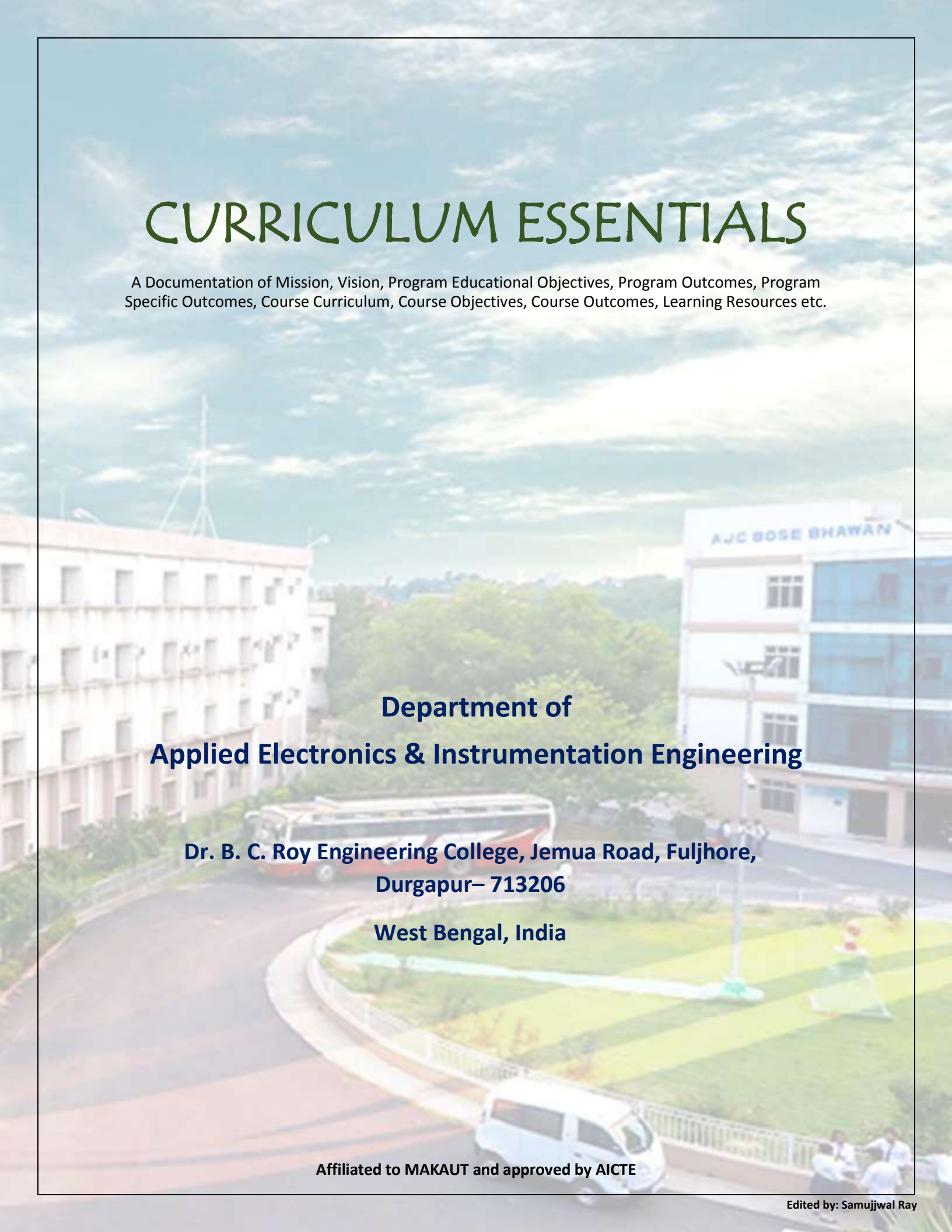

CURRICULUM ESSENTIALS

A Documentation of Mission, Vision, Program Educational Objectives, Program Outcomes, Program Specific Outcomes, Course Curriculum, Course Objectives, Course Outcomes, Learning Resources etc.

Department of
Applied Electronics & Instrumentation Engineering

Dr. B. C. Roy Engineering College, Jemua Road, Fuljhore,
Durgapur– 713206

West Bengal, India

Affiliated to MAKAUT and approved by AICTE

Edited by: Samujjwal Ray

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

VISION

To aspire to be a premiere department; imparting world class technical education and to bridge industry expertise with academic excellence, thereby producing technically competent engineers catering to the needs of the society, environment and the nation.

MISSION

The mission of the Applied Electronics and Instrumentation Engineering Department is to provide

- *foundation in Electronics and Instrumentation, and the underlying mathematics and science*
- *excellent opportunity with strong moral sense of social and ethical responsibilities to promote high standards of professional ethics and accountability*
- *state of the art infrastructure and a facilitating environment to impart quality education*
- *conducive environment for creating networks with alumni, industries, educational institutes and other stake-holders and encourages collaborative research*

in order to build up professionally competent engineers through value-added teaching, learning and research environment.

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PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

1. Graduates of Applied Electronics and Instrumentation Engineering department are expected to excel in professional career or pursue higher education and research or in entrepreneurship by acquiring sound knowledge in basic science, mathematics and core engineering.

2. Graduates of Applied Electronics and Instrumentation Engineering department are expected to abide by professional code of conduct, following the principles of financial management, possessing sound communication skills and ready to take leadership or have enough tolerance to act as a simple and indispensable member of a multicultural team working on a multi-disciplinary project.

3. Graduates of Applied Electronics and Instrumentation Engineering department are expected to be a good citizen, conscious about the society and environment, respect for professional ethics and values and quality to adapt in the fast changing society through life-long learning.

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PROGRAM OUTCOMES (POs)

On completion of the program, the students will be able to:

PO1 Basic Science and Engineering Knowledge: Apply the knowledge of science and mathematics to learn basic science and engineering science courses and thus enables the students to apply them in learning the Professional core course .i.e. Applied Electronics and Instrumentation Engineering.

PO2 Computation Skills: Acquire analytical thinking, problem solving abilities, review research literature, implement modern computational procedures and analyze complex engineering problems to apply on core electronics and instrumentation field.

PO3 Design and development of Solution: Apply core electronics and instrumentation engineering knowledge to design Electronic circuits, highly sensitive sensor networks for monitoring and control of various physical, chemical, pharmaceutical and Industrial parameters and processes.

PO4 Complex Problem Investigation: Apply core instrumentation knowledge to improve working of existing transducers, sensors, telemetry and remote control devices, and derive solutions to interface with dedicated microcontrollers and high end computers and able to measure and control any industrial processes efficiently.

PO5 Modern Tools Utilization: Apply expertise in the utilization of modern software tools like C, JAVA, TASM, MATLAB/Scilab, PLC programming software, and DCS software, and, modern hardware gadgets like the Digital Storage Oscilloscopes, Function Generators, Spectrum Analyzers, stroboscope, LVDT, PID Controllers, PLC, DCS, and flow, level, pressure, and temperature transmitters.

PO6 Engineers for Society: The students of engineering should be motivated to utilize their Scientific, Technological, Computational and Instrumentation skills for the better addressing the societal needs. Design new sophisticated instruments for the high-end Research and Process Industries, Pharmaceutical, Bio-medical fields. They should utilize their expertise to develop indigenous technologies, instruments, gadgets, and inexpensive healthcare systems affordable by common people.

PO7 Environment and sustainability: Utilize their knowledge to design low power consuming, highly sensitive, low radiating ecofriendly devices compatible with modern interfacing techniques in conformity with the specific standards and norms.

PO8 Ethics: The students are motivated to follow a code of ethics and moral perspectives at the individual level as well as at the professional level to protect the interests of all the stakeholders, with a concern for societal responsibilities.

PO9 Individual and team work: Communication skills, Aptitude development programs, Team activities like NSS, project, Seminar Presentations etc. contribute greatly for the development of individual talents/skills. Involvement in Cultural fest, Technical fest, Sports activities provided in the

institute shall also develop capabilities of a student to mold oneself as an Individual member, Team leader or an Organizer.

PO10 Communication Skills: Utilize basic humanities courses and shall acquire excellent communication skills both orally as well as in writing. They shall be able to transform their innovative ideas into excellent technical reports for presentation/publication in seminars/journals.

PO11 Project Management and Finance: Extend their management concepts for drafting of proposals for projects with thorough understanding of the procurement plans (materials, software, and hardware), project management and financial allocations and management during the execution of the project.

PO12 Life-Long learning: Engage their abilities to learn and implement technological changes through life-long learning and also contribute their expertise for the benefit of the current stake holders and the society.

PROGRAM SPECIFIC OUTCOMES (PSOs)

The students of Applied Electronics and Instrumentation Engineering (AEIE) will be able to:

PSO1: Apply the fundamentals of electrical, electronic, computer, mathematics, science and engineering knowledge to identify, design, develop and investigate complex problems of electrical and electronic circuits, electronic process instrumentation, measurement and process control field.

PSO2: Apply appropriate technique and modern engineering hardware and software tools to design, develop, measure and control the electronic and instrumentation system to engage in life-long learning and work efficiently as an individual and in a multidisciplinary team.

PSO3: Understand the impact of professional behavior and ethics and effective communication with engineering community and the society.

Department of Applied Electronics & Instrumentation Engineering
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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
First Year First Semester Curriculum
Applicable from Academic Session 2018-19

FIRST YEAR FIRST SEMESTER PROPOSED SYLLABUS

A. Definition of Credit:

1 Hr. Lecture (L) per week 1 credit

1 Hr. Tutorial (T) per week 1 credit

1 Hr. Practical (P) per week 0.5 credits

B. Range of credits:

A range of credits from 150 to 160 for a student to be eligible to get B.Tech Degree in Engineering. A student will be eligible to get B.Tech Degree with honors, if he/she completes an additional 20 credits. These could be acquired through Massive Open Online Courses (MOOCs).

C. MOOCs for B. Tech Honors:

The additional 20 credits (for obtaining B. Tech with honors) are to be gained through MOOCs. The complete description of the MOOCs relevant for the first year course are given in Annexure-I in the makaut university website. The courses for subsequent years of study will be posted subsequently.

D. Guidelines regarding Mandatory Induction Program for the new students:

All concerned are requested to follow the guidelines given in Annexure-II (Notice dt.06/12/2017) in the makaut university website concerning Mandatory Induction Program. The colleges/ Institute may also refer to the AICTE Model Curriculum for Undergraduate Degree Courses in Engineering & Technology (January 2018) -Volume I (Page No.31-38), if necessary.

E. Mandatory Additional Requirement for earning B. Tech Degree:

All concerned are requested to follow the guidelines in Annexure-III concerning Mandatory Additional Requirements.

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First Year First Semester Curriculum
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FIRST YEAR FIRST SEMESTER							
Mandatory Induction Program – 3 Weeks duration							
Sl No.	**Category**	**Subject Code**	**Subject Name**	**Total Number of Contact Hours**			**Credits**
				L	**T**	**P**	
Theory							
1	Basic Science Course	BS-CH101	Chemistry -I	3	1	0	4
2	Basic Science Course	BS-M102	Mathematics -IB	3	1	0	4
3	Engineering Science Course	ES-EE101	Basic Electrical Engineering	3	1	0	4
	Total Theory			9	3		12
Practical							
1	Basic Science Course	BS-CH191	Chemistry – I Laboratory	0	0	3	1.5
2	Engineering Science Course	ES-EE191	Basic Electrical Engineering Laboratory	0	0	2	1
3	Engineering Science Course	ES-ME191	Engineering Graphics & Design	1	0	4	3
	Total Practical			1		9	5.5
	Total of First Semester			**10**	**3**	**9**	**17.5**

Short Definition of Sub headings used in the course:

Learning Objectives: Learning objectives are statements that define the expected goal of a course in terms of demonstrable skills or knowledge that will be acquired by the student as a result of lectures.

Course Content: Course content means any and all lectures, texts and any other tangible expressions of the intellectual content of the Course.

Course Outcomes: They are the resultant knowledge skills the student acquires at the end of the course.

Learning Resources: They are the textbooks, electronic texts, software, online open access resources or any other printed/non printed materials which supports and enhances, directly or indirectly, learning and teaching.

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Course Category: Basic Science Course (BS)	**Course Coordinator:** Department of Basic Science & Humanities
Program: AEIE	**Semester:** First
Course Code: BS-CH101	**Course Title:** Chemistry-I
Nature of Course: Mandatory	**Full Marks:** 100**
Type of Course: Theory	**Credit Points:** 4
Contact Hour Classification: L-T-P: 3-1-0*	**Total Contact Hours:** 42
Pre-Requisites: High School Chemistry	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total the total numbers of classes assigned to the course in hours/week.

**For Theory, out of 100 marks, 25 marks are allotted for continuous assessment throughout the semester which may consists of class test, viva-voce, assignment, seminar, group discussion etc. And 5 marks can be obtained by regularly attending the classes. Rest 70 marks can be obtained from End semester Examination conducted by the University.
For Practical, out of 100 marks, 35 marks are allotted for continuous assessments consists of performance in practical classes throughout the semester, 5 marks are for the attendance. Rest 60 marks are allotted for End semester Practical Examination conducted by the university.

A. Course Content:

i) Atomic and molecular structure (10 L)

Schrodinger equation. Particle in a box solutions and their applications for simple sample. Molecular orbitals of diatomic molecules (e.g.H2). Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

ii) Spectroscopic techniques and applications (8 L)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

iii) Intermolecular forces and potential energy surfaces (4 L)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena.

iv) se of free energy in chemical equilibria (8 L)

First and second laws of thermodynamics and thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

v) Periodic properties (4 L)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

vi) Stereochemistry (4 L)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

vii) Organic reactions and synthesis of a drug molecule (4 L)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

B. Learning Resources:

1. Engineering Chemistry, Satyaprakash, Khanna Book Publishing, Delhi
2. University chemistry, by B. H. Mahan
3. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
4. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
5. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
6. Physical Chemistry, by P. W. Atkins
7. Spectroscopy of Organic Compounds, by P.S.Kalsi, New Age International Pvt. Ltd Publishers
8. Physical Chemistry, P. C. Rakshit, Sarat Book House
9. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition
   http://bcs.whfreeman.com/vollhardtschore5e/default.asp

C. Course Outcomes (COs):

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels.

The course will enable the student to:

CO1: Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.

CO2: Rationalise bulk properties and processes using thermodynamic considerations.

CO3: Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.

CO4: Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.

CO5: List major chemical reactions that are used in the synthesis of molecules.

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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
First Year First Semester Curriculum
Applicable from Academic Session 2018-19

Course Category: Basic Science Course (BS)	**Course Coordinator:** Department of Basic Science and Humanities
Program: AEIE	**Semester:** First
Course Code: BS-M101	**Course Title:** Mathematics -IB
Nature of Course: Mandatory	**Full Marks:** 100**
Type of Course: Theory	**Credit Points:** 4
Contact Hour Classification: L-T-P: 3-1-0*	**Total Contact Hours:** 42
Pre-Requisites: High School Mathematics	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total the total numbers of classes assigned to the course in hours/week.

**For Theory, out of 100 marks, 25 marks are allotted for continuous assessment throughout the semester which may consists of class test, viva-voce, assignment, seminar, group discussion etc. And 5 marks can be obtained by regularly attending the classes. Rest 70 marks can be obtained from End semester Examination conducted by the University.
For Practical, out of 100 marks, 35 marks are allotted for continuous assessments consists of performance in practical classes throughout the semester, 5 marks are for the attendance. Rest 60 marks are allotted for End semester Practical Examination conducted by the university.

A. Course Content:

Module 1: Calculus (Integration) (8 L)
Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Module 2: Calculus (Differentiation) (6 L)
Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.

Module 3: Sequence and Series (11 L)
Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Module 4: Multivariate Calculus (9 L)
Limit, continuity and partial derivatives, Directional derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, Curl and Divergence.

Module 5: Matrices (8 L)
Inverse and rank of a matrix, Rank-nullity theorem; System of linear equations; Symmetric, Skew-symmetric and Orthogonal matrices; Determinants; Eigenvalues and Eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

B. Learning Resources:

1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.

C. Course Outcomes (COs):

After completing the course the student will be able to

CO1: Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

CO2: Understand the domain of applications of mean value theorems to engineering problems.

CO3: Learn the tools of power series and Fourier series to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.

CO4: Apply the knowledge for addressing the real life problems which comprises of several variables or attributes and identify extremum points of different surfaces of higher dimensions.

CO5: Understand different types of matrices, their eigen values, eigen vectors, rank and also their orthogonal transformations which are essential for understanding physical and engineering problems.

Department of Applied Electronics & Instrumentation Engineering
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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
First Year First Semester Curriculum
Applicable from Academic Session 2018-19

Course Category: Engineering Science Course (ES)	**Course Coordinator:** Department of Electrical Engineering
Program: AEIE	**Semester:** First
Course Code: ES-EE101	**Course Title:** Basic Electrical Engineering
Nature of Course: Mandatory	**Full Marks:** 100**
Type of Course: Theory	**Credit Points:** 4
Contact Hour Classification: L-T-P: 3-1-0*	**Total Contact Hours:** 42
Pre-Requisites: No prerequisites	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total the total numbers of classes assigned to the course in hours/week.

**For Theory, out of 100 marks, 25 marks are allotted for continuous assessment throughout the semester which may consists of class test, viva-voce, assignment, seminar, group discussion etc. And 5 marks can be obtained by regularly attending the classes. Rest 70 marks can be obtained from End semester Examination conducted by the University.
For Practical, out of 100 marks, 35 marks are allotted for continuous assessments consists of performance in practical classes throughout the semester, 5 marks are for the attendance. Rest 60 marks are allotted for End semester Practical Examination conducted by the university.

A. Course Content:

Module 1: DC Circuits (8 L)
Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (8 L)
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 3: Transformers (6 L)
Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines (8 L)
Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5: Power Converters (6 L)
DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations (6 L)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

B. Learning Resources:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Book Publishing Co. (P) Ltd., Delhi.
2. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
3. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
4. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
5. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
6. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

C. Course Outcomes (COs):

After completing the course the student will be able

CO1: To understand and analyze basic electric and magnetic circuits.

CO2: To study the working principles of electrical machines and power converters.

CO3: To introduce the components of low voltage electrical installations.

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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
First Year First Semester Curriculum
Applicable from Academic Session 2018-19

Course Category: Basic Science Course (BS)	**Course Coordinator:** Department of Basic Science & Humanities
Program: AEIE	**Semester:** First
Course Code: BS-CH191	**Course Title:** Chemistry-I Laboratory
Nature of Course: Mandatory	**Full Marks:** 100
Type of Course: Practical	**Credit Points:** 1.5
Contact Hour Classification: L-T-P: 0-0-3*	**Total Contact Hours:** 30
Pre-Requisites: No prerequisites	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total the total numbers of classes assigned to the course in hours/week.

**For Theory, out of 100 marks, 25 marks are allotted for continuous assessment throughout the semester which may consists of class test, viva-voce, assignment, seminar, group discussion etc. And 5 marks can be obtained by regularly attending the classes. Rest 70 marks can be obtained from End semester Examination conducted by the University.
For Practical, out of 100 marks, 35 marks are allotted for continuous assessments consists of performance in practical classes throughout the semester, 5 marks are for the attendance. Rest 60 marks are allotted for End semester Practical Examination conducted by the university.

A. Course Content:

Choose 10 experiments from the following:

1. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
2. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
3. Determination of dissolved oxygen present in a given water sample.
4. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution)
5. Determination of surface tension and viscosity
6. Thin layer chromatography
7. Ion exchange column for removal of hardness of water
8. Determination of the rate constant of a reaction
9. Determination of cell constant and conductance of solutions
10. Potentiometry - determination of redox potentials and emfs
11. aponification/acid value of an oil
12. Chemical analysis of a salt
13. Determination of the partition coefficient of a substance between two immiscible liquids
14. Adsorption of acetic acid by charcoal
15. Use of the capillary viscosimeters to the demonstrate of the isoelectric point as

the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg .

B. Learning Resources:

1. Engineering Chemistry, Satyaprakash, Khanna Book Publishing, Delhi
2. University chemistry, by B. H. Mahan
3. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
4. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
5. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
6. Physical Chemistry, by P. W. Atkins
7. Spectroscopy of Organic Compounds, by P.S.Kalsi, New Age International Pvt. Ltd Publishers
8. Physical Chemistry, P. C. Rakshit, Sarat Book House
9. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp

C. Course Outcomes (COs):

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels.

The course will enable the student to:

CO1: Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.

CO2: Rationalise bulk properties and processes using thermodynamic considerations.

CO3: Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.

CO4: Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.

CO5: List major chemical reactions that are used in the synthesis of molecules.

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First Year First Semester Curriculum
Applicable from Academic Session 2018-19

Course Category: Engineering Science Course (ES)	**Course Coordinator:** Department of Electrical Engineering
Program: AEIE	**Semester:** First
Course Code: ES-EE191	**Course Title:** Basic Electrical Engineering Laboratory
Nature of Course: Mandatory	**Full Marks:** 100
Type of Course: Practical	**Credit Points:** 1
Contact Hour Classification: L-T-P: 0-0-2	**Total Contact Hours:** 20
Pre-Requisites: No prerequisites	

A. Course Content:

Choose 10 experiments from the following:

1. First activity: Introduction to basic safety precautions and mentioning of the do's and Don'ts. Noting down list of experiments to be performed, and instruction for writing the laboratory reports by the students. Group formation. Students are to be informed about the modalities of evaluation.

2. Introduction and uses of following instruments:

(a) Voltmeter
(b) Ammeter
(c) Multimeter
(d) Oscilloscope

Demonstration of real life resistors, capacitors with color code, inductors and autotransformer.

3. Demonstration of cut-out sections of machines: DC machine, Induction machine, Synchronous machine and single phase induction machine.

4. Calibration of ammeter and Wattmeter.

5. Determination of steady state and transient response of R-L, R-C and R-L-C circuit to a step change in voltage.

6. Determination of steady state response of R-L and R-C and R-L-C circuit and calculation of impedance and power factor.

7. Determination of resonance frequency and quality factor of series and parallel R-L-C circuit.

8. (a) Open circuit and short circuit test of a single-phase transformer

(b) Load test of the transformer and determination of efficiency and regulation

9. Demonstration of three phase transformer connections. Voltage and current relationship, phase shifts between the primary and secondary side.

10. Measurement of power in a three phase unbalanced circuit by two wattmeter method.

11. Determination of Torque –Speed characteristics of separately excited DC motor.

12. Determination of Torque speed characteristics and observation of direction reversal by change of phase sequence of connection of Induction motor.

13. Determination of operating characteristics of Synchronous generator.

14. Demonstration of operation of (a) DC-DC converter (b) DC-AC converter (c) DC-AC converter for speed control of an Induction motor

15. Demonstration of components of LT switchgear.

B. Learning Resources:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Book Publishing Co. (P) Ltd., Delhi.
2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
3. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
4. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
5. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
6. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

C. Course Outcomes (COs):

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CO1: To understand and analyze basic electric and magnetic circuits.

CO2: To study the working principles of electrical machines and power converters.

CO3: To introduce the components of low voltage electrical installations.

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First Year First Semester Curriculum
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Course Category: Engineering Science Course (ES)	**Course Coordinator:** Department of Mechanical Engineering
Program: AEIE	**Semester:** First
Course Code: ES-ME191	**Course Title:** Engineering Graphics & Design
Nature of Course: Mandatory	**Full Marks:** 100**
Type of Course: Practical	**Credit Points:** 3
Contact Hour Classification: L-T-P: 1-0-4*	**Total Contact Hours:** 65
Pre-Requisites: No prerequisites	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total the total numbers of classes assigned to the course in hours/week.

**For Theory, out of 100 marks, 25 marks are allotted for continuous assessment throughout the semester which may consists of class test, viva-voce, assignment, seminar, group discussion etc. And 5 marks can be obtained by regularly attending the classes. Rest 70 marks can be obtained from End semester Examination conducted by the University.
For Practical, out of 100 marks, 35 marks are allotted for continuous assessments consists of performance in practical classes throughout the semester, 5 marks are for the attendance. Rest 60 marks are allotted for End semester Practical Examination conducted by the university.

A. Course Content:

1. INTRODUCTION TO ENGINEERING DRAWING (Lecture-1, Practical-4)
Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes.

2. LETTERING, DIMENSIONING, SCALES (Lecture-1, Practical-4)
Plain scale, Diagonal scale and Vernier Scales.

3. GEOMETRICAL CONSTRUCTION AND CURVES (Lecture-1, Practical-4)
Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Arche median Spiral.

4. PROJECTION OF POINTS, LINES, SURFACES (Lecture-1, Practical-4)
Principles of Orthographic Projections-Conventions - 1st and 3rd angle projection, Projections of Points and lines inclined to both planes; Projections of planes (Rectangle, pentagon, Hexagon etc.) inclined Planes - Auxiliary Planes.

5. PROJECTION OF REGULAR SOLIDS (Lecture-1, Practical-4)
Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone).

6. COMBINATION OF REGULAR SOLIDS, FLOOR PLANS (Lecture-1, Practical-4)
Regular solids in mutual contact with each other like Spheres in contact with cones standing on their base. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

7. ISOMETRIC PROJECTIONS (Lecture-1, Practical-4)

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

8. SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS (Lecture-1, Practical-4)

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

9. OVERVIEW OF COMPUTER GRAPHICS, CUSTOMISATION & CAD DRAWING (Lecture-1, Practical-4)

listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

10. ANNOTATIONS, LAYERING & OTHER FUNCTIONS (Lecture-2, Practical-8)

applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

11. DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT (Lecture-2, Practical-8)

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; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206 Affiliated to MAKAUT and approved by AICTE

Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering, First Year First Semester Curriculum (Applicable from Academic Session 2018-19).

General Instructions

1. In every topic some problems are to be done in the class and some are to be given to students as home assignment.
2. The problems for class work are to be prepared on drawing sheet of A1 size in the class/ using AutoCAD software.
3. The problems for home assignments are to be prepared on drawing copy/ using AutoCAD software.
4. Print out of every assignment is to be taken for CAD Drawings on Drawing sheets (A4 Sheets).
5. A title block must be prepared in each sheet/ assignment.

Following is the list of drawing instruments that required for making engineering drawings on paper with perfection.

1. Drawing Board
2. Mini drafter/ Set-squares (45° -45° & 60° -90°), T-square
3. Protractor (180° , 360°)
4. Scales (Plain, Diagonal)
5. Compass (Small and Large)
6. Divider (Small and Large)
7. French Curves
8. Drawing paper (A1 Size)
9. Drawing pencil (H, HB, B)
10. Sharpener
11. Eraser
12. Drawing pins & clips
13. Duster or handkerchief etc.

B. Learning Resources:

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

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

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

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

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

6. Corresponding set of CAD Software Theory and User Manuals

C. Course Outcomes:

CO1: Introduction to engineering design and its place in society.

CO2: Exposure to the visual aspects of engineering design.

CO3: Exposure to engineering graphics standards.

CO4: Exposure to solid modelling

Department of Applied Electronics & Instrumentation Engineering
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Affiliated to MAKAUT and approved by AICTE

Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
First Year Second Semester Curriculum
Applicable from Academic Session 2018-19

FIRST YEAR SECOND SEMESTER PROPOSED SYLLABUS

First Year Second Semester							
Serial No.	**Category**	**Subject Code**	**Subject Name**	**Total Number of Contact Hours**			**Credits**
				L	**T**	**P**	
Theory							
1	Basic Science Course	BS-PH201	Physics -I	3	1	0	4
2	Basic Science Course	BS-M202	Mathematics -IIB	3	1	0	4
3	Engineering Science Course	ES-CS201	Programming for Problem Solving	3	0	0	3
4	Humanities and Social Sciences including Management courses	HM-HU201	English	2	0	0	2
	Total Theory			11	2		13
Practical							
1	Basic Science Course	BS-PH291	Physics – I Laboratory	0	0	3	1.5
2	Engineering Science Course	ES-CS291	Programming for Problem Solving	0	0	4	2
3	Engineering Science Course	ES-ME292	Workshop/Manufacturing Practices	1	0	4	3
4	Humanities and Social Sciences including Management courses	HM-HU291	Language Laboratory	0	0	2	1
	Total Practical			1		13	7.5
	Total of Second Semester			**12**	**2**	**13**	**20.5**

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

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First Year Second Semester Curriculum
Applicable from Academic Session 2018-19

Course Category: Basic Science Course (BS)	**Course Coordinator:** Department of Basic Science & Humanities
Program: AEIE	**Semester:** Second
Course Code: BS-PH201	**Course Title:** Physics-I
Nature of Course: Mandatory	**Full Marks:** 100
Type of Course: Theory	**Credit Points:** 4
Contact Hour Classification: L-T-P: 3-1-0*	**Total Contact Hours:** 44
Pre-Requisites: High School Physics	

*L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total classes assigned in hours/week.

A. Course Content:

Learning Objectives: Basic concepts of mechanics, optics and its applications, electricity, magnetism and qualitative understanding of concepts of quantum physics and statistical mechanics.

1. Mechanics (7 L)

Problems including constraints & friction. Basic ideas of vector calculus and partial differential equations. Potential energy function F = -grad V, equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Conservation laws of energy & momentum. Non-inertial frames of reference. Harmonic oscillator; Damped harmonic motion forced oscillations and resonance. Motion of a rigid body in a plane and in 3D. Angular velocity vector. Moment of inertia.

2. Optics (5 L)

Distinction between interference and diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits (only the expressions for max;min, & intensity and qualitative discussion of fringes); diffraction grating(resolution formulac only), characteristics of diffration grating and its applications.

Polarisation: Introduction, polarisation by reflection, polarisation by double reflection, scattering of light, circular and elliptical polarisation, optical activity.

Lasers: Principles and working of laser, population inversion, pumping, various modes, threshold population inversion with examples.

3. Electromagnetism and Dielectric Magnetic Properties of Materials (8 L)

Maxwell’s equations. Polarisation, permeability and dielectric constant, polar and non-polar dielecrrics, internal fields in a solid, Clausius- Mossotti equation(expression only), applications of dielectrics. Magnetisation, permeability and susceptibility, classification of magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.

4. Quantum Mechanics (16 L)

Introduction to quantum physics, black body radiation, explanation using the photon concept, Compton effect, de Broglie hypothesis, wave-particle duality, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.

5. Statistical Mechanics (8 L)

Macrostate, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics.

B. Learning Resources:

1. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India Learning Private Limited
2. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker , Wiley
3. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press
4. Engineering Mechanics (In SI Units)(SIE), S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati, McGraw Hill Education
5. Classical mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education
6. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education
7. Engineering Mechanics, M.K. Harbola , Cengage India
8. An Introduction to Mechanics (SIE), David Kleppner, Robert Kolenkow, McGraw Hill Education
9. Principles of mechanics, John L. Synge and Byron A. Griffith, New York, McGraw-Hill
10. Mechanics (Dover Books on Physics) , J. P. Den Hartog , Dover Publications Inc.
11. Engineering Mechanics: Dynamics, L.G. Kraige J.L. Meriam, Wiley
12. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, Robert Eisberg, Robert Resnick, Wiley
13. Introduction to Quantum Mechanics, J. Griffiths David , Pearson Education
14. Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press
15. Optics , Hecht, Pearson Education
16. Optics, Ghatak, McGraw Hill Education India Private Limited
17. Fundamentals of Statistical and Thermal Physics, Reif, Sarat Book Distributors
18. Statistical Mechanics , Pathria , Elsevier
19. Statistical Physics, L.D.Landau , E.M. Lifshitz, Butterworth-Heinemann

C. Course Outcomes:

Students will be familiar with **CO1:**

Basic concepts of mechanics

CO2: Bragg's Law and introduction to the principles of lasers, types of lasers and applications.

CO3: Various terms related to properties of materials such as, permeability, polarization, etc.

CO4: Some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials.

CO5: Simple quantum mechanics calculations.

Department of Applied Electronics & Instrumentation Engineering
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Affiliated to MAKAUT and approved by AICTE

Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
First Year Second Semester Curriculum
Applicable from Academic Session 2018-19

Course Category: Basic Science Course (BS)	**Course Coordinator:** Department of Basic Science & Humanities
Program: AEIE	**Semester:** Second
Course Code: BS-M202	**Course Title:** Mathematics-II
Nature of Course: Mandatory	**Full Marks:** 100
Type of Course: Theory	**Credit Points:** 4
Contact Hour Classification: L-T-P: 3-1-0*	**Total Contact Hours:** 40
Pre-Requisites: High School Mathematics & BS-M102	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total classes assigned in hours/week.

A. Course Content:

1. Multivariate Calculus (Integration) (11 L):
Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, change of variables (Cartesian to Polar), Applications: Areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), Orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.

2. First order ordinary differential equations (5 L):
Exact, linear and Bernoulli's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

3. Ordinary differential equations of higher orders (9 L):
Second order linear differential equations with constant coefficients, Use of Doperators, Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

4. Complex Variable – Differentiation (6 L):

Differentiation of complex functions, Cauchy-Riemann equations, Analytic functions, Harmonic functions, determination of harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithmic) and their properties; Conformal mappings, Mobius transformations and their properties.

5. Complex Variable – Integration (9 L):

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, Zeros of analytic functions, Singularities, Laurent's series; Residues, Cauchy residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

B. Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. E. L. Ince, Ordinary Differential Equations, Dover Publications.
8. J. W. Brown and R. V. Churchill, Complex Variables and Applications, Mc-Graw Hill.

C. Course Outcomes:

The students will be able to:

CO1: Learn the methods for evaluating multiple integrals and their applications to different physical problems.

CO2: Understand different techniques to solve first and second order ordinary differential equations with its formulation to address the modelling of systems and problems of engineering sciences.

CO3: Learn different tools of differentiation and integration of functions of a complex variable that are used with various other techniques for solving engineering problems.

CO4: Apply different types of transformations between two 2- dimensional planes for analysis of physical or engineering problems.

Department of Applied Electronics & Instrumentation Engineering
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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
First Year Second Semester Curriculum
Applicable from Academic Session 2018-19

Course Category: Engineering Science Course (ES)	**Course Coordinator:** Department of Information Technology
Program: AEIE	**Semester:** Second
Course Code: ES-CS201	**Course Title:** Programming for Problem Solving
Nature of Course: Mandatory	**Full Marks:** 100
Type of Course: Theory	**Credit Points:** 3
Contact Hour Classification: L-T-P: 3-0-0*	**Total Contact Hours:** 40
Pre-Requisites: No prerequisites	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total classes assigned in hours/week.

A. Course Content:

1. Introduction to Programming (4 L):

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) (1 L).

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. (1 L)

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code. (2 L)

2. Arithmetic expressions and precedence (2 L):

3. Conditional Branching and Loops (6 L):

Writing and evaluation of conditionals and consequent branching (3 L)

Iteration and loops (3 L)

4. Arrays (6 L):

Arrays (1-D, 2-D), Character arrays and Strings

5. Basic Algorithms (6 L):

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

6. Function (5 L):

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

7. Recursion (4 -5 L):

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

8. Structure (4 L):

Structures, Defining structures and Array of Structures

9. Pointers (2 L):

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

10. File handling (only if time is available, otherwise should be done as part of the lab)

B. Learning Resources:

1. R. S. Salaria, Computer Concepts and Programming in C, Khanna Publishers
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

C. Course Outcomes:

The student will learn

CO1: To formulate simple algorithms for arithmetic and logical problems.
CO2: To translate the algorithms to programs (in C language).
CO3: To test and execute the programs and correct syntax and logical errors.
CO4: To implement conditional branching, iteration and recursion.
CO5: To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
CO6: To use arrays, pointers and structures to formulate algorithms and programs.
CO7: To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
CO8: To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
First Year Second Semester Curriculum
Applicable from Academic Session 2018-19

Course Category: Humanities and Social Sciences including Management courses (HM)	**Course Coordinator:** Department of Basic Science & Humanities
Program: AEIE	**Semester:** Second
Course Code: HM-HU201	**Course Title:** English
Nature of Course: Mandatory	**Full Marks:** 100
Type of Course: Theory	**Credit Points:** 2
Contact Hour Classification: L-T-P: 2-0-0*	**Total Contact Hours:**
Pre-Requisites: No prerequisites	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total classes assigned in hours/week.

A. Course Content:

1. Vocabulary Building

1.1 The concept of Word Formation: Compounding, Backformation, Clipping, Blending.

1.2 Root words from foreign languages and their use in English

1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.

1.4 Synonyms, antonyms, and standard abbreviations: Acronyms

2. Basic Writing Skills

2.1 Sentence Structures & Types: Simple, Compound, Complex

2.2 Use of phrases and clauses in sentences: Transformation of sentences, active, passive, narration

2.3 Importance of proper punctuation

2.4 Creating coherence: Arranging paragraphs & Sentences in logical order

2.5 Creating Cohesion: Organizing principles of paragraphs in documents

2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing

3.1 Subject-verb agreement

3.2 Noun-pronoun agreement

3.3 Misplaced modifiers

3.4 Articles

3.5 Prepositions
3.6 Redundancies
3.7 Clichés

4. Nature and Style of sensible Writing

4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence
4.5 Writing introduction and conclusion

5. Writing Practices

5.1 Comprehension
5.2 Précis Writing
5.3 Essay Writing
5.4 Business Letter, Cover Letter & CV; E-mail

Addendum

Some examples of English words with foreign roots

Greek Root/Affix	Examples
Anti	Antisocial, Antiseptic
Auto	Automatic, Autograph
Anthropos	Anthropology, Philanthropy
Bio	Biography
Chronos	Time
Di	Dilemma
Bio	Biology
Biblio	Bibliography
Chron	Chronology
Cracy	Contradiction
Geo	Geology
Hyper	Hyperactive
Hypo	Hypodermic, Hypoglycemia
Macro	Macrocosm
Mono	Monarch
Pan	Panorama
Pathos	Pathetic
Phobia	Hdrophobia

Pod (Gk), Ped (Latin)	Pseudopodia
Poly	Polyglot
Tele	Telephone
Theo	Theology, Theist

Latin Root	Examples
Aud	Audible
Bene	Beneficial
Brev	Abbreviate, brief
Circum	Circulate
Contra	Contradict
Cred	Credible
Dict	Diction
Femina	Feminine
Inter	Internet, interval
Magna	Magnificient
Mal	Malnutrition
Multi	Multinational
Nova	Novel
Multi	Multiple, multiplex
Non	Nonstop
Pre	Previous, predicate
Re	Redo, rewind
Scrib	Scripture
Spect	Spectator
Trans	Transport
Uni	Unity
Omni	Omnipotent
Semi	Semicircle
Sub	Subway
Somnus	Insomnia
Super	Superman
Sym	Sympathy
Scribe	Describe, scribble(write Illegibly), inscribe
Trans	Transform
Un	Unnecessary

Uni	Universal

B. Learning Resources:

(i) Kulbushan Kumar, R S Salaria,Effective Communication Skills, Khanna Publishing House, Delhi.
(ii) Practical English Usage. Michael Swan. OUP. 1995.
(iii) Remedial English Grammar. F.T. Wood. Macmillan.2007
(iv) Writing Well. William Zinsser. Harper Resource Book. 2001
(v) tudy Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
(vi) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
(vii) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
(viii) Universal English Prof. Prasad Kataria Publications, 2019.
(ix) "Communication Skills for Professionals"-Nira Konar, Prentice Hall of India 2nd edition, New Delhi, 2011
(x) Gajendra Singh Chauhan, Smita Kashiramka and L. Thimmesha. Functional English. Cengage , 2019.

C. Course Outcome:

CO1: The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Department of Applied Electronics & Instrumentation Engineering
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First Year Second Semester Curriculum
Applicable from Academic Session 2018-19

Course Category: Basic Science Course (BS)	**Course Coordinator:** Department of Basic Science & Humanities
Program: AEIE	**Semester:** Second
Course Code: BS-PH291	**Course Title:** Physics-I Laboratory
Nature of Course: Mandatory	**Full Marks:** 100
Type of Course: Practical	**Credit Points:** 1.5
Contact Hour Classification: L-T-P: 0-0-3*	**Total Contact Hours:** 30
Pre-Requisites: High School Physics	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total classes assigned in hours/week.

A. Course Content:

Choose 10 experiments including at least one from Optics, Electricity and Magnetism and Quantum Mechanics and at least a total of six from these three groups.

