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite:

1. Basics of Design and Analysis of Algorithm.
2. A deep background in mathematics, including probability.

Course Objectives:

1. To learn the overview of artificial intelligence principles and approaches.
2. To develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents.
3. This course also covers fundamental areas of Local Search Algorithms, Adversarial Searching, and Neural Networks.
4. Analyzing the Application areas in the Instrumentation field.

Course Outcome

On completion of the course, students will be able to

CO1: Understand the concepts of Artificial intelligence

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

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

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

Module 1: Basics of AI [7L]

Introduction [2]
Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem.

Intelligent Agents [2]
Agents & environment, nature of the environment, the structure of agents, goal-based agents, utility-based agents, learning agents.

Learning [3]
Forms of learning, inductive learning, learning decision trees, explanation-based learning, learning using relevance information, neural net learning & genetic learning.

Module 2: Different types of searching algorithms [12L]

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Problem Solving [2]
Problems, Problem Space & search: Defining the problem as state-space search, production system, constraint satisfaction problems, issues in the design of search programs.

Search techniques [3]
Solving problems by searching: Problem-solving agents, searching for solutions; uniform search strategies: breadth-first search, depth-first search, depth limited search, bidirectional search, comparing uniform search strategies.

Heuristic search strategies [4]
Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems.

Adversarial search [3]
Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.

Module 3: Knowledge & Reasoning [12L]

Knowledge & Reasoning [3]
Knowledge representation issues, representation&mapping, approaches to knowledge representation, issues in knowledge representation.

Using predicate logic [4]
Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.

Representing knowledge using rules [2]
Procedural versus declarative knowledge, logic programming, forward versus backward reasoning, matching, control knowledge.

Probabilistic reasoning [3]
Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster- Shafer theory, Fuzzy sets, and fuzzy logic.

Module 4: Different fields of AI [4L]

Natural Language Processing [2]
Introduction, Syntactic processing, semantic analysis, discourse, and pragmatic processing.

Expert Systems [2]
Representing and using domain knowledge, expert system shells, and knowledge acquisition. Basic knowledge of programming languages like Prolog

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Text Books:

1. Artificial Intelligence, Ritch & Knight, TMH
2. Artificial Intelligence, A Modern Approach, Stuart Russel, Peter Norvig,Pearson

Reference Books:

1. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
2. Computational Intelligence, Poole, OUP
3. Logic & Prolog Programming, Saroj Kaushik, New Age International
4. Expert Systems, Giarranto, VIKAS

CO-PO Mapping:

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

CO-PSO matrix

	PSO1	PSO2	PSO3
CO1	3	1	3
CO2	3	1	3
CO3	3	1	3
CO4	3	1	3

Curriculum for B.Tech
Under Autonomy
Applied Electronics & Instrumentation Engineering
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

Power Electronics
Code: EI703A
Contact:3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite: Knowledge of analog electronics & circuit theory.

Course Objective:
1. To understand the constructional features and characteristics of power semiconductor devices

2. To understand the working principle and switching operation of different semiconductor devices.

3. To prepare the students to analyze and design different power converter circuits.

4. To implement the different power supply modules.

Course Outcome:

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

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

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

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

Module I: Power Semiconductor Devices & switching devices:[8L]
Rectifier diodes, fast recovery diode and Schottky barrier diode, BJT, Thyristor (SCR), TRIAC, GTO, MOSFET, IGBT, and MCT.

Module II: Thyristor triggering & commutation techniques:[6L]
UJT and RC triggering circuit, resonant commutation, self commutation, auxiliary commutation, Complementary commutation.

Module III: Converters: [11L]
Rectifiers: Single-phase and three-phase controlled bridge rectifiers, DC to DC converters (Choppers): the principle of step up and step down converters, DC to AC converters (inverters): Single-phase and three-phase inverters, Cycloconverters: Single phase to single-phase and three-phase to single-phase circuits, blocked group

operation, circulating current mode.

Module IV: Applications: **[8L]**

Modern trends in industrial drives and control; AC motor drives in the transportation system and traction; induction heating, electronic ballast, UPS, Intelligent power modules.

Text Books:

1. P.C. Sen, Power Electronics, TMH, New Delhi

2. M. H. Rashid, Power Electronics, PHI/Pearson Education

Reference Books:

3. C. W. Lander, Power Electronics, Mc Graw Hill

5. Mohan N, Underland T M & Robbins WP – Power Electronics, John Wiley & Sons

6. P. S. Bimbhra – Power Electronics, Khanna Publishers

7. Soumitra Kumar Mandal- Power Electronics, Mc Graw Hill Education

CO-PO mapping:

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

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CO-PSO matrix

	PSO1	PSO2	PSO3
CO1	3	1	3
CO2	3	1	3
CO3	3	1	3
CO4	3	1	3

Course Name: Industrial Drives
Course Code: EI703 B
Contact: 3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite: Knowledge of Electrical Machines and Power Electronics.

Course Objectives:

1. To understand the importance of different industrial drives.
2. To understand the working principle of different types of industrial drives.
3. To classify applications in different industries.
4. To understand the different control techniques of industrial drives.

Course Outcome

CO1: Demonstrate the basic requirements of dc drive and ac drive.
CO2: Illustrate the principles of speed control of dc motors and ac motors.
CO3: Classify the industrial applications of dc drive and ac drive.
CO4: Analyze the servo motors and servo drives

Module I: AC Drives [14L]

Basic Elements of a Variable Frequency Drive (VFD), External Components in a typical Power and Control Circuit of a drive for a simple pump application, Drive Control modes: Variable Frequency Control, Sensorless Vector Control, Vector Control with sensor, Flux Vector Control, Direct Torque Control , Basic Specifications and Selection Procedure for AC Drives – with specific reference to Variable Torque and Constant Torque

applications, Use of AC Drives for energy-efficient production as applied to a) Pumps, Fans, Compressors, b) Hoisting, Breaking, Lowering, c) Conveyor Technology.

Module II: DC Drives [12L]

Modern DC Drives and its applications in a) Winders & Un-winders, b) Wire Drawing Machine, c) Bar Rolling Mill, d) Rotary Kiln, Basic Specifications and Selection Procedure for DC Drive.

Module III: Servo Motor and Servo Drives [10L]

Block Diagram of a typical Servo Controlled System with a) velocity and torque feedback, b) velocity and position feedback, DC and AC Servomotors, Selection of Servomotor for an application, Fundamentals of Axis Control and its implementation.