Experiments in Optics

1. Determination of dispersive power of the material of a prism
2. Determination of wavelength of a monochromatic light by Newton's ring
3. Determination of wavelength of a monochromatic light by Fresnel's bi-prism
4. Determination of wavelength of the given laser source by diffraction method

Electricity & Magnetism experiments

1. Determination of thermo electric power of a given thermocouple.
2. Determination of specific charge (e/m) of electron by J.J. Thompson's method.
3. Determination of dielectric constant of a given dielectric material.
4. Determination of Hall coefficient of a semiconductor by four probe method.
5. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.
6. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
7. Determination of unknown resistance using Carey Foster's bridge
8. Study of Transient Response in LR, RC and LCR circuits using expeyes
9. Generating sound from electrical energy using expeyes

Experiments in Quantum Physics

1. Determination of Stefan-Boltzmann constant.
2. Determination of Planck constant using photocell.
3. Determination of Lande-g factor using Electron spin resonance spectrometer.
4. Determination of Rydberg constant by studying Hydrogen spectrum.
5. Determination of Band gap of semiconductor.
6. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.

Miscellaneous experiments

1. Determination of Young's modulus of elasticity of the material of a bar by the method of flexure
2. Determination of bending moment and shear force of a rectangular beam of uniform cross-section
3. Determination of modulus of rigidity of the material of a rod by static method
4. Determination of rigidity modulus of the material of a wire by dynamic method
5. To determine the moment of inertia of a body about an axis passing through its centre of gravity and to determine the modulus of rigidity of the material of the suspended wire
6. Determination of coefficient of viscosity by Poiseulle's capillary flow method

B. Learning Resources:

1. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India Learning Private Limited
2. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker , Wiley
3. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press
4. Engineering Mechanics (In SI Units)(SIE), S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati, McGraw Hill Education
5. Classical mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education
6. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education
7. Engineering Mechanics, M.K. Harbola , Cengage India
8. An Introduction to Mechanics (SIE), David Kleppner, Robert Kolenkow, McGraw Hill Education
9. Principles of mechanics, John L. Synge and Byron A. Griffith, New York, McGraw-Hill
10. Mechanics (Dover Books on Physics) , J. P. Den Hartog , Dover Publications Inc.
11. Engineering Mechanics: Dynamics, L.G. Kraige J.L. Meriam, Wiley
12. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, Robert Eisberg, Robert Resnick, Wiley
13. Introduction to Quantum Mechanics, J. Griffiths David , Pearson Education
14. Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press

15. Optics , Hecht, Pearson Education
16. Optics, Ghatak, McGraw Hill Education India Private Limited
17. Fundamentals of Statistical and Thermal Physics, Reif, Sarat Book Distributors
18. Statistical Mechanics , Pathria , Elsevier
19. Statistical Physics, L.D.Landau , E.M. Lifshitz, Butterworth-Heinemann

C. Course Outcomes:

Students will be familiar with

CO1: Basic concepts of mechanics

CO2: Bragg's Law and introduction to the principles of lasers, types of lasers and applications.

CO3: Various terms related to properties of materials such as, permeability, polarization, etc.

CO4: Some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials.

CO5: Simple quantum mechanics calculations.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
First Year Second Semester Curriculum
Applicable from Academic Session 2018-19

Course Category: Engineering Science Course (ES)	**Course Coordinator:** Department of Information Technology
Program: AEIE	**Semester:** Second
Course Code: ES-CS291	**Course Title:** Programming for Problem Solving
Nature of Course: Mandatory	**Full Marks:** 100
Type of Course: Practical	**Credit Points:** 2
Contact Hour Classification: L-T-P: 0-0-4*	**Total Contact Hours:** 44
Pre-Requisites: No prerequisites	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total classes assigned in hours/week.

A. Course Content:

The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:
Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):

Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures

Tutorial 12: File handling:
Lab 12: File operations

B. Learning Resources:

1. R. S. Salaria, Computer Concepts and Programming in C, Khanna Publishers
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

C. Course Outcomes:

CO1: To formulate the algorithms for simple problems

CO2: To translate given algorithms to a working and correct program

CO3: To be able to correct syntax errors as reported by the compilers

CO4: To be able to identify and correct logical errors encountered at run time

CO5: To be able to write iterative as well as recursive programs

CO6: To be able to represent data in arrays, strings and structures and manipulate them through a program

CO7: To be able to declare pointers of different types and use them in defining self-referential structures.

CO8: To be able to create, read and write to and from simple text files.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
First Year Second Semester Curriculum
Applicable from Academic Session 2018-19

Course Category: Engineering Science Course (ES)	**Course Coordinator:** Department of Mechanical Engineering
Program: AEIE	**Semester:** Second
Course Code: ES-ME292	**Course Title:** Workshop/ Manufacturing Practices
Nature of Course: Mandatory	**Full Marks:** 100
Type of Course: Practical	**Credit Points:** 3
Contact Hour Classification: L-T-P: 1-0-4*	**Total Contact Hours:** 60
Pre-Requisites: No prerequisites	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total classes assigned in hours/week.

A. Course Content:

(i) Lectures & videos:

contents:

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

(ii) Workshop Practice:

Machine shop (8 hours)

Typical jobs that may be made in this practice module:

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

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

Fitting shop (8 hours)

Typical jobs that may be made in this practice module:

To make a Gauge from MS plate.

Carpentry (8 hours)

Typical jobs that may be made in this practice module:

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

Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs))

Typical jobs that may be made in this practice module:

ARC WELDING (4 hours): To join two thick (approx 6mm) MS plates by manual metal arc welding.

GAS WELDING (4 hours): To join two thin mild steel plates or sheets by gas welding.

Casting (8 hours)

Typical jobs that may be made in this practice module:

One/ two green sand moulds to prepare, and a casting be demonstrated.

Smithy (4 hours) ~ 4 hours

Typical jobs that may be made in this practice module:

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

Plastic moulding & Glass cutting (4 hours)

Typical jobs that may be made in this practice module:

For plastic moulding, making at least one simple plastic component should be made.

For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black colour diamond cutter, or similar other components may be made.

Electrical & Electronics (8 hours)

Familiarization with LT switchgear elements, making its sketches and noting down its specification. Kitkat fuse, Glass cartridge fuse, Plastic fuse holders (optional), Iron clad isolators, MCB style isolators, Single phase MCB, Single-phase wire, wiring cable.

Demonstration of domestic wiring involving two MCB, two piano key switches, one incandescent lamp, one LED lamp and plug point.

Simple wiring exercise to be executed to understand the basic electrical circuit.

Simple soldering exercises to be executed to understand the basic process of soldering.

Fabrication of a single-phase full wave rectifier with a step down transformer using four diodes and electrolytic capacitor and to find its volt-ampere characteristics to understand basic electronic circuit fabrication.

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

B. Learning Resources:

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. Kalpakjian S. and Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.
4. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
5. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

C. Course Outcomes:

CO1: Upon completion of this laboratory course, students will be able to fabricate components with their own hands.

CO2: They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

CO3: By assembling different components, they will be able to produce small devices of their interest.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
First Year Second Semester Curriculum
Applicable from Academic Session 2018-19

Course Category: Humanities and Social Sciences including Management courses (HM)	**Course Coordinator:** Department of Basic Science & Humanities
Program: AEIE	**Semester:** Second
Course Code: HM-HU291	**Course Title:** Language Laboratory
Nature of Course: Mandatory	**Full Marks:** 100
Type of Course: Practical	**Credit Points:** 1
Contact Hour Classification: L-T-P: 0-0-2*	**Total Contact Hours:** 19
Pre-Requisites: No prerequisites	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total classes assigned in hours/week.

A. Course Content:

1) Honing 'Listening Skill' and its sub skills through Language Lab Audio device; (3 P)
2) Honing 'Speaking Skill' and its sub skills (2 P)
3) Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/Voice modulation/ Stress/ Intonation/ Pitch &Accent) of connected speech (2 P)
4) Honing 'Conversation Skill' using Language Lab Audio -Visual input; Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone & Role Play Mode) (2 P)
5) Introducing 'Group Discussion' through audio -Visual input and acquainting them with key strategies for success (2 P)
6) G D Practice Sessions for helping them internalize basic Principles (turn- taking, creative intervention, by using correct body language, courtesies & other soft skills) of GD (4 P)
7) Honing 'Reading Skills' and its sub skills using Visual/Graphics/Diagrams/Chart Display/Technical/Non-Technical Passages Learning Global/Contextual/Inferential Comprehension; (2 P)
8) Honing 'Writing Skill' and its sub skills by using Language Lab Audio -Visual input; Practice Sessions (2 P)

B. Learning Resources:

(i) Kulbushan Kumar, R S Salaria,Effective Communication Skills, Khanna Publishing House, Delhi.
(ii) Practical English Usage. Michael Swan. OUP. 1995.
(iii) Remedial English Grammar. F.T. Wood. Macmillan.2007
(iv) Writing Well. William Zinsser. Harper Resource Book. 2001
(v) Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
(vi) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
(vii) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
(viii) Universal English Prof. Prasad Kataria Publications, 2019.
(ix) "Communication Skills for Professionals"-Nira Konar, Prentice Hall of India 2nd edition, New Delhi, 2011
(x) Gajendra Singh Chauhan, Smita Kashiramka and L. Thimmesha. Functional English. Cengage, 2019.

C. Course Outcome:

CO1: The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Second Year Third Semester Curriculum
Applicable from Academic Session 2019-20

SECOND YEAR THIRD SEMESTER PROPOSED SYLLABUS

Serial No.	Category	Subject Code	Subject Name	Total Number of Contact Hours			Credits
				L	T	P	
Theory							
1	Basic Science Course	BS-M301	Mathematics - III	2	1	0	3
2	Professional Core Course	PC-EI301	Network Analysis	3	0	0	3
3	Professional Core Course	PC-EI302	Sensors and Transducers	3	0	0	3
4	Professional Core Course	PC-EI303	Analog Integrated Circuits	3	0	0	3
5	Professional Core Course	PC-EI304	Digital Electronic Circuits	3	0	0	3
6	Mandatory Courses	MC-ES301	Environmental Science	2	0	0	0
	Total Theory			16	1		15
Practical							
1	Professional Core Course	PC-EI391	Circuits and Network Lab	0	0	3	1.5
2	Professional Core Course	PC-EI392	Sensors and Transducers Lab	0	0	3	1.5
3	Professional Core Course	PC-EI393	Analog Circuits Design Lab	0	0	3	1.5
4	Professional Core Course	PC-EI394	Digital Circuits Design Lab	0	0	3	1.5
	Total Practical					12	6
	Total of Third Semester			**16**	**1**	**12**	**21**

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Second Year Third Semester Curriculum
Applicable from Academic Session 2019-20

Course Code : BS-M 301	**Category:** Basic science Courses
Course Name: Mathematics - III	**Semester:** Third
Programme: AEIE	**Course Coordinator:** Department of Basic Science & Humanities
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hour Classification: L-T-P:2-1-0	**Credit:** 3
Total Contact Hours: 45	**Full Marks:** 100
Pre-Requisites: Knowledge of limit, continuity and derivative. Knowledge of Integration, especially definite integral and improper integral. Knowledge of basic probability.	

A. Learning Objectives:

- Providing the core concepts of higher Engineering Mathematics and describing the techniques, this works as an essential tool to solve the problems in their field of applications.
- To provide an overview of probability to engineers.

B. Course Content:

Module No.	Description of Topic	Contact Hrs.
1	Basic Probability: Probability spaces, conditional probability, independence; Bayes theorem. Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Chebyshev's Inequality.	8
2	Continuous Probability Distributions: Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.	4
3	Laplace Transformation: Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property; LT of $\frac{f(t)}{t^n}$, LT of $t\,f(t)$, LT of derivatives of $f(t)$, L.T. of $\int f(u)\,du$. Evaluation of improper integrals using LT, Inverse LT: Definition and its properties; Convolution Theorem (statement only) and its application to the evaluation of inverse LT.	9
4	Fourier Transformation: Fourier Transform of a function, Fourier Sine and Cosine Integral Theorem (statement only), Fourier Cosine & Sine Transforms of elementary functions. Properties of Fourier Transform: Linearity, Shifting, Change of scale, Modulation,	8

	Examples. Fourier Transform of Derivatives, Examples. Convolution Theorem (statement only), Inverse of Fourier Transform, Solution of integration by inverse Fourier transform. Examples.	
5	Approximation in numerical computation and Interpolation: Truncation and rounding errors, Fixed and floating-point arithmetic. Calculus of finite differences, Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation.	7
6	Numerical integration and Numerical solution of equations: Trapezoidal rule, Simpson's 1/3 rule for Integration. Bisection method, Newton-Raphson method and Regular Falsi method algebric and transcendental equation. Euler's method, Runge-Kutta methods for ordinary differential equation.	9

Note: For each module minimum two case studies

C. Course Outcomes:

After completion of this course the students are expected to be able to demonstrate the following knowledge, skills and attitudes. Student will be able to:

CO1: Learn the concepts of the theory of Probability with the purpose of providing mathematical models of situations affected or even directed by chance effects. Solve the problems related to Probability distribution, both discrete and continuous.

CO2: Find the Laplace transform of a function by definition and by use of a table and the inverse Laplace transform of a function.

CO3: Describing the techniques of Fourier transform and using them to transform a problem into one that can be more easily solved.

CO4: Apply numerical methods to obtain approximate solutions of mathematical problems.

D. Learning Resources:

Text Books:

1. AP Baisnab and Jas M-Elements of Probability and Statistics.
2. R. J. Beerends_-Fourier and Laplace Transforms.
3. S. Ali Mollah-Numerical Analysis and Computational Procedures.
4. Balagurusamy-Numerical Methods.
5. R.S. Salaria, Computer Oriented Numerical Methods, Khanna Publishing House, New Delhi.
6. C.Xavier: C Language and Numerical Methods.

Reference Books:

1. D. C. Sanyal, K. Das: A Text Book of Numerical Analysis.
2. Dr. S.K. Sarkar & Dr. D.N. Ghosh: Numerical Methods and Programming.
3. HK Dass-Advanced Engineering Mathematics
4. Chadrika Prasad & Reena Garg, Advanced Engineering Mathematics, Khanna Publishing House, New Delhi

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206 Affiliated to MAKAUT and approved by AICTE

Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Second Year Third Semester Curriculum
Applicable from Academic Session 2019-20

Course Code: PC-EI301	**Category:** Professional Core Courses
Course Name: Network Analysis	**Semester:** Third
Programme: AEIE	**Course Coordinator:** Department of Electrical Engineering
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 45	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

A. Learning Objectives:

- To understand circuit analysis techniques using fundamental network theorems.
- To model and solve electric circuits in the frequency domain.
- To find the relevance of graph theory in electric networks.
- To understand the properties of magnetic coupling.
- To perform network analysis with different types of two port network.

B. Course Content:

Module No.	Description of Topic	Contact Hrs.
1	Introduction: Continuous & Discrete, Fixed & Time varying, Linear and Nonlinear, Lumped and Distributed, Passive and Active networks and systems. Independent & Dependent sources, Step, Ramp, Impulse, Sinusoidal, Square, Saw tooth signals. Network equations: Kirchoff's Voltage Law & Current Law, Formulation of network equations, Source transformation, Loop variable analysis, Node variable analysis.	8
2	Network theorem: Superposition, Thevenin's, Norton's & Maximum power transfer theorem. Millman's theorem, Reciprocity theorem, Solution of Problems with DC & AC sources.	8
3	Resonant Circuits: Analysis of R-C, R-L and R-L-C circuits under AC excitation using phasors. Series and Parallel Resonance, Impedance and Admittance Characteristics, Quality Factor, Half-Power Points, Bandwidth, Resonant voltage rise, Transform diagrams, Solution of Problems.	8
4	Laplace transforms: Transient analysis of R-C, R-L and R-L-C circuits with step excitation. Laplace transform and representation of periodic and periodic signals in Laplace domain. Application of Laplace transform for the analysis of R-C, R-L and R-L-C circuits with step, impulse and ramp input. AC and DC transient analysis of R-L, R-C & RLC circuits.	7
5	Coupled circuits: Magnetic coupling, Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Modelling of coupled circuits, Solution of problems. 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, solution of problems.	9

6	Two port networks analysis: Open circuit Impedance & Short circuit Admittance parameter, Transmission parameters, Hybrid parameters and their inter relations. Driving point impedance & Admittance. Solution of Problems with DC & AC sources.	5

C. Course Outcomes:

CO1: To apply the knowledge of various components in circuit analysis.
CO2: To solve and analyze the circuits using different network theorems.
CO3: To solve electrical circuits using graph theory.
CO4: To analyze the electrical circuits containing passive elements under resonance conditions.
CO5: To use mathematical tools to analyze electrical networks in time domain and frequency domain.
CO6: To find solutions of electrical circuits applying the knowledge of two port parameters.

D. Learning Resources:

Textbook:

1. Asfaq Husain, Networks and Systems, Khanna Publishing House, New Delhi
2. AChakrabarty," Circuit Theory Analysis & Synthesis", DhanpatRai
3. William H. HaytJr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 6th edition, New Delhi, (2002).
4. D. Roy Choudhary, Networks and Systems, Newage Publications, New Delhi

Reference book:

1. S P Ghosh, "Circuit Theory and Networks", Tata McGraw Hill.
2. Sudhakar A and Shyam Mohan SP, "Circuits and Networks- Analysis and Synthesis", McGraw Hill Education, (2015).
3. D. Chattopadhyay and P.C. Rakshit: "Fundamentals of Electrical Circuit Theory", S. Chand

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE
Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Second Year Third Semester Curriculum
Applicable from Academic Session 2019-20

Course Code: PC-EI302	**Category:** Professional Core Course
Course Name: Sensors and Transducers	**Semester:** Third
Programme: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hour Classification: L-T-P :3-0-0	**Credit:** 3
Total Contact Hours: 45	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

A. Learning Objectives:

Throughout their careers as professional engineers and scientists in leading industries and institutions, students will be required to use measurement systems to collect field data for sensors and transducers. The goal of this course is to provide graduate students with a well-founded background in the theory of engineering measurements using sensor technology. With this in mind, this course focuses on principle of measurement, various types of Sensors & Transducers and their working principle for measuring typical physical quantities in solid and fluid mechanical systems.

To gain knowledge about the measuring instruments, the methods of measurement and the uses of different transducers following concepts have to be covered

- Classification and descriptions of transducers
- Optical, mechanical, thermal, magnetic, chemical and smart sensors
- Sensor characteristics
- The properties of a number of useful sensors for measuring position, temperature, strain, force, light etc.
- Design instrumentation that senses desired quantities, transducers to an analogous electrical signal, and amplifies and filters that signal for interfacing to a microcomputer

B. Course Content:

Module No.	Description of Topic	Contact Hrs.
1	Introduction, Definition, significance of measurement and instruments, General concepts and terminology of measurement systems, Static & dynamic characteristics of instruments, Different types of instruments, Types of errors, Limiting error with examples. Principle of sensing & transduction, transducer classification, emerging fields of sensor technologies.	8
2	Resistive transducers: Potentiometers: types, loading error, metal and semiconductor strain gauges, types, resistance measuring methods, strain gauge applications: Load and torque measurement.	5
3	Inductive transducers: Transformer type, synchros, eddy current transducers, LVDT: Construction, material, input-output characteristics. Optical Sensors: LDR, Photo Diode, Stroboscope, IR Sensor.	8
4	Capacitive transducers: Variable distance-parallel plate type, variable area- parallel plate type, cylindrical type, differential type, variable dielectric constant type, calculation of sensitivity.	10

	Capacitive microphone, fluid level measurement. Piezoelectric transducers, proximity sensors. Magnetic Transducer: Hall effect sensors, Magnetostrictive transducers, Seismic instrument.	
5	Thermal sensors: Resistance temperature detector (RTD): principle, materials and types; Thermistor: principle, materials and types; Thermocouple, Thermoelectric effects, laws of thermocouple, thermocouple types, construction. IC temperature sensor.	7
6	Micro-sensors and smart sensors: Construction, characteristics and applications. Standards for smart sensor interface. Recent Trends in Sensor Technologies: Introduction; Film sensors (Thick film sensors, thin film sensor)	7

C. Course Outcomes:

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

CO1: Apply basic concepts to distinguish different sensors and transducers and also compare the methods of measurements

CO2: Identify suitable transducer by comparing different industrial standards and procedures for most complex measurement of several physical parameters

CO3: Estimate the performance of different transducers and interpret the data accurately

CO4: Develop the skill to identify and analyze the complex technical problems and also capable to give a socio-economic solution to that problem

CO5: Acquire the knowledge of independent thinking to design real life electronics and instrumentation measurement systems helpful for humanities

CO6: Build the fundamental concept of latest technological trends like smart sensors, bio-sensors, PLC and Internet of Things.

D. Learning Resources:

Text Books:

1. Murthy D. V. S, “Transducers and Instrumentation”, Prentice Hall, New Delhi.
2. D. Patranabis, “Sensors and Transducers”, 2nd Edition, Prentice Hall India Pvt. Ltd.
3. Doebelin E.O, “Measurement Systems - Application and Design”, 4th Edition, McGraw-Hill, New York, 2003

Reference Books:

1. Neubert H.K.P, “Instrument Transducers - An Introduction to their Performance and Design”, 2nd Edition, Oxford University Press, Cambridge.
2. Waldemar Nawrocki, “Measurement Systems and Sensors”, Artech House.
3. S.M. Sze, “Semiconductor sensors”, John Wiley & Sons Inc., Singapore.
4. B. C. Nakara&Chaudhry, “Instrumentation Measurement and Analysis”, TATA McGraw-Hill, New Delhi.
5. Smart Sensors and Sensing Technology, Daniel E. Suarez, Nova Science Publishers.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Second Year Third Semester Curriculum
Applicable from Academic Session 2019-20

Course Code: PC-EI303	**Category:** Professional Core Course
Course Name: Analog Integrated Circuits	**Semester:** Third
Programme: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 45	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

A. Learning Objectives:

The objective of this course is to introduce the student to familiarize and develop skills in the design and analysis of Analog Integrated Circuit, which form the building blocks of almost any electronic system.

The subject aims to provide the student with:

- In-depth understanding of different biasing arrangement in transistor circuits and also the calculation of operating point or Q-point in different biasing circuits.
- An extensive knowledge and perception of h-model and high frequency model of transistors.
- The concepts of both positive and negative feedback in electronic circuits.
- The broad knowledge of the operation of Transistor amplifiers, oscillators and power supplies.
- The theoretical & circuitry details of the design of an Op-amp, which is the backbone for the basics of Linear integrated circuits.
- Some useful applications of Operational Amplifiers in the field of electronics and instrumentation.
- The functional block diagram of NE565/NE566 and an application of IC 555 timer as monostable and astable multivibrators.
- An overview of series and shunt voltage regulator, 78xx and 79xx series.

B. Course Content:

Module No.	Description of Topic	Contact Hrs.
1	Brief overview of semiconductor and junction diode. Introduction to BJT and FET (JFET & MOSFET). Transistor Biasing Circuits: Different types of biasing circuits for BJT and FET, stability factors, bias compensation, dc & ac load line analysis and thermal runaway.	10
2	Small Signal Analysis of BJT: Transistor hybrid model, derivation of voltage gain, current gain, input impedance and output impedance, trans-conductance, low frequency small signal analysis of CE, CB and CC type RC coupled amplifier using hybrid-π and T model, determination of voltage gain, current gain, input impedance and output impedance, analysis of high frequency model. Frequency response of a RC coupled amplifier.	8
3	Feedback and Oscillator Circuits: Feedback concept, Feedback topologies, classification of amplifiers, Bark-hausen criteria,	5

	Oscillators- Wien bridge oscillator, Phase shift oscillator and Crystal oscillator.	
4	Operational Amplifier (OPAMP): Ideal OPAMP, Equivalent circuit, characteristics, Inverting and non-inverting configuration (ideal & Practical), summer, unity gain buffer, Differential amplifier, CMRR.	6
5	OPAMP Applications: Instrumentation amplifier and its application, comparator (zero crossing & Schmitt trigger), V-I and I-V converter, log and anti-log amplifier, precision rectifier (half & full wave), integrator and differentiator (ideal & Practical), IC 555 timer in monostable and astable mode.	10
6	Introduction to multi-vibrator, IC555, NE565/NE566. Linear Voltage Regulator: Series and Shunt, IC based power supply design.	6

C. Course Outcomes:

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

CO1: Apply the knowledge more effectively during the study of analog integrated circuits.

CO2: Analyze and design simple circuits containing non-linear elements such as Transistors using the concepts of load lines, operating points and incremental analysis.

CO3: Understand the Mid – band analysis of RC coupled amplifier circuits using small – signal equivalent circuits to determine gain, input impedance and output impedance.

CO4: Learn how operational amplifiers are modelled and analysed.

CO5: Design Op-Amp circuits to perform operations such as amplification, integration and differentiation on electronic signals

CO6: Learn how negative feedback is used to stabilize the gain of an Op-Amp-based amplifier and how positive feedback can be used to design an oscillator

CO7: Acquire experience in building and trouble-shooting simple analog electronic circuits.

CO8: Analyze where and how analog components are used.

D. Learning Resources:

Text Books:

1. A.K. Maini, Analog Electronics, Khanna Publishing House, New Delhi
2. D. Roy Choudhury & Shail B. Jain, Linear Integrated Circuits, New Age International Publishers Ltd., New Delhi.
3. Adel S. Sedra & Kenneth C. Smith, Microelectronic Circuits, Oxford University Press, New Delhi.
4. Jacob Millman & Christos C. Halkias, Integrated Electronics, McGraw Hill.

Reference Books:

1. Ramakant A. Gayakwad, Op-Amps and Linear Integrated Circuits, PHI Learning,New Delhi.
2. Sergio Franco, Design with Operational Amplifiers and Analog Integrated Circuits, 3rd Edition, McGraw Hill.
3. Robert L. Boylestad&LouisNashelsky, Electronic Devices and Circuit Theory, Pearson/PHI, New Delhi.
4. Theodore F. Bogart, Jeffrey S. Beasley, &Guillermo Rico, Electronic Devices and Circuits, Pearson/PHI, New Delhi.
5. L.K. Maheshwari, Analog Electronics, Laxmi Publications, New Delhi

Department of Applied Electronics & Instrumentation Engineering
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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Second Year Third Semester Curriculum
Applicable from Academic Session 2019-20

Course Code: PC-EI304	**Category:** Professional Core Course
Course Name: Digital Electronic Circuits	**Semester:** Third
Programme: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 45	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

A. Learning Objectives:

The objective of this course is to acquire the basic knowledge of digital logic circuits and its applications useful to design and implementation of any digital system.

The subject aims to encourage the students with the followings:-

- Introduce the concept of digital and binary systems.
- The concept of Boolean algebra and simplification of logic circuits with K-map and Quine-McClausky (Q-M) method.
- Design and analysis of combinational & arithmetic logic circuits.
- Design and analysis of sequential logic circuits.
- The theoretical & circuitry details of various A/D and D/A converters.
- Basic knowledge of various memory and programmable logic devices & Families using in digital system.

B. Course Content:

Module No.	Description of Topic	Contact Hrs.
1	Number System and Codes : o Introduction to Digital system, Data and number systems, Decimal, binary, octal and hexadecimal number systems and their arithmetic operations; conversion of one number system to another. o Binary codes, natural BCD codes ,weighted, non-weighted, sequential, self-complementing, cyclic, Excess-3, Alphanumeric, EBCDIC and Gray codes, Code conversion- from one code to another. o Signed binary number representation with 1's and 2's complement methods, Binary arithmetic	5
2.	Logic Gates and Boolean algebra : o Logic Operation-NOT, AND, OR, NAND, NOR, XOR and XNOR – operations, truth tables and universal gates; commonly used 7400 series IC's, standard and IEEE symbols of logic gates. o All Postulates and laws of Boolean algebra with proof, De Morgan's theorem. Minimization of Logic Expressions using Algebraic method. o Canonical forms of expressions, minterms and maxterms, SOP and POS forms. o Simplification and minimization of Logic Expressions using K-	7

	map method (up to 6 variables (focussing mainly up to 4 variables)). Concept of don't care and use of don't care terms in K-map method o Limitation of K-map and Quine-McClausky (Q-M) method of minimization of logic functions and concept of PI, EPI, RPI, SPI.	
3	Combinational and arithmetic logic circuit: o Introduction to combinational circuits, Design procedure o Adders: Half Adder, Full Adder, Binary parallel adder, Composite adder, Carry look ahead adder, BCD adder. o Multiplexers and Demultiplexer: basic 2:1, 4:1, 8:1 multiplexer equation and circuit diagram. Implementation of higher order MUX using lower order MUX, function implementation using MUX, basic 1:2 and 1:4 DEMUX equation and circuit diagram. function implementation using DEMUX, application of MUX and DEMUX o Decoders: basic 2:4, 3:8, 4:16 decoder equation and circuit diagram. Implementation of higher order DECODER using lower order DECODER, function implementation using DECODER. Application of Decoder o 3bit and 4 bit EVEN and ODD Parity Generator and checkers, 1 bit,2 bit,4 bit Magnitude Comparators with equation and circuit diagram o 4:2 Encoders and Priority Encoders equation with circuit diagram. Application of DECODER and ENCODER o Code converter: Binary to Gray and Gray to Binary, BCD to XS-3 and XS-3 to BCD, BCD to Binary and Binary to BCD	7
4.	Sequential Logic Circuits: o Concept of Sequential circuit, difference between combinational and sequential circuit, Introduction to latches (S-R Latch, NOR based S-R latch, NAND based S'-R' latch) with characteristic table, truth table, equation and circuit diagram. o Introduction to different types of Flip-Flop(S-R, D, J-K, T) with characteristic table, truth table, Excitation table, equation and circuit diagram. o Triggering of flip-flops, Asynchronous inputs in FF, race around condition, Master-slave configuration; Conversion of Flip-flop and application of FF. o Registers: left, right, serial and parallel shift registers (SISO, SIPO, PIPO, PISO), Bi-directional and universal shift registers, Ring and Johnson (twisted ring) counters, application of register. o Asynchronous counters - Full-sequence length counter, Binary up and down counter, Bidirectional counter, Modulo-N counter Synchronous counters - Full-sequence length counter, Binary up and down counter, Bidirectional counter, Modulo-N counter, Truncated Counter, Arbitrary sequence counter.	12
5.	Analog - Digital Conversion: o Introduction to analog- digital data conversion, specification of D/A converter.	6

	o D/A conversion- R-2R ladder type, weighted resistor type. o Specification of A/D converter; A/D conversion- flash type. o A/D conversion- Flash type, successive approximation type and dual-slope type.	
6	Memory and Programmable Logic Devices & Families: o Types of Memory and basic definition – Register, Main memory, secondary memory, sequential access memory, random access memory, static and dynamic memory, volatile and non volatile memory, magnetic and semiconductor memory, ROM, PROM, EPROM, EEPROM, RAM, DRAM, SRAM o Memory decoding, Memory expansion o Design of combinational logic circuit using ROM PLA,PAL o Introduction to Digital Logic Families; classification of Digital Logic Families; characteristics of Digital ICs. o TTL: characteristics, Totem-Pole output, Open Collector output, Tri-state output, o ECL: characteristics, OR/NOR gate. o MOS: characteristics, PMOS, NMOS. CMOS: characteristics NAND, NOR, logic circuit realization.	8

C. Course Outcomes:

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

CO1: Apply different type of codes and number systems which are used in digital computing and communication systems.
CO2: Develop different types Logic circuit simplification using various mapping and mathematical methods.
CO3: Analyze, design and implement combinational including arithmetic logic circuits.
CO4: Analyze, design and implement sequential logic circuits.
CO5: Built the fundamental knowledge and analyze the operation of various A/D and D/A converters.
CO6: Identify various types of memory elements, PLDs, digital logic families and apply the knowledge in different types of digital circuits for real world application.

D. Learning Resources:

Text Books:

1. Digital Fundamentals by T.L. Floyd & R.P.Jain (Pearson).
2. Fundamental of digital circuits by A. Anand Kumar (PHI).
3. Digital Electronics, Rishabh Anand (Khanna Publishing House)
4. Digital Integrated Electronics by H. Taub & D. Shilling (TMH).

Reference Books:

1. Digital Circuit & Design by S. Aligahanan &S.Aribazhagan (Bikas Publishing)
2. Digital Electronics by A.K. Maini (Wiley-India)
3. Digital Circuits-Vol-I & II by D. RayChaudhuri (Platinum Publishers)
4. Modern Digital Electronics by R.P. Jain (McGraw Hill)

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Second Year Third Semester Curriculum
Applicable from Academic Session 2019-20

Course Code : MC-ES301	**Category:** Mandatory Courses
Programme: AEIE	**Course Coordinator:** Department of Basic Science & Humanities
Course Name: Environmental Science	**Semester:** Third
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hour Classification: L-T-P:2-0-0	**Credit**: NIL
Total Contact Hours: 30	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

A. Course Content:

Module No.	Description of Topic	Contact Hrs.
1	Basic ideas of environment, basic concepts, man, society & environment, their interrelationship. Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development. Materials balance: Steady state conservation system, steady state system with non conservative pollutants, step function. Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering.	4
2	Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem-components types and function. Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web. Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.	4
3	Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems. Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and	8

	marine food.Global warming and its consequence, Control of Global warming. Earth's heat budget. Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion). Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model. Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. Smog, Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green house gases, effect of ozone modification. Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference).	
4	Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. River/Lake/ground water pollution: River: DO, 5 day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river[deoxygenation, reaeration], COD, Oil, Greases, pH. Lake: Eutrophication [Definition, source and effect]. Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only) Standard and control: Waste water standard [BOD, COD, Oil, Grease], Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition. Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic	6
5	Lithosphere; Internal structure of earth, rock and soil Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling. Solid waste management and control (hazardous and biomedical waste).	3

6	Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighborhood noise] Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L_{10} (18 hr Index) , Ld_n . Noise pollution control. Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol.	5

B. Learning Resources:

References:

1. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd., 1991.
2. M.P. Poonia, Environmental Studies, Khanna Publishing House, New Delhi, 2018
3. De, A. K., "Environmental Chemistry", New Age International.
4. O.P. Gupta, Elements of Environmental Pollution Control, Khanna Publishing House, New Delhi 2019

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Second Year Third Semester Curriculum
Applicable from Academic Session 2019-20

Course Code: PC-EI391	**Category:** Professional Core Course
Course Name: Circuits and Network Lab	**Semester:** Third
Programme: AEIE	**Course Coordinator:** Department of Electrical Engineering
Nature of Course: Mandatory	**Type of Course:** Practical
Contact Hour Classification: L-T-P :0-0-3	**Credit:** 1.5
Total Contact Hours: 30	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

A. Course Content:

Laboratory Experiments :	
1	Transient response in R-L and R-C Network: Simulation/hardware
2	Transient response in R-L-C Series & Parallel circuits Network: Simulation/hardware
3	Determination of Impedance (Z) and Admittance(Y) parameters of two port network
4	Frequency response of LP and HP filters
5	Frequency response of BP and BR filters
6	Generation of Periodic, Exponential, Sinusoidal, Damped sinusoidal, Step, Impulse, Ramp signals using MATLAB in both discrete and analog form
7	Determination of Laplace transform and inverse Laplace transformation using MATLAB
8	Spectrum analysis of different signals
9	Mandatory Design and Implementation of Mini Project

B. Course Outcomes:

CO1: To identify various circuit components for their appropriate use in the experiments.
CO2: To apply the concepts of circuit laws and theorems for analysis and verification of laboratory measurements.
CO3: To develop the software skill for analysis and design of circuit based simulations.
CO4: To acquire technical writing skill for effective representation of experimental works.
CO5: To effectively communicate among fellow group members for proper distribution and execution of laboratory assignments.

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Second Year Third Semester Curriculum
Applicable from Academic Session 2019-20

Course Code: PC-EI392	**Category:** Professional Core Course
Course Name: Sensors and Transducers Lab	**Semester:** Third
Programme: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Practical
Contact Hour Classification: L-T-P:0-0-3	**Credit:** 1.5
Total Contact Hours: 30	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

A. Course Content:

Laboratory Experiments :	
1	Temperature measurement using AD590 IC sensor.
2	Displacement measurement by using a capacitive transducer.
3	Pressure and displacement measurement by using LVDT.
4	Study of a load cell with tensile and compressive load.
5	Torque measurement Strain gauge transducer.
6	Speed measurement using magnetic proximity sensor.
7	Speed measurement using a Stroboscope.
8	Study of the characteristics of a LDR.
9	Mandatory Design and Implementation of Mini Project.

B. Course Outcomes:

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

CO1: Identify standard experimental methods and apply the theoretical knowledge to evaluate performance characteristics of different transducers.
CO2: Determine experimental procedures for different types of sensors and transducers.
CO3: Evaluate probable reasons of irregularity between experimental data and theoretical values and also interpret the experimental data.
CO4: Apply appropriate techniques to connect different types of sensors and source and sink devices keeping in mind technical, economical, safety issues.
CO5: Analyse graphical presentations of experimental data and solve different complex technical problems.
CO6: Design sensor based mini instrumentation systems.

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Second Year Third Semester Curriculum
Applicable from Academic Session 2019-20

Course Code: PC-EI393	**Category:** Professional Core Course
Course Name: Analog Circuits Design Lab	**Semester:** Third
Programme: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Practical
Contact Hour Classification: L-T-P:0-0-3	**Credit:** 1.5
Total Contact Hours: 36	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

A. Course Content:

Laboratory Experiments :	
1	Introduction: Study of characteristics curves of B.J.T &F.E.T .
2	Construction of a two-stage R-C coupled amplifier & study of its gain & Bandwidth.
3	Study of class A & class B power amplifiers.
4	Study of class C & Push-Pull amplifiers.
5	Realization of current mirror & level shifter circuit using Operational Amplifiers.
6	Study of timer circuit using NE555 & configuration for monostable &astable multivibrator.
7	Construction & study of Bistable multivibrator using NE555.
8	Study of Switched Mode Power Supply & construction of a linear voltage regulator using regulator IC chip.
9	Construction of a simple function generator using IC.
10	Realization of a Phase Locked Loop using Voltage Controlled Oscillator (VCO).
11	Study of DAC & ADC.
12	Mandatory Design and Implementation of Mini Project.

B. Course Outcomes:

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

CO1: Set up standard experimental methods and select proper instruments to evaluate performance characteristics of different electronic circuits.
CO2: Determine experimental procedures for different types of electronic circuits.
CO3: Evaluate possible reasons of inconsistency between experimental observations and theoretical values and interpret the experimental data.
CO4: Investigate different types of instruments connections keeping in mind technical, economical, safety issues.
CO5: Analyse graphical presentations of experimental data and solve different complex technical problems.
CO6: Design mini electronic based systems.

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Second Year Third Semester Curriculum
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Course Code: PC-EI394	**Category:** Professional Core Course
Course Name: Digital Circuits Design Lab	**Semester:** Third
Programme: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Practical
Contact Hour Classification: L-T-P:0-0-3	**Credit:** 1.5
Total Contact Hours: 45	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

A. Course Content:

Laboratory Experiments :	
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 7-segment 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	Construction of Adder circuit using Shift Register & full Adder.
11	Realization of Asynchronous Up/Down counter.
12	Realization of Synchronous Up/Down counter.
13	Design of Sequential Counter with irregular sequences.
14	Realization of Ring counter & Johnson's counter.
15	Construction of adder circuit using Shift Register & full Adder.
16	Mandatory Design and Implementation of Mini Project.

B. Course Outcomes:

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

- **CO1:** Identify the operation of various basic logic gates ICs to implement different digital circuits.
- **CO2:** Implement logic circuits for various code conversion, magnitude comparator and parity bit generator.
- **CO3:** Demonstrate the basic operation of different combinational circuits including arithmetic circuits.
- **CO4:** Demonstrate the basic operation of different flip-flops as a basic element of sequential circuits.
- **CO5:** Evaluate the applications of flip-flops as binary registers and counters used in large digital integrated circuits.
- **CO6:** Design mini digital electronic circuit based systems.

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Second Year Fourth Semester Curriculum
Applicable from Academic Session 2019-20

SECOND YEAR FOURTH SEMESTER PROPOSED SYLLABUS

Serial No.	Category	Subject Code	Subject Name	Total Number of Contact Hours			Credits
				L	T	P	
Theory							
1	Professional Core Course	PC-EI401	Electrical and Electronic Measurement	3	0	0	3
2	Professional Core Course	PC-EI402	Industrial Instrumentation	3	0	0	3
3	Professional Core Course	PC-EI403	Microprocessor and Microcontroller	3	1	0	4
4	Engineering Science Courses	ES-CS401	Data Structure and Algorithm	3	0	0	3
5	Basic Science course	BS-BIO401	Biology	3	0	0	3
6	Humanities and Social Sciences including Management Courses	HM-HU401	Values and Ethics in Profession	2	0	0	2
	Total Theory			17	1		18
Practical							
1	Professional Core Course	PC-EI491	Electrical & Electronic Measurement Lab	0	0	3	1.5
2	Professional Core Course	PC-EI492	Microprocessor and Microcontroller Lab	0	0	3	1.5
3	Engineering Science Course	ES-CS491	Data Structure and Algorithm	0	0	3	1.5
4	Humanities and Social Sciences including Management Courses	HM-HU481	Advanced Language Lab	0	0	2	1
	Total Practical					11	5.5
	Total of Forth Semester			**17**	**1**	**11**	**23.5**

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Course Code: PC-EI401	**Category:** Professional Core Course
Course Name: Electrical and Electronic Measurement	**Semester:** Fourth
Programme: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Lectures: 45	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

A. Learning Objectives:

- To provide students a brief knowledge of measurements and measuring instruments related to engineering.
- To introduce students how different types of electrical and electronic meters work and their construction.
- To provide students a knowledge to use modern tools necessary for instrumentation projects.

B. Course Content:

Module No.	Description of Topic	Contact Hrs.
1	Measurement and Electromechanical indicating Instruments: Generalized block diagram of Measurement System, Industrial Standards of measurement. Measurement of current & Voltage using PMMC, MI and Electrodynamometer type instruments. Extension of range of instruments- shunts & multipliers-Current transformers- Potential Transformers.	8
2	Power, Energy and Power Factor Measurements: Definition of power, types, Measurement of power with different methods, construction and working of Electrodynamometer type Wattmeter, Errors in power measurements. Measurement of Energy using Induction type energy meter. Electrodynamometer type P.F. meter.	6
3	DC and AC Bridges: Concept of Bridges, Measurement of low resistance by Kelvins Double Bridge Method, A.C. bridges - Maxwell's inductance bridge, Anderson bridge, D-Sauty Bridge, Schering Bridge, Wien bridge- Circuit diagram, phasor diagram, derivations of equations for unknown parameter, Q-factor, dissipation factor, advantages and disadvantages for all the bridges.	6
4	Analogue Electronic Instruments: Q- Meter circuit and its operation, errors in Q- Meter circuits, Voltmeters with IC Operational Amplifiers, Peak Response and rectifying type AC Voltmeters, True rms Voltmeter, Electronic Ohmmeters, Current	11

	Analogue Electronic Instruments -Current-to-voltage converter type Electronic Ammeters. Digital Instruments: Introduction, Digital voltmeters, Digital Frequency Meter, Errors in frequency measurement – possible remedies, Time and Ratio measurement. Frequency Divider Generator, Signal Generator, Digital Multimeter.	
5	Instrument for Generation and Analysis of Waveforms: Oscilloscopes and its applications: Cathode Ray Tube, Oscilloscope Time Base, Delay line, Dual-Trace Oscilloscopes, Oscilloscope Probes, Delayed time base oscilloscope, Digital Storage Oscilloscope. Signal Analysis: Wave Analyzer, Spectrum Analyzer.	8
6	Digital Data Acquisition System: Interfacing transducers to Electronics Control and Measuring System. Voltage to frequency (V-F) converter, Frequency to voltage (F-V) converter. An Introduction to Virtual Instrumentation, Interference and Noises.	6

C. Course Outcomes:

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

CO1: Identify various types of errors which may occur during measurement and take necessary steps to minimize them.

CO2: Demonstrate the working of various instruments used for measurement of different parameters like voltage, current, power, energy, resistance, capacitance, inductance, frequency, phase etc. in industry.

CO3: Select the appropriate analog and digital instruments for measurement of different electrical and electronic engineering parameters and select appropriate passive or active transducers for measurement of physical phenomenon.

CO4: Analyze and solve the varieties of problems and issues in the field of electrical and electronic measurements.

CO5: Calibrate and standardize various measuring instruments.

CO6: Believe about the improvement of existing technology in terms of accuracy, precision, resolution, cost, durability and user friendliness.

D. Learning Resources:

Text Books:

1. A.K.Sawhney, Electrical & Electronics Measurements and Instrumentation; DhanpatRai and Sons.
2. E.W Golding, Electrical Measurement and Measuring Instruments; Wheeler Publication
3. Electronic Measurement & Instrumentation By H. Cooper – PHI.

Reference Books:

1. Electronics Instruments & Measurement by David A. Bell – PHI.
2. J.B.Gupta, Electrical & Electronics Measurements and Instrumentation; S.K. Kataria and Sons.
3. Kalsi, G.C., Electronic Instrumentation, TMH.
4. Bouwens, A.J., Digital Instrumentation, McGraw Hill.

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Second Year Fourth Semester Curriculum
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Course Code: PC-EI402	Professional Core Courses
Course Name: Industrial Instrumentation	**Semester:** Fourth
Programme: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Lectures: 45	
Pre-Requisites: Sensors and Transducers	

A. Learning Objectives:

The objective of this course is:

- To familiar the students with industrial instruments used in various industries.
- To acquire knowledge about various techniques used for measurement of process variables such as temperature, pressure, flow and level.
- To equip the students with the basic knowledge of industrial processes.
- To learn the construction and working of different types of temperature, pressure, flow and level transducers.
- To provide the concept of possible sources of error and possible remedies when performing measurements.
- To realize the basic concepts of hazardous area classification.

B. Course Content:

Module No.	Description of Topic	Contact Hrs.
1	Temperature Measurement: Temperature and heating definitions, Standards, Temperature scales. Filled in Systems Thermometer: Liquid, gas and vapor pressure, construction details and comparison, ranges, sources of errors in filled in systems and their compensation, Bimetallic thermometer and thermostats. Electrical Methods of Temperature Measurement: Resistance Temperature Detector (RTD), Thermistor, Thermocouple, Thermo-well, Thermo-pile. Radiation Methods of Temperature Measurement: Radiation fundamentals, general form of radiation measurement system. Total radiation & selective radiation pyrometers, Optical	8
2	Pressure Measurement: Units of pressure, Classification of pressure gauges. Manometer: Various types, accuracy, range, errors. Elastic Pressure Gauges: Bourdon tube, diaphragm, Capsule gauge, Differential pressure gauge and its applications, Testing and Calibration of pressure gauges – Dead weight tester. Electrical Type: Capacitive, Piezo-electric, Piezo resistive and Resonator type. Vacuum Gauges: McLeod gauge, Knudsen gauge, Thermal conductivity gauges and Ionization gauges. Pneumatic instrumentation - Flapper nozzle system.	8
3	Flow Measurement-I: General consideration of fluid flow rate meters, classification of flow	8

	meters, units, Laminar flow, Reynolds number. Effect of temperature and pressure on flow rate measurement. Fixed and variable head type flow meters: Orifice plate- types, installation, pressure tapping and discharge coefficient variation, Venturi tube, Flow nozzle, Dall tube, Pitot tube – principle, installation, Annubar - analysis and calculation. Straight run requirements for flow meters. Rotameter - theory, types,	
4	Flow Measurement-II: Mass flow meters: Coriolis, Thermal and Impeller type. Electrical type: Electromagnetic flow meter- principle, construction, different types of excitation schemes used, Ultrasonic flow meter – principle,types, Anemometers. Positive displacement flow meters, Vortex flow meter, Target flow meter and open channel flow measurement. Guidelines for selection and calibration of flow meters.	8
5	Level Measurement: Gauge glass, Float type, Displacers and torque tube- construction and working, errors and ranges. Air purge/ bubbler system, Hydrostatic pressure type, Boiler drum level measurement. D/P type sensors and their installation arrangement. Electrical types: Resistance tapes, Capacitance level sensor- principle, types, installation, Ultrasonic sensor, Optical level sensor, Laser level, Microwave type, Radiation type.	7
6	Industrial Safety Measurement: Introduction, Electrical hazards, Hazardous areas and classification, Non hazardous areas, Enclosures – NEMA and IP codes Methods of Protection – Explosion proof, intrinsic safety, Purging and Pressurization, Non-Incendiary; IEC, Equipment Protection Level (EPL). Electromagnetic Interference and earth loops	5

C. Course Outcomes:

Upon successful completion of this course, a student will be able to:

CO1: Acquire the knowledge of use of temperature, pressure, flow and level sensors and transducers in the field of Instrumentation.
CO2: Explain the operation of transducers for temperature, pressure, fluid flow and level measurement.
CO3: Describe the specification of different process instruments and advantages and disadvantages.
CO4: Identify, formulate and solve engineering problems related to measurement of process parameters.
CO5: Select and design suitable instruments to meet the requirements of industrial applications.
CO6: Comprehend the methods of hazard identification and safety measures.

D. Learning Resources:

Text Books:

1. Krishnaswamy. K & Vijayachitra. S, Industrial Instrumentation, New Age International

Publishers, New Delhi.
2. Patranabis. D, Principle of Industrial Instrumentation, 2nd edition, Tata McGraw Hill, New Delhi.
3. Singh S.K, Industrial Instrumentation and Control, Tata McGraw Hill, New Delhi.
4. Anand M.M.S., Electronic Instruments and Instrumentation Technology, Prentice Hall of India, New Delhi.

Reference Books:

1. Liptak B.G., Process Measurement and Analysis, 3rd edition, Chilton Book Company, Radnor, Pennsylvania, 1995.
2. Douglas M. Considine, Process/Industrial Instruments and Control Handbook, 4th edition, McGraw Hill, Singapore.
3. Doeblin E. O., Measurement Systems: Application and Design, 4th edition, McGraw Hill, New York.
4. Curtis D. Johnson, Process Control Instrumentation Technology, Prentice Hall, India.

Department of Applied Electronics & Instrumentation Engineering
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Affiliated to MAKAUT and approved by AICTE
Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Second Year Fourth Semester Curriculum
Applicable from Academic Session 2019-20

Course Code: PC-EI403	**Category:** Professional Core Courses
Course Name: Microprocessor and Microcontroller	**Semester:** Fourth
Programme: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-1-0	**Credit:** 4
Total Lectures: 60	**Full Marks:** 100
Pre-Requisites: Digital Electronics	

A. Learning Objectives:

- To introduce the architecture and organization of typical microprocessors and microcontroller
- To develop assembly language programming skill of microprocessor and microcontroller along with applications.
- To familiarize the technique for interfacing memory and peripheral devices to microprocessor, including several specific standard I/O devices.
- To understand the hardware/software trade-offs involved in the design of microprocessor based systems.

B. Course content:

Module No.	Description of Topic	Contact Hrs.
1	8085 Processor: Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization and interfacing –I/O ports and data transfer concepts– Timing Diagram – Interrupts.	14
2	Programming of 8085 Processor: Instruction -format and addressing modes – Assembly language format – Data transfer, data manipulation & control instructions – Programming: Loop structure with counting & Indexing – Look up table – Subroutine instructions – stack.	14
3	8051 Micro Controller: Hardware Architecture, pintouts – Functional Building Blocks of Processor – Memory organization –I/O ports and data transfer concepts– Timing Diagram – Interrupts.	10
4	Peripheral Interfacing: Study on need, Architecture, configuration and interfacing, with ICs: 8255, 8254, 8251, A/D and D/A converters &Interfacing with 8085.	10
5	Micro Controller Programming & Applications: Data Transfer, Manipulation, Control Algorithms& I/O instructions – Simple programming exercises key board and display interface.	6
6	Architecture of Typical 16-Bit Microprocessors (Intel 8086): Introduction to a 16 bit microprocessor, Architecture and Register Organization, Memory address space and data organization.	6

C. Course Outcomes:

CO1: To construct and analyze assembly language program in 8085 and 8086 microprocessor to solve various complex engineering problem.

CO2: To evaluate processing time of program and devise technique to reduce execution time to improve microprocessor performance.

CO3: To design interfacing circuits to the microprocessor to communicate with external devices, which can be associated with public safety, health, security and other societal and environmental concerns.

CO4: To design memory devices using memory chips and utilize the knowledge in memory based devices used in academics and industry.

CO5: To study 8051 microcontroller for using it in real life applications.

CO6: To learn architecture and programming of programmable peripheral devices such as 8255, 8254, 8279 to use them in larger industrial and societal application.

D. Learning Resources:

Text Books:

1. Ramesh S. Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085A /8080A, WILEY EASTERN LIMITED.
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, Second Edition, Pearson education, 2011.
3. A.H. Mukhopadhyay, Microprocessor, Microcomputer and Their Applications, 3rd Edition Alpha Science International, Ltd.

References:

1. Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085, 8086, 8051, McGraw Hill Edu, 2013.
2. M. Rafiquzzman: Microprocessors: Theory & Applications (Intel & Motorola), PHI. 2. Berry .B. Bray INTEL 8086/88, 80186, 286, 386, 486, Pentium Pro & Pentium IV.
3. Berry .B. Bray INTEL 8086/88, 80186, 286, 386, 486, Pentium Pro & Pentium IV.

Department of Applied Electronics & Instrumentation Engineering
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Second Year Fourth Semester Curriculum
Applicable from Academic Session 2019-20

Course Code: ES-CS401	**Category:** Engineering Science Courses
Course Name: Data Structure and Algorithm	**Semester:** Fourth
Programme: AEIE	**Course Coordinator:** Department of Computer Science
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Lectures: 45	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

A. Learning Objectives:

In view of the notable advancement of data structure in recent few years, it is essential for the students to be familiar with various algorithmic approaches to write program thereby solving problems. The objectives of the course are mentioned below:

- To represent the significance of algorithms with its properties for solving problems in different engineering domains
- To provide the characteristics of various Abstract Data Type for creating the solution-strategies
- To demonstrate the significance of non-linear data structures with respect to the access and organization of records
- To clarify various sorting and searching algorithms
- To expose merits and demerits of altered algorithms in terms of time-complexity
- To enhance the ability of selecting appropriate data structure and algorithm for solving specific problems

B. Course Content:

Module No.	Description of Topic	Contact Hours.
1	Introduction of Data Structure: Necessity of data structure. Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type. Algorithms and programs, basic idea of pseudo-code. Properties of an Algorithm, Algorithm efficiency and analysis, time and space analysis of algorithms – order notations.	3
2	Array and Linked List :Array: Different representations – row major, column major. Sparse matrix - its implementation and usage. Array representation of polynomials. Linked List: Singly linked list, Insertion-Deletion-Display(also in reverse order) Operations of Linked List, circular linked list, doubly linked list, linked list representation of polynomial and applications.	7
3	Linear Data Structure: Stack and Queue:Stack and its implementations (using array, using linked list), applications. Queue, circular queue, dequeues. Implementation of queue- both linear and circular (using array, using linked list), applications.	10

	Recursion: Principles of recursion – use of stack, differences between recursion and iteration, tail recursion. Applications - The Tower of Hanoi, Eight Queens Puzzle.	
4	Nonlinear Data structures: Trees Basic terminologies, forest, tree representation (using array, using linked list). Binary trees - binary tree traversal (pre-, in-, post- order), threaded binary tree (left, right, full) - non-recursive traversal, algorithms using threaded binary tree, expression tree. Binary search tree- operations (creation, insertion, deletion, searching). Height balanced binary tree – AVL tree (insertion, deletion with examples only). B- Trees – operations (insertion, deletion with examples only), Brief overview of B++ tree, Red-Black tree.	11
5	Nonlinear Data structures: Graphs Graph definitions and concepts (directed/undirected graph, weighted/un-weighted edges, sub-graph, degree, cut-vertex/articulation point, pendant node, clique, complete graph, connected components – strongly connected component, weakly connected component, path, shortest path, isomorphism).Graph representations/storage implementations – adjacency matrix, adjacency list, adjacency multi-list. 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	6
6	Searching, Sorting, Hashing: Sorting Algorithms: Bubble sort and its optimizations, insertion sort, shell sort, selection sort, merge sort, quick sort, heap sort (concept of max heap, application – priority queue), radix sort, bucket sort. Searching: Sequential search, binary search, interpolation search. Hashing: Hashing functions, collision resolution techniques	8

C. Course Outcomes:

Upon successful completion of this course, a student will be able to:

CO1: Acquaint with the different properties of algorithm and recognize various types of data structure along with the relevance of their application for solving real world problems.

CO2: Comprehend the concept of linked list along with its difference from array and its many applications for solving different problems.

CO3: Know the concept of ADT (like stack, queue) and recognize its significance for mapping various real life problems to the programming ground to get the solutions of the
corresponding problems.

CO4: Create the concept of non-linear data structure like graph, tree and their appliance in various problems in societal issues.

CO5: Know different searching and sorting approaches and select proper data structure and algorithm by analyzing time complexity and space complexity for specific problems.

CO6: Apply hashing techniques for minimizing searching time and have the knowledge of file organization.

D. Learning Resources:

Text Books:

1. "Data Structures And Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung.
2. "Fundamentals of Data Structures of C" by Ellis Horowitz, SartajSahni, Susan Anderson-freed.
3. "Data Structures in C" by Aaron M. Tenenbaum.
4. "Data Structures" by S. Lipschutz.

Reference Books:

1. "Data Structures Using C" by ReemaThareja
2. "Data Structure Using C", 2/e by A.K. Rath, A. K. Jagadev.
3. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.

Department of Applied Electronics & Instrumentation Engineering
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Second Year Fourth Semester Curriculum
Applicable from Academic Session 2019-20

Course Code: BS-BIO401	**Category:** Basic Science course
Course Name: Biology	**Semester:** Fourth
Programme: AEIE	**Course Coordinator:** Department of Basic Science & Humanities
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hour Classification: L-T-P :3-0-0	**Credit:** 3
Total lectures: 45	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

A. Learning Objectives:

The syllabus of Environmental Engineering has been formulated for B. Tech. students by MAKAUT with an eye to

- Convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry.
- Provide basic knowledge about our environment and importance of different types of ecosystem and biodiversity on existence of life on Earth.
- Convey that classification per se is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted.
- Convey that "Genetics is to biology what Newton's laws are to Physical Sciences"
- Convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine.
- Convey that without catalysis life would not have existed on earth.
- Understand the molecular basis of coding and decoding genetic information and information transfer from parent to offspring.
- Analyze different biological processes.
- Convey that the fundamental principles of energy transactions are the same in the physical and biological world.

B. Course content:

Module No.	Description of Topic	Contact Hours
1	Introduction: Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry. Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.	4

2	Classification Purpose: To convey that classification per se is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilisation -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitataacquatic or terrestrial (f) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D.Melanogaster, C.elegance, A. Thaliana,	5
3	Genetics Purpose: To convey that "Genetics is to biology what Newton's laws are to Physical Sciences". Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.	6
4	Bio molecules Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids. Enzymes Purpose: To convey that without catalysis life would not have existed on earth. Enzymology: How to monitor enzyme catalysed reactions. How does an enzyme catalyse reactions? Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.	11
6	Metabolism Purpose: The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO_2 + H_2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis).Energy yielding and energy consuming reactions. Concept of Energy charge.	7

	Microbiology Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.	

C. Course Outcomes:

After studying the course, the student will be able to:

- **CO1:** Describe how biological observations of 18th Century that lead to major discoveries.
- **CO2:** Convey that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological.
- **CO3:** Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring.
- **CO4:** Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one canimagine.
- **CO5:** Classify enzymes and distinguish between different mechanisms of enzyme action.
- **CO6:** Identify DNA as a genetic material in the molecular basis of information transfer.
- **CO7:** Analyse biological processes at the reductionistic level.
- **CO8:** Apply thermodynamic principles to biological systems.
- **CO9:** Identify and classify microorganisms.

D. Learning Resources:

1. Biology:Aglobalapproach:Campbell,N.A.;Reece,J.B.;Urry,Lisa;Cain,M,L.;Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2. OutlinesofBiochemistry,Conn,E.E;Stumpf,P.K;Bruening,G;Doi,R.H.JohnWileyandSons
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers.

Department of Applied Electronics & Instrumentation Engineering
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Second Year Fourth Semester Curriculum
Applicable from Academic Session 2019-20

Course Code: HM-HU401	**Category:** Humanities and Social Sciences including Management Courses
Course Name: Values and Ethics in Profession	**Semester:** Fourth
Programme: AEIE	**Course Coordinator:** Department of Basic Science & Humanities
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hour Classification: L-T-P:2-0-0	**Credit:** 2
Total Contact Hours: 30	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

A. Learning Objectives: To understand the ethical and moral problems faced in the corporate and wider philosophical settings along with social importance and their intellectual challenges are given its due placement.

B. Course Content:

Module No.	Description of Topic	Contact Hrs.
1	Being good and responsible Gandhian values such as truth and non-violence – comparative analysis on leaders of past and present – society's interests versus self interests – Prevention of harassment, violence and terrorism - Personal Social Responsibility: Helping the needy, charity and serving the society	4
2	Profession and Human Values Values Crisis in contemporary society, Nature of values: Value Spectrum of a good life, Psychological values: Integrated personality; mental health, Dishonesty - Stealing - Malpractices in Examinations - Plagiarism – Abuse of technologies: Hacking and other Cyber Crimes, addiction to mobile phone usage, video games and social networking websites.	6
3	Corruption: ethical values, causes, impact, laws, prevention – electoral malpractices – white collar crimes - tax evasions – unfair trade practices.	2
4	Addiction and Health Peer pressure, Drug Abuse Alcoholism: ethical values, causes, impact, laws, prevention-ill effects of smoking-Prevention of suicides-Sexual Health: Prevention and impact of pre- marital pregnancy and Sexually Transmitted Diseases. Abuse of different types of legal and illegal drugs: ethical values, causes, impact, laws and prevention	4
5	Ethics of Profession Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.	6
6	Effects of Technological Growth Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development, Energy Crisis: Renewable Energy Resources, Environmental degradation and pollution. Eco-friendly Technologies.	8

	Environmental Regulations, Environmental Ethics, Appropriate, Technology Movement of Schumacher; later developments, Technology and developing notions. Problems of Technology transfer, Technology assessment impact analysis. Human Operator in Engineering projects and industries. Problems of man, machine, interaction, Impact of assembly line and automation.	

C. Course Outcomes:

On completion of the course, the students will be able to solve the day-to-day problems and their allied alternative decision making towards social impact.
Analyse and give solution to business environment.
Expected this course meets the following student outcomes:

- **CO1:** An understanding of professional, ethical, legal, security and social issues and responsibilities g) An ability to communicate effectively with a range of audiences.
- **CO2:** An ability to address contemporary issues and analyze the local and global impact of computing and engineering solutions on individuals, organizations and society
- **CO3:** Recognition of the need for and an ability to engage in continuing professional learning (lifelong learning)

D. Learning Resources:

Textbooks:

1. Human Values- A.N Tripathi.
2. Christine E. Gudorf, James Edward Huchingson, 'Boundaries: A Casebook in Environmental Ethics', Georgetown University Press, 2010

References:

1. Ethics- S. Balachandran, K.C.R.Raja& B.K Neir
2. Values and Ethics in Profession-SisirMazumder (Everest)
3. Ethics in Engineering- Martin Schinzinge
4. Mike W Martin & Ronald Schnizinger, Engineering Ethics, New Delhi: Tata Reference McGraw Hill, Latest Edition
5. OC Ferrell, John Paul Frederich, Linda Ferrell; Business Ethics – Ethical Books Decision making and Cases- 2007 Edition, Biz Tantra, New Delhi
6. L.H. Newton & Catherine K.D., "Classic cases in Environmental Ethics", Belmont: California Wadsworth, 2006

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Second Year Fourth Semester Curriculum
Applicable from Academic Session 2019-20

Course Code: PC-EI491	**Category:** Professional Core Course
Course Name: Electrical & Electronic Measurement Lab	**Semester:** 4th
Programme: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Practical
Contact Hour Classification: L-T-P:0-0-3	**Credit:** 1.5
Pre-Requisites: No pre-requisites	

A. Course Content:

Laboratory Experiments :	
1	Calibration of dynamometer type Ammeter and voltmeter by Potentiometer.
2	Measurement of Low Resistance using Kelvin Double Bridge.
3	Measurement of frequency by Wien Bridge.
4	Measurement of inductance by Anderson Bridge.
5	Measurement of capacitance by De Sauty Bridge.
6	Study the Static Characteristics of a Measuring Instrument.
7	Study the Dynamic Characteristics of a Measurement System.
8	Acquaintance with basic Structure of Digital Multi Muter and Measurement of Different Electrical Parameters.
9	Wave and Spectrum Analysis using Q – Meter.
10	Study the static and dynamic characteristics of VCO.
11	Mandatory Design and Implementation of Mini Project

B. Course Outcomes:

At the end of the course a student will be able to –

CO1: Identify different analogue & digital instruments both AC and DC, source and sink devices, their specifications, constructions using basic knowledge of electrical measurement.

CO2: Perform the experiments, interpret measured data and compare the measured value with the true value of a quantity, calculate error in measurement, draw calibration & error curve using appropriate techniques.

CO3: Develop the concept of calibration and understand the limitations of the different measuring instruments.

CO4: Review and analyse different methods of measurement of frequency, self-inductance, Capacitance and resistance using AC and DC bridges and provide valid concluding remarks.

CO5: Learn the necessity of safety measures of using different instruments and handling of high voltage AC.

CO6: Work as a member in a team, communicate with each other, and share their independent thinking to perform the experiment successfully.

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Second Year Fourth Semester Curriculum
Applicable from Academic Session 2019-20

Course Code: PC-EI492	**Category:** Professional Core Course
Course Name: Microprocessor and Microcontroller Lab	**Semester:** 4th
Programme: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Practical
Contact Hour Classification: L-T-P:0-0-3	**Credit:** 1.5
Pre-Requisites: Digital Electronics	

A. Course Content:

Laboratory Experiments :	
1	a) Familiarization with 8085 trainer kit components. b) Familiarization with 8085 simulator on PC.
2	a) Study of prewritten programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical) on the simulator. b) Assignments based on above
3	PROGRAMMING USING KIT/SIMULATOR FOR i)Table look up ii) Copying a block of memory iii) Shifting a block of memory iv) Packing and unpacking of BCD numbers v) Addition of BCD numbers vi) Binary to ASCII conversion vii) String Matching etc
4	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 through 8255.
5	INTERFACING WITH I/O MODULES: a) ADC b) Speed control of mini DC motor using DAC c) Stepper motor d) Temperature sensor and display temperature e) Relay
6	Mandatory Design and Implementation of Mini Project

B. Course Outcomes:

CO1: To construct and apply the assembly level programming of microprocessor and microcontroller.
CO2: To develop the programming logic and concept with the help of algorithm or flowchart.
CO3: To troubleshoot assembly language program along with interactions between software and hardware.
CO4: To practice the interfacing of microprocessor with peripheral devices for various applications.
CO5: To develop the ability to communicate effectively with fellow group members for dividing and sharing the assignments among themselves.

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Second Year Fourth Semester Curriculum
Applicable from Academic Session 2019-20

Course Code: ES-CS491	**Category:** Engineering Science Courses
Course Name: Data Structure and Algorithm	**Semester:** 4th
Programme: AEIE	**Course Coordinator:** Department of Computer Science
Nature of Course: Mandatory	**Type of Course:** Practical
Contact Hour Classification: L-T-P:0-0-3	**Credit:** 1.5
Pre-Requisites: No pre-requisites	

A. Course Content:

Laboratory Experiments :	
1	Array Addition & Multiplication of Arrays Implementation of Sparse Matrices
2	Abstract Data Type Stacks and Queues: Implementation of Stack using Array, Conversion of infix notation into its corresponding prefix & postfix forms along with the evaluation of postfix expression Addition, Deletion of elements of Linear Queue & Circular Queue Implementation of Stack using Queue and vice-versa
3	Recursion Tail-Recursion, Tower of Hanoii
4	Linked List Implementation of linked lists: inserting, deleting, and inverting a linked list. Implementation of stacks & queues using linked list Polynomial addition, Polynomial multiplication
5	Searching & Sorting Operations Searching: Linear Search, Binary Search Sorting: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort & Heap Sort
6	Nonlinear Data structures Tree Traversal of Binary Search Tree, Threaded binary tree traversal Height balanced binary tree – AVL tree (insertion, deletion) & B- Trees – operations (insertion, deletion)
7	Hashing Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.
8	Mandatory Design and Implementation of Mini Project

B. Course Outcomes:

CO1: To know the concept of linear data structure like array along with its applications for solving various mathematical problems concerned with different topics like the operations of matrices.

CO2: To recognize the various types of ADT like stack & queue with their operations and also their applications in the conversion among infix, prefix & postfix notations.

CO3: To comprehend the significance of recursion for solving problems like Tower of Hanoi.

CO4: To be acquainted with the concept of linked list with its classification and the relevance of the usage of such concepts according to the nature of the problems.

CO5: To be aware with various algorithms applied for searching and sorting purposes with the differences regarding their working principles.

CO6: To understand the significance of non-linear data structures by the implementations of operations done by Binary Search Tree(BST) etc. and also find the importance of hashing in case of any searching problems.

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Second Year Fourth Semester Curriculum
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Course Code: HM-HU481	**Category:** Humanities and Social Sciences including Management Courses
Course Name: Advanced Language Lab	**Semester:** 4th
Programme: AEIE	**Course Coordinator: :** Department of Basic Science & Humanities
Nature of Course: Mandatory	**Type of Course:** Practical
Contact Hour Classification: L-T-P:0-0-2	**Credit:** 1
Pre-Requisites: No pre-requisites	

Objective: The overall aim of this course is to inculcate a sense of confidence in the students and help them to become good communicators in their social as well as professional lives.

A. Course Content:

Introductory lecture is to be given to the students so that they get a clear idea of the syllabus and understand the need for having such a practice lab in the first place (3 hours)

Listening Skills: Audios & Videos related to current affairs will be shown from sources like British Council, BBC, NDTV, TOEFL, IELTS etc to hone the listening skills of students so that they may identify important points and effective strategies in preparation for their speaking skills

Speaking Skills:

1. Prerequisite for Speaking Activities: Mastering Linguistic, Paralinguistic features, Pronunciation, Body Language Voice modulation Stress, Intonation, Pitch & Accent of connected speech

2. One Minute Speech: Students will be taught to organize their thoughts and ideas and present them in a coherent manner in front of an audience on any given topic. While giving the speech they will be taught to demonstrate correct body language, voice modulation and appropriate pronunciation

3. Group Discussion: The students are made to understand proper language, etiquette and strategies for group discussion. Audio -Visual aids as pre-requisite for group discussion will be used to hone listening skills. After wards the class is divided into groups and the students have to discuss on given topic.

4. Mock Interview: Students are taught the strategies of a successful interview. They then have to face rigorous practices of mock-interviews.

Reading Skills:

News Paper Reading: Students are advised to how to read current affairs from leading newspapers, comprehend and summaries the news articles and express their opinion in their own words. This activity will help the students immensely to speak during one minute speech and group discussion.

Writing Skills:

- Resume Writing: Students will be taught how to write a professional resume for campus placement & future career.

B. Course Outcomes:

CO1: To distinguish between various contexts of human communication, e.g., one-to-one, small group, organizational, formal, informal, media, family, intercultural communication, technologically mediated communication, etc.

CO2: To use knowledge of interview processes in answering typical HR questions and to demonstrate proper interview etiquette.

CO3: To analyze a given topic, enumerate main points and deliver a structured speech with proper introduction and conclusion.

CO4: To utilize the key skills like active listening, managing conflict, collaborative communication, and proper body language successfully while discussing any given topic in a group.

CO5: To defend opinions with evidence and argument while speaking to an audience or discussing a topic in a group.

CO6: To employ effective presentation skills to speak about general and academic topics in front of an audience and transfer this skill successfully to higher semester seminars and future career.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Third Year Fifth Semester Curriculum
(Applicable from Academic Session 2020-21).

THIRD YEAR FIFTH SEMESTER PROPOSED SYLLABUS

Third Year Fifth Semester								
Theory								
Sl No	Category	Code	Course Title	Contact				Credit Points
				L	T	P	Total	
1	Professional Core Courses	PC-EI501	Control System	3	0	0	3	3
2	Professional Core Courses	PC-EI502	Communication Techniques	3	0	0	3	3
3	Professional Core Courses	PC-EI503	Electromagnetic Theory	3	0	0	3	3
4	Professional Elective Courses-I	PE-EI501/ PE-EI502	Fiber Optic Communication & Instrument/Introduction to MEMS	3	0	0	3	3
	Professional Elective Courses-II	PE-EI503/ PE-EI504	Embedded System/Power Electronics & Drives	3	0	0	3	3
5	Open Elective Courses-I	OE-EI501/ OE-EI502	Object Oriented Programming Language/Data Base Management System	3	0	0	3	3
Total Theory								18
Practical								
1	Professional Core Courses	PC-EI591	Control System Lab	0	0	3	3	1.5
2	Open Elective Courses -I	OE- EI591/ OE- EI592	Object Oriented Programming Language Lab/Data Base Management System Lab	0	0	3	3	1.5
3	Professional Core Courses	PC-EI592	Industrial Instrumentation Lab	0	0	3	3	1.5
4	Seminar	EI581	Seminar					2
Total Practical								6.5
Total of Fifth Semester								**24.5**

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Third Year Fifth Semester Curriculum
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Course Code: PC-EI501	**Category:** Professional Core Course
Course Name: Control System	**Semester:** Fifth
Program: AEIE	**Course Coordinator:** Electrical Department
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 46	**Full Marks:** 100
Pre-Requisites: Engineering mathematics that teaches complex variables and Laplace transform.	

A. Learning Objectives:

- To understand the use of transfer function models for analysis of physical systems and introduce the control system components.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open lop and closed–loop frequency responses of systems.
- To introduce state variable representation of physical systems.
- To introduce stability analysis and design of compensators.

B. Course Content:

Module No.	Description of Topics	Contact Hours
1.	Introduction and overview: Define the Control problem with examples. Meaning of reference input, Control input, disturbance input and controlled output.	2
2.	Modeling: Define Linear Time variant system. Modeling problem for linear time invariant system. Impulse response and convolution integral for LTI system. Transfer function modeling of systems: Input output relation in Laplace domain and Transfer function; Block Diagram reduction, signal flow graph, Mason's Gain theorem. Representation of system and reduction to their transfer function. Modeling of some physical system--- Electrical circuit, Mechanical motors, thermal (room temperature), pneumatic etc. Concepts of States, State space modeling, Solution of state equations, State space to transfer function, transfer function to state space (realization problem). Examples of state space modeling---- Coupled tank system, inverted pendulum, biological system etc.	10
3.	Characterization of Plant:	10

	Definition of stability. Criteria for stability of a system. Pole-zero concept, Routh-Hurwitz Criterion, Eigen value. Equivalence of pole and Eigen value. Time domain: Standard test signals. Time response of first and second order systems for standard test inputs. Application of initial and final value theorem. Design specifications for second-order systems based on the time-response. Frequency-domain: Meaning of frequency response, Analytical evaluation of Frequency response of given transfer function. Polar plots, Bode plots and Nyquist plot for representation of frequency response. Gain cross over frequency, phase cross over frequency. Role off rate. DC gain, corner frequency.	
4.	Characterization of feedback loop: Advantages of feedback. Loop Stability: Bode and Nyquist plot criteria. Bode stability criteria Nyquist stability criteria, loop robustness, gain margin, phase margin, delay margin. Loop performance: Frequency domain parameter sensitivity, tracking, disturbance rejection. Loop performance in time domain: Transient response: Root locus, Steady state response: Steady state error.	9
5.	Controller Design problem: PID Control. Frequency domain Loop shaping approach: Lead, Lag, Lag-lead compensator. Model matching approach: Two degree of freedom controller. State feedback approach: Controllability, Observability, Pole placement, State Observer.	8
6.	Introduction to Optimal Control and Nonlinear Control: Nonlinear Control: Linearization about operating points. Optical Control: Performance Indices and their optimization. LQR problem.	7

C. Course Outcomes:

At the end of this course, students will understand

CO1: The modeling of linear-time-invariant systems using transfer function and state-space representations.

CO2: The concept of stability and its assessment for linear-time invariant systems.

CO3: Characterization of plants and control loops.

CO4: The need for compensation, & the methods used for compensation techniques.

CO5: Linearization of non-linear system

CO6: Performance indices for optimal control.

D. Learning Resources:

1. Automatic Control System: Basic analysis and design by William A. Wolovich, The Oxford Series in Electrical and Computer Engineering.
2. B. C. Kuo, "Automatic Control System", 10th Mc Graw Hill.
3. K. Ogata, "Modern Control Engineering", Prentice Hall, 5th edition.
4. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International, 2009
5. Control Systems Engineering, 6th edition, ISV (WSE), by Norman Nise, Wiley
6. Control Systems, Ambikapathy, Khanna Publishing House, 2018.
7. Control Systems, N K Sinha, New Age International Pvt, 2013.

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Third Year Fifth Semester Curriculum
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Course Code: PC-EI502	**Category:** Professional Core Course
Course Name: Communication Techniques	**Semester:** Fifth
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 45	**Full Marks:** 100
Pre-Requisites: Knowledge of signals and systems and some probability.	

A. Learning Objectives:

- To introduce the concepts of various analog modulations and their spectral characteristics.
- To understand the properties of random process.
- To know the effect of noise on communication systems.
- To study the limits set by Information Theory.

B. Course Content:

Module No.	Description of Topics	Contact Hours
1.	The elements of communication systems, need for antenna, origin of noise and its effects, important of different noise in communication, importance of SNR in the system design **Basic principle of Amplitude Modulation:** Time domain representation of AM signal (expression derived using a single tone message), modulation index, frequency domain (spectral) representations, illustration of the carrier and side band components; transmission bandwidth for AM. **Generation and Detection of AM wave:** Different methods of generation and demodulation.	9
2.	Principle of Super heterodyne receivers: Super heterodyning principle, intermediate frequency, Local oscillator frequency, image frequency. Basic principle of non-linear (FM and PM) modulation, Generation of FM wave and detection of PM wave, relation between FM and PM, generation of PM from FM and vice versa. Sampling theorem, sampling rate, impulse sampling, reconstruction from sampling, Aliasing. Analog Pulse Modulation-PAM (natural and flat top sampling), PPM, PWM. Basic concept of Pulse Code Modulation-Block diagram of PCM, Multiplexing-	9
3.	Digital transmission: Concept of Quantization & Quantization error, Uniform quantizer, Non-uniform quantizer, A-law and μ-law. Encoding, coding efficiency. Line coding & properties, NRZ & RZ, AMI, Manchester coding, PCM, DPCM. Base band pulse transmission, Matched filter, error rate due to noise, ISI, Raised cosine function, for distortion-less base band binary transmission, Eye pattern, Signal power in binary digital signal.	7

4.	Bit rate, Baud rate, Information capacity, Shanon's limit, M-ary encoding, Introduction to the different digital modulation techniques- ASK.FSK, PSK, BPSK, QPSK, mention of 8 BPSK, 16 BPSK. Bit rate, Baud rate, Information capacity, Shanon's limit, M-ary encoding, Introduction to the different digital modulation techniques- ASK.FSK, PSK, BPSK, QPSK, mention of 8 BPSK, 16 BPSK.	7
5.	Introduction to QAM, basic of 8 QAM, 16 QAM. Basic concept of Delta modulating, Adaptive delta modulation. Introduction to the concept DPCM. Basic concept of spread spectrum modulation.	6
6.	Introduction to coding theory: Introduction, News value & Information content, Entropy, Mutual information, Information rate, Shanon-Fano algorithm for encoding, Shanon's theorem- source coding theorem, Channel coding theorem, Information capacity theorem. Basic principle of Error control & coding.	7

C. Course Outcomes:

CO1: Analyze and compare different analog modulation schemes for their efficiency and bandwidth.

CO2: Analyze the behavior of a communication system in presence of noise.

CO3: Investigate pulsed modulation system and analyze their system performance.

CO4: Analyze different digital modulation schemes and can compute the bit error performance.

D. Learning Resources:

Text Books:

1. An Introduction to Analog and Digital communication, Simon Haykin, Wiley India.
2. Analog communication system, P. Chakrabarti, Dhanpat Rai & Co.
3. Principle of digital communication, P. Chakrabarti, Dhanpat Rai & Co.
4. Modern Digital and Analog Communication systems, B.P. Lathi, Oxford university press

Reference Books:

1. Digital and Analog communication Systems, Leon W Couch II, Pearson Education Asia.
2. Communication Systems, A.B. Carlson, Mc-Graw Hill.