Text Books:

1. Fundamentals of Industrial Drives, B.N. Sarkar, PHI
2. Fundamentals of Electric Drives, Gopal K Dubey, Narosa
3. Electrical Drives And Control, U.A. Bakshi, M.V.Bakshi, Technical Publications

Reference Books:

1. Industrial Drives, Mukhtar Ahmad, MacMillan
2. Electric Drives, V Subramanyam, McGraw-Hill
3. Electric Drives, Boldea& Nasar, CRC
4. Vector Control of AC Drives, Boldea& Nasar, CRC

CO-PO Mapping:

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

Curriculum for B.Tech
Under Autonomy
Applied Electronics & Instrumentation Engineering
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CO-PSO matrix

	PSO1	PSO2	PSO3
CO1	3	1	3
CO2	3	1	3
CO3	3	1	3
CO4	3	1	3

Non-Conventional Energy Sources
Code: EI703C
Contact: 3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite:
Student requires the knowledge of basic chemistry & physics; Knowledge of basic thermodynamics.

Course Objective:

1. To know different non-conventional energy resources.
2. To explain the different techniques of energy extraction from non-conventional energy resources.
3. To understand and compare the different energy conversion techniques.
4. To choose and design the energy conversion plant after survey the suitability fruitfulness of the plant.

Course Outcome:

Students will be able to

CO1: Explain the different non-renewable sources.
CO2: Apply solar energy in different Fields using photovoltaic cells.

CO3: Analyses the performance and testing of different energy resources.
CO4: Select the design parameters of the non-conventional energy plants.

Course Content:

Module I: Introduction to Energy Sources [2L]

Renewable and non-renewable energy sources, energy consumption as a measure of Nation's development; strategy for meeting the future energy requirements Global and National scenarios, Prospects of renewable energy sources. Impact of renewable energy generation on the environment.

Module II: Solar Energy & Applications photovoltaic cell [10L]

Solar radiation: beam and diffuse radiation, solar constant, earth-sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset, and day length. Flat plate collectors and their materials, applications, and performance, focusing on collectors and their materials, applications, and performance; Photovoltaic - solar cells, different types of PV Cells, Monopoly Crystalline and amorphous Silicon solar cells. Design of PV array. Efficiency and cost of PV systems & it's applications. PV hybrid systems**.** Types and performance characteristics. Characteristics equivalent circuit photovoltaic effect photovoltaic for battery charging applications. Solar air heaters-types, solar driers, storage of solar energy-thermal storage, solar pond, solar water heaters, solar distillation, solar still, solar cooker, solar heating & cooling of buildings, Solar thermal power plants, thermal energy storage for solar heating and cooling, limitations. Solar cell power plant and limitations solar collectors.

Module III: Biomass Energy Systems: [4L]

Availability of Biomass and its conversion theory, production processes, Gasification, Anaerobic Digestion, Pyrolysis, Biogas, performance analysis, and testing.

Module IV: Wind Energy: [8L]

Wind distribution, principles of wind energy conversion basic components of wind energy conversion advantages and disadvantages, principles of operation of wind turbines, types of wind turbines and characteristics, Generators for wind Turbines, Control strategies. Performance and limitations of energy conversion systems.

Module V: Geothermal Ocean, wave & Tidal Energy [8L]

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Resources of geothermal energy, thermodynamics of geothermal energy conversion- electrical conversion, non-electrical conversion, environmental considerations. Principle of working of various types of fuel cells and their working, performance, and limitations. Ocean Thermal Energy conversion: Availability, theory and working principle, performance, and limitations. Wave and Tidal wave: Principle of working, performance and limitations, waste recycling plants.

Text Books:

1. G.D.Rai"Non-Conventional Energy sources", Khanna publishers, New Delhi, 1999.
2. G.N.Tiwari and M.K.Ghosal, "Renewable energy resources, Basic principles and Applications", Narosa Publishing house, New Delhi.
3. S.N.Badra, D.Kastha and S.Banerjee"Wind electrical systems", Oxford University Press, New Delhi.
4. M.V.R.KoteswaraRao"EnergyresourcesConventional&Non-conventional" BS publications Hyderabad, 2004.
5. Gilbert M.Masters "Renewable and Efficient electric power systems" Wileyinterscience Publications, 2004

Reference Books:

1. "Ecosystem Management and Non-Conventional Energy Sources" by Craig Zodikoff,
2. "Non-Conventional Energy System" by S.K. Agarwal,
3. Non-conventional Energy Systems" by KM Mital,
4. "Non-Conventional Energy Source and Utilization" by R K Rajput,
5. "Energy Technologies and Economics" by Patrick A Narbel and Jan R Lien,

CO-PO Mapping:

CO	PO1	PO 2	PO3	PO4	PO5	PO 6	PO7	PO8	PO9	P10	P11	P12
CO1	3	1	3	2	1	2	1	1	1	1	1	1
CO2	3	2	1	2	2	2	1	1	1	1	1	1
CO3	3	1	1	1	1	2	1	1	1	1	1	1
CO4	2	2	2	3	2	1	1	1	1	1	1	2

CO-PSO matrix

Curriculum for B.Tech
Under Autonomy
Applied Electronics & Instrumentation Engineering
L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

	PSO1	PSO2	PSO3
CO1	3	1	3
CO2	3	1	3
CO3	3	1	3
CO4	3	1	3

Course Name: Satellite Communication
Course Code: EI704A
Contacts: 3L
Credits: 3
Total Contact Hours: 36

Pre-requisite: Communication Engineering

Course Objectives:

1. To enable the student to become familiar with satellites and satellite services.
2. Study of satellite orbits and launching.
3. Study of earth segment and space segment components
4. Study of satellite access by various users.

Course Outcomes:

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

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

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

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

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

Module 1:

Introduction to Satellite Communication phenomena, the Frequency spectrum for satellite communication, and

expression for Doppler shift. Satellite link budget

Module II:

Flux density and received signal power equations, Calculation of System noise temperature for satellite receiver, noise power calculation, Drafting of satellite link budget, and C/N ratio calculations in clear air and rainy conditions.

Module III:

Modulation and Multiple Access Schemes: Various modulation schemes used in satellite communication, Meaning of Multiple Access, Multiple access scheme introduction to Satellite Communication: Principles and architecture of satellite Communication, Brief history of Satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication.

Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity, and Arreal velocity of a satellite, concepts of Solar day and Sidereal day.

Module IV:

Satellite sub-systems: Study of Architecture and Roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), Communication sub-system, power sub-systems, etc.

Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effects, remedies for Eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift es based on time, frequency, and code sharing namely TDMA, FDMA, and CDMA.