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Third Year Fifth Semester Curriculum
(Applicable from Academic Session 2020-21).

Course Code: PC-EI503	**Category:** Professional Core Course
Course Name: Electromagnetic Theory	**Semester:** Fifth
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 45	**Full Marks:** 100
Pre-Requisites: Knowledge of differential and integral calculus.	

A. Learning Objectives:

1. To introduce the basic mathematical concepts related to electromagnetic vector fields
2. To impart knowledge on the concepts of Electrostatic fields, electrical potential, energy density and their applications. Magneto static fields, magnetic flux density, vector potential and its applications.
3. Different methods of emf generation and Maxwell's equations Electromagnetic waves and characterizing parameters.

B. Course Content:

Module No.	Description of Topics	Contact Hrs
1.	Introduction: Co-ordinate systems and transformation, Cartesian coordinates, Circular cylindrical coordinates, Spherical coordinates & their transformation. Differential length, area and volume in different coordinate systems. Solution of problems. Introduction to Vector calculus: DEL operator, Gradient of a scalar, Divergence of a vector & Divergence theorem, Curl of a vector & Strokes theorem, Laplacian of a scalar, Classification of vector fields, Helmholtz's theorem. Solution of problems.	9
2.	Scalar and Vector fields, Coulomb's Law and concept of Electric Field, Divergence, the Divergence Theorem and Gauss' Law, Concept of Electrostatic Potential, Poisson's Equation, Energy in the Field, Capacitance, capacitance of common two-plate capacitors, including two-wire capacitors, Dielectrics, dielectric boundary conditions, Solution of Laplace's Equation and Poisson's Equation in 1-D Capacitance. Scalar and Vector fields, Coulomb's Law and concept of Electric Field, Divergence, the Divergence Theorem and Gauss' Law.	9
3.	Concept of Electrostatic Potential, Poisson's Equation, Energy in the Field, Capacitance, capacitance of common two-plate capacitors, including two-wire capacitors, Dielectrics, dielectric boundary conditions, Solution of Laplace's Equation and Poisson's Equation in 1-D Capacitance.	6

4.	Force due to a Magnetic field, Force due to combined Electric and Magnetic fields, Biot-Savart Law, calculation of Magnetic Field for simple coil configurations, Ampere's Law, Magnetic flux, Stokes theorem, Magnetic materials, magnetic boundary conditions, Solution of problems. Electromagnetic fields: Faraday's law, Transformer and motional emf, Displacement current, Maxwell's equations, Time varying Potential, Time harmonic fields. Solution of problems.	6
5.	Electromagnetic wave propagation: Wave equation, Wave propagation in lossy dielectric, Plane waves in loss less dielectric, Plane wave in free space, Plane wave in good conductor, Skin effect, Skin depth, Power & Poynting vector, Reflection of a plane wave at normal incidence, reflection of a plane wave at oblique incidence, Polarization. Solution of problems. Electromagnetic wave propagation: Wave equation, Wave propagation in lossy dielectric, Plane waves in loss less dielectric, Plane wave in free space, Plane wave in good conductor, Skin effect, Skin depth, Power & Poynting vector, Reflection of a plane wave at normal incidence, reflection of a plane wave at oblique incidence, Polarization. Solution of problems	9
6.	Transmission line: Concept of lump & distributed parameters, Line parameters, Transmission line equation & solutions, Physical significance of solutions, Propagation constants, Characteristic impedance, Wavelength, Velocity of propagation. Solution of problems.	6

C. Course Outcomes:

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

CO1: To understand the basic laws of electromagnetism.
CO2: To obtain the electric and magnetic fields for simple configurations under static conditions.
CO3: To analyze time varying electric and magnetic fields.
CO4: To understand Maxwell's equation in different forms and different media.
CO5: To understand the propagation of EM waves.
CO6: To impart knowledge on the concepts of Electrostatic fields, electrical potential, energy density and their applications. Magneto static fields, magnetic flux density, vector potential and its applications. Different methods of emf generation and Maxwell's equations Electromagnetic waves and characterizing parameters.

D. Learning Resources:

Text/References:

1. Principles and Applications of Electromagnetic Fields - Plonsey, R.and Collin, R.E., McGraw Hill. 1961.
2. Engineering Electromagnetics - William H. Hayt, Jr. Fifth Edition.TMH.1999
3. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
4. A Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.
5. A Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.

Department of Applied Electronics & Instrumentation Engineering
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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Third Year Fifth Semester Curriculum
(Applicable from Academic Session 2020-21).

Course Code: PE-EI501	**Category:** Professional Elective Courses - I
Course Name: Optical Instrumentation	**Semester:** Fifth
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Elective	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 45	**Full Marks:** 100
Pre-Requisites: Knowledge of basic optics, Fundamentals of Electromagnetic theory	

A. Learning Objectives:

- To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures.
- To understand the different kind of losses, signal distortion, SM fibers.
- To learn the various optical sources, materials and fiber splicing
- To learn the fiber optical receivers and noise performance in photo detector.

B. Course Content:

Module No.	Description of Topics	Contact Hours
1.	Optical Fibers and Their Properties: Introduction to optical fiber – fiber characteristics – principles of light propagation through a fiber – Different types of fibers and their properties – Losses in the optical fiber – Dispersion – advantages and disadvantages of optical fibers, Connector and splices. Optical Fibers and Their Properties: Introduction to optical fiber – fiber characteristics – principles of light propagation through a fiber – Different types of fibers and their properties – Losses in the optical fiber – Dispersion – advantages and disadvantages of optical fibers, Connector and splices.	12
2.	Optoelectronic Components: Optical sources: LED, Double Heterojunction LED, LD – Optical detectors: PIN, APD – Electro-optic, Magneto optic and Acousto- optic Modulators.	10
3.	Optical switches – coupled mode analysis of directional couplers, electro-optic switches. Optical amplifiers - EDFA, Raman amplifier	3
4.	LASER fundamentals: Three level and four level lasers –Properties of laser –Laser modes – Resonator configuration –Q-switching and mode locking –Cavity damping –Types of lasers –Gas lasers, solid lasers, liquid lasers, semiconductor lasers	9
5.	Industrial Application of LASERS: Laser for measurement of distance, length, velocity, acceleration, current, voltage and Atmospheric effect –Material processing –Laser heating, welding, melting and trimming of material –Removal and vaporization. Medical applications of lasers, laser and tissue	8

6.	Holography– Basic principle-Methods–Holographic interferometry and application.	3

C. Course Outcomes:

CO1: Recognize the structures of Optical fiber and their properties.
CO2: Understand the principles fiber-optic communication, the components and the bandwidth advantages.
CO3: Understand the properties of the optical fibers and optical components.
CO4: Understand operation of lasers, LEDs, and detectors
CO5: Realize the application of Laser.
CO6: Understand the basic principle of Holography.

D. Learning Resources:

Text/Reference Books:

1. Optical Fiber Communication – Principles and Practice, J.M. Senior, Prentice Hall of India, 1985.
2. Fiber Optics and Optoelectronics by R. P. Khare Oxford University Press, 2004
3. Lasers: Principles, Types and Application -K.R.Nambiar
4. Introduction to Optoelectronics, J. Wilson and J.F.B. Hawkes, Prentice Hall of India, 2001.

Department of Applied Electronics & Instrumentation Engineering
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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Third Year Fifth Semester Curriculum
(Applicable from Academic Session 2020-21).

Course Code: PE-EI502	**Category:** Professional Elective Courses -I
Course Name: Introduction to MEMS	**Semester:** Fifth
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Elective	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 45	**Full Marks:** 100
Pre-Requisites: Knowledge of semiconductor device	

A. Learning Objectives:

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques.
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS.

B. Course Content:

Module No.	Description of Topics	Contact Hours
1.	Introduction: Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication – Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.	9
2.	Sensors and Actuators-I: Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors – Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph – Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys.	9
3.	Sensors and Actuators-II: Piezoresistive sensors – Piezoresistive sensor materials – Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.	8
4.	Micromachining: Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies –Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process - Assembly of 3D MEMS – Foundry process.	8

5.	Mechanics of solids in MEMS: Stresses, Strain, Hookes's law, Poisson effect, Linear Thermal Expansion, Bending; Energy methods, Overview of finite element method, Modeling of coupled electromechanical systems.	4
6.	POLYMER AND OPTICAL MEMS: Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.	7

C. Course Outcomes:

CO1: Ability to understand the working principle of MEMS devices and their application.
CO2: Students will be able to explain micro-sensors, micro-actuators, their types and applications.
CO3: Students will be able to explain about fabrication processes for producing micro-sensors and actuators.
CO4: Ability to understand and analyze linear and digital electronic circuits

D. Learning Resources:

Text/Reference 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).
3. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001
4. M. Madou, Fundamentals of Microfabrication, CRC Press, 1997
5. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, 1998
6. M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and Gyroscopes, Elsevier, New York, 2000.

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Third Year Fifth Semester Curriculum
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Course Code: PE-EI503	**Category:** Professional Elective Courses -II
Course Name: Embedded System	**Semester:** Fifth
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Elective	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 45	**Full Marks:** 100
Pre-Requisites: Microprocessor and Microcontroller	

A. Learning Objectives:

- To have knowledge about the basic working of a microcontroller system and its programming in assembly language.
- To provide experience to integrate hardware and software for microcontroller applications systems.

B. Course Content:

Module No.	Description of Topics	Contact Hours
1	Introduction to Embedded System : Embedded system VS General computing systems, Purpose of Embedded systems, Design challenge – optimizing design metrics, embedded processor technology, Microprocessor and Microcontroller, Hardware architecture of the real time systems. A/D converter and D/A Converter, RISC vs CISC, Example of Embedded system.	7
2.	Introduction to AVR microcontroller: Introduction to AVR (ATmega 328p-pu) microcontroller, pin layout, architecture, program memory, Data Direction register , Port Registers (PORTx), PWM registers (8-bit), ADC registers, basics of communication, overview and interfacing I/O devices with I2C Bus, UART and Serial Peripheral Interchange (SPI) bus, Programming Embedded Systems with AVR (Arduino API).	10
3.	Introduction to ARM microcontroller: Architecture of ARM Embedded microcontroller, ARM instruction set, Introduction to ARMv8-A based embedded development board (i.e. Raspberry Pi rev.4), Programming a Raspberry Pi rev.4 using Python 2.7, User defined LED blink using Raspberry Pi GPIOs, communication between an Arduino UNO rev.3 with Raspberry Pi 4 over USB serial.	10

4.	Embedded operating systems : Operating system basics, types of operating systems, tasks, process and threads, multiprocessing and multitasking, task scheduling; task communication: shared memory, message passing, remote procedure call and sockets, task synchronization: task communication/synchronization issues, task synchronization techniques, device drivers, how to choose an RTOS.	10
5.	CASE Studies: i) Interfacing with Temperature Sensor.(AVR MICROCONTROLLER and ARM MICROCONTROLLER Based) ii) Interfacing with Servo Motor.(AVR MICROCONTROLLER and ARM MICROCONTROLLER Based) iii) Interfacing with Gas Sensor.(AVR MICROCONTROLLER and ARM MICROCONTROLLER Based) iv)Interfacing with Ldr light sensor.(AVR MICROCONTROLLER and ARM MICROCONTROLLER Based)	8

C. Course Outcomes:

To acquire knowledge about microcontrollers embedded processors and their applications.

- **CO1:** Foster ability to understand the internal architecture and interfacing of different peripheral devices with Microcontrollers.
- **CO2:** Foster ability to write the programs for microcontroller.
- **CO3:** Foster ability to understand the role of embedded systems in industry.
- **CO4:** Design processor and controller based intelligent systems for real life problems.

D. Learning Resources:

Text/References:

1. Raj Kamal, Embedded systems- Architecture, Programming and Design, McGraw Hill Education (India) Pvt. Ltd.
2. Dhananjay Gadre, “Programming and Customizing the AVR Microcontroller”; McGraw Hill Education, 2014.
3. Elliot Williams, “AVR Programming: Learning to Write Software for Hardware”, Maker Media, Incorporated, 2014
4. An Embedded Software Primer – David E. Simon, Pearson Ed., 2005.

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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Third Year Fifth Semester Curriculum
(Applicable from Academic Session 2020-21).

Course Code: PE-EI504	**Category:** Professional Elective Courses -II
Course Name: Power Electronics and Drives	**Semester:** Fifth
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Elective	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 46	**Full Marks:** 100
Pre-Requisites: Knowledge of Analog Electronics	

A. Learning Objectives:

- To present the principles of power electronics and its applications.
- The student will learn analysis and design techniques for switch -mode converters using the buck, boost, and buck-boost topologies.
- The course will emphasize complex theoretical analysis and computer simulation tools as course project.

B. Course Content:

Module No.	Description of Topics	Contact Hours
1	Power switching devices: Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Firing circuit for thyristor; Voltage and current commutation of a thyristor; Gate drive circuits for MOSFET and IGBT.	8
2.	Thyristor rectifiers: Single-phase half-wave and full-wave rectifiers, Single-phase full- bridge thyristor rectifier with R-load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input current wave shape and power factor.	7
3.	DC-DC buck converter: Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage. Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage.	5

4.	Single-phase voltage source inverter Single-phase voltage source inverter: Power circuit of single-phase voltage source inverter, switch states and instantaneous output voltage, square wave operation of the inverter, concept of average voltage over a switching cycle, bipolar sinusoidal modulation and unipolar sinusoidal modulation, modulation index and output voltage	10
5.	Three-phase voltage source inverter: Power circuit of a three-phase voltage source inverter, switch states, instantaneous output voltages, average output voltages over a sub- cycle, three-phase sinusoidal modulation Power circuit of a three- phase voltage source inverter, switch states, instantaneous output voltages, average output voltages over a sub-cycle, three-phase sinusoidal modulation	8
6.	Electric drives: Introduction and classification. DC motor drives: speed-torque characteristics of shunt, series, PMDC motors; dynamic models; speed and position control methods; AC motor drives: d-q model of induction motor; constant flux speed control structure; vector control model; vector control structure.	8

C. Course Outcomes:

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

- **CO1:** Understand the differences between signal level and power level devices.
- **CO2:** Analyse controlled rectifier circuits.
- **CO3:** Learn about the control of various converters.
- **CO4:** Analyse the operation of DC-DC choppers.
- **CO5:** Analyse the operation of voltage source inverters.
- **CO6:** Develop capability to choose a suitable DC and AC Motor and Power Electronic Converter
- **CO7:** Develop design knowledge on how to design the speed control and current control loops of a DC Motor drive

D. Learning Resources:

Text/References:

1. M. H. Rashid, “Power electronics: circuits, devices, and applications”, Pearson Education India, 2009.
2. N. Mohan and T. M. Undeland, “Power Electronics: Converters, Applications and v Design”, John Wiley & Sons, 2007.
3. R. W. Erickson and D. Maksimovic, “Fundamentals of Power Electronics”, Springer Science & Business Media, 2007.
4. L. Umanand, “Power Electronics: Essentials and Applications”, Wiley India, 2009.
5. B. K. Bose, Modern Power Electronics and AC Drives, Pearson Education, 2003.
6. Fundamentals of Electric Drives, Gopal K Dubey, Narosa

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Third Year Fifth Semester Curriculum
(Applicable from Academic Session 2020-21).

Course Code: OE-EI501	**Category:** Open Elective Courses -I
Course Name: Object Oriented Programming Language	**Semester:** Fifth
Program: AEIE	**Course Coordinator:** CSE Department/IT Department
Nature of Course: Open Elective	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 45	**Full Marks:** 100
Pre-Requisites:	

A. Learning Objectives:

- To understand Object Oriented Programming concepts and basic characteristics of Java.
- To know the principles of packages, inheritance and interfaces.
- To define exceptions and use I/O streams.
- To develop a java application with threads and generics classes.
- To design and build simple Graphical User Interfaces

B. Course Details:

Module No.	Description of Topics	Contact Hours
1.	Introduction to oop and java fundamentals Object Oriented Programming – Abstraction – objects and classes – Encapsulation- Inheritance – Polymorphism- OOP in Java –	5
2.	Characteristics of Java – The Java Environment – Java Source File Structure – Compilation. Fundamental Programming Structures in Java – Defining classes in Java – constructors, methods -access specifiers – static members - Comments, Data Types, Variables, Operators, Control Flow, Arrays , Packages – JavaDoc Comments.	5
3.	Inheritance And Interfaces Inheritance – Super classes- sub classes –Protected members – constructors in sub classes- the Object class – abstract classes and methods- final methods and classes – Interfaces – defining an interface, implementing interface, differences between classes and interfaces and extending interfaces – Object cloning -inner classes, ArrayLists – Strings	9
4.	Exception Handling And I/O Exceptions – exception hierarchy – throwing and catching exceptions – built-in exceptions, creating own exceptions, Stack Trace Elements. Input / Output Basics – Streams – Byte streams and Character streams – Reading and Writing Console – Reading and Writing Files	8

5.	Multithreading And Generic Programming Differences: Between multi-threading and multitasking, thread life cycle, creating threads, synchronizing threads, Inter-thread communication, daemon threads, and thread groups. Generic Programming – Generic classes – generic methods – Bounded Types – Restrictions and Limitations.	9
6.	Event Driven Programming Graphics programming – Frame – Components – working with 2D shapes – Using color, fonts, and images – Basics of event handling – event handlers – adapter classes – actions – mouse events – AWT event hierarchy – Introduction to Swing – layout management – Swing Components – Text Fields , Text Areas – Buttons- Check Boxes – Radio Buttons – Lists- choices- Scrollbars – Windows – Menus – Dialog Boxes.	9

C. Course Outcomes:

CO1: Develop Java programs using OOP principles.
CO2: Develop Java programs with the concepts inheritance and interfaces.
CO3: Build Java applications using exceptions and I/O streams.
CO4: Develop Java applications with threads and generics classes.
CO5: Develop interactive Java programs using swings

D. Learning Resources:

Text Books:

1. Herbert Schildt, —Java The complete reference , 8th Edition, McGraw Hill Education, 2011.
2. Steven Holzner, —Java 2 Black book , Dreamtech press, 2011.
3. Timothy Budd, —Understanding Object-oriented programming with Java , Updated Edition, Pearson Education, 2000.
4. R.S. Salaria – Mastering Object-Oriented Programming using C++, Khanna Publishing House, 2018.

Department of Applied Electronics & Instrumentation Engineering
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Affiliated to MAKAUT and approved by AICTE

Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Third Year Fifth Semester Curriculum
(Applicable from Academic Session 2020-21).

Course Code: OE-EI502	**Category:** Open Elective Courses -I
Course Name: Database Management Systems	**Semester:** Fifth
Program: AEIE	**Course Coordinator:** CSE/IT Department
Nature of Course: Open Elective	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 45	**Full Marks:** 100
Pre-Requisites:	

A. Learning Objectives:

- To understand the different issues involved in the design and implementation of a database system.
- To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
- To understand and use data manipulation language to query, update, and manage a database
- To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
- To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.

B. Course Details:

Module No.	Description of Topics	Contact Hours
1.	Introduction: Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.	4
2.	Entity-Relationship Model : Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.	6
3.	Relational Model: Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications Of the Database.	5

4.	SQL and Integrity Constraints: 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.	8
5.	Relational Database Design: Functional Dependency, Different anamolies in designing a Database., Normalization using functional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Nomalization using multi-valued dependencies, 4NF, 5NF	9
6.	Internals of RDBMS 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.	7
7.	File Organization & Index Structures: File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree .	6

C. Course Outcomes:

At the end of the course, students will demonstrate following abilities

- **CO1:** For a given query write relational algebra expressions for that query and optimize the developed expressions
- **CO2:** For a given specification of the requirement design the databases using ER method and normalization.
- **CO3:** For a given specification construct the SQL queries for Open source and Commercial DBMS -MYSQL, ORACLE, and DB2.
- **CO4:** For a given query optimize its execution using Query optimization algorithms
- **CO5:** For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.
- **CO6:** Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.

D. Learning Resources:

Text/References:

1. "Database System Concepts", 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.
2. "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer Science Press.
3. "Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe, Pearson Education
4. "Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Third Year Fifth Semester Curriculum
(Applicable from Academic Session 2020-21).

Course Code: PC-EI591	**Category:** Professional Core Courses
Course Name: Control System Lab	**Semester:** Fifth
Program: AEIE	**Course Coordinator:** Electrical Department
Nature of Course: Mandatory	**Type of Course:** Practical
Contact Hour Classification: L-T-P:0-0-3	**Credit:** 1.5
Total Contact Hours:	**Full Marks:** 100
Pre-Requisites: No Pre-requisites	

A. Course Details:

Laboratory Experiments:

1.	Familiarization with MATLAB control system toolbox, MATLAB-SIMULINK toolbox and PSPICE.
2.	Study of step response for first and second order system with unity feedback with display on CRT screen and calculation of parameters for different system designs.
3.	Simulation of impulse response for types 0, 1 and 2 with unity feedback using MATLAB and PSPICE.
4.	Determination of root-locus, Bode plot, Nyquist plot using MATLAB toolbox for a given second order transfer function and listing of the specifications.
5.	Determine the effect of P, I, D actions on first order simulated process and obtaining the system transfer functions from Bode plot
6.	Lag and lead compensation – Magnitude and phase plot
7.	Create the state space model of a linear continuous system.

B. Course Outcomes:

CO1: To understand the different ways of system representations such as Transfer function representation and state space representations and to assess the system dynamic response.
CO2: To assess the system performance using time domain analysis and methods for improving it.
CO3: To assess the system performance using frequency domain analysis and techniques for improving the performance.
CO4: To design various controllers and compensators to improve system performance.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Third Year Fifth Semester Curriculum
(Applicable from Academic Session 2020-21).

Course Code: OE-EI591	**Category:** Open Elective Courses - I
Course Name: Object Oriented Programming Language Lab	**Semester:** Fifth
Program: AEIE	**Course Coordinator:** CSE/IT Department
Nature of Course: Open Elective	**Type of Course:** Practical
Contact Hour Classification: L-T-P:0-0-3	**Credit:** 1.5
Total Contact Hours:	**Full Marks:** 100
Pre-Requisites: No Pre-requisites	

A. Course Details:

Laboratory Experiments:

1	Assignments on class, constructor, overloading, inheritance, overriding
2	Assignments on wrapper class, arrays
3	Assignments on developing interfaces- multiple inheritance, extending interfaces
4	Assignments on creating and accessing packages
5	Assignments on multithreaded programming
6	Assignments on applet programming

Note: Use Java for programming
Preferably download "java_ee_sdk-6u4-jdk7-windows.exe" from
http://www.oracle.com/technetwork/java/javaee/downloads/java-ee-sdk-6u3-jdk-7u1-downloads-523391.html

B. Course Outcomes:

CO1: Gain the basic knowledge on Object Oriented concepts.
CO2: Ability to develop applications using Object Oriented Programming Concepts.
CO3: Ability to implement features of object oriented programming to solve real world problems.
CO4: Understand advanced features of C++ specifically stream I/O, templates and operator overloading
CO5: Understand how to apply the major object-oriented concepts to implement object oriented programs in C++, encapsulation, inheritance and polymorphism

Department of Applied Electronics & Instrumentation Engineering
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Third Year Fifth Semester Curriculum
(Applicable from Academic Session 2020-21).

Course Code: OE-EI592	**Category:** Open Elective Courses - I
Course Name: Database Management System Lab	**Semester:** Fifth
Program: AEIE	**Course Coordinator:** CSE/IT Department
Nature of Course: Open Elective	**Type of Course:** Practical
Contact Hour Classification: L-T-P:0-0-3	**Credit:** 1.5
Total Contact Hours: NA	**Full Marks:** 100
Pre-Requisites: No Pre-requisites	

A. Course Details:

Laboratory Experiments:	
1.	Creating Database Creating a Database Creating a Table Specifying Relational Data Types Specifying Constraints Creating Indexes
2.	Table and Record Handling INSERT statement Using SELECT and INSERT together DELETE, UPDATE, TRUNCATE statements DROP, ALTER statements
3.	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 JOIN ☐ Sub queries
4.	Database Management ☐ Creating Views ☐ Creating Column Aliases ☐ Creating Database Users ☐ Using GRANT and REVOKE

B. Course Outcomes:

CO1: Understand, appreciate and effectively explain the underlying concepts of database technologies.
CO2: Design and implement a database schema for a given problem-domain.

CO3: Normalize a database.
CO4: Populate and query a database using SQL DML/DDL commands.
CO5: Programming PL/SQL including stored procedures, stored functions, cursors, packages.
CO6: Design and build a GUI application using a 4GL

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206 Affiliated to MAKAUT and approved by AICTE

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Third Year Fifth Semester Curriculum
(Applicable from Academic Session 2020-21).

Course Code: PC-EI592	**Category:** Professional Core Courses
Course Name: Industrial Instrumentation Lab	**Semester:** Fifth
Program: AEIE	**Course Coordinator:** Departmental
Nature of Course: Mandatory	**Type of Course:** Practical
Contact Hour Classification: L-T-P:0-0-3	**Credit:** 1.5
Total Contact Hours: NA	**Full Marks:** 100
Pre-Requisites: Knowledge of sensor & Transducers	

A. Course Details:

Laboratory Experiments:

1.	Calibration of Pressure Gauge using Dead Weight Tester.
2.	Study of Thermocouple characteristics and Measurement of Temperature with it.
3.	Study of RTD characteristics and Measurement of Temperature with it.
4.	Measurements of flow rate and velocity of fluid flow by head type flow meter.
5.	Measurements of flow rate and velocity of fluid flow by Variable Area type flow meter.
6.	Measurement of level using capacitive type level instrument.
7.	Measurement of moisture using moisture analyser
8.	Measurement of viscosity

B. Course Outcomes:

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

CO1: Illustrate the different methods for the measurement of length and angle
CO2: Elucidate the construction and working of various industrial devices used to measure pressure, level and flow.
CO3: Explicate the construction and working of various industrial devices used to measure temperature, level, vibration, viscosity and moisture.
CO4: Ability to analyze, formulate and select suitable sensor for the given industrial applications
CO5: Demonstrate a working knowledge of safety practices used in the measurement and control of real time processes.
CO6: Demonstrate skills in trouble shooting problems with the measurement and control of industrial processes.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

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Third Year Fifth Semester Curriculum
(Applicable from Academic Session 2020-21).

Course Code: EI581	**Category:** Seminar
Course Name: Seminar	**Semester:** Fifth
Program: AEIE	**Course Coordinator:** Departmental
Nature of Course: Mandatory	**Type of Course:** Seminar
Contact Hour Classification: L-T-P:0-0-4	**Credit:** 2
Total Contact Hours: NA	**Full Marks:** 100
Pre-Requisites: No Pre-requisite	

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE
Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Third Year Sixth Semester Curriculum
Applicable from Academic Session 2020-21

THIRD YEAR SIXTH SEMESTER PROPOSED SYLLABUS

Third Year Sixth Semester								
Sl No	Category	Code	Course Title	Contact hours/week				Credit Points
				L	T	P	Total	
Theory								
1	Professional Core Courses	PC-EI601	Process Control	3	0	0	3	3
2	Professional Core Courses	PC-EI602	Biomedical Instrumentation	3	0	0	3	3
3	Open Elective Courses-II	OE-EI601/ OE-EI602	Internet of Things(IoT)/Artificial Intelligence(AI)	3	0	0	3	3
4	Open Elective Courses-III	OE-EI603/ OE-EI604	Digital signal Processing /Soft Computing Techniques	3	0	0	3	3
5	Humanities and Social Sciences including Management Courses	HM- HU601	Economics for Engineers	2	0	0	2	2
6	Mandatory Courses	MC- ES601	Indian Constitution and Cultures	1	0	0	1	
Total Theory								14
Laboratory								
1	Professional Core Courses	PC-EI691	Process Control Lab	0	0	3	3	1.5
2	Professional Core Courses	PC-EI692	Instrumentation System Design Lab	0	0	3	3	1.5
3	Open elective Courses-II	OE-EI691/ OE-EI692	Internet of Things Lab(IoT)/Artificial Intelligence Lab(AI)	0	0	3	3	1.5
Total Practical								4.5
Total of Sixth Semester								**18.5**

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE
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Third Year Sixth Semester Curriculum
Applicable from Academic Session 2020-21

Course Code: PC-EI601	**Category:** Professional Core Course
Course Name: Process Control	**Semester:** Sixth
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 44	**Full Marks:** 100
Pre-Requisites: Engineering mathematics that teaches complex variables and Laplace transform.	

A. Learning Objectives:

- To study the operation of different types of industrial processes.
- To study the different control strategies used in industrial applications.

B. Course Content:

Module No.	Description of Topic	Contact Hours
1	General review of process, Process control & automation, Servo and regulatory control, Basic process control loop block diagram. Characteristic parameter of a process: Process quality, Process potential, Process resistance, Process capacitance, Process lag, Self regulation.	8
2	Different control modes: On-off control, Multistep , Time proportional, Proportional, Offset-why it appears and how it is eliminated- mathematical analysis, Proportional-integral, Proportional -derivative, Proportional-integral-derivative, integral windup, bump less transfer, Inverse derivative control, controller selection guideline. Effect of disturbances and variation in set point in process control.	8
3	Tuning of controllers: Controller performance indices, Concept of good control, close loop and open loop tuning methods, comparison of tuning methods. Electronic P, PI, PD, PID controller design Pneumatic Controllers - brief analysis	8
4	Different control strategies - schemes, brief analysis and uses (i) Feedforward control (ii) Cascade control (iii) Ratio control (iv) verride control (v) Adaptive control (Programmed or scheduled and self adaptive control) (vi) Continuous control and Batch control.	6
5	Final control elements: Classification. Actuators: self-operated, pneumatic, electro-pneumatic, and stepper motor operated actuators. Valve positioner. Classification of control valves, performance and application of different control valves, valve type and construction, Single & Double Seated Valves, valve sizing, valve characteristics, Cavitation, Flashing, valve selection guidelines. Control Valve Accessories – Air Filter Regulator, I/P Converter.	8

6	Programmable Logic Controller: Block diagram, Classification, Basic Architecture and Functions; Input-Output Modules. PLC Programming: PLC function block timers, function block counters, arithmetic function blocks, real time LADDER diagram; programming examples for maintenance and control. DCS: Computer based control, History and overviewof DCS, Concept of centralized and distributed control systems, system architecture, brief view on operator station, engineering station, field control station.	6

C. Course Outcomes:

On successful completion of the course, students will be able to:

- **CO1:** Construct the block diagram of feedback control loop and demonstrate its various components.
- **CO2:** Analyze the different process characteristics with suitable examples.
- **CO3:** Classify different types of controllers according to their feature and use.
- **CO4:** Apply the concept of controller tuning in practical processes.
- **CO5:** Illustrate the construction and use of different types of control valves.
- **CO6:** Differentiate between different control schemes such as feedforward control, cascade control, ratio control, etc.
- **CO7:** Construct LADDER program to operate batch processes.

D. Learning Resources:

Text books:

1. Process Control-Principles and application, S. Bhanot, Oxford University press.
2. Principle of Process control, D. Patranabis, TMH.
3. Automatic Process Control, D.P. Eckman, John Wiley.
4. Instrumentation and Process Control, D.C. Sikdar, Khanna Publishing House.

Reference books:

1. Process control, P. Harriott, McGraw Hill.
2. Chemical process control, G. Stephanpoulos, PHI.
3. Process control instrumentation technology, C.D. Johnson, PHI
4. Process Control, S.K. Singh, PHI.
5. Instrument Engineers Handbook, B.G. Liptak, Chilton Book Co. Philadelphia
6. Elements of Chemical Process Technology, O.P. Gupta, Khanna Publishing House

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Third Year Sixth Semester Curriculum
Applicable from Academic Session 2020-21

Course Code: PC-EI602	**Category:** Professional Core Course
Course Name: Biomedical Instrumentation	**Semester:** Sixth
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 40	**Full Marks:** 100
Pre-Requisites: No pre-requisites.	

A. Learning Objectives:

- To introduce students information about biomedical instrumentation and its application.
- To familiarize students about different types bio-signals like ECG, EEG, EMG.

B. Course Content:

Module No.	Description	Contact Hours
1	BASIC PHYSIOLOGY AND TRANSDUCERS Introduction to the physiology of cardiac, nervous and muscular and respiratory systems. Transducers- Different types of transducers and their selection criteria for biomedical applications.	6
2	BIOPOTENTIAL & BIOELECTRODES Action and resting potential .Electrode theory-different types of electrodes -Hydrogen Calomel, Ag-AgCI, pH, PO2 and Pco2 electrode and selection criteria of electrodes.	6
3	ELECTRO – PHYSIOLOGICAL MEASUREMENTS:Electrocardiography,Measurement of Electrical Activities in Muscles and Brain: Eectromyography, Electroencephalography and their interpretation.	6
4	NON-ELECTRICAL PARAMETER MEASUREMENTS Measurement of Blood Pressure and Blood flow. Cardiac output and Cardiac rate.	8
5	MEDICAL IMAGING Ultrasound and IR Imaging X-ray machine - Radio graphic and fluoroscopic techniques, Computer tomography . MRI – Ultrasonography	8
6	BIOTELEMETRY Transmission and Reception aspects of Biological signals via long distance. Application of biotelemetry in patient care.	6

C. Course Outcomes:

CO1: At the end of the course, a student will be able to:
CO2: Inspect common biomedical signals.
CO3: Describe the origin of various bio-potentials and explain the role of bio-potential electrodes.
CO4: Explain the measurement principles for blood flow, blood pressure.
CO5: Indentify various imaging techquines.
CO6: Illustrate the application of biotelemetry system.

D. Learning Resources:

Text Books:

1. Cromwell – Biomedical Instrumentation and Measurement, PHI
2. Webster J S – Medical Instrumentation – Application and Design
3. Khandpur R S – Handbook of Biomedical Instrumentation, TMH,

Reference Books:

1. Carr – Introduction to Biomedical Equipment Technology 4/e – Pearson
2. Chatterjee Miller – Biomedical Instrumentation, Cengage Learning
3. Astor B R – Introduction to Biomedical Instrumentation and Measurement, McMillan.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Third Year Sixth Semester Curriculum
Applicable from Academic Session 2020-21

Course Code: OE-EI601	**Category:** Open Elective Courses - II
Course Name: Internet of Things (IoT)	**Semester:** Sixth
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Open Elective	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 44	**Full Marks:** 100
Pre-Requisites: Sensors & Actuators, Microcontrollers, Basic programming knowledge	

A. Learning Objectives:

- Able to understand the application areas of IOT
- Able to understand building blocks of Internet of Things and characteristics
- Able to realize the revolution of Internet in Mobile Devices & Sensor Networks

B. Course Content:

Module No.	Description of Topic	Contact Hours
1	Introduction to IoT, Concept of Smart sensors and actuators	6
2	Basic of IoT networking Internet Communications: An Overview MQTT, CoAP, REST Api and gRPC, Different Communication protocols :(RFID, IEEE 802.15.4, Zigbee, 6LoWPAN, Bluetooth), LoRa, Machine-to-Machine (M2M) Communications, MQTT Broker	4
3	Introduction to Python programming with IoT modules i.e. Paho MQTT, Web modules: urllib2, Flask, Flask-RESTful	12
4	Introduction to Arduino Programming, integration of Sensors having analog and i2c. Connecting Arduino with ESP8266 WiFi module	10
5	Introduction to Python Raspberry Pi, Implementation of IoT with Raspberry Pi.	10
6	IoT application: Smart Cities and Smart Homes	2

C. Course Outcomes:

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

CO1: Understand the application areas of IOT.
CO2: Realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks.
CO3: Understand building blocks of Internet of Things and characteristics.
CO4: Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.
CO5: Building state of the art architecture in IoT.

D. Learning Resources:

Text books:

1. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wileypublication, 1st Edition, November 2013.
2. Jeeva Jose, Internet of Things, Khanna Publishing House, New Delhi (AICTE Recommended – 2018)
3. Michale Miller, "The Internet of Things: How Smart TVs, Smart Cars, Smart Homes, and Smart Cities Are Changing the World", PearsonEducation
4. Hanes David ,Salgueiro Gonzalo, Grossetete Patrick, Barton Rob ,"IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things" , PearsonEducation
5. RMD SundaramShriram, K Vasudevan, Abhishek S Nagarajan,"Internet of Things" ,Wiley publication,

Reference books:

1. Yasuura, H., Kyung, C.-M., Liu, Y., Lin, Y.-L., Smart Sensors at the IoT Frontier, Springer International Publishing
2. Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., Smart Sensors and Systems,Springer International Publishing

Department of Applied Electronics & Instrumentation Engineering
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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Third Year Sixth Semester Curriculum
Applicable from Academic Session 2020-21

Course Code: OE-EI602	**Category:** Open Elective Courses - II
Course Name: Artificial Intelligence (AI)	**Semester:** Sixth
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Open Elective	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 45	**Full Marks:** 100
Pre-Requisites: Algorithmic approach of Problem Solving, Discrete Mathematics and Statistics.	

A. Learning Objectives:

- Problem solving using knowledge of AI techniques.
- Data Analysis and Forecasting using AI Tools.

B. Course Content:

Module No.	Description of Topic	Contact Hours
1	Overview – Overview of AI, Turing Test, Problems of AI, Intelligent Agent, Environment and Types of agents. State Space search problem, Production Systems explanation using standard problems like water-jug, wolf-goat-cabbage, missionary cannibals, 8-puzzle etc.	6
2	Search Techniques – BFS, DFS, Iterative deepening and broadening, bidirectional and Comparisons among the techniques. Heuristics based searches, Greedy, Uniform Cost and A* techniques.	7
3	Hill Climbing, AND-OR search, Constraint Satisfaction Problems. Adversarial Search- Min-max search and alpha-beta pruning	8
4	Knowledge Representation – Propositional Logic and proof by contradiction, FOPL, Resolution, Unification Algorithm Basic Knowledge of Programming in Prolog and Python.	8
5	Probabilistic Reasoning – Bayesian Learning, Belief Network, Fuzzy Logic and Sets, NLP, Expert Systems	8
6	Machine Learning – Types of learning (Supervised, Unsupervised, Reinforcement), Classification Model and Learning Steps, Common Classification Algorithms (kNN, Decision Tree, Random Forest, SVM)	8

C. Course Outcomes:

CO1: Explain what constitutes "Artificial" Intelligence and how to identify systems with Artificial Intelligence.
CO2: Explain how Artificial Intelligence enables capabilities that are beyond conventional technology, for example, chess-playing computers, self-driving cars, robotic vacuum cleaners.
CO3: Use classical Artificial Intelligence techniques, such as search algorithms, minimax algorithm.
CO4: Ability to apply Artificial Intelligence techniques for problem solving.

D. Learning Resources:

Text books:

1. Artificial Intelligence, Ritch and Knight, TMH
2. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
3. Artificial Intelligence and Soft Computing, Amit Konar.
4. A Classical Approach to Artificial Intelligence, M.C. Trivedi, Khanna Publishing House

Reference books:

1. Machine Learning, Saikat Dutta, Subramanian Chandramouli, Amit Kumar Das, Pearson.
2. Introduction to Machine Learning, Jeeva Jose, Khanna Publishing House

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE
Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Third Year Sixth Semester Curriculum
Applicable from Academic Session 2020-21

Course Code: OE-EI603	**Category:** Open Elective Courses - III
Course Name: Digital Signal Processing	**Semester:** Sixth
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Open Elective	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 42	**Full Marks:** 100
Pre-Requisites: No pre-requisite.	

A. Learning Objectives:

- To provide students a brief concept of signals and systems related to signal processing.
- To acquire knowledge of different types of signal processing methods.
- To familiar with the importance of Fourier Transformation in signal processing and its different methods.
- To realize the importance of filter and their various designing techniques.