Text Books:

1. Timothy Pratt Charles W. Bostian, Jeremy E. Allnutt: Satellite Communications: Wiley India. 2nd edition 2002
2. Tri T. Ha: Digital Satellite Communications: Tata McGraw Hill, 2009
3. Dennis Roddy: Satellite Communication: 4th Edition, McGraw Hill,2009

Reference Books:

1.Viswanathan Thiagarajan: Telecommunication Switching Systems and Networks: Prentice Hall India Learning Private Limited

CO-PO Matrices:

Curriculum for B.Tech
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COs	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO9	PO10	PO11	PO12
CO1	2	2	3	1	1	1	1	1	1	1	1	1
CO2	3	2	1	1	1	1	1	1	1	1	1	2
CO3	3	3	3	1	1	1	1	1	1	1	1	1
CO4	2	2	1	1	1	1	1	1	2	1	1	1

CO-PSO matrix

	PSO1	PSO2	PSO3
CO1	3	1	3
CO2	3	1	3
CO3	3	1	3
CO4	3	2	3

Course Name: Wireless Sensor Network
Course Code:EI704B
Contacts: 3L
Credits: 3
Total Contact Hours: 36

Course Objectives:

1. To understand the WSN node Architecture and Network Architecture
2. To identify the Wireless Sensor Network Platforms
3. To program WSN using embedded C
4. To design and Develop wireless sensor node

Course Outcomes:

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

CO1: Design wireless sensor networks for a given application
CO2: Understand emerging research areas in the field of sensor networks
CO3: Understand MAC protocols used for different communication standards used in WSN
CO4: Explore new protocols for WSN

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Course Content

Module I:
Introduction to Sensor Networks, unique constraints, and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks.

Module II:
Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks.

Module III

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard, and ZigBee, Dissemination protocol for large sensor network. Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

Module IV

Design Principles for WSNs, Gateway Concepts Need for the gateway, WSN to Internet Communication, and the Internet to WSN Communication. Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC.

Computer network: Data acquisition and RS232.

Text Books:

1. WaltenegusDargie, Christian Poellabauer, “Fundamentals Of Wireless Sensor Networks Theory And Practice”, By John Wiley & Sons Publications,2011.
2. SabrieSoloman, “Sensors Handbook" by McGraw Hill publication. 2009.

Reference Books:
1. Feng Zhao, Leonidas Guibas, “Wireless Sensor Networks”, Elsevier Publications,2004
2. Kazem Sohrby, Daniel Minoli, “Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Inter science 5. Philip Levis, And David Gay "TinyOS Programming” by Cambridge University Press 2009

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L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO-PO Matrices:

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

CO-PSO matrix

	PSO1	PSO2	PSO3
CO1	1	2	2
CO2	3	2	3
CO3	1	1	3
CO4	3	2	3

Course Name: Quantum Computing
Course Code: EI704C
Contacts: 3L
Credits: 3
Total Contact Hours: 36

Course Objective:
1. To make students familiar with the basics of quantum computation
2. To provide a basic idea about quantum circuits
3. To compare between classical and quantum information theory
4. To learn students about quantum algorithms

Course Outcome:
After successful completion of the course, students will be able to
CO1: explain the basics of quantum computation

CO2: solve different quantum circuits
CO3: describe quantum Information and cryptography protocols
CO4: write quantum algorithms

Module 1: **Introduction to Quantum Computation:**
Concept of quantum computation, How it differs for conventional computation, Quantum systems, Basics of Quantum theory, Schrodinger's time-dependent equation, Wave nature of Particles
3

Module 2:Background Mathematics and Physics:
Complex numbers and geometrical representations, Complex vector spaces, inner products, and Hilbert spaces, Hermitian and unitary matrices, Tensor products of vector spaces, Deterministic Systems Probabilities and measurements, entanglement, density operators and correlation, basics of quantum mechanics, Measurements in bases other than computational basis.
8

Module 3:Quantum Circuits:

Single qubit gates, multiple qubit gates, design of quantum, circuits. Probabilistic descriptions and, state vector, operators, postulates of quantum mechanics, Dirac formalism, Stern-Gerlach experiment, electron spin, superposition of states, entanglement, Bits and Qubits, Classical gates versus quantum gates
08L

Module 4:Quantum Information and Cryptography:

Comparison between classical and quantum information theory. Introduction to quantum cryptography and quantum information theory, Bell states. Quantum teleportation. Quantum Cryptography, no-cloning theorem.
8

Module 5: Quantum Algorithms:

Classical computation on quantum computers. Relationship between quantum and classical complexity classes. Deutsch's algorithm, Deutsch's-Jozsa algorithm, Shor factorization, Grover search. Concept of Quantum programming languages, Probabilistic and Quantum computations
9

Text Book :
1. Quantum computing for computer scientists, Noson S. Yanofsky, Mirco A. Mannucci, Cambridge University Press 2008

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Reference Books :

1. Quantum computing explained, David McMahon, Wiley-interscience, John Wiley & Sons, Inc. Publication 2008

2. Quantum computation and quantum information, Michael A. Nielsen and Isaac L. Chuang, Cambridge University Press 2010

3 Nielsen M. A., Quantum Computation and Quantum Information, Cambridge University Press. 2002

Reference Books :

1. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. 2. Basic Concepts, Vol II: Basic Tools and Special Topics, World Scientific. 2004.

3. Online math tutorial: http://patrickjmt.com/

CO-PO Matrices:

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

CO-PSO matrix

	PSO1	PSO2	PSO3
CO1	3	1	3
CO2	3	1	3
CO3	3	1	3
CO4	3	1	3

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B. PRACTICAL

Telemetry and Remote Control lab
Code: EI791A
CONTACT: 3P
CREDITS: 1.5
Course Outcome:

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

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

storage, and processing.

CO2: Apply mathematical relationships describing fundamental physical, geometric, and

computational principles relevant to remote sensing.

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

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

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

Experiments:

1. Study of voltage telemetry system using a process variable transducer.

2. Study of 4-20 mA current telemetry system: 2 wire and 3 wire systems.

3. Study of a frequency telemetry system using a VCO and a PSD.

4. Study of an FDM and Demultiplexing system using wire transmission for 2 to 4 channels.

5. Study of a PCM system.

6. Study of a BioTelemetry System.

7. Study of a (wireless) remote control system.

8. Study of Computerized control wireless telemetry system.

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L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO-PO Matrix of the Course:

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

CO-PSO matrix

	PSO1	PSO2	PSO3
CO1	3	1	2
CO2	2	1	3
CO3	3	1	2
CO4	3	2	3
CO5	3	2	3

Curriculum for B.Tech
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ANALYTICAL INSTRUMENTATION LAB
CODE: EI791B
CONTACT: 3P
CREDITS: 1.5

Course Outcome:

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

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

storage, and processing.

CO2: Apply mathematical relationships describing fundamental physical, geometric, and

computational principles relevant to remote sensing.

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

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

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

Experiments:

1. Study of Blackbody radiation and analyzing the difference between a light bulb an LED and the sun.
2. Study spectrophotometer and analyze the trading rules: Signal-to-Noise, Resolution, Ensemble Averaging, Digital Smoothing.
3. Analyze the performance characteristics of the spectrophotometer.
4. Study the Spectrophotometric analysis of a mixture and determination of caffeine and benzoic acid in a soft drink.
5. Determination of Chlorophyll in Olive Oil by UV-Visible and Fluorescence Spectroscopies.
6. Study the Qualitative Gas Chromatography and obtain the Van Deemter plot and optimum separation.
7. Study of Oxygen analyzer
8. Study of CO2 analyzer
9. Study of CO analyzer
10. Pollutant analysis of the atmosphere using analytical instruments.
11. Extramural Experiments.