B. Course Content:

Module No.	Description of Topic	Contact Hours
1	Discrete-time signals: Concept of signals and systems, Advantages and application of digital signal processing, Analog signal to digital signal conversion, Sampling theorem, Reconstruction of signal, Concept of Discrete –time signal, Representation of discrete time sequences, Classifications of discrete time sequences with example, Mathematical operations on sequences. Discrete-time System Classifications of Discrete time systems, LTI systems, Representation of Discrete time signal using Impulse response, Concept and properties of linear convolution, Methods of convolution process between two signals by both graphical and tabular form procedure, De-convolution, interconnections of LTI systems with physical interpretations, stability and causality conditions, recursive and non-recursive systems .	5
2	Z-Transform: Defination, Relationship between Laplace Transform and Fourier Transform, Mapping between s-plane and z-plane, concept of unit circle (Fourier transformation from z transformation, stability of a system using z transformation, concept of ROC, Z-transformation of finite and infinite sequences and their ROC, z-transformation of sequences, properties of z-transform Inverse Z-transform : Direct evaluation of inverse Z-transform -Residue theorem, partial fraction method, Long division or power series expansion method, convolution process	3

3	Discrete Time Fourier Transform (DTFT): Concept of Fourier series of discrete time signals, difference between continuous time and discrete time Fourier series, frequency spectrum of periodic discrete time signals, properties of discrete time Fourier series and its example, definition of DTFT, frequency spectrum of discrete time signal, properties of DTFT, DTFT of periodic discrete time signals,analysis of discrete time system using DTFT and its frequency response. Discrete Fourier Transform: Concept of DFT/IDFT, relation between DFT and IDFT, Properties of DFT, Twiddle factors and their properties, computational burden on direct DFT, DFT/IDFT as lineartransformations and computation of DFT in matrix form, multiplication of DFTs or concept of circular convolution,computation of circular convolution by graphical and matrix form, relationship between linear convolution and circular convolution, computation of linear convolution from circular convolution, , linear filtering using DFT, aliasing error, filtering of long data sequences – Overlap-Save and Overlap-Add methods .	5
4	Fast Fourier Transform (FFT): Complexity analysis of direct computation of DFT, Concept of FastFourier transformation, Radix-2 computation of FFT using decimation-in-time and decimation-in-frequency algorithms, signal flow graphs, Butterflies, computations of FFT in one place using both algorithms, bitreversal process, examples for DIT & DIF FFT Butterfly computations .	5
5	FIR Filter Design: Basic concepts of IIR and FIR filters, Gibbs Phenomenon, design of linear phase FIR filters, no. of taps, concept of window technique to design FIR filter,Fourier series method of FIR filter designing, different types of window sequences and their spectrum-rectangular, Bartlett, Hamming, Hanning, Blackman and Kaiser windows, Design of FIR filter using window techniques.	6
6	IIR Filter Design: Concept of IIR digital filter, recursive and nonrecursive system, analog to digital domain transformation- impulse invariant method and bilinear transformation and their properties, limitations of bilinear transformation, warping and prewarping, methods to find out the order of IIR filter, mapping of poles and zeroes of filter in analog domain, computation of filter transfer function in analog domain, digital filter realization techniques, procedure to design Butterworth digital IIR filters.	8

C. Course Outcomes:

CO1: Distinguish different types of signals, can acquire a brief idea about analog and digital signals and their conversion techniques , criterion for stability of a system.

CO2: To evaluate different types of mathematical operation on signals.

CO3: Learn a good idea about Z-transform and importance of analog to digital domain transformation technique.

CO4: Appropriately distinguish between Fourier series and Fourier transformation, properly compute it, Know different types of filters, distinguish between analog and digital filter, methods to transform from one type to another types of filter.

CO5: Acquire a clear idea of different filter designing techniques and their realization methods.

D. Learning Resources:

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.

Reference books:

1. Digital Signal Processing, A. NagoorKani, TMH Education
2. Digital Signal Processing, P. Rameshbabu, Scitech Publications (India).
3. Digital Signal Processing, S. Salivahanan, A. Vallabraj & C. Gnanapriya, TMH Publishing Co.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE
Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Third Year Sixth Semester Curriculum
Applicable from Academic Session 2020-21

Course Code: OE-EI604	**Category:** Open Elective Courses - III
Course Name: Soft Computing Techniques	**Semester:** Sixth
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Open Elective	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 45	**Full Marks:** 100
Pre-Requisites: No pre-requisite.	

A. Course Content:

Module No.	Description of Topic	Contact Hours
1	Introduction to Soft-computing, Its Constituent components, Fuzzy Sets, General Idea and importance in practical life, definition,	7
2	Basic Operators, T- Norms, S- Norms, other aggregation operators, Fuzzy relations, implications, extensions, projections and compositions	6
3	Approximate reasoning, compositional rule of inference, rule based systems, term set, Fuzzification, reasoning, defuzzification	7
4	Different Fuzzy models (MA/TS), Applications of Fuzzy rule based systems	6
5	Basics of Genetic Algorithm, its adaptation for computing, Application	10
6	Studies of some Fuzzy-neural, Neuro-fuzzy and Fuzzy-GA systems	9

B. Learning Resources:

Text Books:

1. Dirankov and Hellendrom Fuzzy logic control, Narosa
2. Rajsekhar and Pai, Neural Networks, Fuzzy logic and Genetic Algorithm: Synthetic and Applications, Pearson Education
3. Goldberg - Genetic algorithm, Pearson 2003
4. Freeman - Neural Networks, Pearson 2003
5. Jang - Neuro-fuzzy and soft Computing, Pearson 2003

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Third Year Sixth Semester Curriculum
Applicable from Academic Session 2020-21

Course Code: HM-HU601	**Category:** Humanities & Social Sciences including Management Courses
Course Name: Economics for Engineers	**Semester:** Sixth
Program: AEIE	**Course Coordinator:** Basic Science & Humanities Department
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hour Classification: L-T-P:2-0-0	**Credit:** 2
Total Contact Hours: 45	**Full Marks:** 100
Pre-Requisites: No pre-requisite.	

A. Learning Objectives:

- To provide students the basic concepts of Economic theories related to Engineering so that they can analyse the economic viability of any engineering course of action.
- To provide students the basic concepts of Finance and the methods of Accounting so that they can use such methods and concepts in order to analyse the economic viability of the engineering or any other courses of action related to any project.

B. Course Content:

Module No.	Description of Topic	Contact Hours
1	1. Economic Decisions Making – Overview, Problems, Role, Decision making process. 2. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - Per-Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits.	6
2	3. Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value of Money, Debt repayment, Nominal& Effective Interest. 4. Cash Flow & Rate Of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate Of Return, Calculating Rate of Return,	9
3	5. Incremental Analysis; Best Alternative Choosing An Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, 6. Sensitivity And Breakeven Analysis. Economic Analysis In The Public Sector - Quantifying And Valuing Benefits & drawbacks.	6

4	7. Inflation And Price Change – Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates. 8. Uncertainty In Future Events - Estimates and Their Use in Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Riskvs Return, Simulation, Real Options.	9
5	9. Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives 10. Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, DepreciationCalculation Fundamentals,	6
6	11. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems. 12. Accounting – Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.	9

C. Course Outcomes:

CO1: Understand the Principles of Engineering Economy and the Engineering Decision-making process. Apply the appropriate type of Estimating Model to determine Engineering Cost.

CO2: Understand the basic concept of Time value of money and apply such formulas to analyze Situations of both Single cash flow and multiple cash flow. Apply such knowledge to Evaluate financial feasibility of different types of investment situations in Engineering Projects.

CO3: Understand the causes and Effect of Inflation & Deflation and Use the Price Indexes in Engineering Economic Analysis.

CO4: Understand the basic concept of Probability and expected value and of Depreciation and Obsolescence. Also apply the Fundamental methods of calculation of depreciation.

CO5: Understand Replacement Analysis Replacement Map and determine Minimum Cost Life of a New Asset.

CO6: Understand Accounting Function, Balance Sheet, Income Statement and apply such knowledge in calculation of Financial Ratios and apply Cost Accounting Principles for Direct and Indirect Cost Allocation.

D. Learning Resources:

Text books:

1. R. Paneer Seelvan: Engineering Economics, PHI
2. Premvir Kapoor, Sociology & Economics for Engineers, Khanna Publishing House
3. Bhabatosh Banerjee : Cost Accounting ,The World Press Private Ltd.

4. Bhabatosh Banerjee : Cost & Management Accounting ,The World Press Private Ltd.
5. Amit Kumar De & Samiron Mukherjee: Economics for Engineers, Matrix Educare Pvt. Ltd.
6. Financial Accounting I : Soumya Mukherjee & Abhik Kr. Mukherjee ,Oxford University Press

Reference books:

1. Sullivan and Wicks: Engineering Economy, Pearson
2. James L. Riggs, David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e ,Tata McGraw-Hill
3. Cost & Management Accounting I :J. K. Mitra , Oxford University Press

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE
Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Third Year Sixth Semester Curriculum
Applicable from Academic Session 2020-21

Course Code: MC-ES601	**Category:** Mandatory Courses
Course Name: Indian Constitution and Cultures	**Semester:** Sixth
Program: AEIE	**Course Coordinator:** Basic Science & Humanities Department
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hour Classification: L-T-P:1-0-0	**Credit:** 0
Total Contact Hours: 40	**Full Marks:** 100
Pre-Requisites: No pre-requisite.	

A. Learning Objectives:

- To provide basic knowledge about the Indian Constitution.
- To have working idea about the functioning of the Executive, Legislative and Judiciary bodies in our country.

B. Course Content:

Module No.	Description of Topic	Contact Hours
1	Indian Constitution Sources of Constitutional history, Preamble and its Salient Features, Citizenship, Fundamental Rights and Duties, Directive Principles of State Policy	5
2	Union Government and its administration. Structure of the Indian Union. Legislative bodies: LokSabha and the RajyaSabha, The Speaker and the Chairperson of the RajyaSabha. Executive Bodies. The President and the Vice-President - Role, Power and the method of Election and Amenities and Removal Procedure The Prime Minister and the Council of Ministers. Central Secretariat	10
3	State Government/s and its administration. Federalism. Centre-State relationship The Governor – Role and Function The Chief Minister and the State Council of Ministers State Secretariat	5
4	The Judiciary The Supreme Court – Organization, Procedure, Jurisdiction and Power Chief Justice and other Judges High Court/s - Organization, Procedure, Jurisdiction and Power Chief Justice and other Judges Subordinate Courts – Structure, Jurisdiction and Procedure LokAdalats PIL – Scope, Principle and Features	10

5	Local Administration – Urban Municipalities, Municipal Corporations, Town Area, Notified Area Mayor – Role and Function	5
6	Local Administration – Rural ZillaParishad, AanchalParishad and Gram Panchayats Powers, Functions and Key Functionaries Grassroot Empowerment	5

C. Course Outcome:

After the completion of this course learners will be able to:

CO1: Identify the authority to redress the problems in their profession or society
CO2: Describe:
The features of Indian Constitution
Workings of the various Legislative, Executive and Judicial bodies in the country
Appreciate the democratic workings at the grassroots level
Understand the jurisdiction and procedures of our courts

D. Learning Resources:

Text books:

1. Indian Polity, M Laxminath, Mcgraw Hill Publications, 5th Edition.

Reference books:

1. Introduction to the Constitution of India, D DBasu, Lexis Nexis Publications of India, 21st Edition.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Third Year Sixth Semester Curriculum
Applicable from Academic Session 2020-21

Course Code: PC-EI691	**Category:** Professional Core Courses
Course Name: Process Control Lab	**Semester:** Sixth
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Practical
Contact Hour Classification: L-T-P:0-0-3	**Credit:** 1.5
Total Contact Hours:	**Full Marks:** 100
Pre-Requisites: No pre-requisite.	

A. Course Content:

Laboratory Experiments :	
1	Study of flow, level, pressure processes and construction of the PI diagrams in accordance with ISA guidelines / standards.
2	Study of a typical Temperature Control Loop having Furnace, suitable final control element, Temperature transmitter, conventional PID controller.
3	Study of a typical Pressure Control Loop having Pressure source, Pressure Transmitter, Motorized/Pneumatic control valve, and conventional PID controller.
4	Study of a typical Flow Control Loop having suitable Flow meter, Motorized/ Pneumatic control valve, and conventional PID controller.
5	Study of a typical Level Control Loop having Level Transmitter, Motorized/ Pneumatic control valve, and conventional PID controller.
6	Study of a typical Air Duct Flow Monitoring and Control.
7	Study the performance of DCS for controlling multiple processes from remote end.
8	Familiarization with PLC & LADDER Programs

B. Course Outcome:

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

CO1: Analyze the operation of different types of control action.
CO2: Apply the concept of controller tuning in practical processes.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE
Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Third Year Sixth Semester Curriculum
Applicable from Academic Session 2020-21

Course Code: PC-EI692	**Category:** Professional Core Courses
Course Name: Instrumentation System Design Lab	**Semester:** Sixth
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Practical
Contact Hour Classification: L-T-P:0-0-3	**Credit:** 1.5
Total Contact Hours:	**Full Marks:** 100
Pre-Requisites: No pre-requisite.	

A. Course Content:

Guidelines:

1. Design of sensors for measurement of process parameters.
2. Design of appropriate signal conditioning circuit for different sensors.
3. Design of process control loop.
4. Design of PC based instrumentation system.
5. Electronic system design employing microcontrollers.
6. Electronic circuit design using PCB layout with suitable software

B. Course Outcomes:

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

1. Learn the issues related to practical implementation of applications using electronic circuits.
2. Design sensors and suitable signal conditioning circuit.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Third Year Fifth Semester Curriculum
(Applicable from Academic Session 2020-21).

Course Code: OE-EI691	**Category:** Open Elective Courses - II
Course Name: Internet of Things Lab	**Semester:** Sixth
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Open Elective	**Type of Course:** Practical
Contact Hour Classification: L-T-P:0-0-3	**Credit:** 1.5
Total Contact Hours:	**Full Marks:** 100
Pre-Requisites: No pre-requisite.	

A. Course Content:

Laboratory Experiments :

1	Familiarization with Python and writing programs in PyCharm IDE using Anaconda Framework.
2	Program to implement Paho MQTT client in Python.
3	Program simple web server in Python using Flask framework.
4	Familiarization with Arduino IDE and writing a program using Arduino IDE for LED blinking.
5	Study of LM35/DHT-11 temperature sensors and write programs to monitor them with Arduino with Thing Speak.
6	Setup Raspbian on the Raspberry Pi and write a program to blink an LED using Python.
7	Interfacing digital sensors and relay boards with Raspberry Pi
8	Familiarization with Python and writing programs in PyCharm IDE using Anaconda Framework.

B. Course Outcomes:

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

CO1: Gather engineering knowledge related to IoT.
CO2: Students can analyse the problem and able to design/develop the solutions

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

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Third Year Fifth Semester Curriculum
(Applicable from Academic Session 2020-21).

Course Code: OE-EI692	**Category:** Open Elective Courses - II
Course Name: Artificial Intelligence Lab	**Semester:** Sixth
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Open Elective	**Type of Course:** Practical
Contact Hour Classification: L-T-P:0-0-3	**Credit:** 1.5
Total Contact Hours:	**Full Marks:** 100
Pre-Requisites: No pre-requisite.	

A. Course Content:

Laboratory Experiments :Solve the problems Using Prolog/LISP	
1	Concepts on number: Factorial, GCD, LCM, Digit count.
2	Concept on list: Maximum, Minimum, Palindrome Searching, Union, Intersection
3	Sorting of list: Selection sort, Quick sort,
4	Knowledge Base: Create KB and apply rules.
5	Graph Searching algorithms: DFS,BFS
6	Implement Puzzle: Wolf Goat cabbage, Monkey Banana Problem.

B. Course Outcome:

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

CO1: Apply Artificial Intelligence techniques for problem solving.

Department of Applied Electronics & Instrumentation Engineering
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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Fourth Year Seventh Semester Curriculum
Applicable from Academic Session 2021-22

Fourth Year Seventh Semester								
Serial No	Category	Code	Course Title	Contact hours/week				Credit Points
				L	T	P	Total	
Theory								
1	Professional Elective Courses-III	PE-EI701/ PE-EI702	Mechatronics & Robotics/Digital Control System	3	0	0	3	3
2	Professional Elective Courses-IV	PE-EI703/ PE-EI704	Analytical Instrumentation/ Non Destructive Testing	3	0	0	3	3
3	Open Elective Courses-IV	OE-EI701/ OE-EI702	Telemetry & wireless Sensor Network/Non-Conventional Energy System	3	0	0	3	3
4	Engineering Science Courses	ES-CS701	Computer Networks	3	0	0	3	3
Total Theory								12
Practical								
1	Project Stage-I	PW-EI791	Project I	0	0	8	8	4
2	Industrial Training	EI781	Industrial Training Evaluation	0	0	2	2	1
Total Practical								5
Total of Seventh Semester								**17**

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

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Fourth Year Seventh Semester Curriculum
Applicable from Academic Session 2021-22

Course Code: PE-EI701	**Category:** Professional Elective Courses - III
Course Name: Mechatronics & Robotics	**Semester:** Seventh
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Elective	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 30	**Full Marks:** 100
Pre-Requisites: To understand this course, the learner must have idea of Sensor and Transducer, Measurement, Control System.	

A. Learning Objectives:

- To acquaint the Mechatronics & Robotics with theory and working principles of different types of sensors and mechanical systems used in the manufacturing industry and their applications.

B. Course Content:

Module No.	Description of Topic	Contact Hours
1.	General Concepts of Mechatronics Introduction, Definition of Mechatronics, Mechanical Systems: Introduction to various systems of units, mathematical modeling of mechanical systems, Newton's laws, moment of inertia, forced response and natural response, rotational systems, spring mass system, free vibration, spring mass damper system, mechanical systems with dry friction, work energy and power, passive elements and active elements an energy method for deriving equations of motion, energy and power transformers.	5
2.	Fluid and Thermal systems: Mathematical modeling of liquid level system: Resistance and capacitance of liquid level systems with interaction. Mathematical modeling of pneumatic systems: Resistance and capacitance of pneumatic systems, mathematical modeling of a pneumatic systems, liberalization of non-linear systems. Mathematical modeling ofhydraulic systems: Hydraulic circuits, hydraulic servometer and mathematical model of hydraulic servo motor dashpots. Mathematical modeling of thermal systems: Thermal resistance and thermal capacitance mathematical modeling of thermal systems	5
3.	General Concepts of Robotics Introduction, Definition of robot, classification of robots according to coordinate system (Robot configurations: Polar, Cartesian, cylindrical and Jointed-arm configuration) and control method, Main components of robots – manipulator, sensors, controller etc, Robot characteristics –payload, reach, repeatability, accuracy, resolution.	6
4.	Robot End effecters & Actuators: Types, mechanical grippers, other types of grippers, Tools as end effecters. Characteristics of actuating systems, Actuating System – Hydraulic devices, pneumatic devices, electric motors, other special actuators.	6

5.	Transmission Kinematics of Robot: Homogenous coordinates, Homogeneous transformation matrices, Direct and Inverse Kinematics of robots, Trajectory Planning.	4
6.	Application Application of Robots: Handling, loading and unloading, Welding, Spray painting, Assembly, Machining, Inspection, Rescue robots, Underwater robots, Parallel robot, and Medical robot.	4

C. Course Outcomes:

The students will be able to -

- **CO1:** Understand the basic concept of Mechatronics system. Engineering for designing the mechatronics system.
- **CO2:** Analyzethe different mathematical modelling of the liquid level, pneumatic systems, hydraulic systems and thermal systems for actuation of mechatronics systems.
- **CO3:** Understand the working of robot design with coordinate system.
- **CO4:** Apply the knowledge of different parts of robots for real time application and robot design.
- **CO5:** Understand and applythe robot kinematics in real time problem.
- **CO6:** Apply the knowledge in different application for mankind.

D. Learning Resources:

Text Books:

1. Bolton, W, Mechatronics. 3rd edn, Addison-Wesley.
2. Robotics: Control, Sensing, Vision and Intelligence by Fu, Gonzalez and Lee
3. Introduction to Robotics:Mechanics and Control (3rdEdition) by John J. Craig
4. Robot Dynamics and Control: by Spong and Vidyasagar
5. Introduction to Robotics, S K Saha, McGrew Hill

Reference Books:

1. Fuller, J, Robotics: Introduction, Programming and Projects, 2nd edn, Prentice-Hall.
2. Schuler, C, &McNammee, W, Industrial Electronics & Robotics, McGraw-Hill.
3. Karnopp DC, Margolis DL & Rosenberg RC, System Dynamics: Modeling and Simulation of Mechatronics Systems. 3rd edn. Wiley Interscience.
4. Control of Robot Manipulations: F.I.Lewis, C.T.Abdallah, D.M.Dawson
5. Kinematic Analysis of Robot Manipulators: Carl D. Crane and Joseph Duffy
6. Robotics for Engineers: Koren Y.
7. Robot Modelling: Control and Application with software: by P.G.Ranky and C.Y.Ho

Department of Applied Electronics & Instrumentation Engineering
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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Fourth Year Seventh Semester Curriculum
Applicable from Academic Session 2021-22

Course Code: PE-EI702	**Category:** Professional Elective Courses - III
Course Name: Digital Control System	**Semester:** Seventh
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Elective	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 40	**Full Marks:** 100
Pre-Requisites: Basic Electronics, Control System, Sensors & Transducers, Measurement	

A. Learning Objectives:

- To apply the control strategy in digital domain. To build the system small and useful for our daily life.

B. Course Content:

Module No.	Description of Topic	Contact Hours
1	Discrete Representation of Continuous Systems – Basics of Digital Control Systems. Discrete representation of continuous systems. Sample and hold circuit. Mathematical Modelling of sample and hold circuit. Effects of Sampling and Quantization. Choice of sampling frequency. ZOH equivalent.	6
2	Discrete System Analysis Z-Transform and Inverse Z Transform for analyzing discrete time systems. Pulse Transfer function. Pulse transfer function of closed loop systems. Mapping from s-plane to z plane. Solution of Discrete time systems. Time response of discrete time system.	6
3	Stability of Discrete Time System Stability analysis by Jury test. Stability analysis using bilinear transformation. Root locus method in z plane. Design of digital control system with dead beat response. Practical issues with dead beat response design	4
4	State Space Approach for discrete time systems State space models of discrete systems, State space analysis. Lyapunov Stability. Controllability, reach-ability, Reconstructibility and observability analysis. Effect of pole zero cancellation on the controllability & observability	10
5	Design of Digital Control System Design of Discrete PID Controller, Design of discrete state feedback controller. Design of set point tracker. Design of Discrete Observer for LTI System. Design of Discrete compensator. Digital Control Algorithms :- (a) Dead beat control (b) Dahlin's algorithm.	8
6	Fuzzy logic control Crisp Set, Fuzzy Set, Fuzzy Operators, Overview of FLC, Different Fuzzy models (MA/TS), Applications of Fuzzy rule based systems: Studies of some Fuzzy-neural, Neuro-fuzzy and Fuzzy-GA systems	6

C. Course Outcomes:

The students will be able to -

- **CO1:** Understand the discrete representation of continuous systems with mathematical modelling.
- **CO2:** Analyze discrete system.
- **CO3:** Analyze stability of discrete time system.
- **CO4:** Analyze state space approach of discrete time system.
- **CO5:** Design the controller for discrete time system.
- **CO6:** Understand the Fuzzy logic control.

D. Learning Resources:

Text Books:

1. Digital Control and State Variable Methods– M. Gopal, McGraw Hill Education
2. Digital Control Systems - B. C. Kuo, Oxford University Press-New Delhi
3. Digital Control System, V.I.George and C.P.Kurien, Cengage Learning.
4. Digital Control Engineering Analysis and Design, M.SamiFadali, Antonio Visioli, Academic Press.
5. Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications by Rajasekharan and Rai – PHI Publication.
6. Introduction to Neural Networks using MATLAB 6.0 – S.N.Sivanandam, S.Sumathi, S.N.Deepa, TMH

Reference Books:

1. C.M. Houpis, G.B.Lamount, ‘ Digital Control Systems- Theory, Hardware, Software’, International Student Edition, McGraw Hill Book Co.,
2. Kannan M.Moddgalya, Digital Control, Wiley India,
3. C.L. Philips and J.M.Pan, “Feedback Control System, Pearson
4. Klir.G, Yuan B.B. “Fuzzy sets and Fuzzy Logic Prentice Hall of India private limited
5. Laurance Fausett, “Fundamentals of Neural Networks”, Prentice hall
6. Gen, M. and Cheng R. “Genetic Algorithm and Engineering Design”, John Wiley

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Fourth Year Seventh Semester Curriculum
Applicable from Academic Session 2021-22

Course Code: PE-EI703	**Category:** Professional Elective Courses - IV
Course Name: Analytical Instrumentation	**Semester:** Seventh
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Elective	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 34	**Full Marks:** 100
Pre-Requisites: Chemistry, Process Control, Sensors & Transducers, Measurement	

A. Learning Objectives:

- To make acquainted with Instrumentation application in industry for analyzing the sensors used for measuring the physical sensor parameters (Example: gas, liquid, optical etc.)

B. Course Content:

Module No.	Description of Topic	Contact Hours
1.	Introduction to Analytical Instrumentation: Classification, types of Instrumental methods Measurement of Humidity: dry & wet psychrometer, hair hygrometer, electrical type, Electrolysis type hygrometer, dew point meter.	4
2.	Moisture: electrical conductivity type, capacitive method type, IR method, microwave method, crystal oscillator method. Viscosity:Poiseuilles formula, Saybolt's viscometer, rotameter type viscometer, friction tube viscometer, Searle's rotating cylinder type. Density: pressure head type, buoyancy effect type, Gow-Mac densitometer, radioactive type, photoelectric type, displacer	6
3	Gas Analysis:) Thermal conductivity method.) Heat of Reaction method. Oxygen Analysis:) Magneto Dynamic instrument(Pauling cell)) Thermomagnetic type or Hot wire type instrument.) Zirconia oxygen analyzer.) Mackerth type galvanic analyzer for dissolved oxygen analysis.	4
4.	Liquid analysis: Electrodes-Ion selective, Molecular selective types- their variations. pH analysis: pH electrodes, circuit for pH measurement and applications. Conductivity cells – standards, circuits. Polarography- apparatus, circuits and techniques-pulse polarography, applications Colorimetry	6

5.	Spectroscopic Methods: Introduction, Laws relating to 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. Plasma Spectroscopy: Sequential & Simultaneous multichannel Instruments. Atomic X Ray spectrometry: Absorption & diffraction phenomena, sources, detectors, techniques.	8
6.	Chromatography: Introduction, basic definitions, some relationships. Gas Chromatography: basic parts, columns, detectors, techniques. LC : types, HPLC: basic parts, sample injection system, column, detectors, Applications	6

C. Course Outcomes:

The students will be able to -

- **CO1:** Understand why Analytical Instrumentation is useful for industrial application.
- **CO2:** Analyse Moisture, Viscosity with different method of measurement.
- **CO3:** Analyse Gas and Oxygen with various methods.
- **CO4:** Analyse Liquid with various practical experiments.
- **CO5:** Understand and analyse Spectroscopy is significantindetermining composition, temperature, density, motion etc.,
- **CO6:** Understand and analyse how Chromatography used for separation of mixture.

D. Learning Resources:

Text Books:

1. Principles of Industrial Instrumentation- D.C. Patranabis, Publisher: Tata McGraw Hill
2. Principles of Instrumental Analysis- Skoog, Holler, Nieman, Publisher: Thomson Brooks/Cole
3. Introduction to Instrumental Analysis-Robert D. Braun, Publisher: Pharma Book Syndicate
4. Handbook of Analytical Instruments- R.S. Khandpur, Publisher: Tata McGraw Hill

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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Fourth Year Seventh Semester Curriculum
Applicable from Academic Session 2021-22

Course Code: PE-EI704	**Category:** Professional Elective Courses - IV
Course Name: Non-Destructive Testing	**Semester:** Seventh
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Elective	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 30	**Full Marks:** 100
Pre-Requisites: Chemistry, Process Control, Sensors & Transducers, Measurement	

A. Course Content:

Module No.	Description of Topic	Contact Hours
1	Introduction and importance of NDT. General Principles and Basic Elements of NDT.	4
2	Surface feature inspection and testing: General, Visual, Chemical, and Mechanical Magnetic-magnetization, flux, and Electro potential, Electrical resistivity, Electromagnetic-eddy current techniques.	10
3	Ultrasonic waves, principle of propagation, Ultrasonic Test methods: Echo, Transit time, Resonance, Direct contact and immersion types	8
4	Ultrasonic methods of measuring thickness, depth, flow, level etc. Various parameters affecting ultrasonic testing and measurements, their remedy Ultrasonic in medical diagnosis and therapy.	8

B. Course Outcomes:

The students will be able to -

- **CO1:** Understand why Non Destructive Testing (NDT) is useful for industry or clinical process.
- **CO2:** Understand and analyze different techniques of NDT General, Visual, Chemical and Mechanical system.
- **CO3:** Understand and analyze Ultrasonic wave used in NDT.
- **CO4:** Understand and analyze Ultrasonic method in Industry and Medical measurement techniques.

C. Learning Resources:

Reference 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
5. U. Schnars, W. Jeuptner - Digital Holograpy, Springer, 2005
6. W. J. Price – Nuclear radiation Detection, McGraw Hill, New York, 1958
7. Krauthsamer J and Krauthsamer H – Ultrasonic Testing of Materials, Springer Verlag, Berlin, New York.
8. Wells N T – Biomedical Ultrasonics, Academic Press,London 1977

Department of Applied Electronics & Instrumentation Engineering
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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Fourth Year Seventh Semester Curriculum
Applicable from Academic Session 2021-22

Course Code: OE-EI701	**Category:** Open Elective Courses - IV
Course Name: Telemetry & Wireless Sensor Network	**Semester:** Seventh
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Open Elective	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 40	**Full Marks:** 100
Pre-Requisites: Communication, Sensors, Basic Computer Knowledge.	

A. Course Content:

Module No.	Description of Topic	Contact Hours
1	Purpose of telemetry, basic scheme, voltage, current and frequency telemetry Modulation Codes: PAM, PFM, PTM, PCM Review of modulation and multiplexing: FM-AM, FM-FM, PAM-AM, PAM-FM, PCM-AM, etc. Quantization and error in quantization. Inter symbol interference, Bit error rate, noise.	8
2	FDM systems, IRIG standards in FDM systems. SCO's, Mux and Demux circuits, Detectors and Demodulators, Pulse averaging, Quadrature FM and PLL, Mixers. TDM systems (architecture)- TDM- PAM, PAM- PM, TDM- PCM systems, synchronization	8
3	Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks.	5
4	Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks (WSNs), Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks.	4
5	Routing Protocols, MAC Protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC Protocol, IEEE 802.15.4 Standard, ZigBee, Wifi. 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.	10
6	Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.	5

B. Course Outcomes:

The students will be able to -

CO1: Understand the basic concept of telemetry and communication modulation code
CO2: Understand Frequency-division multiplexing (FDM) and Time-division multiplexing (TDM) in

practical field.

CO3: Understand and working of the sensor network and its application in Industry.
CO4: Understand and working of the Mobile Ad-hoc Networks and wireless sensor networks.
CO5: Understand and apply routing protocol in Industry.
CO6: Understand the WSNs Communication techniques.

C. Learning Resources:

Text Books:

1. D. Patranabis, Telemetry principles, TMH, New Delhi
2. E. L. Gruenberg, Handbook of Telemetry and Remote control, McGraw Hill
3. B. P. Lathi, Modern Digital and Analog Communication Systems, Oxford University Press
4. Swobada G – Telecontrol Method and Application of Telemetering and Remote Control, Von Nostrand.

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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Fourth Year Seventh Semester Curriculum
Applicable from Academic Session 2021-22

Course Code: OE-EI702	**Category:** Open Elective Courses - IV
Course Name: Non-Conventional Energy System	**Semester:** Seventh
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Open Elective	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 30	**Full Marks:** 100
Pre-Requisites:	

A. Course Content:

Module No.	Description of Topic	Contact Hours
1	Classification of Energy Sources Advantages of Non-Conventional Energy Sources over Conventional Sources Economics, Impact on Environment.	4
2	Thermal Energy Generation from Solar Energy: Solar radiation and its Characteristics. Solar Collector: flat Plate, evacuated tube, focusing, Solar Energy use for water heating, Solar thermal power generation. Principle of energy conversion in Solar Photovoltaic cells, Different types of PV Cells, Mono-poly crystalline and amorphous Silicon solar cells. Design of PV array. Efficiency and cost of PV systems.	6
3	Electricity Generation from Wind Energy: Wind as energy source, Design of Wind turbine, Selection of site of Wind farm, characteristics of different types of wind generators used with wind turbines.	4
4	Electricity Generation from Bio Energy: Resources and conversion process: bio gas conversion, bio gas plant, bio mass gasifier, cogeneration. Bio diesel: Sources, usability and advantages over mineral product	6
5	Electricity Generation from Tidal Energy: Principle, selection of site, Economics and future prospect. Electricity Generation from Wave Energy: Principle, selection of site and future prospect Electricity Generation from Geo Thermal Energy: Principle , location , economics and prospect Introduction to Energy Conservation & Audit	8
6	Introduction to Energy Conservation & Audit	2

B. Course Outcomes:

The students will be able to -

CO1: Understand the basic concept of Non-Conventional Energy source and application in real life.
CO2: Understand and explain Solar Energy generation and application.
CO3: Understand and apply Electricity Generation from Wind Energy
CO4: Understand and apply Electricity Generation from Bio Energy and Bio diesel techniques.
CO5: Understand and explain Electricity generation from Tidal, Wave and Thermal energy.
CO6: Understand the audit and energy conservation.

C. Learning Resources:

1. Bansal, Kleeman & Melisa - "Renewable Energy Sources & Conversion Technology" - TMH New Delhi.
2. S P Sukhatme - "Solar Energy"
3. Twidell & Weir - "Renewable Energy Resources"; ELBS
4. Non Conventional Energy Sources – G. D. Rai
5. Non-Conventional Energy Resources – Chandra & Chandra, Khanna Publishing House
6. Energy Technology, O.P. Gupta, Khanna Publishing House

Department of Applied Electronics & Instrumentation Engineering
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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Fourth Year Seventh Semester Curriculum
Applicable from Academic Session 2021-22

Course Code: ES-CS701	**Category:** Engineering Science Courses
Course Name: Computer Networks	**Semester:** Seventh
Program: AEIE	**Course Coordinator:** CSE/IT Department
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 30	**Full Marks:** 100
Pre-Requisites: Communication Engineering	

A. Course Content:

Module No.	Description of Topic	Contact Hours
1	Data communication Components: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN	5
2	Techniques for Bandwidth utilization: Multiplexing – Frequency division, Time division and Wave division, Concepts on spread spectrum.	3
3	Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols – Stopand Wait, Go back – NARQ, Selective Repeat ARQ, Sliding Window, Piggybacking. Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA,CSMA/CD,CDMA/CA	8
4	Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols	4
5	Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.	
6	Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography	5

B. Course Outcomes:

The students will be able to -

CO1: Understand research problem formulation.
CO2: Analyse research related information

CO3: Follow research ethics

CO4: Understand that today's world is controlled by Computer, Information Technology but tomorrow's worldwill be ruled by ideas, concept, and creativity.

CO5: Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual property right to be promoted among students in general & engineering in particular.

CO6: Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better product and in turn brings about, economic growth and social benefits.

C. Learning Resources:

1. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.
3. "An Integrated Approach to Computer Networks" by Bhavneet Sidhu, Khanna Publishing House
4. "Algorithm Design" by Kleinberg and Tardos.
5. "Design & Analysis of Algorithms", Gajendra Sharma, Khanna Publishing House, New Delhi

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Fourth Year Seventh Semester Curriculum
Applicable from Academic Session 2021-22

Course Code: PW-EI791	**Category:** Project Work
Course Name: Project I	**Semester:** Seventh
Program: AEIE	**Course Coordinator:** Departmental
Nature of Course: Project Work	**Type of Course:** Project Work
Contact Hour Classification: L-T-P:0-0-8	**Credit:** 4
Total Contact Hours:	**Full Marks:** 100
Pre-Requisites:	

Course Code: EI781	**Category:** NA
Course Name: Industrial Training Evaluation	**Semester:** Seventh
Program: AEIE	**Course Coordinator:** Departmental Evaluation
Nature of Course: NA	**Type of Course:** Evaluation
Contact Hour Classification: L-T-P:0-0-2	**Credit:** 1
Total Contact Hours:	**Full Marks:** 100
Pre-Requisites:	

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Fourth Year Eighth Semester Curriculum
Applicable from Academic Session 2021-22

FOURTH YEAR EIGHTH SEMESTER PROPOSED SYLLABUS

Fourth Year Eighth Semester								
Sl No	Category	Code	Course Title	Contact hours/week				Credit Points
				L	T	P	Total	
Theory								
1	Professional Elective Courses-V	PE-EI801/ PE-EI802	Power Plant Instrumentation/Nano Electronics	3	0	0	3	3
2	Open Elective Courses-V	OE-EI801/ OE-EI802	Digital Image Processing /Big Data Analysis	3	0	0	3	3
3	Humanities and Social Sciences including Management Courses	HM- HU801	Project Management & Entrepreneurship	2	0	0	2	2
Total Theory								8
Practical								
1	Project Stage-II	PW-EI891	Project II	0	0	16	16	8
2	Grand Viva	EI881	Grand Viva-Voce					1.5
Total Practical								9.5
Total of Eighth Semester								17.5

Department of Applied Electronics & Instrumentation Engineering
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Affiliated to MAKAUT and approved by AICTE

Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Fourth Year Eighth Semester Curriculum
Applicable from Academic Session 2021-22

Course Code: PE-EI801	**Category:** Professional Elective Courses - V
Course Name: Power Plant Instrumentation	**Semester:** Eighth
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Elective	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 30	**Full Marks:** 100
Pre-Requisites: To understand this course, the learner must have idea of Sensor and Transducer, Industrial instrumentation and Process control.	

Learning Objectives:

- To acquaint the Power Plant Professionals with theory and working principles of different types of instruments used in the power plant and their applications.

Course Content:

Module No.	Description of Topic	Contact Hours
1.	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.	6
2.	Instrumentation for 1) Turbines 2) Condensers 3) Generators 4) Coal handling 5) Water treatment 6) Feed water, combustion air and flue gases	10
3.	Control Boiler Control - Steam pressure control, combustion control, Furnace Draft control, Steam temperature Control, Feed water control, Data logger and computer control, supervisory control and monitoring system.	5
4.	Safety Instrumentation for safety interlocks - protective gears, emergency measures, Alarm systems and Analysis etc. Pollution measurement, monitoring and control.	3
5.	Transmission Data handling-processing, logging, acquisition, accounting, display and storage. Instrumentation for Generator and Busbar coupling.	4
6.	Modelling and simulation Introduction to power plant modelling/simulation, Understand the basic interface (HMI) of a typical power plant with all safety measures.	2

Department of Applied Electronics & Instrumentation Engineering
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Fourth Year Eighth Semester Curriculum
Applicable from Academic Session 2021-22

Course Outcomes:

The students will be able to -

- **CO1:** Create an overall perception about different types of power plant like Thermal, Hydel and Nuclear along with the measuring instruments associated with these particular types of process.
- **CO2:** Evaluate instruments parameter to get overall control of a power plant by knowing the working principle of each block such as Turbine, Condensers, Generators, Coal handling, Water treatment, Feed water, combustion air and flue gases.
- **CO3:** Analyze the feedback signal for different control unit of power plant such as Boiler control, Furnace draft control, Steam temperature control and Feed water control etc. The supervisory control and monitoring is accompanying with different control loop for enhanced closed loop responses.
- **CO4:** Apply all type of safety interlock to ensure zero accident by incorporating protective gears, emergency measures and Alarm systems. Moreover, the pollution due to the power plant is also measured, monitor and control for the environmental safety.
- **CO5:** Understand the data handling processing, logging, acquisition, accounting, display and storage of data from Power plant. The coupling between the turbine and generator along with transmission through three phases are considered as an output side of the power plant.
- **CO6:** Describes the modelling and simulation of power plant in HMI section using DCS and PLC for better closed loop control.