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CO-PO Matrix of the Course:

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

CO-PSO matrix

	PSO1	PSO2	PSO3
CO1	3	1	3
CO2	3	1	3
CO3	3	1	3
CO4	3	1	3
CO5	3	2	3

Curriculum for B.Tech
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Digital Image Processing Lab
CODE: EI791C
CONTACT: 3P
CREDITS: 1.5

Course Outcome:

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

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

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

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

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

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

Experiments:

1. Simulation and Display of an Image, Negative of an Image(Binary & Gray Scale)
2. Implementation of Relationships between Pixels
3. Implementation of Transformations of an Image
4. Contrast stretching of a low contrast image, Histogram, and Histogram Equalization
5. Display of bit planes of an Image
6. Display of FFT(1-D & 2-D) of an image
7. Computation of Mean, Standard Deviation, the Correlation coefficient of the given Image
8. Implementation of Image Smoothening Filters(Mean and Median filtering of an Image)
9. Implementation of image sharpening filters and Edge Detection using Gradient Filters
10. Image Compression by DCT, DPCM, HUFFMAN coding
11. Extramural Experiments

Curriculum for B.Tech
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L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

CO-PO Matrix of the Course:

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

CO-PSO matrix

	PSO1	PSO2	PSO3
CO1	3	1	3
CO2	3	1	3
CO3	3	1	3
CO4	3	1	3
CO5	2	1	3

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C. MANDATORY ACTIVITIES / COURSES

Course: Entrepreneurship & Innovation Skill
Paper Code: MC781
Stream: B. Tech
Total contact Hours: 48
Credit: 4

Course Objective

1. To understand the function of the entrepreneur in the successful, commercial application of innovations.
2.To investigate methods and behaviors used by entrepreneurs to identify business opportunities and put them into practice.
3. To discuss how ethical behavior impacts on business decisions for a selected business startup.
4. To get better knowledge about the necessary traits for an entrepreneur.
5. To build and check the feasibility of business projects and the development of the projects for the same.
6. To provide the overview of Business Ethics and its importance

Course Outcomes:

CO1	This will help to understand the basics and needs of Entrepreneurship.
CO2	This will help Entrepreneurs develop the need and nature so, that they can run their business.
CO3	This unit helps to generate start-ups with various business decisions.
CO4	Helps the student to develop certain skills of Entrepreneurship.
CO5	This helps to develop business projects which develop to build business projects.
CO6	Student will able to describe examples of entrepreneurial business and actual practice, both successful and unsuccessful, and explain the role and significance of entrepreneurship as a career, in the firm, and in society.

Course Content
Module I

Unit1: Introduction to Entrepreneurship [4L]
Theories of Entrepreneurship, Role and Importance of Entrepreneur in Economic Growth.

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Unit 2: Entrepreneurial Behaviour [10L]
Entrepreneurial Motivation, Need for Achievement Theory, Risk-taking Behavior, Innovation and Entrepreneur

Unit 3: Entrepreneurial Traits [4L]
Definitions, Characteristics of Entrepreneurs, Entrepreneurial Types, Functions of Entrepreneur

Unit 4: Project Feasibility Analysis [12L]
Business Ideas – Sources, processing; Input Requirements, Sources of Financing, Technical Assistance, Marketing Assistance, Preparation of Feasibility Reports, Legal Formalities and Documentation.

Module II

Unit 5: Creativity [10L]
Introduction – Meaning - Scope – Types of Creativity – Importance of Creativity – Steps of Creativity

Unit 6: Innovation [8L]
Introduction –Steps in Innovation – Stages of Innovation – Technology aspects in Innovation.

Text Books:

1. Entrepreneurship, Arya Kumar, Pearson.
2. Introducing Entrepreneurship Development, Chakraborty, Tridib, Modern Book Agency.

Reference Books:

1. Entrepreneurial Policies and Strategies, Manimala, M.J., TMH
2. Everyday Entrepreneurs - The harbingers of Prosperity and creators of Jobs, Dr. Aruna Bhargava.

CO-PO Mapping

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

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CO-PSO matrix

	PSO1	PSO2	PSO3
CO1	3	1	3
CO2	3	1	3
CO3	3	1	3
CO4	3	1	3
CO5	3	2	3
CO6	3	2	3

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4th Year 2nd Semester

Sl No	Course Code	Paper Code	Theory	Contact Hours /Week				Credit Points
				L	T	P	Total	
A. THEORY								
1	PE	EI801	A. Plant Automation and IIOT B. Nano Electronics C. Biomedical Signal Processing	3	0	0	3	3
2	OE	EI802	A. Computer Networking B. Computer graphics and Multimedia C. Object-Oriented Programming	3	0	0	3	3
3	OE	EI803	A. Mobile Communication B. VLSI and Microelectronics C. Microwave Theory and Technique	3	0	0	3	3
B. PRACTICAL								
4	PROJECT	PR 891	Major Project-II	0	0	0	12	6
5	PROJECT	PR 892	Grand Viva	0	0	0	0	1
C. MANDATORY ACTIVITIES / COURSES								
8	MC	MC 881	Essence of Indian Knowledge Tradition	0	0	3	3	3 Units
TOTAL CREDIT								**16**

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A. Theory

Course Name: Plant Automation and IIOT
CODE: EI801A
CONTACT: 3:0:0
CREDITS: 3

Prerequisite: Knowledge of Process Control

Course Objective:

The objective of this course is to provide the student with basic skills useful in identifying the concepts of automated machines and equipment and describe the terms and phrases associated with industrial automation.

Course Outcome:

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

CO1: Understand the operational functions of PLC, DCS, and SCADA.
CO2: Analyze Industrial Networking, Networking protocols, and topologies.
CO3: Demonstrate competence in maintaining and troubleshooting technology, detecting more serious problems, generating workable solutions to correct deviations, and recognizing when to get additional help.
CO4: analyze the automation technologies in different types of plants.

Module I: [8]
Introduction to Plant Automation, Architecture, Recapitulation Basic Components and Functions of DCS, PLC, HMI (OS and ES); ISO/OSI Reference Model; TCP/IP Basics, Industrial Ethernet, Fieldbus, Network Access Protocols, Network Topology, and Arbitration Methods; Computer Integrated Processing; OPC and OLE Connectivity Network topology, OSI reference model, TCP/IP Basics, UDP, IP, OPC, Data connectivity issues in the pre-OPC period. A client-server software architecture using OPC, OPC protocols, OPC UA

Module II: [10]
Plant Automation System network Elements of Plant Automation System (PAS): Smart Sensors, Sensor networks, Intelligent actuators, SCADA systems, I/O Modules (wired and wireless), RTUs, AS-Interface. Safety Interlocks, Sequence Controls PAS network and typical system architecture using the above elements PAS developed into MES (manufacturing execution systems) integrated with high-level software

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Module III: [4]
Automation Solutions: PLC-based systems; HMI and SCADA-based systems PC-based automation systems, Safety in industries.

Module IV: [8]

FIELDBUS: Cloud and Edge computing – their difference, Bridging the OT and IT world, Types of IoT networks, Seven-layer IoT architecture, IoT addressing Concept of Fieldbus, Advantages, Types, Topology, HART, Foundation Fieldbus: H1 and HSE, OSI reference model, DLL: MAC, LAS, Redundancy.

PROFIBUS: Types, Cyclic & Acyclic communication, Slave to slave communication, Bus access method in PROFIBUS PA. MODBUS: Communication stack, Network architecture Intrinsically Safe Fieldbus Systems: Types Wireless Fieldbuses: WHART and ISA 100.11a

Module V: IIOT [6]
Introduction, What is IoT, What is IIoT, Differences between IoT and IIoT, Evolution of IIoT, Architecture of IIoT, IIoT Characteristics, IIoT Platform, IIoT Protocols, Application Areas of IIoT, Challenges: Adaptability, Scalability, Security; Benefits of IIoT

Text Books:
1. Process Automation Handbook: A Guide to Theory and Practice. J LOVE, Springer 2007
2. Overview of Industrial Process Automation, KLS Sharma, Elsevier, 2011
3. Automation Made Easy, P. G. Martin & H. Gregory, ISA, 2009

Reference Books:
1. Fieldbus and Networking in process automation, CRC Press, 2nd edition, 2021
2. Industrial Automation, Circuit Design and components, D W Pessen
3. Serial Networked Field Instrumentation, JR Jordan, Wiley Series - Measurement Science and Technology
4. Springer Handbook of Automation

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CO-PO Mapping:

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

CO-PSO matrix

	PSO1	PSO2	PSO3
CO1	3	1	3
CO2	3	2	3
CO3	3	2	3
CO4	2	2	1

Course Name: Nano-electronics
CODE: EI801B
CONTACT: 3:0:0
CREDITS: 3
Prerequisite: Basics of Electronics

Course Objective:

The objective of this course is to provide the student the concept of nanotechnology and introduce the nanoelectronic components.

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L – Lecture; T- Tutorial; P- Practical [1L=1Cr, 1T=1Cr, 1P =0.5 Cr]

Course Outcome:

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

1. Understand various aspects of nano-technology and the processes involved in making nano components and materials.
2. Leverage advantages of the nano-materials and appropriate use in solving practical problems.
3. Understand various aspects of nano-technology and the processes involved in making nano components and materials.
4. Leverage advantages of the nano-materials and appropriate use in solving practical problems.

Module I:
Introduction to nanotechnology, mesostructures, Basics of Quantum Mechanics: Schrodinger equation, Density of States. Particle in a box Concepts, Degeneracy. Band Theory of Solids. KronigPenny Model. Brillouin Zones.

Module II:
Shrink-down approaches: Introduction, CMOS Scaling, The nanoscale MOSFET, Finfets, Vertical MOSFETs, limits to scaling, system integration limits (interconnect issues, etc.),

Module III:
Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single-electron transistors, Carbon nanotube electronics, Bandstructure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation

Text/ Reference Books:

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Material and Novel Devices), Wiley-VCH, 2003.
3. K.E. Drexler, Nanosystems, Wiley, 1992.
4. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998.
5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003

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CO-PO Mapping:

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

CO-PSO matrix

	PSO1	PSO2	PSO3
CO1	3	2	1
CO2	3	1	2
CO3	3	1	1
CO4	2	2	1

Course Name: Biomedical Signal Processing
CODE: EI801C
CONTACT: 3:0:0
CREDITS: 3

Pre-requisites: Biomedical Instrumentation

Course Objective:

The objective of this course is to provide the student the concept of nanotechnology and introduce the nanoelectronic components.

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Course Outcome:

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

CO1: Understand the basics of digital signals and biological signals.
CO2: Apply knowledge of math, engineering and science to understand the principle of biomedical signal processing.
CO3: Demonstrate basics of signal pre-processing and digital filtering
CO4: Analyze the ECG pattern recognition and classification algorithms

Module-1: Introduction to Biomedical Signals 8L

Introduction to Biomedical Signals: The nature of Biomedical Signals, Examples of Biomedical Signals, Objectives and difficulties in Biomedical analysis, Electrocardiography: Basic electrocardiography, ECG lead systems, ECG signal characteristics, Signal Conversion: Simple signal conversion systems, Conversion requirements for biomedical signals, Signal conversion circuits.

Module-2: Signal Averaging 8L

Signal Averaging: Basics of signal averaging, signal averaging as a digital filter, a typical averager, software for signal averaging, limitations of signal averaging, Adaptive Noise Cancelling: Principal noise canceller model, 60-Hzadaptive canceling using a sine wave model, other applications of adaptive filtering

Module-3: Data Compression Techniques 8L

Data Compression Techniques: Turning point algorithm, AZTEC algorithm, Fan algorithm, Huffman coding, data reduction algorithms The Fourier transform, Correlation, Convolution, Power spectrum estimation, Frequency domain analysis of the ECG.

Module-4: Cardiological and Neurological signal processing 10L

Cardiological signal processing: Basic Electrocardiography, ECG data acquisition, ECG lead system, ECG signal characteristics (parameters and their estimation), Analog filters, ECG amplifier, and QRS detector, the Power spectrum of the ECG, Bandpass filtering techniques, Differentiation techniques, Template matching techniques, Realtime ECG processing algorithm, ECG interpretation.

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Neurological signal processing: The EEG signal and its characteristics (EEG rhythms, waves, and transients), Correlation. Analysis of EEG channels: Detection of EEG rhythms, Template matching for EEG, spike, and wave detection.

CO-PO Mapping:

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

CO-PSO matrix

	PSO1	PSO2	PSO3
CO1	2	1	3
CO2	3	**2**	3
CO3	3	1	3
CO4	2	2	1

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Course Name: Computer Networking
Code: EI802A
Contact (Periods/Week): 3:0:0
Credit: 3
Total No. of Lectures: 36

Prerequisites:

1. Familiarity and knowledge of Operating Systems and Computer Architecture

2. Programming languages concepts like C, Java.

Course Objective:

1. To educate basic knowledge of networking technologies and network management concepts

2. To interpret the layering concepts in computer networks.

3. To analyze the functions of each layer and gain knowledge in different applications that use computer networks.

4. To emphasize the hands-on experience of network topology in a laboratory environment

5. To be familiar with contemporary issues in networking technologies.

Course Outcome:
After completion of the course, students will be able to

CO1: Understand Basic introduction of Computer Network along with Physical layer of OSI and TCP/IP model.
CO2: Analyze Datalink layer protocols with MAC and LAN technologies.
CO3: Design applications using internet protocols, routing, and UDP, TCP.
CO4: Develop application layer protocols and understand socket programming

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Module I: Introduction to Computer Network [6L]

Introduction: Computer Network, data communication, topology, OSI & TCP/IP Reference Models, layers and characteristics, Wireless Network, comparison to the wired and wireless network.