Learning Resources:

Text Books:

1. Power Plant Instrumentation, K. Krishnaswamy, M. PonniBala, PHI Learning Private Limited.
2. Principles of Industrial Instrumentation, D. Patranabis, TMH New Delhi

Reference Books:

1. Electric Power Engineering Handbook – Edited by L. L. Grigsby.
2. Instrument Engineers Handbook, B. G. Liptak, Chilton Book Co., Philadelphia

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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering, Fourth Year Eighth Semester Curriculum Applicable from Academic Session 2021-22

Course Code: PE-EI802	**Category:** Professional Elective Courses - V
Course Name: Nano Electronics	**Semester:** Eighth
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Elective	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 34	**Full Marks:** 100
Pre-Requisites: Basic Electronics	

Course Content:

Module No.	Description of Topic	Contact Hours
1	Fundamentals on Nano electronics Concepts of Nano electronics, Technological revolution from Microelectronics to Nano electronics and beyond, Moore's Law Trends and Limits, Technological advantages in various applications like - Automotive, Health Care, Biochips, Lab- on-Chips , Safety and Security, Industrial Applications, etc.	4
2	Nano diode – classification of nanostructure (1D or quantum well, 2D or quantum wire, 3D or quantum dot), band structure and energy level modification in various nanostructures, electron transport in nanostructures, design of Nano diodes, Resonant-tunneling diodes, Nano Light-emitting diodes, Nano lasers, Nano solar cell, etc.	6
3	Nano transistor & Nano Display systems – Nano transistor, Nano Field-effect transistors, Single-electron-transfer devices, Potential-effect transistors, Nano display system, etc.	6
4	Nano Logic Devices – Nano MOSFET & CMOS Devices, Device structure and Speed Performance of Nano FETs, Switching Delay Formulation, Power dissipation, Parasitic Capacitance in Logic Devices, FinFET and Double-Gate Devices, Choice of Materials for Advanced CMOS	6
5	Nano Memory Devices - Mainstream Memories (DRAM and NAND), Evolution and Scaling Limits, Various Memories Technologies like Ferroelectric Memories, Magnetic Memories, Phase Change Memories, Resistive RAMs, OxRAM and CBRAM, Emerging Memories Architectures, From Cell to Arrays, 3D RRAM Architectures, Opportunities for Emerging Memories etc.	6
6	Nano Integrated Sensors and Actuators – Nano Mechanical sensors, Nano MEMS, Nano Pressure Sensors, Acceleration Sensors, Nano Gas Sensors, Biosensors, Electrostatic, Electromagnetic and Piezoelectric Sensors, Nano Optical Fibers, Integrated Fiber Sensors for Industrial applications.	6

Course Outcomes:

The students will be able to -

CO1: Identify the concept, advantages and challenges of Nano electronics
CO2: Describe the characteristics of carrier distribution and transport in nanoscale structures
CO3: Identify different types of Nano diodes, Nano transistors and their junction physics
CO4: Describe the construction and operation of various Nano display, logic and memory devices
CO5: Compose different Nano-photonics devices for optical fiber sensor systems

CO6: Design various nanofiber sensors for industrial applications like temperature, pressure, displacement, fluid flow, rotation, etc.

Learning Resources:

Books:

1. Nanoelectronics - Materials,Devices,Applications – R. Puers, et al (Ed), Wiely VCH, 2016
2. Introduction to Nanoelectronics Science, Nanotechnology, Engineering, and Applications – V. V. Mitin, V.A. Kochelap and M. A. Stroscio, Cambridge University Press, 2008
3. Fundamentals of Nanoelectronics - G. W. Hanson, Pearson/Prentice Hall, 2008
4. Intersubband Transitions in Quantum Structures – R. Paiella (Ed), MaGraw-Hill, 2006
5. Nano photonics and Nanostructured Fiber Sensors – A. B. Maity, Narosa, 2019
6. Sensors Based on Nanostructured Materials - F. J. Arregui (Ed), Springer, 2009

Department of Applied Electronics & Instrumentation Engineering
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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources
for
Applied Electronics & Instrumentation Engineering,
Fourth Year Eighth Semester Curriculum
Applicable from Academic Session 2021-22

Course Code: OE-EI801	**Category:** Open Elective Courses - V
Course Name: Digital Image Processing	**Semester:** Eighth
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Open Elective	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 40	**Full Marks:** 100
Pre-Requisites: Digital Signal Processing, Signals and Systems.	

Learning Objectives:

- To understand the different representation of digital images.
- To understand the importance of adequate sampling frequencies and the appearance of artefacts.
- To study the image fundamentals and mathematical transforms necessary for image processing.

Course Content:

Module No.	Description of Topic	Contact Hours
1.	Introduction to structure of human eye, Image formation in the human eye, Brightness adaptation and discrimination, Image sensing and acquisition, storage, Processing, Communication, Display Image Sampling and quantization, Basic relationships between pixels.	4
2.	Introduction to Fourier transform, DFT and 2-D DFT, Properties of 2-D DFT, FFT, IFFT, Walsh transform, Hadamard transform, Discrete cosine transform, Slant transform, Optimum transform: Karhunen- Loeve(Hotelling) transform, Wavelet Transform.	10
3.	Gray level transformations, Histogram processing, Arithmetic and logic operations, Spatial filtering: Introduction, Smoothing and sharpening filters. Frequency domain filters: Homomorphic filtering.	6
4.	Fundamentals, Redundancies: Coding, Inter pixel Psycho- visual, fidelity criteria, Image compression models, Error free compression, Lossy compression, Image compression standards: Binary image and Continuous tone Still Image compression standards, Video compression standards.	7
5.	Introduction, Dilation, Erosion, Opening, closing, Hit -or- miss transformation, Morphologicalalgorithm operations on binary Images, Morphological algorithm, operations on gray- scale Images.	6
6.	Image Segmentation, Representation and Description: Detection of discontinuities, Edge linking and Boundary detection, ThresholdingRegion based segmentation, Image Representation schemes, Boundary descriptors, and Regionaldescriptors.	7

Department of Applied Electronics & Instrumentation Engineering
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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for
Applied Electronics & Instrumentation Engineering,
Fourth Year Eighth Semester Curriculum
Applicable from Academic Session 2021-22

Course Outcomes:

The students will be able to -

- **CO1:** Mathematically represent the various types of images and analyze them.
- **CO2:** Process these images for the enhancement of certain properties or for optimized use of the resources.
- **CO3:** Analyze images in the frequency domain using various transforms.
- **CO4:** Design and implement the algorithms related to morphological image processing.
- **CO5:** Design and implement algorithms that perform basic image processing (e.g. noise removal and image enhancement).
- **CO6:** Design and implement algorithms for advanced image analysis (e.g. image compression, image segmentation).

Learning Resources:

Text Books:

1. R.C Gonzalez and R. Woods :-Digital Image Processing, (Indian reprint: Pearson publication,2001)
2. Anil K. Jain :- Digital Image Processing (Prentice-Hall,India)

Reference Books:

1. W. K. Pratt :-Digital Image Processing, - 2nd Edition, (John Wiley &Sons).
2. B. Chanda& D. Dutta Majumder, Digital Image Processing andAnalysis, (Prentice-Hall, India)
3. M. A. Sid-Ahmed :- Image Processing- Theory, Algorithms &Architecture, (McGraw-Hill)

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Fourth Year Eighth Semester Curriculum
Applicable from Academic Session 2021-22

Course Code: OE-EI802	**Category:** Open Elective Courses - V
Course Name: Big Data Analysis	**Semester:** Eighth
Program: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Open Elective	**Type of Course:** Theory
Contact Hour Classification: L-T-P:3-0-0	**Credit:** 3
Total Contact Hours: 40	**Full Marks:** 100
Pre-Requisites:	

Course Content:

Module No.	Description of Topic	Contact Hours
1	INTRODUCTION TO BIG DATA Introduction– distributed file system–Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce	6
2	INTRODUCTION TO HADOOP AND HADOOP ARCHITECTURE Big Data – Apache Hadoop&HadoopEcoSystem, Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce -, Data Serialization.	8
3	HDFS, HIVE AND HIVEQL, HBASE HDFS-Overview, Installation and Shell, Java API; Hive Architecture and Installation, Comparison with Traditional Database, HiveQL Querying Data, Sorting And Aggregating, Map Reduce Scripts, Joins & Sub queries, HBase concepts, Advanced Usage, Schema Design, Advance Indexing, PIG, Zookeeper , how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with	6
4	SPARK Introduction to Data Analysis with Spark, Downloading Spark and Getting Started, Programming with RDDs, Machine Learning with MLlib.	8
5	NoSQL What is it?, Where It is Used Types of NoSQL databases, Why NoSQL?, Advantages of NoSQL, Use of NoSQL in Industry, SQL vsNoSQL, NewSQL	5
6	Data Base for the Modern Web Introduction to MongoDB key features, Core Server tools, MongoDB through the JavaScript's Shell, Creating and Querying through Indexes, Document-Oriented, principles of schema design, Constructing queries on Databases, collections and Documents, MongoDB Query Language.	7

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Fourth Year Eighth Semester Curriculum
Applicable from Academic Session 2021-22

Course Outcomes:

Upon completion of this course, students will be able to do the following:

- **CO1:** Students will to build and maintain reliable, scalable, distributed systems with Apache Hadoop.
- **CO2:** Students will be able to write Map-Reduce based Applications Learning with MLlib. 5 NoSQL What is it?, Where It is Used Types of NoSQL databases, Why NoSQL?, Advantages of NoSQL, Use of NoSQL in Industry, SQL vs NoSQL, NewSQL 05 12 6 Data Base for the Modern Web Introduction to MongoDB key features, Core Server tools, MongoDB through the JavaScript's Shell, Creating and Querying through Indexes, Document-Oriented, principles of schema design, Constructing queries on Databases, collections and Documents, MongoDB Query Language. 08 15
- **CO3:** Students will be able to design and build MongoDB based Big data Applications and learn MongoDB query language
- **CO4:** Students will learn difference between conventional SQL query language and NoSQL basic concepts
- **CO5:** Students will learn tips and tricks for Big Data use cases and solutions.

Learning Resources:

Reference Books:

1. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, ISBN: 9788126551071, 2015.
2. Chris Eaton, Dirkderooset al. , "Understanding Big data ", McGraw Hill, 2012.
3. BIG Data and Analytics, Sima Acharya, Subhashini Chhellappan, Willey
4. MongoDB in Action, Kyle Banker,PiterBakkum , Shaun Verch, Dream tech Press
5. Tom White, "HADOOP: The definitive Guide", O Reilly 2012.
6. VigneshPrajapati, "Big Data Analyticswith R and Haoop", Packet Publishing 2013.
7. Learning Spark: Lightning-Fast Big Data Analysis Paperback by Holden Karau
8. V.K. Jain, Big Data and Hadoop, Khanna Publishing House, 2017.

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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Fourth Year Eighth Semester Curriculum
Applicable from Academic Session 2021-22

Course Code: HM-HU801	**Category:** : Humanities and social sciences including Management Courses
Course Name: Project Management and Entrepreneurship	**Semester:** Eighth
Program: AEIE	**Course Coordinator:** MBA Department
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hour Classification: L-T-P:2-0-0	**Credit:** 2
Total Contact Hours: 30	**Full Marks:** 100
Pre-Requisites:	

Course Content:

Module No.	Description of Topic	Contact Hours
1	Introduction Concept of Management, Management: Art and Science, Management Vs Administration, Levels of Management, Functions of management, Management as a Profession, Management skills, Qualities and characteristics of managers. Evolution of Management thought: Early contributions: Taylor and Scientific Management, Fayol's Administrative Management, Bureaucracy, Human Relations, and Modern Approach, Social responsibility of managers, Managerial Ethics.	6
2	Planning and Organizing Concept of planning, Significance of planning, Classification of planning: Strategic plan, Tactical plan and Operational plan, Process of planning, Barriers to effective planning. MBO, Management by Exception. Decision Making: Strategies of decision making, Steps in rational decision making process, Factors influencing decision making process, Psychological bias and decision support system. Organizing: Defining organizing, Principles of organizing, Process of organizing, Types of organizational structure, Span of control, Line and Staff Relationship, Centralization vs. Decentralization of authority, Informal organization.	10
3	Staffing, Directing and Motivation Staffing: Concept, Objective of staffing, System approach to staffing, Manpower planning. Directing: Concept, Techniques of directing and supervision, Types of supervision, Essential characteristics of supervisor. Motivation: Concept, Forms of employee motivation, Need for motivation. Theories of motivation: Maslow, Herzberg, Mc- Clelland, Vroom, Porter and Lawler, Job Satisfaction.	6

4	Leadership and Control Leadership vs Management, Process of Leadership, Importance of leadership, Characteristics of an effective leader, Communication Process, Channels and Barriers, Effective Communication, Controlling: Concept, Importance of controlling, Types of control, Steps in control process, Coordination Concept, Importance, Principles and Techniques of Coordination, Concept of Managerial Effectiveness.	8

Course Outcomes:

The students will be able to -

- **CO1:** To understand the basic concept of management, diagnose the management issues in organizations, explain and analyze key principles of management planning, leading and controlling in business organizations
- **CO2:** To explain the ethical standards and external environmental aspects of the organizations, list and exercise social responsibility and sustainability in the practical context and maintaining good governance for organization
- **CO3:** To explain the basic concept, tools and environmental framework of marketing management and its importance on the organization in order to develop the effective marketing communications strategy
- **CO4:** To explain the basic concept and functions of human resource management, human resource development and their applications in the organization, training and knowledge of human factors in engineering and various job designs
- **CO5:** To evaluate various kinds of skills in inter-personal communication, team work, leading people, and handling conflict in organizations
- **CO6:** To understand individual personalities and interpersonal skills needed for effective communications in a diverse business environment.

Learning Resources:

Text Books:

1. Durai, P. (2015). Principles of Management, Text and Cases. New Delhi: Pearson Education.
2. Koontz, H. (2010). Essentials of Management. New Delhi: Tata McGraw-Hill Education.
3. Stoner, Freeman & Gilbert Jr. (2009). Management. New Delhi: Prentice Hall.
4. Premvir Kapoor (2018), Principles of Management, Khanna Publishing House, New Delhi

Reference book:

1. Weihrich, H. & Koontz, H. (2010). Management- A Global Perspective: New Delhi: Tata McGraw-Hill Education.
2. Robbins & Coulter (2013). Management. New Delhi: Prentice Hall.
3. Robbins, S.P. &Decenzo, D. A. (2014). Fundamentals of Management: Essential Concepts and Applications. New Delhi: Pearson Education.
4. Luthans, F. (2010). Organizational Behaviour. New York: McGraw-Hill

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
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Documentation of Course Objectives, Course Contents, Course Outcomes and, Learning Resources for Applied Electronics & Instrumentation Engineering,
Fourth Year Eighth Semester Curriculum
Applicable from Academic Session 2021-22

Course Code: PW-EI891	**Category:** Project Work
Course Name: Project II	**Semester:** Eighth
Program: AEIE	**Course Coordinator:** Departmental
Nature of Course: Project Work	**Type of Course:** Project Work
Contact Hour Classification: L-T-P:0-0-16	**Credit:** 8
Total Contact Hours:	**Full Marks:** 100
Pre-Requisites:	

Course Code: EI881	**Category:** NA
Course Name: Grand Viva-voce	**Semester:** Eighth
Program: AEIE	**Course Coordinator:** Departmental Evaluation
Nature of Course: NA	**Type of Course:** Evaluation
Contact Hour Classification:	**Credit:** 1.5
Total Contact Hours:	**Full Marks:** 100
Pre-Requisites:	

Annexure-I

MOOCs for B. Tech Honours

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Maulana Abul Kalam Azad University of Technology, West Bengal

Notice

1st May, 2018

MOOCs for B.Tech Honours
(Applicable from the session 2018-2019)

Preamble

All India Council for Technical Education (AICTE) has introduced Model Curriculum for Bachelor of Technology programme with 160 credits in the entire programme of 4 years, and additional 20 credits will be required to be done for the degree of Bachelor of Technology with Honours. These additional 20 credits will have to be acquired with online courses (MOOCs) as per AICTE. So students will have to complete additional 20 credits through MOOCs within 4 years of time. This creates an excellent opportunity for students to acquire the necessary skill set for employability through massive online courses where the rare expertise of world famous experts from academics and industry are available. Maulana Abul Kalam Azad University of Technology, West Bengal (MAKAUT,WB) has thus decided to introduce AICTE model curriculum for its B.Tech Programmes and suggest baskets for MOOCs available year wise for the four-year long B.Tech programme from the sessions 2018-2019. The basket for MOOCs will be a dynamic one, as courses keep on updating with time. Few essential skill sets required for employability are also identified year wise by MAKAUT,WB. For MOOCs platforms where examination or assessment is absent (like SWAYAM) or where certification is costly (like Coursera or edX), faculty members of the Institutes are to audit the courses and prepare the examination question papers, for the courses undertaken by the students of respective Institutes, so that MAKAUT,WB can conduct examination for the course. The total of 20 credits that is required to be attained for B.Tech Honours degree are distributed over four years in the following way:

For first year	:	8 credits
For second year	:	4 credits
For third year	:	4 credits
For fourth year	:	4 credits

A student of first year has to cover courses from at least three skills :

1. Computer Programing with Python / R
2. Soft skill
3. Ethics

Courses are * marked in the above areas

If a student is unable to cover the credits assigned for the first year, he/she can do these courses in either of the subsequent years, but he/she has to choose the courses from the basket of MOOCs announced by MAKAUT,WB from time to time. The same rule will be applicable for the other years of the programme.

The basket for MOOCs for the 1st year B. Tech for the session 2018-2019 are made available herewith.

By order.

MOOCs for First Year, Engineering and Technology

Sl. No	Course	Provider	Duration	Credits	Name of University / Institution
1.	Presentation Skills: Designing Presentation Slides	Coursera *	4 weeks	1	Tomsk State University
2.	Effective Problem-Solving and Decision-Making	Coursera	4 weeks	1	University of California
3.	Communication in the 21st Century Workplace	Coursera *	4 weeks	1	University of California
4.	Psychology at Work	Coursera *	6 weeks	2	University of Western Australia
5.	Critical Thinking & Problem Solving	EdX *	3 weeks	3	Rochester Institute of Technology
6.	Successful Career Development	Coursera	7 weeks	2	University System of Georgia
7.	Working in Teams: A Practical Guide	edX	4 weeks	1	University of Queensland
8.	Communication theory: bridging academia and practice	Coursera	9 weeks	3	Higher School of Economics
9.	Speaking Effectively	NPTEL *	8 weeks	3	Indian Institute of Technology, Kharagpur
10.	Introduction to Philosophy	Coursera	5 weeks	1	University of Edinburgh
11.	Moralities of Everyday Life	Coursera	6 weeks	2	Yale University
12.	Introduction to Logic	Coursera *	10 weeks	3	Stanford University
13	Write Professional Emails in English	Coursera *	5 weeks	2	Georgia Institute of Technology
14	Technical Writing	Coursera	5 weeks	1	Moscow Institute of Physics and Technology
15	Learn to Program: The Fundamentals	Coursera	7 weeks	2	University of Toronto
16	The Science of Everyday Thinking	edX	12 weeks	4	University of Queensland
17	Introduction to Problem Solving and Programming	NPTEL	12 weeks	4	NPTEL
18	The Science of Well Being	Coursera	6 weeks	2	Yale University
19	Developing Soft Skills and Personality	NPTEL	8 weeks	3	
20	Programming Basics	edX	9 weeks	3	IIT Bombay
21	Introduction to Python: Absolute Beginner	EdX *	5 weeks	2	Microsoft
22	Inferential Statistics	Coursera *	7 weeks	2	University of Amsterdam
23	Linear Regression and Modelling	Coursera	4 weeks	1	Duke University
24	Foundation of Data Structures	edX	6 weeks	2	IIT Bombay
25	Introduction to Logic	NPTEL	12 weeks	4	NPTEL
26	Introduction to Probability and Data	Coursera *	5 weeks	1	Duke University
27	Ethics	NPTEL *	12 weeks	4	
28	Science, Technology and Society	NPTEL	12 weeks	4	
29	Creating Innovation	Coursera	6 weeks	2	Macquarie University
30	Ethical Leadership Through Giving Voice to Values	Coursera *	4 weeks	2	University of Virginia
31	Creativity, Innovation, and Change	Coursera *	6 weeks	2	Pennsylvania State University
32	Interpersonal Communication for Engineering Leaders	Coursera	4 weeks	1	Rice University

33	Learn to Program: The Fundamentals	Coursera *	7 weeks	3	University of Toronto
34	Introduction to Mathematical Thinking	Coursera *	9 weeks	3	Stanford University
35	The Science of Everyday Thinking	edX	12 weeks	4	University of Queensland
36	A Life of Happiness and Fulfillment	Coursera	6 weeeks	2	Indian School of Business
37	Model Thinking	Coursera	12 weeks	4	University of Michigan
38	Introduction to Philosophy: God, Knowledge, and Consciousness	edX	12 weeks	4	MIT
39	Soft skills	NPTEL *	12 Weeks	4	IIT Roorkee
40	Developing Soft Skills and Personality	NPTEL *	8 weeks	3	IIT Kanpur
41	Indian Fiction in English	NPTEL	12 Weeks	4	IIT Madras
42	Development of Sociology in India	NPTEL	4 Weeks	1	IIT Kanpur
43	Intellectual Property	NPTEL	12 Weeks	4	IIT Madras
44	Essential Statistics for Data Analysis using Excel	EdX *	Self Paced	3	Microsoft
45	Ethics and Law in Data and Analytics	edX	Self Paced	4	Microsoft
46	Climate Change Mitigation in Developing Countries	Coursera *	6 weeks	3	University of Cape town
47	Web Design for Everybody (Basics of Web Development and Coding) Specialization	Coursera	15weeks	4	University of Michigan
48	Ecology: Ecosystem Dynamics and Conservation	Coursera	5 weeks	1	American Museum of Natural History, Howard Hughes Medical Institute
49	Environmental Studies: A Global Perspective	EdX *	Self Paced	4	Curtin University
50	Introduction to Computer Science and Programming Using Python	edX *	Self Paced	4	MIT, USA
51	Statistics and R	edX *	Self Paced	4	Harvard University
52	Introduction to Programming in C	Coursera *	4 weeks	4	Duke University
53	Java Programming: Solving Problems with Software	Coursera	4 weeks	4	Duke University
54	Grammar and Punctuation	Coursera	4 weeks	1	University of California
55	How to Write an Essay	Coursera *	5 weeks	1	University of California, Berkeley
56	Conversational English Skills	EdX *	10 weeks	3	Tsinghua University
57	Advanced Writing	Coursera *	4 weeks	1	University of California, Irvine
58	Speak English Professionally: In Person, Online & On the Phone	Coursera *	5 weeks	1	Georgia Institute of Technology
59	English for Science, Technology, Engineering, and Mathematics	Coursera	5 weeks	1	University of Pennsylvania
60	English Composition	edX	8 weeks	3	Arizona State University
61	Take Your English Communication Skills to the Next Level	Coursera *	4 weeks	1	Georgia Institute of Technology

Annexure-II

Guidelines regarding Mandatory Induction Program for the new students

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Date: 06.12.2017

Maulana Abul Kalam Azad University of Technology, West Bengal

Guidelines regarding Induction Programme for the new students

(As per Model Curriculum for 1st Year UG degrees courses in Engineering & Technology, November 2017)

To be followed from the 2018-19 academic session

Preamble: Engineering education has evolved globally in a continuous manner to address the twin needs of industry and society. It is now an accepted fact that the institutions imparting technical education should aspire to create manpower who will possess strong technical knowledge and skill, have leadership qualities and be a team player, capable of coming up with innovative solutions and be alive to societal and community concerns.

The aim of the Induction Programme is to acclimatize the students to the environment of their engineering institution, give them a flavour of the exciting new world of education that they are entering, provide them with mentoring schemes, and make them aware of their neighbourhood, society and people. This will allow them to evolve as well rounded individuals.

The following schedule is laid down by the University to implement the three week long Induction Programme:

Week 1	1st Half	Day 1	Overall introduction of the new students to the Institution, its different Departments & Faculty Members
	2nd Half	Day 1	(a) Assignment of faculty mentors to the new students (b) Assessment and allotment for mentoring by senior students preferably from the second year
	2 hrs	Day 2, 3, 4, 5	Lectures by eminent personalities on different areas such as (a) Introduction to Engineering (b) Various topics of science and technology (c) Innovation and entrepreneurship (d) Creative and performing arts (e) Social issues
	2 hrs.	Day 2, 3, 4, 5	Participation in Games, Yoga, Meditation etc.
	2 hrs	Day 2, 3, 4, 5	Visit to the different Departments of the Institute
Week 2 (All Days)	2hrs		Scheduled class lectures as per time table.
	2hrs		Students to be conducted through proficiency modules to be prepared by respective Colleges for ascertaining English skills & Computer knowledge of the students

			and to prepare a report on the same
	2hrs		Participation in Games, Sports, Yoga, Creative arts etc.
Week 3	2hrs		Scheduled class lectures as per time table
		Day 1	Visits to neighbourhood locations
		Day 2	Visits to natural spots in adjoining areas to understand the effect of nature on society
		Day 3	Visits to Science Museum / laboratories
		Day 4 Day 5	Visits to NGOs

Any other activity, as deemed fit by the Director/Principal of the affiliated Colleges, may be proposed and discussed with the Academic Coordinator of the University, by sending email to the following address: academics.makaut@gmail.com.

Note: 1) If necessary, networking may be established with NGOs to facilitate the different components and aspects of the Induction Programme.

Annexure-III

Mandatory Additional Requirement

for earning B. Tech Degree

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Maulana Abul Kalam Azad University of Technology, West Bengal
BF-142, Sector-I, Saltlake

Notice

Mandatory Additional Requirement for earning B.Tech Degree

Addressing the needs of the industry and the society: Globally, engineering education systems have continuously evolved, in order to address the needs of the industry and the society. It is becoming imperative that every University should create opportunities for the students to inculcate attributes, which are not restricted only to engineering knowledge and acumen. Industry needs professionals who can work successfully in teams, who have leadership qualities, who are alive to social and community needs and who can bring innovation and creativity to their work and who are also digitally proficient. Hence, in order to prepare its students to match these multiple requirements, MAKAUT,WB has created a unique mechanism of awarding 100 Activity Points over and above the academic grades. It is planned that the students at MAKAUT,WB will be able to reap benefits from these activities at their own pace and comfort. It is expected that by the time MAKAUT,WB's students reach their Final Year, they would have developed themselves so well both through their studies in the respective technological field and through their active participation in the co-curricular and extra-curricular activities as also through SAWYAM based learning activities that they would be well-prepared for contributing to building the India and the world of their dreams.

The additional requirement applies to: Every student, who is admitted to the 4 years B.Tech program from the academic year 2018-19 onwards, is required to earn minimum 100 Activity Points in addition to the required academic grades, for getting MAKAUT,WB's B.Tech degree. Similarly, it is mandatory to earn 75 Activity Points, in addition to the academic grades, for getting B.Tech degree by a student (Lateral Entry) who is admitted to the B.Tech program from the academic year 2018-19 onwards. *(Please see Table* 1 *for details.)* [Lateral Entry students will have a multiplying factor of 1.33 to bring uniformity in score].

Level of Entry in B.Tech Course	Total duration for earning Points	Minimum Points
1st Year from the academic year 2018-19 onwards	1st to 4th Year	100
2nd Year from the academic year 2018-19 onwards (Lateral Entry)	2nd to 4th Year	75

Table – I

For existing Students (except students in the 4th year): Every student, who is admitted to the 4 years B.Tech program prior to the academic year 2018-19, is required to earn minimum number of Activity Points as per Table II in addition to the required academic grades, for getting MAKAUT,WB's B.Tech degree.

Current Semester	Total Points to be earned During the full course
2nd	100
4th	75
6th	50

Table –II

These points must be earned on the basis of active participation in co-curricular and extracurricular activities spanning through all the semesters of study. Every student may choose, as per his/her liking, activities in order to achieve the mandatory points (as per Table-III, depending on his/her entry level), before becoming eligible for award of the Degree. These activities can be spread over the years, as per convenience of the student.

Notes:

- **Current 4th year students who are going to sit for Final Semester examination in May-June, 2018 are outside the preview of this Mandatory Additional Requirement**
- Every student shall participate in the co-curricular and extra-curricular activities and produce documentary proof to the designated Faculty Members appointed by the Head of Department / Principal / Director in the respective college. Thereby the student should earn the required Points before *her* she appears for his/ her Final Examinations.
- A student's result of his/her Final Examinations will be withheld until he/she completes the minimum Activity Points by the end of his/her B.Tech Program.
- In every semester, every student is required to prepare a file containing documentary proofs of activities, done by him / her. This file will be duly verified and Activity Points will be assigned by the teachers as appointed above, at the end of every semester.
- The college will form a 3 members committee and finalize the Activity Points for each student before entering them into the Online Point Entry System (at the URL, as specified by the COE of the University).
- Every student has to earn at least 100 activity points. The points students has earned will be reflected in the student's marksheet.
- Activity points earned by Lateral Entry students will be multiplied by 1.33.

Table III provides a List of Activity Heads and Sub-Activity Heads along with their capping of the Activity Points that can be earned by the students during the entire B.Tech duration.

Sl. No.	Name of the Activity	Points	Maximum Points Allowed
1.	MOOCS (SWAYAM/NPTEL/Spoken Tutorial) (per course)	20	40
2.	Tech Fest/Teachers Day/Freshers Welcome		
	Organizer	5	10
	Participants	3	6
5.	Rural Reporting	5	10
6.	Tree Plantation (per tree)	1	10
7.	Participation in Relief Camps	20	40
8.	Participation in Debate/Group Discussion/ Tech quiz	10	20
9.	Publication of Wall magazine in institutional level (magazine/article/internet)	10	20
10.	Publication in News Paper, Magazine & Blogs	10	20
11.	Research Publication (per publication)	15	30
12.	Innovative Projects (other than course curriculum)	30	60
13.	Blood donation	8	16
	Blood donation camp Organization	10	20
15.	Participation in Sports/Games		
	College level	5	10
	University Level	10	20
	District Level	12	24
	State Level	15	30
	National/International Level	20	20
21.	Cultural Programme (Dance, Drama, Elocution, Music etc.)	10	20
22.	Member of Professional Society	10	20
23.	Student Chapter	10	20
24.	Relevant Industry Visit & Report	10	20
25.	Photography activities in different Club(Photography club, Cine Club, Gitisansad)	5	10
26.	Participation in Yoga Camp (Certificate to be submitted)	5	10
27.	Self-Entrepreneurship Programme	20	20
28.	Adventure Sports with Certification	10	20
29.	Training to under privileged/Physically challenged	15	30
30.	Community Service & Allied Activities	10	20

Suggestions from the College Principals will be considered to append in the above Table-III.

Sd/-

Registrar(Acting)
MAKAUT,WB

Maulana Abul Kalam Azad University of Technology, West Bengal
Record of Activities for Mandatory Additional Requirement

Annexure-I
Rev:00

College Name (College Code):							**Department:**						
Student Name:		**University Roll No:**					**Registration No:**						
Sl No	**Activity**	**Points**	**Max. Points Allowed**	**Points Earned**									
				Sem1	**Sem2**	**Sem3**	**Sem4**	**Sem5**	**Sem6**	**Sem7**	**Sem8**	**Total**
1	*MOOCS (SWAYAM/NPTEL/Spoken Tutorial) per course*											
	For 12 weeks duration	**20**	**40**									
	For 8 weeks duration	**16**										
2	*Tech Fest/Teachers Day/Freshers Welcome*											
	Organizer	**5**	**10**									
	Participants	**3**	**6**									
3	Rural Reporting	**5**	**10**									
4	Tree Plantation and up keeping (per tree)	**1**	**10**									
5	Participation in Relief Camps	**20**	**40**									
6	Participation in Debate/Group Discussion/ Tech quiz	**10**	**20**									
7	*Publication of Wall magazine in institutional level (magazine/article/internet)*											
	Editor	**10**	**20**									
	Writer	**6**	**12**									
8	Publication in News Paper, Magazine & Blogs	**10**	**20**									
9	Research Publication (per publication)	**15**	**30**									
10	Innovative Projects (other than course curriculum)	**30**	**60**									
11	Blood donation	**8**	**16**									
	Blood donation camp Organization	**10**	**20**									

Maulana Abul Kalam Azad University of Technology, West Bengal
Record of Activities for Mandatory Additional Requirement

Annexure-I
Rev:00

Sl No	Activity	Points	Max. Points Allowed	Points Earned								
				Sem1	Sem2	Sem3	Sem4	Sem5	Sem6	Sem7	Sem8	Total
12	*Participation in Sports/Games*											
	College level	**5**	**10**									
	University Level	**10**	**20**									
	District Level	**12**	**24**									
	State Level	**15**	**30**									
	National/International Level	**20**	**20**									
13	Cultural Programme (Dance, Drama, Elocution, Music etc.)	**10**	**20**									
14	Member of Professional Society	**10**	**20**									
15	Student Chapter	**10**	**20**									
16	Relevant Industry Visit & Report	**10**	**20**									
17	Photography activities in different Club(Photography club, Cine Club, Gitisansad)	**5**	**10**									
18	Participation in Yoga Camp (Certificate to be submitted)	**5**	**10**									
19	Self-Entrepreneurship Programme	**20**	**20**									
20	Adventure Sports with Certification	**10**	**20**									
21	Training to under privileged / Differently abled	**15**	**30**									
22	Community Service & Allied Activities	**10**	**20**									
	Total Points											
	Signature of Mentor											
	Signature of HOD											

*Please abide strictly to the **Notes at the end of the Notice by Registrar,** MAKAUT,WB regarding **Mandatory Additional Requirement for earning B.Tech Degree**

* *Annexure-I* is to be retained in the Institute records with all documentary proofs of activities (*to be verified by the University as and when required*).

CURRICULUM ESSENTIALS

Department of Applied Electronics & Instrumentation Engineering

Dr. B. C. Roy Engineering College,
Durgapur – 713206

Affiliated to MAKAUT and approved by AICTE

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

VISION OF THE DEPARTMENT

To aspire to be a premiere department; imparting world class technical education and to bridge industry expertise with academic excellence, thereby producing technically competent engineers catering to the needs of the society, environment and the nation.

MISSION OF THE DEPARTMENT

The mission of the Applied Electronics and Instrumentation Engineering Department is to provide

- *foundation in Electronics and Instrumentation, and the underlying mathematics and science*
- *excellent opportunity with strong moral sense of social and ethical responsibilities to promote high standards of professional ethics and accountability*
- *state of the art infrastructure and a facilitating environment to impart quality education*
- *conducive environment for creating networks with alumni, industries, educational institutes and other stake-holders and encourages collaborative research*

in order to build up professionally competent engineers through value-added teaching, learning and research environment.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

1. Graduates of Applied Electronics and Instrumentation Engineering department are expected to excel in professional career or pursue higher education and research or in entrepreneurship by acquiring sound knowledge in basic science, mathematics and core engineering.

2. Graduates of Applied Electronics and Instrumentation Engineering department are expected to abide by professional code of conduct, following the principles of financial management, possessing sound communication skills and ready to take leadership or have enough tolerance to act as a simple and indispensable member of a multicultural team working on a multi-disciplinary project.

3. Graduates of Applied Electronics and Instrumentation Engineering department are expected to be a good citizen, conscious about the society and environment, respect for professional ethics and values and quality to adapt in the fast changing society through life-long learning.

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PROGRAM OUTCOMES (POs) OF THE DEPARTMENT

On completion of the program, the students will be able to:

PO1 Basic Science and Engineering Knowledge: Apply the knowledge of science and mathematics to learn basic science and engineering science courses and thus enables the students to apply them in learning the Professional core course .i.e. Applied Electronics and Instrumentation Engineering.

PO2 Computation Skills: Acquire analytical thinking, problem solving abilities, review research literature, implement modern computational procedures and analyze complex engineering problems to apply on core electronics and instrumentation field.

PO3 Design and development of Solution: Apply core electronics and instrumentation engineering knowledge to design Electronic circuits, highly sensitive sensor networks for monitoring and control of various physical, chemical, pharmaceutical and Industrial parameters and processes.

PO4 Complex Problem Investigation: Apply core instrumentation knowledge to improve working of existing transducers, sensors, telemetry and remote control devices, and derive solutions to interface with dedicated microcontrollers and high end computers and able to measure and control any industrial processes efficiently.

PO5 Modern Tools Utilization: Apply expertise in the utilization of modern software tools like C, JAVA, TASM, MATLAB/Scilab, PLC programming software, and DCS software, and, modern hardware gadgets like the Digital Storage Oscilloscopes, Function Generators, Spectrum Analyzers, stroboscope, LVDT, PID Controllers, PLC, DCS, and flow, level, pressure, and temperature transmitters.

PO6 Engineers for Society: The students of engineering should be motivated to utilize their Scientific, Technological, Computational and Instrumentation skills for the better addressing the societal needs. Design new sophisticated instruments for the high-end Research and Process Industries, Pharmaceutical, Bio-medical fields. They should utilize their expertise to develop indigenous technologies, instruments, gadgets, and inexpensive healthcare systems affordable by common people.

PO7 Environment and sustainability: Utilize their knowledge to design low power consuming, highly sensitive, low radiating ecofriendly devices compatible with modern interfacing techniques in conformity with the specific standards and norms.

PO8 Ethics: The students are motivated to follow a code of ethics and moral perspectives at the individual level as well as at the professional level to protect the interests of all the stakeholders, with a concern for societal responsibilities.

PO9 Individual and team work: Communication skills, Aptitude development programs, Team activities like NSS, project, Seminar Presentations etc. contribute greatly for the development of individual talents/skills. Involvement in Cultural fest, Technical fest, Sports activities provided in the

institute shall also develop capabilities of a student to mold oneself as an Individual member, Team leader or an Organizer.

PO10 Communication Skills: Utilize basic humanities courses and shall acquire excellent communication skills both orally as well as in writing. They shall be able to transform their innovative ideas into excellent technical reports for presentation/publication in seminars/journals.

PO11 Project Management and Finance: Extend their management concepts for drafting of proposals for projects with thorough understanding of the procurement plans (materials, software, and hardware), project management and financial allocations and management during the execution of the project.

PO12 Life-Long learning: Engage their abilities to learn and implement technological changes through life-long learning and also contribute their expertise for the benefit of the current stake holders and the society.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
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Documentation of Course Content, Learning Resources and, Course Outcomes (COs) for
Applied Electronics & Instrumentation Engineering
(Applicable from Academic Session 2018-19)

FIRST YEAR FIRST SEMESTER PROPOSED SYLLABUS

A. Definition of Credit:

1 Hr. Lecture (L) per week 1 credit

1 Hr. Tutorial (T) per week 1 credit

1 Hr. Practical (P) per week 0.5 credits

B. Range of credits:

A range of credits from 150 to 160 for a student to be eligible to get B.Tech Degree in Engineering. A student will be eligible to get B.Tech Degree with honors, if he/she completes an additional 20 credits. These could be acquired through Massive Open Online Courses (MOOCs).

C. MOOCs for B. Tech Honors:

The additional 20 credits (for obtaining B. Tech with honors) are to be gained through MOOCs. The complete description of the MOOCs relevant for the first year course are given in Annexure-I in the makaut university website. The courses for subsequent years of study will be posted subsequently.

D. Guidelines regarding Mandatory Induction Program for the new students:

All concerned are requested to follow the guidelines given in Annexure-II (Notice dt.06/12/2017) in the makaut university website concerning Mandatory Induction Program. The colleges/ Institute may also refer to the AICTE Model Curriculum for Undergraduate Degree Courses in Engineering & Technology (January 2018) -Volume I (Page No.31-38), if necessary.

E. Mandatory Additional Requirement for earning B. Tech Degree:

All concerned are requested to follow the guidelines in Annexure-III concerning Mandatory Additional Requirements.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Content, Learning Resources and, Course Outcomes (COs) for Applied Electronics & Instrumentation Engineering (Applicable from Academic Session 2018-19)

First Year First Semester							
Mandatory Induction Program – 3 Weeks duration							
Sl No.	**Category**	**Subject Code**	**Subject Name**	**Total Number of Contact Hours**			**Credits**
				L	**T**	**P**	
Theory							
1	Basic Science Course	BS-CH101	Chemistry -I	3	1	0	4
2	Basic Science Course	BS-M102	Mathematics -IB	3	1	0	4
3	Engineering Science Course	ES-EE101	Basic Electrical Engineering	3	1	0	4
	Total Theory			9	3		12
Practical							
1	Basic Science Course	BS-CH191	Chemistry – I Laboratory	0	0	3	1.5
2	Engineering Science Course	ES-EE191	Basic Electrical Engineering Laboratory	0	0	2	1
3	Engineering Science Course	ES-ME191	Engineering Graphics & Design	1	0	4	3
	Total Practical			1		9	5.5
	Total of First Semester			**10**	**3**	**9**	**17.5**

Department of Applied Electronics & Instrumentation Engineering
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MAKAUT and approved by AICTE

Documentation of Course Content, Learning Resources and, Course Outcomes (COs) for
B. Tech in Applied Electronics & Instrumentation Engineering
(Applicable from Academic Session 2018-19)

Course Category: Basic Science Course (BS)	**Course Coordinator:** Department of Basic Science & Humanities
Programme: AEIE	**Semester:** First
Course Code: BS-CH101	**Course Title:** Chemistry-I
Nature of Course: Mandatory	**Full Marks:** 100
Type of Course: Theory	**Credit Points:** 4
Contact Hours: L-T-P: 3-1-0*	**Total Contact Hours:** 42
Pre-Requisites: High School Chemistry	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total classes assigned in hours/week.

Course Content:

i) Atomic and molecular structure (10 L)

Schrodinger equation. Particle in a box solutions and their applications for simple sample. Molecular orbitals of diatomic molecules (e.g.H2). Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

ii) Spectroscopic techniques and applications (8 L)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

iii) Intermolecular forces and potential energy surfaces (4 L)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena.

iv) se of free energy in chemical equilibria (8 L)

First and second laws of thermodynamics and thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

v) Periodic properties (4 L)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

vi) Stereochemistry (4 L)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

vii) Organic reactions and synthesis of a drug molecule (4 L)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Learning Resources:

1. Engineering Chemistry, Satyaprakash, Khanna Book Publishing, Delhi
2. University chemistry, by B. H. Mahan
3. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
4. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
5. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
6. Physical Chemistry, by P. W. Atkins
7. Spectroscopy of Organic Compounds, by P.S.Kalsi, New Age International Pvt. Ltd Publishers
8. Physical Chemistry, P. C. Rakshit, Sarat Book House
9. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition
   http://bcs.whfreeman.com/vollhardtschore5e/default.asp

Course Outcome (CO):

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels.

The course will enable the student to:

CO1: Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.

CO2: Rationalise bulk properties and processes using thermodynamic considerations.

CO3: Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.

CO4: Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.

CO5: List major chemical reactions that are used in the synthesis of molecules.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206 Affiliated to
MAKAUT and approved by AICTE

Documentation of Course Content, Learning Resources and, Course Outcomes (COs) for
B. Tech in Applied Electronics & Instrumentation Engineering
(Applicable from Academic Session 2018-19)

Course Category: Basic Science Course (BS)	**Course Coordinator:** Department of Basic Science and Humanities
Programme: AEIE	**Semester:** First
Course Code: BS-M101	**Course Title:** Mathematics -IB
Nature of Course: Mandatory	**Full Marks:** 100
Type of Course: Theory	**Credit Points:** 4
Contact Hours: L-T-P: 3-1-0*	**Total Contact Hours:** 42
Pre-Requisites: High School Mathematics	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total classes assigned in hours/week.

Course Content:

Module 1: Calculus (Integration) (8 L)
Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Module 2: Calculus (Differentiation) (6 L)
Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.

Module 3: Sequence and Series (11 L)
Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Module 4: Multivariate Calculus (9 L)
Limit, continuity and partial derivatives, Directional derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, Curl and Divergence.

Module 5: Matrices (8 L)
Inverse and rank of a matrix, Rank-nullity theorem; System of linear equations; Symmetric, Skew-symmetric and Orthogonal matrices; Determinants; Eigenvalues and Eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206 Affiliated to MAKAUT and approved by AICTE

Documentation of Course Content, Learning Resources and, Course Outcomes (COs) for B. Tech in Applied Electronics & Instrumentation Engineering (Applicable from Academic Session 2018-19)

Learning Resources:

1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.

Course Outcome (CO):

After completing the course the student will be able to

CO1: Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

CO2: Understand the domain of applications of mean value theorems to engineering problems.

CO3: Learn the tools of power series and Fourier series to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.

CO4: Apply the knowledge for addressing the real life problems which comprises of several variables or attributes and identify extremum points of different surfaces of higher dimensions.

CO5: Understand different types of matrices, their eigen values, eigen vectors, rank and also their orthogonal transformations which are essential for understanding physical and engineering problems.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206 Affiliated to
MAKAUT and approved by AICTE

Documentation of Course Content, Learning Resources and, Course Outcomes (COs) for
B. Tech in Applied Electronics & Instrumentation Engineering
(Applicable from Academic Session 2018-19)

Course Category: Engineering Science Course (ES)	**Course Coordinator:** Department of Electrical Engineering
Programme: AEIE	**Semester:** First
Course Code: ES-EE101	**Course Title:** Basic Electrical Engineering
Nature of Course: Mandatory	**Full Marks:** 100
Type of Course: Theory	**Credit Points:** 4
Contact Hours: L-T-P: 3-1-0*	**Total Contact Hours:** 42
Pre-Requisites: No prerequisites	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total classes assigned in hours/week.

Course Content:

Module 1: DC Circuits (8 L)
Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (8 L)
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 3: Transformers (6 L)
Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

Module 4: Electrical Machines (8 L)
Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 5: Power Converters (6 L)
DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations (6 L)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Learning Resources:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Book Publishing Co. (P) Ltd., Delhi.
2. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
3. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
4. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
5. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
6. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Course Outcome (CO):

After completing the course the student will be able

CO1: To understand and analyze basic electric and magnetic circuits.

CO2: To study the working principles of electrical machines and power converters.

CO3: To introduce the components of low voltage electrical installations.

Department of Applied Electronics & Instrumentation Engineering
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MAKAUT and approved by AICTE

Documentation of Course Content, Learning Resources and, Course Outcomes (COs) for
B. Tech in Applied Electronics & Instrumentation Engineering
(Applicable from Academic Session 2018-19)

Course Category: Basic Science Course (BS)	**Course Coordinator:** Department of Basic Science & Humanities
Programme: AEIE	**Semester:** First
Course Code: BS-CH191	**Course Title:** Chemistry-I Laboratory
Nature of Course: Mandatory	**Full Marks:** 100
Type of Course: Practical	**Credit Points:** 1.5
Contact Hours: L-T-P: 0-0-3*	**Total Contact Hours:** 30
Pre-Requisites: No prerequisites	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total classes assigned in hours/week.

Course Content:

Choose 10 experiments from the following:

1. Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
2. pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
3. Determination of dissolved oxygen present in a given water sample.
4. To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution)
5. Determination of surface tension and viscosity
6. Thin layer chromatography
7. Ion exchange column for removal of hardness of water
8. Determination of the rate constant of a reaction
9. Determination of cell constant and conductance of solutions
10. Potentiometry - determination of redox potentials and emfs
11. aponification/acid value of an oil
12. Chemical analysis of a salt
13. Determination of the partition coefficient of a substance between two immiscible liquids
14. Adsorption of acetic acid by charcoal
15. Use of the capillary viscosimeters to the demonstrate of the isoelectric point as

the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg .

Learning Resources:

1. Engineering Chemistry, Satyaprakash, Khanna Book Publishing, Delhi
2. University chemistry, by B. H. Mahan
3. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
4. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
5. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
6. Physical Chemistry, by P. W. Atkins
7. Spectroscopy of Organic Compounds, by P.S.Kalsi, New Age International Pvt. Ltd Publishers
8. Physical Chemistry, P. C. Rakshit, Sarat Book House
9. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp

Course Outcome (CO):

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels.

The course will enable the student to:

CO1: Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.

CO2: Rationalise bulk properties and processes using thermodynamic considerations.

CO3: Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.

CO4: Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.

CO5: List major chemical reactions that are used in the synthesis of molecules.

Department of Applied Electronics & Instrumentation Engineering
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MAKAUT and approved by AICTE

Documentation of Course Content, Learning Resources and, Course Outcomes (COs) for
B. Tech in Applied Electronics & Instrumentation Engineering
(Applicable from Academic Session 2018-19)

Course Category: Engineering Science Course (ES)	**Course Coordinator:** Department of Electrical Engineering
Programme: AEIE	**Semester:** First
Course Code: ES-EE191	**Course Title:** Basic Electrical Engineering Laboratory
Nature of Course: Mandatory	**Full Marks:** 100
Type of Course: Practical	**Credit Points:** 1
Contact Hours: L-T-P: 0-0-2*	**Total Contact Hours:** 20
Pre-Requisites: No prerequisites	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total classes assigned in hours/week.

Course Content:

Choose 10 experiments from the following:

1. First activity: Introduction to basic safety precautions and mentioning of the do's and Don'ts. Noting down list of experiments to be performed, and instruction for writing the laboratory reports by the students. Group formation. Students are to be informed about the modalities of evaluation.

2. Introduction and uses of following instruments:

(a) Voltmeter
(b) Ammeter
(c) Multimeter
(d) Oscilloscope

Demonstration of real life resistors, capacitors with color code, inductors and autotransformer.

3. Demonstration of cut-out sections of machines: DC machine, Induction machine, Synchronous machine and single phase induction machine.

4. Calibration of ammeter and Wattmeter.

5. Determination of steady state and transient response of R-L, R-C and R-L-C circuit to a step change in voltage.

6. Determination of steady state response of R-L and R-C and R-L-C circuit and calculation of impedance and power factor.

7. Determination of resonance frequency and quality factor of series and parallel R-L-C circuit.

8. (a) Open circuit and short circuit test of a single-phase transformer
   (b) Load test of the transformer and determination of efficiency and regulation
9. Demonstration of three phase transformer connections. Voltage and current relationship, phase shifts between the primary and secondary side.
10. Measurement of power in a three phase unbalanced circuit by two wattmeter method.
11. Determination of Torque –Speed characteristics of separately excited DC motor.
12. Determination of Torque speed characteristics and observation of direction reversal by change of phase sequence of connection of Induction motor.
13. Determination of operating characteristics of Synchronous generator.
14. Demonstration of operation of (a) DC-DC converter (b) DC-AC converter (c) DC-AC converter for speed control of an Induction motor
15. Demonstration of components of LT switchgear.

Learning Resources:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Book Publishing Co. (P) Ltd., Delhi.
2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
3. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
4. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
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CO3: To introduce the components of low voltage electrical installations.

Department of Applied Electronics & Instrumentation Engineering
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MAKAUT and approved by AICTE

Documentation of Course Content, Learning Resources and, Course Outcomes (COs) for
B. Tech in Applied Electronics & Instrumentation Engineering
(Applicable from Academic Session 2018-19)

Course Category: Engineering Science Course (ES)	**Course Coordinator:** Department of Mechanical Engineering
Programme: AEIE	**Semester:** First
Course Code: ES-ME191	**Course Title:** Engineering Graphics & Design
Nature of Course: Mandatory	**Full Marks:** 100
Type of Course: Practical	**Credit Points:** 3
Contact Hours: L-T-P: 1-0-4*	**Total Contact Hours:** 65
Pre-Requisites: No prerequisites	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total classes assigned in hours/week.

Course Content:

1. INTRODUCTION TO ENGINEERING DRAWING (Lecture-1, Practical-4)
Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes.

2. LETTERING, DIMENSIONING, SCALES (Lecture-1, Practical-4)
Plain scale, Diagonal scale and Vernier Scales.

3. GEOMETRICAL CONSTRUCTION AND CURVES (Lecture-1, Practical-4)
Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Arche median Spiral.

4. PROJECTION OF POINTS, LINES, SURFACES (Lecture-1, Practical-4)
Principles of Orthographic Projections-Conventions - 1st and 3rd angle projection, Projections of Points and lines inclined to both planes; Projections of planes (Rectangle, pentagon, Hexagon etc.) inclined Planes - Auxiliary Planes.

5. PROJECTION OF REGULAR SOLIDS (Lecture-1, Practical-4)
Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone).

6. COMBINATION OF REGULAR SOLIDS, FLOOR PLANS (Lecture-1, Practical-4)
Regular solids in mutual contact with each other like Spheres in contact with cones standing on their base. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

7. ISOMETRIC PROJECTIONS (Lecture-1, Practical-4)

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

8. SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS (Lecture-1, Practical-4)

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

9. OVERVIEW OF COMPUTER GRAPHICS, CUSTOMISATION & CAD DRAWING (Lecture-1, Practical-4)

listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

10. ANNOTATIONS, LAYERING & OTHER FUNCTIONS (Lecture-2, Practical-8)

applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

11. DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT (Lecture-2, Practical-8)

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; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Department of Applied Electronics & Instrumentation Engineering
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Documentation of Course Content, Learning Resources and, Course Outcomes (COs) for B. Tech in Applied Electronics & Instrumentation Engineering (Applicable from Academic Session 2018-19)

General Instructions

1. In every topic some problems are to be done in the class and some are to be given to students as home assignment.
2. The problems for class work are to be prepared on drawing sheet of A1 size in the class/ using AutoCAD software.
3. The problems for home assignments are to be prepared on drawing copy/ using AutoCAD software.
4. Print out of every assignment is to be taken for CAD Drawings on Drawing sheets (A4 Sheets).
5. A title block must be prepared in each sheet/ assignment.

Following is the list of drawing instruments that required for making engineering drawings on paper with perfection.

1. Drawing Board
2. Mini drafter/ Set-squares (45° -45° & 60° -90°), T-square
3. Protractor (180° , 360°)
4. Scales (Plain, Diagonal)
5. Compass (Small and Large)
6. Divider (Small and Large)
7. French Curves
8. Drawing paper (A1 Size)
9. Drawing pencil (H, HB, B)
10. Sharpener
11. Eraser
12. Drawing pins & clips
13. Duster or handkerchief etc.

Learning Resources:

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

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

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

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

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

6. Corresponding set of CAD Software Theory and User Manuals

Course Outcome (CO):

The student will learn:

CO1: Introduction to engineering design and its place in society

CO2: Exposure to the visual aspects of engineering design

CO3: Exposure to engineering graphics standards

CO4: Exposure to solid modelling

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Content, Learning Resources and, Course Outcomes (COs) for Applied Electronics & Instrumentation Engineering
(Applicable from Academic Session 2018-19)

FIRST YEAR SECOND SEMESTER PROPOSED SYLLABUS

First Year Second Semester							
Sl No.	**Category**	**Subject Code**	**Subject Name**	**Total Number of Contact Hours**			**Credits**
				L	**T**	**P**	
Theory							
1	Basic Science Course	BS-PH201	Physics -I	3	1	0	4
2	Basic Science Course	BS-M202	Mathematics -IIB	3	1	0	4
3	Engineering Science Course	ES-CS201	Programming for Problem Solving	3	0	0	3
4	Humanities and Social Sciences including Management courses	HM-HU201	English	2	0	0	2
	Total Theory			11	2		13
Practical							
1	Basic Science Course	BS-PH291	Physics – I Laboratory	0	0	3	1.5
2	Engineering Science Course	ES-CS291	Programming for Problem Solving	0	0	4	2
3	Engineering Science Course	ES-ME292	Workshop/Manufacturing Practices	1	0	4	3
4	Humanities and Social Sciences including Management courses	HM-HU291	Language Laboratory	0	0	2	1
	Total Practical			1		13	7.5
	Total of Second Semester			**12**	**2**	**13**	**20.5**

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206 Affiliated to
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Documentation of Course Content, Learning Resources and, Course Outcomes (COs) for
Applied Electronics & Instrumentation Engineering
(Applicable from Academic Session 2018-19)

Course Category: Basic Science Course (BS)	**Course Coordinator:** Department of Basic Science & Humanities
Programme: AEIE	**Semester:** Second
Course Code: BS-PH201	**Course Title:** Physics-I
Nature of Course: Mandatory	**Full Marks:** 100
Type of Course: Theory	**Credit Points:** 4
Contact Hours: L-T-P: 3-1-0*	**Total Contact Hours:** 44
Pre-Requisites: High School Physics	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total classes assigned in hours/week.

Course Content:

Course objectives: Basic concepts of mechanics, optics and its applications, electricity, magnetism and qualitative understanding of concepts of quantum physics and statistical mechanics.

1. Mechanics (7 L)

Problems including constraints & friction. Basic ideas of vector calculus and partial differential equations. Potential energy function F = -grad V, equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Conservation laws of energy & momentum. Non-inertial frames of reference. Harmonic oscillator; Damped harmonic motion forced oscillations and resonance. Motion of a rigid body in a plane and in 3D. Angular velocity vector. Moment of inertia.

2. Optics (5 L)

Distinction between interference and diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits (only the expressions for max;min, & intensity and qualitative discussion of fringes); diffraction grating(resolution formulac only), characteristics of diffration grating and its applications.

Polarisation: Introduction, polarisation by reflection, polarisation by double reflection, scattering of light, circular and elliptical polarisation, optical activity.

Lasers: Principles and working of laser, population inversion, pumping, various modes, threshold population inversion with examples.

3. Electromagnetism and Dielectric Magnetic Properties of Materials (8 L)

Maxwell’ s equations. Polarisation, permeability and dielectric constant, polar and non-polar dielecrrics, internal fields in a solid, Clausius- Mossotti equation(expression only), applications of dielectrics. Magnetisation, permeability and susceptibility, classification of magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.

4. Quantum Mechanics (16 L)

Introduction to quantum physics, black body radiation, explanation using the photon concept, Compton effect, de Broglie hypothesis, wave-particle duality, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.

5. Statistical Mechanics (8 L)

Macrostate, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics.

Learning Resources:

1. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India Learning Private Limited
2. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker , Wiley
3. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press
4. Engineering Mechanics (In SI Units)(SIE), S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati, McGraw Hill Education
5. Classical mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education
6. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education
7. Engineering Mechanics, M.K. Harbola , Cengage India
8. An Introduction to Mechanics (SIE), David Kleppner, Robert Kolenkow, McGraw Hill Education
9. Principles of mechanics, John L. Synge and Byron A. Griffith, New York, McGraw-Hill
10. Mechanics (Dover Books on Physics) , J. P. Den Hartog , Dover Publications Inc.
11. Engineering Mechanics: Dynamics, L.G. Kraige J.L. Meriam, Wiley
12. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, Robert Eisberg, Robert Resnick, Wiley
13. Introduction to Quantum Mechanics, J. Griffiths David , Pearson Education
14. Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press
15. Optics , Hecht, Pearson Education
16. Optics, Ghatak, McGraw Hill Education India Private Limited
17. Fundamentals of Statistical and Thermal Physics, Reif, Sarat Book Distributors
18. Statistical Mechanics , Pathria , Elsevier
19. Statistical Physics, L.D.Landau , E.M. Lifshitz, Butterworth-Heinemann

Course Outcome (CO):

Students will be familiar with

CO1: Basic concepts of mechanics

CO2: Bragg's Law and introduction to the principles of lasers, types of lasers and applications.

CO3: Various terms related to properties of materials such as, permeability, polarization, etc.

CO4: Some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials.

CO5: Simple quantum mechanics calculations.

Department of Applied Electronics & Instrumentation Engineering
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Documentation of Course Content, Learning Resources and, Course Outcomes (COs) for
Applied Electronics & Instrumentation Engineering
(Applicable from Academic Session 2018-19)

Course Category: Basic Science Course (BS)	**Course Coordinator:** Department of Basic Science & Humanities
Programme: AEIE	**Semester:** Second
Course Code: BS-M202	**Course Title:** Mathematics-II
Nature of Course: Mandatory	**Full Marks:** 100
Type of Course: Theory	**Credit Points:** 4
Contact Hours: L-T-P: 3-1-0*	**Total Contact Hours:** 40
Pre-Requisites: High School Mathematics & BS-M102	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total classes assigned in hours/week.

Course Content:

1. Multivariate Calculus (Integration) (11 L):
Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, change of variables (Cartesian to Polar), Applications: Areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), Orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.

2. First order ordinary differential equations (5 L):
Exact, linear and Bernoulli's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

3. Ordinary differential equations of higher orders (9 L):
Second order linear differential equations with constant coefficients, Use of Doperators, Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

4. Complex Variable – Differentiation (6 L):

Differentiation of complex functions, Cauchy-Riemann equations, Analytic functions, Harmonic functions, determination of harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithmic) and their properties; Conformal mappings, Mobius transformations and their properties.

5. Complex Variable – Integration (9 L):

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, Zeros of analytic functions, Singularities, Laurent's series; Residues, Cauchy residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. E. L. Ince, Ordinary Differential Equations, Dover Publications.
8. J. W. Brown and R. V. Churchill, Complex Variables and Applications, Mc-Graw Hill.

Course Outcome (CO):

The students will be able to:

CO1: Learn the methods for evaluating multiple integrals and their applications to different physical problems.

CO2: Understand different techniques to solve first and second order ordinary differential equations with its formulation to address the modelling of systems and problems of engineering sciences.

CO3: Learn different tools of differentiation and integration of functions of a complex variable that are used with various other techniques for solving engineering problems.

CO4: Apply different types of transformations between two 2- dimensional planes for analysis of physical or engineering problems.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206 Affiliated to
MAKAUT and approved by AICTE

Documentation of Course Content, Learning Resources and, Course Outcomes (COs) for
Applied Electronics & Instrumentation Engineering
(Applicable from Academic Session 2018-19)

Course Category: Engineering Science Course (ES)	**Course Coordinator:** Department of Information Technology
Programme: AEIE	**Semester:** Second
Course Code: ES-CS201	**Course Title:** Programming for Problem Solving
Nature of Course: Mandatory	**Full Marks:** 100
Type of Course: Theory	**Credit Points:** 3
Contact Hours: L-T-P: 3-0-0*	**Total Contact Hours:** 40
Pre-Requisites: No prerequisites	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total classes assigned in hours/week.

Course Content:

1. Introduction to Programming (4 L):

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) (1 L).

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. (1 L)

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code. (2 L)

2. Arithmetic expressions and precedence (2 L):

3. Conditional Branching and Loops (6 L):

Writing and evaluation of conditionals and consequent branching (3 L)

Iteration and loops (3 L)

4. Arrays (6 L):

Arrays (1-D, 2-D), Character arrays and Strings

5. Basic Algorithms (6 L):

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

6. Function (5 L):

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

7. Recursion (4 -5 L):

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

8. Structure (4 L):

Structures, Defining structures and Array of Structures

9. Pointers (2 L):

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

10. File handling (only if time is available, otherwise should be done as part of the lab)

Learning Resources:

1. R. S. Salaria, Computer Concepts and Programming in C, Khanna Publishers
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Course Outcome (CO):

The student will learn

CO1: To formulate simple algorithms for arithmetic and logical problems.
CO2: To translate the algorithms to programs (in C language).
CO3: To test and execute the programs and correct syntax and logical errors.
CO4: To implement conditional branching, iteration and recursion.
CO5: To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
CO6: To use arrays, pointers and structures to formulate algorithms and programs.
CO7: To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
CO8: To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206 Affiliated to
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Documentation of Course Content, Learning Resources and, Course Outcomes (COs) for
Applied Electronics & Instrumentation Engineering
(Applicable from Academic Session 2018-19)

Course Category: Humanities and Social Sciences including Management courses (HM)	**Course Coordinator:** Department of Basic Science & Humanities
Programme: AEIE	**Semester:** Second
Course Code: HM-HU201	**Course Title:** English
Nature of Course: Mandatory	**Full Marks:** 100
Type of Course: Theory	**Credit Points:** 2
Contact Hours: L-T-P: 2-0-0*	**Total Contact Hours:**
Pre-Requisites: No prerequisites	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total classes assigned in hours/week.

Course Content:

1. Vocabulary Building

1.1 The concept of Word Formation: Compounding, Backformation, Clipping, Blending.

1.2 Root words from foreign languages and their use in English

1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.

1.4 Synonyms, antonyms, and standard abbreviations: Acronyms

2. Basic Writing Skills

2.1 Sentence Structures & Types: Simple, Compound, Complex

2.2 Use of phrases and clauses in sentences: Transformation of sentences, active, passive, narration

2.3 Importance of proper punctuation

2.4 Creating coherence: Arranging paragraphs & Sentences in logical order

2.5 Creating Cohesion: Organizing principles of paragraphs in documents

2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing

3.1 Subject-verb agreement

3.2 Noun-pronoun agreement

3.3 Misplaced modifiers

3.4 Articles

3.5 Prepositions
3.6 Redundancies
3.7 Clichés

4. Nature and Style of sensible Writing

4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence
4.5 Writing introduction and conclusion

5. Writing Practices

5.1 Comprehension
5.2 Précis Writing
5.3 Essay Writing
5.4 Business Letter, Cover Letter & CV; E-mail

Addendum

Some examples of English words with foreign roots

Greek Root/Affix	Examples
Anti	Antisocial, Antiseptic
Auto	Automatic, Autograph
Anthropos	Anthropology, Philanthropy
Bio	Biography
Chronos	Time
Di	Dilemma
Bio	Biology
Biblio	Bibliography
Chron	Chronology
Cracy	Contradiction
Geo	Geology
Hyper	Hyperactive
Hypo	Hypodermic, Hypoglycemia
Macro	Macrocosm
Mono	Monarch
Pan	Panorama
Pathos	Pathetic
Phobia	Hdrophobia

Pod (Gk), Ped (Latin)	Pseudopodia
Poly	Polyglot
Tele	Telephone
Theo	Theology, Theist

Latin Root	Examples
Aud	Audible
Bene	Beneficial
Brev	Abbreviate, brief
Circum	Circulate
Contra	Contradict
Cred	Credible
Dict	Diction
Femina	Feminine
Inter	Internet, interval
Magna	Magnificient
Mal	Malnutrition
Multi	Multinational
Nova	Novel
Multi	Multiple, multiplex
Non	Nonstop
Pre	Previous, predicate
Re	Redo, rewind
Scrib	Scripture
Spect	Spectator
Trans	Transport
Uni	Unity
Omni	Omnipotent
Semi	Semicircle
Sub	Subway
Somnus	Insomnia
Super	Superman
Sym	Sympathy
Scribe	Describe, scribble(write Illegibly), inscribe
Trans	Transform
Un	Unnecessary

Department of Applied Electronics & Instrumentation Engineering
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Documentation of Course Content, Learning Resources and, Course Outcomes (COs) for
Applied Electronics & Instrumentation Engineering
(Applicable from Academic Session 2018-19)

Uni	Universal

Learning Resources:

(i) Kulbushan Kumar, R S Salaria,Effective Communication Skills, Khanna Publishing House, Delhi.
(ii) Practical English Usage. Michael Swan. OUP. 1995.
(iii) Remedial English Grammar. F.T. Wood. Macmillan.2007
(iv) Writing Well. William Zinsser. Harper Resource Book. 2001
(v) tudy Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
(vi) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
(vii) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
(viii) Universal English Prof. Prasad Kataria Publications, 2019.
(ix) "Communication Skills for Professionals"-Nira Konar, Prentice Hall of India 2nd edition, New Delhi, 2011
(x) Gajendra Singh Chauhan, Smita Kashiramka and L. Thimmesha. Functional English. Cengage , 2019.

Course Outcome (CO):

CO1: The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Department of Applied Electronics & Instrumentation Engineering
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MAKAUT and approved by AICTE

Documentation of Course Content, Learning Resources and, Course Outcomes (COs) for
Applied Electronics & Instrumentation Engineering
(Applicable from Academic Session 2018-19)

Course Category: Basic Science Course (BS)	**Course Coordinator:** Department of Basic Science & Humanities
Programme: AEIE	**Semester:** Second
Course Code: BS-PH291	**Course Title:** Physics-I Laboratory
Nature of Course: Mandatory	**Full Marks:** 100
Type of Course: Practical	**Credit Points:** 1.5
Contact Hours: L-T-P: 0-0-3*	**Total Contact Hours:** 30
Pre-Requisites: High School Physics	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total classes assigned in hours/week.

Course Content:

Choose 10 experiments including at least one from Optics, Electricity and Magnetism and Quantum Mechanics and at least a total of six from these three groups.

Experiments in Optics

1. Determination of dispersive power of the material of a prism
2. Determination of wavelength of a monochromatic light by Newton's ring
3. Determination of wavelength of a monochromatic light by Fresnel's bi-prism
4. Determination of wavelength of the given laser source by diffraction method

Electricity & Magnetism experiments

1. Determination of thermo electric power of a given thermocouple.
2. Determination of specific charge (e/m) of electron by J.J. Thompson's method.
3. Determination of dielectric constant of a given dielectric material.
4. Determination of Hall coefficient of a semiconductor by four probe method.
5. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.
6. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance.
7. Determination of unknown resistance using Carey Foster's bridge
8. Study of Transient Response in LR, RC and LCR circuits using expeyes
9. Generating sound from electrical energy using expeyes

Experiments in Quantum Physics

1. Determination of Stefan-Boltzmann constant.
2. Determination of Planck constant using photocell.
3. Determination of Lande-g factor using Electron spin resonance spectrometer.
4. Determination of Rydberg constant by studying Hydrogen spectrum.
5. Determination of Band gap of semiconductor.
6. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.

Miscellaneous experiments

1. Determination of Young's modulus of elasticity of the material of a bar by the method of flexure
2. Determination of bending moment and shear force of a rectangular beam of uniform cross-section
3. Determination of modulus of rigidity of the material of a rod by static method
4. Determination of rigidity modulus of the material of a wire by dynamic method
5. To determine the moment of inertia of a body about an axis passing through its centre of gravity and to determine the modulus of rigidity of the material of the suspended wire
6. Determination of coefficient of viscosity by Poiseulle's capillary flow method

Learning Resources:

1. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India Learning Private Limited
2. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker , Wiley
3. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press
4. Engineering Mechanics (In SI Units)(SIE), S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati, McGraw Hill Education
5. Classical mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education
6. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education
7. Engineering Mechanics, M.K. Harbola , Cengage India
8. An Introduction to Mechanics (SIE), David Kleppner, Robert Kolenkow, McGraw Hill Education
9. Principles of mechanics, John L. Synge and Byron A. Griffith, New York, McGraw-Hill
10. Mechanics (Dover Books on Physics) , J. P. Den Hartog , Dover Publications Inc.
11. Engineering Mechanics: Dynamics, L.G. Kraige J.L. Meriam, Wiley
12. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, Robert Eisberg, Robert Resnick, Wiley
13. Introduction to Quantum Mechanics, J. Griffiths David , Pearson Education
14. Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press

15. Optics , Hecht, Pearson Education
16. Optics, Ghatak, McGraw Hill Education India Private Limited
17. Fundamentals of Statistical and Thermal Physics, Reif, Sarat Book Distributors
18. Statistical Mechanics , Pathria , Elsevier
19. Statistical Physics, L.D.Landau , E.M. Lifshitz, Butterworth-Heinemann

Course Outcome (CO):

Students will be familiar with **CO1:**

Basic concepts of mechanics

CO2: Bragg's Law and introduction to the principles of lasers, types of lasers and applications.

CO3: Various terms related to properties of materials such as, permeability, polarization, etc.

CO4: Some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials.

CO5: Simple quantum mechanics calculations.

Department of Applied Electronics & Instrumentation Engineering
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Documentation of Course Content, Learning Resources and, Course Outcomes (COs) for
Applied Electronics & Instrumentation Engineering
(Applicable from Academic Session 2018-19)

Course Category: Engineering Science Course (ES)	**Course Coordinator:** Department of Information Technology
Programme: AEIE	**Semester:** Second
Course Code: ES-CS291	**Course Title:** Programming for Problem Solving
Nature of Course: Mandatory	**Full Marks:** 100
Type of Course: Practical	**Credit Points:** 2
Contact Hours: L-T-P: 0-0-4*	**Total Contact Hours:** 44
Pre-Requisites: No prerequisites	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total classes assigned in hours/week.

Course Content:

The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:
Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):

Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures

Tutorial 12: File handling:
Lab 12: File operations

Learning Resources:

1. R. S. Salaria, Computer Concepts and Programming in C, Khanna Publishers
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Course Outcome (CO):

CO1: To formulate the algorithms for simple problems

CO2: To translate given algorithms to a working and correct program

CO3: To be able to correct syntax errors as reported by the compilers

CO4: To be able to identify and correct logical errors encountered at run time

CO5: To be able to write iterative as well as recursive programs

CO6: To be able to represent data in arrays, strings and structures and manipulate them through a program

CO7: To be able to declare pointers of different types and use them in defining self-referential structures.

CO8: To be able to create, read and write to and from simple text files.

Department of Applied Electronics & Instrumentation Engineering
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Documentation of Course Content, Learning Resources and, Course Outcomes (COs) for
Applied Electronics & Instrumentation Engineering
(Applicable from Academic Session 2018-19)

Course Category: Engineering Science Course (ES)	**Course Coordinator:** Department of Mechanical Engineering
Programme: AEIE	**Semester:** Second
Course Code: ES-ME292	**Course Title:** Workshop/ Manufacturing Practices
Nature of Course: Mandatory	**Full Marks:** 100
Type of Course: Practical	**Credit Points:** 3
Contact Hours: L-T-P: 1-0-4*	**Total Contact Hours:** 60
Pre-Requisites: No prerequisites	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total classes assigned in hours/week.

Course Content:

(i) Lectures & videos:

contents:

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

(ii) Workshop Practice:

Machine shop (8 hours)

Typical jobs that may be made in this practice module:

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

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

Fitting shop (8 hours)

Typical jobs that may be made in this practice module:

To make a Gauge from MS plate.

Carpentry (8 hours)

Typical jobs that may be made in this practice module:

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

Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs))

Typical jobs that may be made in this practice module:

ARC WELDING (4 hours): To join two thick (approx 6mm) MS plates by manual metal arc welding.

GAS WELDING (4 hours): To join two thin mild steel plates or sheets by gas welding.

Casting (8 hours)

Typical jobs that may be made in this practice module:

One/ two green sand moulds to prepare, and a casting be demonstrated.

Smithy (4 hours) ~ 4 hours

Typical jobs that may be made in this practice module:

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

Plastic moulding & Glass cutting (4 hours)

Typical jobs that may be made in this practice module:

For plastic moulding, making at least one simple plastic component should be made.

For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black colour diamond cutter, or similar other components may be made.

Electrical & Electronics (8 hours)

Familiarization with LT switchgear elements, making its sketches and noting down its specification. Kitkat fuse, Glass cartridge fuse, Plastic fuse holders (optional), Iron clad isolators, MCB style isolators, Single phase MCB, Single-phase wire, wiring cable.

Demonstration of domestic wiring involving two MCB, two piano key switches, one incandescent lamp, one LED lamp and plug point.

Simple wiring exercise to be executed to understand the basic electrical circuit.

Simple soldering exercises to be executed to understand the basic process of soldering.

Fabrication of a single-phase full wave rectifier with a step down transformer using four diodes and electrolytic capacitor and to find its volt-ampere characteristics to understand basic electronic circuit fabrication.

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

Learning Resources:

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. Kalpakjian S. and Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.
4. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
5. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Course Outcome (CO):

CO1: Upon completion of this laboratory course, students will be able to fabricate components with their own hands.

CO2: They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

CO3: By assembling different components, they will be able to produce small devices of their interest.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206 Affiliated to
MAKAUT and approved by AICTE

Documentation of Course Content, Learning Resources and, Course Outcomes (COs) for
Applied Electronics & Instrumentation Engineering
(Applicable from Academic Session 2018-19)

Course Category: Humanities and Social Sciences including Management courses (HM)	**Course Coordinator:** Department of Basic Science & Humanities
Programme: AEIE	**Semester:** Second
Course Code: HM-HU291	**Course Title:** Language Laboratory
Nature of Course: Mandatory	**Full Marks:** 100
Type of Course: Practical	**Credit Points:** 1
Contact Hours: L-T-P: 0-0-2*	**Total Contact Hours:** 19
Pre-Requisites: No prerequisites	

* L stands for Lecture classes, T stands for Tutorial classes and, P stands for Practical classes. L-T-P shown are total classes assigned in hours/week.

Course Content:

1) Honing 'Listening Skill' and its sub skills through Language Lab Audio device; (3 P)

2) Honing 'Speaking Skill' and its sub skills (2 P)

3) Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/Voice modulation/ Stress/ Intonation/ Pitch &Accent) of connected speech (2 P)

4) Honing 'Conversation Skill' using Language Lab Audio -Visual input; Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone & Role Play Mode) (2 P)

5) Introducing 'Group Discussion' through audio -Visual input and acquainting them with key strategies for success (2 P)

6) G D Practice Sessions for helping them internalize basic Principles (turn- taking, creative intervention, by using correct body language, courtesies & other soft skills) of GD (4 P)

7) Honing 'Reading Skills' and its sub skills using Visual/Graphics/Diagrams/Chart Display/Technical/Non-Technical Passages Learning Global/Contextual/Inferential Comprehension; (2 P)

8) Honing 'Writing Skill' and its sub skills by using Language Lab Audio -Visual input; Practice Sessions (2 P)

Learning Resources:

(i) Kulbushan Kumar, R S Salaria,Effective Communication Skills, Khanna Publishing House, Delhi.
(ii) Practical English Usage. Michael Swan. OUP. 1995.
(iii) Remedial English Grammar. F.T. Wood. Macmillan.2007
(iv) Writing Well. William Zinsser. Harper Resource Book. 2001
(v) Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
(vi) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
(vii) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
(viii) Universal English Prof. Prasad Kataria Publications, 2019.
(ix) "Communication Skills for Professionals"-Nira Konar, Prentice Hall of India 2nd edition, New Delhi, 2011
(x) Gajendra Singh Chauhan, Smita Kashiramka and L. Thimmesha. Functional English. Cengage, 2019.

Course Outcome (CO):

CO1: The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Contents, Course Outcomes (COs) and, Learning Resources for Applied Electronics & Instrumentation Engineering

(Applicable from Academic Session 2019-20)

SECOND YEAR THIRD SEMESTER PROPOSED SYLLABUS

Sl No.	Category	Subject Code	Subject Name	Total Number of Contact Hours			Credits
				L	T	P	
Theory							
1	Basic Science Course	BS-M301	Mathematics - III	2	1	0	3
2	Professional Core Course	PC-EI301	Network Analysis	3	0	0	3
3	Professional Core Course	PC-EI302	Sensors and Transducers	3	0	0	3
4	Professional Core Course	PC-EI303	Analog Integrated Circuits	3	0	0	3
5	Professional Core Course	PC-EI304	Digital Electronic Circuits	3	0	0	3
6	Mandatory Courses	MC-ES301	Environmental Science	2	0	0	0
	Total Theory			16	1		15
Practical							
1	Professional Core Course	PC-EI391	Circuits and Network Lab	0	0	3	1.5
2	Professional Core Course	PC-EI392	Sensors and Transducers Lab	0	0	3	1.5
3	Professional Core Course	PC-EI393	Analog Circuits Design Lab	0	0	3	1.5
4	Professional Core Course	PC-EI394	Digital Circuits Design Lab	0	0	3	1.5
	Total Practical					12	6
	Total of Third Semester			**16**	**1**	**12**	**21**

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Contents, Course Outcomes (COs) and, Learning Resources for Applied Electronics & Instrumentation Engineering

(Applicable from Academic Session 2019-20)

Course Code : BS-M 301	**Category:** Basic science Courses
Course Name: Mathematics - III	**Semester:** Third
Programme: AEIE	**Course Coordinator:** Department of Basic Science & Humanities
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hours: L-T-P:2-1-0	**Credit:** 3
Total Lectures: 45	**Full Marks:** 100
Pre-Requisites: Knowledge of limit, continuity and derivative. Knowledge of Integration, especially definite integral and improper integral. Knowledge of basic probability.	

Objectives:

1. Providing the core concepts of higher Engineering Mathematics and describing the techniques, this works as an essential tool to solve the problems in their field of applications.
2. To provide an overview of probability to engineers.

Course Content:

Module No.	Description of Topic	Contact Hrs.
1	Basic Probability: Probability spaces, conditional probability, independence; Bayes theorem. Discrete random variables, Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Chebyshev's Inequality.	8
2	Continuous Probability Distributions: Continuous random variables and their properties, distribution functions and densities, normal, exponential and gamma densities.	4
3	Laplace Transformation: Definition and existence of LT, LT of elementary functions, First and second shifting properties, Change of scale property; LT of $\frac{f(t)}{t^n}$, LT of $t\,f(t)$, LT of derivatives of $f(t)$, L.T. of $\int f(u)\,du$. Evaluation of improper integrals using LT, Inverse LT: Definition and its properties; Convolution Theorem (statement only) and its application to the evaluation of inverse LT.	9
4	Fourier Transformation: Fourier Transform of a function, Fourier Sine and Cosine Integral Theorem (statement only), Fourier Cosine & Sine Transforms of elementary functions. Properties of Fourier Transform: Linearity, Shifting, Change of scale, Modulation,	8

	Examples. Fourier Transform of Derivatives, Examples. Convolution Theorem (statement only), Inverse of Fourier Transform, Solution of integration by inverse Fourier transform. Examples.	
5	Approximation in numerical computation and Interpolation: Truncation and rounding errors, Fixed and floating-point arithmetic. Calculus of finite differences, Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation.	7
6	Numerical integration and Numerical solution of equations: Trapezoidal rule, Simpson's 1/3 rule for Integration. Bisection method, Newton-Raphson method and Regular Falsi method algebric and transcendental equation. Euler's method, Runge-Kutta methods for ordinary differential equation.	9

Note: For each module minimum two case studies

Course Outcome:

After completion of this course the students are expected to be able to demonstrate the following knowledge, skills and attitudes. Student will be able to:

CO1: Learn the concepts of the theory of Probability with the purpose of providing mathematical models of situations affected or even directed by chance effects. Solve the problems related to Probability distribution, both discrete and continuous.