Physical Layer: Overview of data (analog & digital), signal (analog & digital), transmission (analog & digital) & transmission media (guided & unguided); Circuit switching: time division & space division switch, TDM bus; Telephone Network.

Module II: Data Link Layer [10L]

Framing, Error Control, Error Detection and Correction, Flow Control, Data Link Protocols, Simple Stop-and-Wait Protocol, ARQ mechanism, Sliding Window Protocols, One-Bit Sliding Window Protocol, Go-Back-N and Selective Repeat, HDLC, PPP Medium Access Control Sublayer, The Channel Allocation. Multiple Access Protocols**:** ALOHA, Carrier Sense Multiple Access Protocols, IEEE 802.x Ethernet, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet, Wireless LANs - IEEE 802.xx, Bluetooth, RFID, Bridges, Virtual LANs, Switching**.**

Module III: Network Layer & Transport Layer [16L]

Network Layer:
IP Addressing, IPv4 and IPv6. Difference IPv4 and IPv6, Conversion of IPv4 and IPv6, Sub netting, Super netting, ARP, IP, ICMP and DHCP–Delivery protocols Other Protocols such as mobile IP in wireless Network.Routing: Shortest Path Algorithms, Flooding, Distance Vector Routing, Link State Routing, RIP, OSPF, BGP

Transport Layer:
Process to Process delivery; UDP; TCP, Congestion control in TCP, Quality of service: Techniques to improve QoS: Leaky bucket algorithm.

Module IV: Application Layer [4L]

Introduction to DNS, SMTP, SNMP, FTP, HTTP & WWW: Cryptography (Public, Private Key based), Digital Signature, Firewalls [2L]
Socket Programming [2L] :Introduction to Socket Programming, UDP socket and TCP Socket

Text books:

1. B. A. Forouzan – "Data Communications and Networking (3rd Ed.) " –

TMH 2. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson

Education/PHI

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Reference books:

1. Kurose and Rose – " Computer Networking -A top down approach featuring the internet" – Pearson Education
2. Leon, Garica, Widjaja – "Communication Networks" – TMH
3. Walrand – "Communication Networks" – TMH.
4. Comer – "Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.)" – Pearson Education/PHI
5. W. Stallings – "Data and Computer Communications (5th Ed.)" – PHI/ Pearson Education
6. 4. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP

CO-PO Mapping:

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

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CO-PSO matrix

	PSO1	PSO2	PSO3
CO1	2	1	3
CO2	3	**2**	3
CO3	3	1	3
CO4	2	1	1

Course Name: Computer Graphics and Multimedia
Code: EI802B
Contact (Periods/Week):3:0:0
Credit : 3
Total No. of Lectures: 36

Prerequisite:
Computer Programming, Mathematics

Course Objective:
The objective of the course is
1. To become familiar with various software programs used in the creation
2. To gain knowledge about graphics hardware devices and software used
3. to implement multi-media in devices and software used

Course Outcome
After completion of this course, students will be able to

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

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

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

CO4: Understood Different types of Multimedia File Format.

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Module 1

INTRODUCTION TO COMPUTER GRAPHICS [2L]
Overview of computer graphics, Basic Terminologies in Graphics, lookup table,3D viewing devices, Plotters, printers, digitizers, light pens, etc., Active &Passive graphics, Computer graphics software.

DISPLAY DEVICES & COLOR MODEL [3L]
Light sources, basic illumination models, halftone patterns and dithering techniques, Intuitive colour concepts, RGB colour model, YIQ colour model, CMY colour model, HSV colour model, HLS colour model, Colour selection. Raster Scan and Random scan displays, CRT basics, video basics, Flat panel displays, Interpolative shading model

Module 2

SCAN CONVERSION [8L]
Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm, Ellipse generating algorithm;
Scan line polygon fill algorithm, boundary fill algorithm, flood fill algorithm

Module 3

TWO-DIMENSIONAL GRAPHICS [8L]

Two-dimensional geometric transformations, Matrix representations and homogeneous coordinates, composite transformations, Two-dimensional viewing, viewing pipeline, viewing coordinate reference frame, window-to-viewport coordinate transformation, Two-dimensional viewing functions, clipping operations, point, line, and polygon clipping algorithms.

Module 4

MULTIMEDIA SYSTEM DESIGN & MULTIMEDIA FILE HANDLING [8L]

Multimedia basics, Multimedia applications, Multimedia system architecture, Evolving technologies for multimedia, Defining objects for multimedia systems, Multimedia data interface standards, Multimedia databases. Compression and decompression, Data and file format standards, Multimedia I/O technologies, Digital voice and audio, Video image and animation, Full motion video, Storage, and retrieval technologies. Multimedia Editing and authoring tools.

Module 5

HYPERMEDIA [7L]
Multimedia authoring and user interface, Hypermedia messaging, Mobile messaging, Hypermedia message component, Creating hypermedia message, Integrated multimedia message standards,

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Integrated document management, Distributed multimedia systems.

Text Books:

1. Hearn Baker Carithers, - "Computer Graphics with Open GL", Pearson New International Edition

2. Ze-Nian Li & Mark S. Drew - "Fundamentals of Multimedia", PHI

Reference Books:

1. Donald Hearn and Pauline Baker M, ―Computer Graphics", Prentice Hall, New Delhi, 2007 [UNIT I – III]

2. Andleigh, P. K and Kiran Thakrar, ―Multimedia Systems and Design‖, PHI, 2003.[UNIT IV,V]

3. Judith Jeffcoate, ―Multimedia in practice: Technology and Applications, PHI, 1998.

4. Foley, Vandam, Feiner and Hughes, ―Computer Graphics: Principles and Practice, 2nd Edition, Pearson Education, 2003.

5. William M. Newman and Robert F.Sproul, ― Principles of Interactive Computer Graphics, Mc Graw Hill 1978.

CO-PO Mapping

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

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CO-PSO matrices:

	PSO1	PSO2	PSO3
CO1	2	1	3
CO2	3	**2**	3
CO3	3	1	3
CO4	3	2	2

Course Name: Object-Oriented Programming
Course Code: EI802C
Contact: 3:0:0
Total Contact Hours: 36
Credits: 3

Prerequisites:

1. Computer Fundamentals
2. A Basic understanding of Computer Programming and related Programming Paradigms
3. Problem Solving Techniques with proper logic Implementation.
4. Basic Computer memory architecture with data accession.

Course Objectives:

1. It allows to map with real-world Object (Object orientation) rather than action (Procedure) that comes to produce software as separated code modules which rise up decoupling and increase code re-usability.
2. It demonstrates that how can you change the implementation of an object without affecting any other code by increasing data security and protecting unwanted data access. (Encapsulation).
3. It allows you to have many different functions, all with the same name, all doing the same job, but depending upon different data. (Polymorphism).
4. It guides you to write generic code: which will work with a range of data, so you don't have to write basic stuff over, and over again. (Generics).
5. It lets you write a set of functions, then expand them in different directions without changing or copying them in any way. (Inheritance)

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Course Outcomes:

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

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

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

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

Module 1: [5L]

Introduction:

Object-Oriented Analysis & Design-Concepts of object-oriented programming language, Object, Class. **[1L];** Relationships among objects and classes-Generalization, Specialization, Aggregation, Association, Composition, links, Meta-class. **[1L];** Object-Oriented Programming concepts - Difference between OOP and another conventional programming – advantages and disadvantages. Class, Object, Method. **[1L];** Properties of OOP- message passing, inheritance, encapsulation, polymorphism, data abstraction. **[1L];** Difference between different OOPs Languages. **[1L].**

Module 2: [9L]

Java Basics:

Basic concepts of java programming - Advantages of java, Byte-code & JVM, Data types, Different types of Variables. **[1L];** Access specifiers, Operators, Control statements & loops. **[1L];** Array. **[1L];** Creation of class, object, method. **[1L];** Constructor- Definition, Usage of Constructor, Different types of Constructor. **[1L];** finalize method and garbage collection, Method & Constructor overloading. **[1L];** this keyword, use of objects as parameter & methods returning objects. **[1L];** Call by value & call by reference. **[1L];** Static variables & methods. Nested & inner classes. **[1L].**

Module 3: [4L]

Basic String handling & I/O:

Basic string handling concepts- Concept of mutable and immutable string, Methods of String class- charAt(), compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring(). **[1L];** toCharArray(), toLowerCase(), toString(), toUpperCase() , trim() , valueOf() methods, Methods of String buffer class- append(), capacity(), charAt(), delete(), deleteCharAt(). **[1L];** ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString(). **[1L];** Command line arguments, basics of I/O operations – keyboard input using BufferedReader& Scanner classes. **[1L].**

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Module 4: [8L]
Inheritance and Java Packages:

Inheritance - Definition, Advantages, Different types of inheritance and their implementation. **[1L];** Super and final keywords, super () method. **[1L];** Method overriding, Dynamic method dispatch. **[1L];** Abstract classes & methods. **[1L];** Interface - Definition, Use of Interface. **[1L];** Multiple inheritances by using Interface. **[1L];** Java Packages -Definition, Creation of packages. **[1L];** Importing packages, member access for packages. **[1L]**

Module 5: [10L]
Exception handling, Multithreading and Applet Programming:
Exception handling - Basics, different types of exception classes. Difference between Checked & Unchecked Exception. **[1L];** Try & catch related case studies **[1L];** Throw, throws & finally. **[1L];** Creation of user defined exception. **[1L];** Multithreading - Basics, main thread, thread life cycle.**[1L];** Creation of multiple threads-yield(), suspend(), sleep(n), resume(), wait(), notify(), join(), isAlive().**[1L];** Thread priorities, thread synchronization.**[1L];** Interthread communication, deadlocks for threads**[1L];** Applet Programming - Basics, applet life cycle, difference between application & applet programming**[1L];** Parameter passing in applets. **[1L]**

Textbooks:
1. Herbert Schildt – "Java: The Complete Reference " – 9th Ed. – TMH
2. E. Balagurusamy – " Programming with Java: A Primer " – 3rd Ed. – TMH.

Reference Books:
1. R.K Das – " Core Java for Beginners " – VIKAS PUBLISHING.
2. Rambaugh, James Michael, Blaha – " Object Oriented Modelling and Design " – Prentice Hall, India.
3. Rajkumar Buyya, S Thamarai Selvi and Xingchen Chu – " Object Oriented Programming with JAVA: Essentials and Applications" – TMH.
4. D. Samanta – " Object-Oriented Programming with C++ and JAVA" – Prentice Hall, India.
5. Danny Poo, Derek Kiong and Swarnalatha Ashok – " Object-Oriented Programming and Java" – Springer.

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CO-PO Mapping:

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

CO-PSO Matrices:

	PSO1	PSO2	PSO3
CO1	2	1	3
CO2	3	**2**	3
CO3	3	1	3
CO4	2	2	1

Course Name:Mobile Communication
Course Code: EI803A
Contacts: 3:0:0
Credits: 3
Total No. Of Lectures: 36

Prerequisite: Analog and Digital Communication System

Course Objective:
1. To make students familiar with the basics of mobile communication systems.

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2. To choose a system (TDMA/FDMA/CDMA) according to the cost of installation, complexity, speed of propagation, channel properties, etc.
3. To compare mobile communication and static communication.
4. To identify the advantages, limitations, and design techniques of 2G and 3G wireless mobile communications.
5. This subject can be considered as a prerequisite for the course in Wireless LANs.

Course Outcome:

CO1: By the end of the course, the student will be able to analyze and design wireless and mobile cellular systems.
CO2: By the end of the course, the student will have the ability to work in advanced research wireless and mobile cellular programs.
CO3: By the end of the course, the student will be able to realize all the applications of wireless protocols
CO4: By the end of the course, the student will be able to design mobile networks.

Module 1 [3L]

Introduction: Vision of mobile communication. The historical perspective in the development of mobile communication - 1G to 4G and beyond (5G). Wireless standards.

Module 2 [9L]

Cellular system principle and planning: Cellular concepts - cell structure, frequency reuse, cell splitting and channel assignments, cellular network architecture. Location updating and Call setup. Handoff techniques and power control. Selection of uplink and downlink frequencies.

Module 3 [6L]

Global System of Mobile communication (GSM): System overview, GSM architecture. Mobility management. Network signaling.

Module 4 [6L]

GSM system architecture and function partitioning. Introduction to Mobile System (MS). Base Station System (BSS). Home Location Register (HLR), Visiting Location Register (VLR), Equipment Identity Register (EIR).

Module 5 [6L]

GSM radio aspects: Wireless Medium Access Control – FDMA, TDMA, CDMA, WCDMA. GSM radio standards. Frequency band and channel allocation.

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Module 6 [4L]
Mobile data communication. Wireless LANS (WLANS). IEEE 802.11 Standards, Mobile IP

Module 7 [2L]

Introduction to GPS systems and its applications in real life.

Text Books:

1. Mobile Cellular Telecommunications – Analog & Digital Systems, William C. Y. Lee, McGraw Hill, 1995
2. Mobile Communications Design Fundamentals, William C. Y. Lee, A Wiley-Interscience Publication
3. Mobile Communications, J. Schiller, Pearson Education

Reference Books:
1. Wireless Communications, T. S. Rappaport, Prentice Hall International, 2002. 2. Wireless Network Evolution, V. K. Garg - Pearson Ed.

CO-PO matrices:

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

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CO-PSO Matrices

	PSO1	PSO2	PSO3
CO1	2	1	3
CO2	3	**2**	3
CO3	3	1	3
CO4	3	1	1

Course Name: VLSI & Microelectronics
Course Code: EI803B
Contacts: 3:0:0
Credits: 3
Total Contact Hours: 36

Prerequisite: Concept of courses Solid State Devices; Analog Electronic Circuit; Digital Electronic and Circuit

Course Objective:

1. To understand the basic concepts of designing combinational and sequential circuits and the design of VLSI ICs
2. To motivate students to design VLSI circuits in the area of digital, analog
3. To encourage the design of IC with low power and high speed.
4. To study various programmable logic devices like PLDs and FPGA.

Course Outcome:

The Students will be able to

CO1: Understand the scale of integration and VLSI design flow and VLSI Design steps.
CO2: Calculate and analyze the different parameters related to the different MOS devices and design the combinational and sequential logic circuits.
CO3: Describe fabrication steps of IC and construct stick diagram & layout of CMOS inverter and basic gates based on Layout design rules.
CO4: Understand the VHDL basics and construct the combinational and sequential logic circuits.

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Course Content

Module –I: Introduction to VLSI Design: [9L]

Historical perspective development of VLSI from discrete electronic circuit to VLSI. IC, MSI, LSI, Microelectronics & VLSI.
Types of VLSI Chips (General purpose, ASIC, PLA, FPGA),photo-resist Basic CMOS Technology – (Steps in fabricating CMOS), Basic n-well CMOS proc VLSI Design Concepts, Moor's Law, Scale of Integration (SSI, MSI, LSI, VLSI, ULSI – basic idea only), Types of VLSI Chips (Analog & Digital VLSI chips, General purpose, ASIC, PLA, FPGA), Design principles (Digital VLSI – Concept of Regularity, Granularity, etc), Design Domains (Behavioral, Structural, Physical), Y-Chart, Digital VLSI Design Steps.

Module-II: MOS structure: [2L]

E-MOS & D-MOS, Charge inversion in E-MOS, Threshold voltage, Flat band voltage, Potential balance & Charge balance, Inversion, MOS capacitances. Three Terminal MOS Structure: Body effect. Four Terminal MOS Transistor: Drain current, I-V characteristics. Current-voltage equations (simple derivation). Scaling in MOSFET, General scaling, Constant Voltage & Field scaling.] CMOS: CMOS inverter, Simple Combinational Gates - NAND gate and NOR Gate using CMOS.

Module-III: Micro-electronic Processes for VLSI Fabrication: [10L]

Silicon Semiconductor Technology- An Overview, Wafer processing, Oxidation, Epitaxial deposition, Ion-implantation & Diffusion, Cleaning, Etching, Photo-lithography – Positive & Negative ess, p-well CMOS process, Twin tub process, Silicon on insulator Layout Design Rule: Stick diagram with examples, Layout rules.

Module –IV: Hardware Description Language: [6L]
VHDL or Verilog Combinational & Sequential Logic circuit Design.

Text Books:

1. Digital Integrated Circuit , J.M.Rabaey, Chandrakasan, Nicolic, Pearson Education 2. CMOS Digital Integrated Circuits Analysis and Design , S.M.Kang & Y.Leblebici,TMH. 3. CMOS Analog Circuit Design , Allen & Holberg , Oxford
4. Design of Analog CMOS Integrated Circuits , Behzad Razavi , TMH .

Reference Books:

1. Microelectronic Circuits , Sedra & Smith , Oxford
2. Introduction to VLSI Circuits and System , Uyemura , Wiley
3. VLSI Design , Debaprasad Das , Oxford
4. VLSI Design and EDA Tools , Angsuman Sarkar , Swapnadip De , C.K. Sarkar , Scitech
5. VLSI Design Techniques for Analog and Digital Circuits , Geiger , Allen , Strader , TMH

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CO-PO Mapping:

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

CO-PSO Matrices:

	PSO1	PSO2	PSO3
CO1	2	1	3
CO2	3	**2**	3
CO3	3	1	3
CO4	2	2	2

Course Name: Microwave Theory and Technique
Course Code: EI803C
Contacts: 3L
Credits: 3
Total Contact Hours: 36

Course Objective:

1. To make students familiar with the basics of microwave systems.
2. To provide a fundamental understanding of microwave transmission lines.
3. To have an idea of the application areas like the application of microwave on the human body, etc.

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

CO1: Understand various microwave system components their properties.
CO2: Appreciate that during analysis/ synthesis of microwave systems, a different mathematical treatment is required compared to general circuit analysis.
CO3: Design principles of microwave measurement systems.
CO4: Understanding of application areas

Module 1 **8L**

Introduction to Microwaves-History of Microwaves, Microwave Frequency bands; Applications of Microwaves: Civil and Military, Medical, EMI/ EMC. Mathematical Model of Microwave Transmission-Concept of Mode, Features ofTEM, TE and TM Modes, Losses associated with microwave transmission, Concept of Impedance in Microwave transmission.
Analysis of RF and Microwave Transmission Lines- Coaxial line, Rectangularwaveguide, Circular waveguide, Stripline, Micro strip line. Microwave Network Analysis- Equivalent voltages and currents for non-TEM lines, Network parameters for microwave circuits, Scattering Parameters.

Module 2 **8L**

Passive and Active Microwave Devices- Microwave passive components: Directional Coupler, Power Divider, Magic Tee, Attenuator, Resonator. Microwave active components: Diodes, Transistors, Oscillators, Mixers. Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes. Microwave Tubes: Klystron, TWT, Magnetron.

Module 3 **8L**

Microwave Design Principles-Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power Amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design. Microwave AntennasAntenna parameters, Antenna for ground-based systems, Antennas for airborne and satellite-borne systems, Planar Antennas.

Module 4: **12L**

Microwave Measurements- Power, Frequency and impedance measurement at microwave frequency, Network Analyzer and measurement of scattering parameters, Spectrum Analyzer and measurement of the spectrum of a microwave signal, Noise at microwave frequency and measurement of noise figure. Measurement of Microwave antenna parameters.

Microwave Systems- Radar, Terrestrial, and Satellite Communication, Radio Aids to Navigation, RFID, GPS. Modern Trends in Microwaves Engineering- Effect of Microwaves on the human body, Medical and Civil applications of microwaves, Electromagnetic interference and Electromagnetic

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Compatibility (EMI & EMC), Monolithic Microwave ICs, RFMEMS for microwave components, Microwave Imaging.

Text Book :
1. R.E. Collins, Microwave Circuits, McGraw Hill.

Reference Books :
1. K.C. Gupta and I.J. Bahl, Microwave Circuits, Artech house

CO-PO Mapping:

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

CO-PSO Matrices:

	PSO1	PSO2	PSO3
CO1	2	1	3
CO2	3	**2**	3
CO3	3	1	3
CO4	2	1	2

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