CO2: Find the Laplace transform of a function by definition and by use of a table and the inverse Laplace transform of a function.

CO3: Describing the techniques of Fourier transform and using them to transform a problem into one that can be more easily solved.

CO4: Apply numerical methods to obtain approximate solutions of mathematical problems.

Learning Resources:

Text Books:

1. AP Baisnab and Jas M-Elements of Probability and Statistics.
2. R. J. Beerends_-Fourier and Laplace Transforms.
3. S. Ali Mollah-Numerical Analysis and Computational Procedures.
4. Balagurusamy-Numerical Methods.
5. R.S. Salaria, Computer Oriented Numerical Methods, Khanna Publishing House, New Delhi.
6. C.Xavier: C Language and Numerical Methods.

Reference Books:

1. D. C. Sanyal, K. Das: A Text Book of Numerical Analysis.
2. Dr. S.K. Sarkar & Dr. D.N. Ghosh: Numerical Methods and Programming.
3. HK Dass-Advanced Engineering Mathematics
4. Chadrika Prasad & Reena Garg, Advanced Engineering Mathematics, Khanna Publishing House, New Delhi

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206 Affiliated to MAKAUT and approved by AICTE

Documentation of Course Contents, Course Outcomes (COs) and, Learning Resources for Applied Electronics & Instrumentation Engineering

(Applicable from Academic Session 2019-20)

Course Code: PC-EI301	**Category:** Professional Core Courses
Course Name: Network Analysis	**Semester:** Third
Programme: AEIE	**Course Coordinator:** Department of Electrical Engineering
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hours: L-T-P:3-0-0	**Credit:** 3
Total Lectures: 45	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

Objectives:

1. To understand circuit analysis techniques using fundamental network theorems.
2. To model and solve electric circuits in the frequency domain.
3. To find the relevance of graph theory in electric networks.
4. To understand the properties of magnetic coupling.
5. To perform network analysis with different types of two port network.

Course Content:

Module No.	Description of Topic	Contact Hrs.
1	Introduction: Continuous & Discrete, Fixed & Time varying, Linear and Nonlinear, Lumped and Distributed, Passive and Active networks and systems. Independent & Dependent sources, Step, Ramp, Impulse, Sinusoidal, Square, Saw tooth signals. Network equations: Kirchoff's Voltage Law & Current Law, Formulation of network equations, Source transformation, Loop variable analysis, Node variable analysis.	8
2	Network theorem: Superposition, Thevenin's, Norton's & Maximum power transfer theorem. Millman's theorem, Reciprocity theorem, Solution of Problems with DC & AC sources.	8
3	Resonant Circuits: Analysis of R-C, R-L and R-L-C circuits under AC excitation using phasors. Series and Parallel Resonance, Impedance and Admittance Characteristics, Quality Factor, Half-Power Points, Bandwidth, Resonant voltage rise, Transform diagrams, Solution of Problems.	8
4	Laplace transforms: Transient analysis of R-C, R-L and R-L-C circuits with step excitation. Laplace transform and representation of periodic and periodic signals in Laplace domain. Application of Laplace transform for the analysis of R-C, R-L and R-L-C circuits with step, impulse and ramp input. AC and DC transient analysis of R-L, R-C & RLC circuits.	7
5	Coupled circuits: Magnetic coupling, Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Modelling of coupled circuits, Solution of problems. 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, solution of problems.	9

6	Two port networks analysis: Open circuit Impedance & Short circuit Admittance parameter, Transmission parameters, Hybrid parameters and their inter relations. Driving point impedance & Admittance. Solution of Problems with DC & AC sources.	5

Course Outcome:

CO1: To apply the knowledge of various components in circuit analysis.
CO2: To solve and analyze the circuits using different network theorems.
CO3: To solve electrical circuits using graph theory.
CO4: To analyze the electrical circuits containing passive elements under resonance conditions.
CO5: To use mathematical tools to analyze electrical networks in time domain and frequency domain.
CO6: To find solutions of electrical circuits applying the knowledge of two port parameters.

Learning Resources:

Textbook:

1. Asfaq Husain, Networks and Systems, Khanna Publishing House, New Delhi
2. AChakrabarty," Circuit Theory Analysis & Synthesis", DhanpatRai
3. William H. HaytJr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", Tata McGraw Hill publishers, 6th edition, New Delhi, (2002).
4. D. Roy Choudhary, Networks and Systems, Newage Publications, New Delhi

Reference book:

1. S P Ghosh, "Circuit Theory and Networks", Tata McGraw Hill.
2. Sudhakar A and Shyam Mohan SP, "Circuits and Networks- Analysis and Synthesis", McGraw Hill Education, (2015).
3. D. Chattopadhyay and P.C. Rakshit: "Fundamentals of Electrical Circuit Theory", S. Chand

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
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Documentation of Course Contents, Course Outcomes (COs) and, Learning Resources for Applied Electronics & Instrumentation Engineering

(Applicable from Academic Session 2019-20)

Course Code: PC-EI302	**Category:** Professional Core Course
Course Name: Sensors and Transducers	**Semester:** Third
Programme: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hours: L-T-P :3-0-0	**Credit:** 3
Total Lectures: 45	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

Objectives:

Throughout their careers as professional engineers and scientists in leading industries and institutions, students will be required to use measurement systems to collect field data for sensors and transducers. The goal of this course is to provide graduate students with a well-founded background in the theory of engineering measurements using sensor technology. With this in mind, this course focuses on principle of measurement, various types of Sensors & Transducers and their working principle for measuring typical physical quantities in solid and fluid mechanical systems.

To gain knowledge about the measuring instruments, the methods of measurement and the uses of different transducers following concepts have to be covered

1. Classification and descriptions of transducers
2. Optical, mechanical, thermal, magnetic, chemical and smart sensors
3. Sensor characteristics
4. The properties of a number of useful sensors for measuring position, temperature, strain, force, light etc.
5. Design instrumentation that senses desired quantities, transducers to an analogous electrical signal, and amplifies and filters that signal for interfacing to a microcomputer

Course Content:

Module No.	Description of Topic	Contact Hrs.
1	Introduction, Definition, significance of measurement and instruments, General concepts and terminology of measurement systems, Static & dynamic characteristics of instruments, Different types of instruments, Types of errors, Limiting error with examples. Principle of sensing & transduction, transducer classification, emerging fields of sensor technologies.	8
2	Resistive transducers: Potentiometers: types, loading error, metal and semiconductor strain gauges, types, resistance measuring methods, strain gauge applications: Load and torque measurement.	5
3	Inductive transducers: Transformer type, synchros, eddy current transducers, LVDT: Construction, material, input-output characteristics. Optical Sensors: LDR, Photo Diode, Stroboscope, IR Sensor.	8
4	Capacitive transducers: Variable distance-parallel plate type, variable area- parallel plate type, cylindrical type, differential type, variable dielectric constant type, calculation of sensitivity.	10

	Capacitive microphone, fluid level measurement. Piezoelectric transducers, proximity sensors. Magnetic Transducer: Hall effect sensors, Magnetostrictive transducers, Seismic instrument.	
5	Thermal sensors: Resistance temperature detector (RTD): principle, materials and types; Thermistor: principle, materials and types; Thermocouple, Thermoelectric effects, laws of thermocouple, thermocouple types, construction. IC temperature sensor.	7
6	Micro-sensors and smart sensors: Construction, characteristics and applications. Standards for smart sensor interface. Recent Trends in Sensor Technologies: Introduction; Film sensors (Thick film sensors, thin film sensor)	7

Course Outcome:

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

CO1: Apply basic concepts to distinguish different sensors and transducers and also compare the methods of measurements

CO2: Identify suitable transducer by comparing different industrial standards and procedures for most complex measurement of several physical parameters

CO3: Estimate the performance of different transducers and interpret the data accurately

CO4: Develop the skill to identify and analyze the complex technical problems and also capable to give a socio-economic solution to that problem

CO5: Acquire the knowledge of independent thinking to design real life electronics and instrumentation measurement systems helpful for humanities

CO6: Build the fundamental concept of latest technological trends like smart sensors, bio-sensors, PLC and Internet of Things.

Learning Resources:

Text Books:

1. Murthy D. V. S, “Transducers and Instrumentation”, Prentice Hall, New Delhi.
2. D. Patranabis, “Sensors and Transducers”, 2nd Edition, Prentice Hall India Pvt. Ltd.
3. Doebelin E.O, “Measurement Systems - Application and Design”, 4th Edition, McGraw-Hill, New York, 2003

Reference Books:

1. Neubert H.K.P, “Instrument Transducers - An Introduction to their Performance and Design”, 2nd Edition, Oxford University Press, Cambridge.
2. Waldemar Nawrocki, “Measurement Systems and Sensors”, Artech House.
3. S.M. Sze, “Semiconductor sensors”, John Wiley & Sons Inc., Singapore.
4. B. C. Nakara&Chaudhry, “Instrumentation Measurement and Analysis”, TATA McGraw-Hill, New Delhi.
5. Smart Sensors and Sensing Technology, Daniel E. Suarez, Nova Science Publishers.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
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Documentation of Course Contents, Course Outcomes (COs) and, Learning Resources for Applied Electronics & Instrumentation Engineering

(Applicable from Academic Session 2019-20)

Course Code: PC-EI303	**Category:** Professional Core Course
Course Name: Analog Integrated Circuits	**Semester:** Third
Programme: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hours: L-T-P:3-0-0	**Credit:** 3
Total Lectures: 45	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

Objectives:

The objective of this course is to introduce the student to familiarize and develop skills in the design and analysis of Analog Integrated Circuit, which form the building blocks of almost any electronic system.

The subject aims to provide the student with:

1. In-depth understanding of different biasing arrangement in transistor circuits and also the calculation of operating point or Q-point in different biasing circuits.
2. An extensive knowledge and perception of h-model and high frequency model of transistors.
3. The concepts of both positive and negative feedback in electronic circuits.
4. The broad knowledge of the operation of Transistor amplifiers, oscillators and power supplies.
5. The theoretical & circuitry details of the design of an Op-amp, which is the backbone for the basics of Linear integrated circuits.
6. Some useful applications of Operational Amplifiers in the field of electronics and instrumentation.
7. The functional block diagram of NE565/NE566 and an application of IC 555 timer as monostable and astable multivibrators.
8. An overview of series and shunt voltage regulator, 78xx and 79xx series.

Course Content:

Module No.	Description of Topic	Contact Hrs.
1	Brief overview of semiconductor and junction diode. Introduction to BJT and FET (JFET & MOSFET). Transistor Biasing Circuits: Different types of biasing circuits for BJT and FET, stability factors, bias compensation, dc & ac load line analysis and thermal runaway.	10
2	Small Signal Analysis of BJT: Transistor hybrid model, derivation of voltage gain, current gain, input impedance and output impedance, trans-conductance, low frequency small signal analysis of CE, CB and CC type RC coupled amplifier using hybrid-π and T model, determination of voltage gain, current gain, input impedance and output impedance, analysis of high frequency model. Frequency response of a RC coupled amplifier.	8
3	Feedback and Oscillator Circuits: Feedback concept, Feedback topologies, classification of amplifiers, Bark-hausen criteria,	5

	Oscillators- Wien bridge oscillator, Phase shift oscillator and Crystal oscillator.	
4	Operational Amplifier (OPAMP): Ideal OPAMP, Equivalent circuit, characteristics, Inverting and non-inverting configuration (ideal & Practical), summer, unity gain buffer, Differential amplifier, CMRR.	6
5	OPAMP Applications: Instrumentation amplifier and its application, comparator (zero crossing & Schmitt trigger), V-I and I-V converter, log and anti-log amplifier, precision rectifier (half & full wave), integrator and differentiator (ideal & Practical), IC 555 timer in monostable and astable mode.	10
6	Introduction to multi-vibrator, IC555, NE565/NE566. Linear Voltage Regulator: Series and Shunt, IC based power supply design.	6

Course Outcome:

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

CO1: Apply the knowledge more effectively during the study of analog integrated circuits.

CO2: Analyze and design simple circuits containing non-linear elements such as Transistors using the concepts of load lines, operating points and incremental analysis.

CO3: Understand the Mid – band analysis of RC coupled amplifier circuits using small – signal equivalent circuits to determine gain, input impedance and output impedance.

CO4: Learn how operational amplifiers are modelled and analysed.

CO5: Design Op-Amp circuits to perform operations such as amplification, integration and differentiation on electronic signals

CO6: Learn how negative feedback is used to stabilize the gain of an Op-Amp-based amplifier and how positive feedback can be used to design an oscillator

CO7: Acquire experience in building and trouble-shooting simple analog electronic circuits.

CO8: Analyze where and how analog components are used.

Learning Resources:

Text Books:

1. A.K. Maini, Analog Electronics, Khanna Publishing House, New Delhi
2. D. Roy Choudhury & Shail B. Jain, Linear Integrated Circuits, New Age International Publishers Ltd., New Delhi.
3. Adel S. Sedra & Kenneth C. Smith, Microelectronic Circuits, Oxford University Press, New Delhi.
4. Jacob Millman & Christos C. Halkias, Integrated Electronics, McGraw Hill.

Reference Books:

1. Ramakant A. Gayakwad, Op-Amps and Linear Integrated Circuits, PHI Learning,New Delhi.
2. Sergio Franco, Design with Operational Amplifiers and Analog Integrated Circuits, 3rd Edition, McGraw Hill.
3. Robert L. Boylestad&LouisNashelsky, Electronic Devices and Circuit Theory, Pearson/PHI, New Delhi.
4. Theodore F. Bogart, Jeffrey S. Beasley, &Guillermo Rico, Electronic Devices and Circuits, Pearson/PHI, New Delhi.
5. L.K. Maheshwari, Analog Electronics, Laxmi Publications, New Delhi

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Contents, Course Outcomes (COs) and, Learning Resources for Applied Electronics & Instrumentation Engineering

(Applicable from Academic Session 2019-20)

Course Code: PC-EI304	**Category:** Professional Core Course
Course Name: Digital Electronic Circuits	**Semester:** Third
Programme: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hours: L-T-P :3-0-0	**Credit:** 3
Total Lectures: 45	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

Objectives:

The objective of this course is to acquire the basic knowledge of digital logic circuits and its applications useful to design and implementation of any digital system.

The subject aims to encourage the students with the followings:-

1. Introduce the concept of digital and binary systems.
2. The concept of Boolean algebra and simplification of logic circuits with K-map and Quine-McClausky (Q-M) method.
3. Design and analysis of combinational & arithmetic logic circuits.
4. Design and analysis of sequential logic circuits.
5. The theoretical & circuitry details of various A/D and D/A converters.
6. Basic knowledge of various memory and programmable logic devices & Families using in digital system.

Course Content:

Module No.	Description of Topic	Contact Hrs.
1	Number System and Codes : o Introduction to Digital system, Data and number systems, Decimal, binary, octal and hexadecimal number systems and their arithmetic operations; conversion of one number system to another. o Binary codes, natural BCD codes ,weighted, non-weighted, sequential, self-complementing, cyclic, Excess-3, Alphanumeric, EBCDIC and Gray codes, Code conversion- from one code to another. o Signed binary number representation with 1's and 2's complement methods, Binary arithmetic	5
2.	Logic Gates and Boolean algebra : o Logic Operation-NOT, AND, OR, NAND, NOR, XOR and XNOR – operations, truth tables and universal gates; commonly used 7400 series IC's, standard and IEEE symbols of logic gates. o All Postulates and laws of Boolean algebra with proof, De Morgan's theorem. Minimization of Logic Expressions using Algebraic method. o Canonical forms of expressions, minterms and maxterms, SOP and POS forms. o Simplification and minimization of Logic Expressions using K-	7

	map method (up to 6 variables (focussing mainly up to 4 variables)). Concept of don't care and use of don't care terms in K-map method o Limitation of K-map and Quine-McClausky (Q-M) method of minimization of logic functions and concept of PI, EPI, RPI, SPI.	
3	Combinational and arithmetic logic circuit: o Introduction to combinational circuits, Design procedure o Adders: Half Adder, Full Adder, Binary parallel adder, Composite adder, Carry look ahead adder, BCD adder. o Multiplexers and Demultiplexer: basic 2:1, 4:1, 8:1 multiplexer equation and circuit diagram. Implementation of higher order MUX using lower order MUX, function implementation using MUX, basic 1:2 and 1:4 DEMUX equation and circuit diagram. function implementation using DEMUX, application of MUX and DEMUX o Decoders: basic 2:4, 3:8, 4:16 decoder equation and circuit diagram. Implementation of higher order DECODER using lower order DECODER, function implementation using DECODER. Application of Decoder o 3bit and 4 bit EVEN and ODD Parity Generator and checkers, 1 bit,2 bit,4 bit Magnitude Comparators with equation and circuit diagram o 4:2 Encoders and Priority Encoders equation with circuit diagram. Application of DECODER and ENCODER o Code converter: Binary to Gray and Gray to Binary, BCD to XS-3 and XS-3 to BCD, BCD to Binary and Binary to BCD	7
4.	Sequential Logic Circuits: o Concept of Sequential circuit, difference between combinational and sequential circuit, Introduction to latches (S-R Latch, NOR based S-R latch, NAND based S'-R' latch) with characteristic table, truth table, equation and circuit diagram. o Introduction to different types of Flip-Flop(S-R, D, J-K, T) with characteristic table, truth table, Excitation table, equation and circuit diagram. o Triggering of flip-flops, Asynchronous inputs in FF, race around condition, Master-slave configuration; Conversion of Flip-flop and application of FF. o Registers: left, right, serial and parallel shift registers (SISO, SIPO, PIPO, PISO), Bi-directional and universal shift registers, Ring and Johnson (twisted ring) counters, application of register. o Asynchronous counters - Full-sequence length counter, Binary up and down counter, Bidirectional counter, Modulo-N counter Synchronous counters - Full-sequence length counter, Binary up and down counter, Bidirectional counter, Modulo-N counter, Truncated Counter, Arbitrary sequence counter.	12
5.	Analog - Digital Conversion: o Introduction to analog- digital data conversion, specification of D/A converter.	6

	o D/A conversion- R-2R ladder type, weighted resistor type. o Specification of A/D converter; A/D conversion- flash type. o A/D conversion- Flash type, successive approximation type and dual-slope type.	
6	Memory and Programmable Logic Devices & Families: o Types of Memory and basic definition – Register, Main memory, secondary memory, sequential access memory, random access memory, static and dynamic memory, volatile and non volatile memory, magnetic and semiconductor memory, ROM, PROM, EPROM, EEPROM, RAM, DRAM, SRAM o Memory decoding, Memory expansion o Design of combinational logic circuit using ROM PLA,PAL o Introduction to Digital Logic Families; classification of Digital Logic Families; characteristics of Digital ICs. o TTL: characteristics, Totem-Pole output, Open Collector output, Tri-state output, o ECL: characteristics, OR/NOR gate. o MOS: characteristics, PMOS, NMOS. CMOS: characteristics NAND, NOR, logic circuit realization.	8

Course Outcome:

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

CO1: Apply different type of codes and number systems which are used in digital computing and communication systems.
CO2: Develop different types Logic circuit simplification using various mapping and mathematical methods.
CO3: Analyze, design and implement combinational including arithmetic logic circuits.
CO4: Analyze, design and implement sequential logic circuits.
CO5: Built the fundamental knowledge and analyze the operation of various A/D and D/A converters.
CO6: Identify various types of memory elements, PLDs, digital logic families and apply the knowledge in different types of digital circuits for real world application.

Learning Resources:

Text Books:

1. Digital Fundamentals by T.L. Floyd & R.P.Jain (Pearson).
2. Fundamental of digital circuits by A. Anand Kumar (PHI).
3. Digital Electronics, Rishabh Anand (Khanna Publishing House)
4. Digital Integrated Electronics by H. Taub & D. Shilling (TMH).

Reference Books:

1. Digital Circuit & Design by S. Aligahanan &S.Aribazhagan (Bikas Publishing)
2. Digital Electronics by A.K. Maini (Wiley-India)
3. Digital Circuits-Vol-I & II by D. RayChaudhuri (Platinum Publishers)
4. Modern Digital Electronics by R.P. Jain (McGraw Hill)

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Contents, Course Outcomes (COs) and, Learning Resources for Applied Electronics & Instrumentation Engineering

(Applicable from Academic Session 2019-20)

Course Code : MC-ES301	**Category:** Mandatory Courses
Programme: AEIE	**Course Coordinator:** Department of Basic Science & Humanities
Course Name: Environmental Science	**Semester:** Third
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hours: L-T-P:2-0-0	**Credit**: NIL
Total Lectures: 30	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

Course Content:

Module No.	Description of Topic	Contact Hrs.
1	Basic ideas of environment, basic concepts, man, society & environment, their interrelationship. Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development. Materials balance: Steady state conservation system, steady state system with non conservative pollutants, step function. Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering.	4
2	Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem-components types and function. Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web. Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.	4
3	Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems. Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and	8

	marine food.Global warming and its consequence, Control of Global warming. Earth's heat budget. Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion). Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model. Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. Smog, Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green house gases, effect of ozone modification. Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference).	
4	Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. River/Lake/ground water pollution: River: DO, 5 day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river[deoxygenation, reaeration], COD, Oil, Greases, pH. Lake: Eutrophication [Definition, source and effect]. Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only) Standard and control: Waste water standard [BOD, COD, Oil, Grease], Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition. Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic	6
5	Lithosphere; Internal structure of earth, rock and soil Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling. Solid waste management and control (hazardous and biomedical waste).	3

6	Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighborhood noise] Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L_{10} (18 hr Index) , Ld_n . Noise pollution control. Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol.	5

Learning Resources:

References:

1. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd., 1991.
2. M.P. Poonia, Environmental Studies, Khanna Publishing House, New Delhi, 2018
3. De, A. K., "Environmental Chemistry", New Age International.
4. O.P. Gupta, Elements of Environmental Pollution Control, Khanna Publishing House, New Delhi 2019

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206 Affiliated to MAKAUT and approved by AICTE

Documentation of Course Contents, Course Outcomes (COs) and, Learning Resources for Applied Electronics & Instrumentation Engineering

(Applicable from Academic Session 2019-20)

Course Code: PC-EI391	**Category:** Professional Core Course
Course Name: Circuits and Network Lab	**Semester:** Third
Programme: AEIE	**Course Coordinator:** Department of Electrical Engineering
Nature of Course: Mandatory	**Type of Course:** Practical
Contact Hours: L-T-P :0-0-3	**Credit:** 1.5
Total Contact Hours: 30	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

Course Content:

Laboratory Experiments :	
1	Transient response in R-L and R-C Network: Simulation/hardware
2	Transient response in R-L-C Series & Parallel circuits Network: Simulation/hardware
3	Determination of Impedance (Z) and Admittance(Y) parameters of two port network
4	Frequency response of LP and HP filters
5	Frequency response of BP and BR filters
6	Generation of Periodic, Exponential, Sinusoidal, Damped sinusoidal, Step, Impulse, Ramp signals using MATLAB in both discrete and analog form
7	Determination of Laplace transform and inverse Laplace transformation using MATLAB
8	Spectrum analysis of different signals
9	Mandatory Design and Implementation of Mini Project

Course Outcome:

CO1: To identify various circuit components for their appropriate use in the experiments.
CO2: To apply the concepts of circuit laws and theorems for analysis and verification of laboratory measurements.
CO3: To develop the software skill for analysis and design of circuit based simulations.
CO4: To acquire technical writing skill for effective representation of experimental works.
CO5: To effectively communicate among fellow group members for proper distribution and execution of laboratory assignments.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Contents, Course Outcomes (COs) and, Learning Resources for Applied Electronics & Instrumentation Engineering

(Applicable from Academic Session 2019-20)

Course Code: PC-EI392	**Category:** Professional Core Course
Course Name: Sensors and Transducers Lab	**Semester:** Third
Programme: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Practical
Contact Hours: L-T-P:0-0-3	**Credit:** 1.5
Total Contact Hours: 30	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

Course Content:

Laboratory Experiments :	
1	Temperature measurement using AD590 IC sensor.
2	Displacement measurement by using a capacitive transducer.
3	Pressure and displacement measurement by using LVDT.
4	Study of a load cell with tensile and compressive load.
5	Torque measurement Strain gauge transducer.
6	Speed measurement using magnetic proximity sensor.
7	Speed measurement using a Stroboscope.
8	Study of the characteristics of a LDR.
9	Mandatory Design and Implementation of Mini Project.

Course Outcome:

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

CO1: Identify standard experimental methods and apply the theoretical knowledge to evaluate performance characteristics of different transducers.
CO2: Determine experimental procedures for different types of sensors and transducers.
CO3: Evaluate probable reasons of irregularity between experimental data and theoretical values and also interpret the experimental data.
CO4: Apply appropriate techniques to connect different types of sensors and source and sink devices keeping in mind technical, economical, safety issues.
CO5: Analyse graphical presentations of experimental data and solve different complex technical problems.
CO6: Design sensor based mini instrumentation systems.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Contents, Course Outcomes (COs) and, Learning Resources for Applied Electronics & Instrumentation Engineering

(Applicable from Academic Session 2019-20)

Course Code: PC-EI393	**Category:** Professional Core Course
Course Name: Analog Circuits Design Lab	**Semester:** Third
Programme: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Practical
Contact Hours: L-T-P:0-0-3	**Credit:** 1.5
Total Contact Hours: 36	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

Course Content:

Laboratory Experiments :	
1	Introduction: Study of characteristics curves of B.J.T &F.E.T .
2	Construction of a two-stage R-C coupled amplifier & study of its gain & Bandwidth.
3	Study of class A & class B power amplifiers.
4	Study of class C & Push-Pull amplifiers.
5	Realization of current mirror & level shifter circuit using Operational Amplifiers.
6	Study of timer circuit using NE555 & configuration for monostable &astable multivibrator.
7	Construction & study of Bistable multivibrator using NE555.
8	Study of Switched Mode Power Supply & construction of a linear voltage regulator using regulator IC chip.
9	Construction of a simple function generator using IC.
10	Realization of a Phase Locked Loop using Voltage Controlled Oscillator (VCO).
11	Study of DAC & ADC.
12	Mandatory Design and Implementation of Mini Project.

Course Outcome:

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

CO1: Set up standard experimental methods and select proper instruments to evaluate performance characteristics of different electronic circuits.
CO2: Determine experimental procedures for different types of electronic circuits.
CO3: Evaluate possible reasons of inconsistency between experimental observations and theoretical values and interpret the experimental data.
CO4: Investigate different types of instruments connections keeping in mind technical, economical, safety issues.
CO5: Analyse graphical presentations of experimental data and solve different complex technical problems.
CO6: Design mini electronic based systems.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Contents, Course Outcomes (COs) and, Learning Resources for Applied Electronics & Instrumentation Engineering

(Applicable from Academic Session 2019-20)

Course Code: PC-EI394	**Category:** Professional Core Course
Course Name: Digital Circuits Design Lab	**Semester:** Third
Programme: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Practical
Contact Hours: L-T-P:0-0-3	**Credit:** 1.5
Total Contact Hours: 45	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

Course Content:

Laboratory Experiments :	
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 7-segment 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	Construction of Adder circuit using Shift Register & full Adder.
11	Realization of Asynchronous Up/Down counter.
12	Realization of Synchronous Up/Down counter.
13	Design of Sequential Counter with irregular sequences.
14	Realization of Ring counter & Johnson's counter.
15	Construction of adder circuit using Shift Register & full Adder.
16	Mandatory Design and Implementation of Mini Project.

Course Outcome:

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

- **CO1:** Identify the operation of various basic logic gates ICs to implement different digital circuits.
- **CO2:** Implement logic circuits for various code conversion, magnitude comparator and parity bit generator.
- **CO3:** Demonstrate the basic operation of different combinational circuits including arithmetic circuits.
- **CO4:** Demonstrate the basic operation of different flip-flops as a basic element of sequential circuits.
- **CO5:** Evaluate the applications of flip-flops as binary registers and counters used in large digital integrated circuits.
- **CO6:** Design mini digital electronic circuit based systems.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Details, Course Outcomes (COs) and, Learning Resources for Applied Electronics & Instrumentation Engineering (Applicable from Academic Session 2019-20)

SECOND YEAR FOURTH SEMESTER PROPOSED SYLLABUS

Sl No.	Category	Subject Code	Subject Name	Total Number of Contact Hours			Credits
				L	T	P	
Theory							
1	Professional Core Course	PC-EI401	Electrical and Electronic Measurement	3	0	0	3
2	Professional Core Course	PC-EI402	Industrial Instrumentation	3	0	0	3
3	Professional Core Course	PC-EI403	Microprocessor and Microcontroller	3	1	0	4
4	Engineering Science Courses	ES-CS401	Data Structure and Algorithm	3	0	0	3
5	Basic Science course	BS-BIO401	Biology	3	0	0	3
6	Humanities and Social Sciences including Management Courses	HM-HU401	Values and Ethics in Profession	2	0	0	2
	Total Theory			17	1		18
Practical							
1	Professional Core Course	PC-EI491	Electrical & Electronic Measurement Lab	0	0	3	1.5
2	Professional Core Course	PC-EI492	Microprocessor and Microcontroller Lab	0	0	3	1.5
3	Engineering Science Course	ES-CS491	Data Structure and Algorithm	0	0	3	1.5
4	Humanities and Social Sciences including Management Courses	HM-HU481	Advanced Language Lab	0	0	2	1
	Total Practical					11	5.5
	Total of Forth Semester			**17**	**1**	**11**	**23.5**

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Details, Course Outcomes (COs) and, Learning Resources for Applied Electronics & Instrumentation Engineering (Applicable from Academic Session 2019-20)

Course Code: PC-EI401	**Category:** Professional Core Course
Course Name: Electrical and Electronic Measurement	**Semester:** Fourth
Programme: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hours: L-T-P :3-0-0	**Credit:** 3
Total Lectures: 45	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

Objectives:

1. To provide students a brief knowledge of measurements and measuring instruments related to engineering.
2. To introduce students how different types of electrical and electronic meters work and their construction.
3. To provide students a knowledge to use modern tools necessary for instrumentation projects.

Course content:

Module No.	Description of Topic	Contact Hrs.
1	Measurement and Electromechanical indicating Instruments: Generalized block diagram of Measurement System, Industrial Standards of measurement. Measurement of current & Voltage using PMMC, MI and Electrodynamometer type instruments. Extension of range of instruments- shunts & multipliers-Current transformers- Potential	8
2	Power, Energy and Power Factor Measurements: Definition of power, types, Measurement of power with different methods, construction and working of Electrodynamometer type Wattmeter, Errors in power measurements. Measurement of	6
3	DC and AC Bridges: Concept of Bridges, Measurement of low resistance by Kelvins Double Bridge Method, A.C. bridges - Maxwell's inductance bridge, Anderson bridge, D-Sauty Bridge, Schering Bridge, Wien bridge- Circuit diagram, phasor diagram, derivations of equations for unknown parameter, Q-factor, dissipation factor, advantages and disadvantages for all the bridges.	6
4	Analogue Electronic Instruments: Q- Meter circuit and its operation, errors in Q- Meter circuits, Voltmeters with IC Operational Amplifiers, Peak Response and rectifying type AC Voltmeters, True rms Voltmeter, Electronic Ohmmeters, Current	11

	Analogue Electronic Instruments -Current-to-voltage converter type Electronic Ammeters. Digital Instruments: Introduction, Digital voltmeters, Digital Frequency Meter, Errors in frequency measurement – possible remedies, Time and Ratio measurement. Frequency Divider Generator, Signal Generator, Digital Multimeter.	
5	Instrument for Generation and Analysis of Waveforms: Oscilloscopes and its applications: Cathode Ray Tube, Oscilloscope Time Base, Delay line, Dual-Trace Oscilloscopes, Oscilloscope Probes, Delayed time base oscilloscope, Digital Storage Oscilloscope. Signal Analysis: Wave Analyzer, Spectrum Analyzer.	8
6	Digital Data Acquisition System: Interfacing transducers to Electronics Control and Measuring System. Voltage to frequency (V-F) converter, Frequency to voltage (F-V) converter. An Introduction to Virtual Instrumentation, Interference and Noises.	6

Course Outcomes:

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

CO1: Identify various types of errors which may occur during measurement and take necessary steps to minimize them.

CO2: Demonstrate the working of various instruments used for measurement of different parameters like voltage, current, power, energy, resistance, capacitance, inductance, frequency, phase etc. in industry.

CO3: Select the appropriate analog and digital instruments for measurement of different electrical and electronic engineering parameters and select appropriate passive or active transducers for measurement of physical phenomenon.

CO4: Analyze and solve the varieties of problems and issues in the field of electrical and electronic measurements.

CO5: Calibrate and standardize various measuring instruments.

CO6: Believe about the improvement of existing technology in terms of accuracy, precision, resolution, cost, durability and user friendliness.

Learning Resources:

Text Books:

1. A.K.Sawhney, Electrical & Electronics Measurements and Instrumentation; DhanpatRai and Sons.
2. E.W Golding, Electrical Measurement and Measuring Instruments; Wheeler Publication
3. Electronic Measurement & Instrumentation By H. Cooper – PHI.

Reference Books:

1. Electronics Instruments & Measurement by David A. Bell – PHI.
2. J.B.Gupta, Electrical & Electronics Measurements and Instrumentation; S.K. Kataria and Sons.
3. Kalsi, G.C., Electronic Instrumentation, TMH.
4. Bouwens, A.J., Digital Instrumentation, McGraw Hill.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
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Documentation of Course Details, Course Outcomes (COs) and, Learning Resources for Applied Electronics & Instrumentation Engineering (Applicable from Academic Session 2019-20)

Course Code: PC-EI402	Professional Core Courses
Course Name: Industrial Instrumentation	**Semester:** Fourth
Programme: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hours: L-T-P:3-0-0	**Credit:** 3
Total Lectures: 45	
Pre-Requisites: Sensors and Transducers	

Objectives:

The objective of this course is:

1. To familiar the students with industrial instruments used in various industries.
2. To acquire knowledge about various techniques used for measurement of process variables such as temperature, pressure, flow and level.
3. To equip the students with the basic knowledge of industrial processes.
4. To learn the construction and working of different types of temperature, pressure, flow and level transducers.
5. To provide the concept of possible sources of error and possible remedies when performing measurements.
6. To realize the basic concepts of hazardous area classification.

Course content:

Module No.	Description of Topic	Contact Hrs.
1	Temperature Measurement: Temperature and heating definitions, Standards, Temperature scales. Filled in Systems Thermometer: Liquid, gas and vapor pressure, construction details and comparison, ranges, sources of errors in filled in systems and their compensation, Bimetallic thermometer and thermostats. Electrical Methods of Temperature Measurement: Resistance Temperature Detector (RTD), Thermistor, Thermocouple, Thermo-well, Thermo-pile.	8
2	Pressure Measurement: Units of pressure, Classification of pressure gauges. Manometer: Various types, accuracy, range, errors. Elastic Pressure Gauges: Bourdon tube, diaphragm, Capsule gauge, Differential pressure gauge and its applications, Testing and Calibration of pressure gauges – Dead weight tester. Electrical Type: Capacitive, Piezo-electric, Piezo resistive and Resonator type. Vacuum Gauges: McLeod gauge, Knudsen gauge, Thermal conductivity gauges and Ionization gauges. Pneumatic instrumentation - Flapper nozzle system.	8
3	Flow Measurement-I: General consideration of fluid flow rate meters, classification of flow	8

	meters, units, Laminar flow, Reynolds number. Effect of temperature and pressure on flow rate measurement. Fixed and variable head type flow meters: Orifice plate- types, installation, pressure tapping and discharge coefficient variation, Venturi tube, Flow nozzle, Dall tube, Pitot tube – principle, installation, Annubar - analysis and calculation. Straight run requirements for flow meters. Rotameter - theory, types,	
4	Flow Measurement-II: Mass flow meters: Coriolis, Thermal and Impeller type. Electrical type: Electromagnetic flow meter- principle, construction, different types of excitation schemes used, Ultrasonic flow meter – principle, types, Anemometers. Positive displacement flow meters, Vortex flow meter, Target flow	8
5	Level Measurement: Gauge glass, Float type, Displacers and torque tube- construction and working, errors and ranges. Air purge/ bubbler system, Hydrostatic pressure type, Boiler drum level measurement. D/P type sensors and their installation arrangement. Electrical types: Resistance tapes, Capacitance level sensor- principle, types, installation, Ultrasonic sensor, Optical level sensor, Laser level, Microwave type, Radiation type.	7
6	Industrial Safety Measurement: Introduction, Electrical hazards, Hazardous areas and classification, Non hazardous areas, Enclosures – NEMA and IP codes Methods of Protection – Explosion proof, intrinsic safety, Purging and Pressurization, Non-Incendiary; IEC, Equipment Protection Level (EPL). Electromagnetic Interference and earth loops	5

Course Outcomes:

Upon successful completion of this course, a student will be able to:

CO1: Acquire the knowledge of use of temperature, pressure, flow and level sensors and transducers in the field of Instrumentation.
CO2: Explain the operation of transducers for temperature, pressure, fluid flow and level measurement.
CO3: Describe the specification of different process instruments and advantages and disadvantages.
CO4: Identify, formulate and solve engineering problems related to measurement of process parameters.
CO5: Select and design suitable instruments to meet the requirements of industrial applications.

CO6: Comprehend the methods of hazard identification and safety measures.

Learning Resources:

Text Books:

1. Krishnaswamy. K & Vijayachitra. S, Industrial Instrumentation, New Age International

Publishers, New Delhi.
2. Patranabis. D, Principle of Industrial Instrumentation, 2nd edition, Tata McGraw Hill, New Delhi.
3. Singh S.K, Industrial Instrumentation and Control, Tata McGraw Hill, New Delhi.
4. Anand M.M.S., Electronic Instruments and Instrumentation Technology, Prentice Hall of India, New Delhi.

Reference Books:

1. Liptak B.G., Process Measurement and Analysis, 3rd edition, Chilton Book Company, Radnor, Pennsylvania, 1995.
2. Douglas M. Considine, Process/Industrial Instruments and Control Handbook, 4th edition, McGraw Hill, Singapore.
3. Doeblin E. O., Measurement Systems: Application and Design, 4th edition, McGraw Hill, New York.
4. Curtis D. Johnson, Process Control Instrumentation Technology, Prentice Hall, India.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Details, Course Outcomes (COs) and, Learning Resources for Applied Electronics & Instrumentation Engineering (Applicable from Academic Session 2019-20)

Course Code: PC-EI403	**Category:** Professional Core Courses
Course Name: Microprocessor and Microcontroller	**Semester:** Fourth
Programme: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hours: L-T-P :3-1-0	**Credit:** 4
Total Lectures: 60	**Full Marks:** 100
Pre-Requisites: Digital Electronics	

Objectives:

1. To introduce the architecture and organization of typical microprocessors and microcontroller
2. To develop assembly language programming skill of microprocessor and microcontroller along with applications.
3. To familiarize the technique for interfacing memory and peripheral devices to microprocessor, including several specific standard I/O devices.
4. To understand the hardware/software trade-offs involved in the design of microprocessor based systems.

Course content:

Module No.	Description of Topic	Contact Hrs.
1	8085 Processor: Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization and interfacing –I/O ports and data transfer concepts– Timing Diagram – Interrupts.	14
2	Programming of 8085 Processor: Instruction -format and addressing modes – Assembly language format – Data transfer, data manipulation & control instructions – Programming: Loop structure with counting & Indexing – Look up table – Subroutine instructions – stack.	14
3	8051 Micro Controller: Hardware Architecture, pintouts – Functional Building Blocks of Processor – Memory organization –I/O ports and data transfer concepts– Timing Diagram – Interrupts.	10
4	Peripheral Interfacing: Study on need, Architecture, configuration and interfacing, with ICs: 8255, 8254, 8251, A/D and D/A converters &Interfacing with 8085.	10
5	Micro Controller Programming & Applications: Data Transfer, Manipulation, Control Algorithms& I/O instructions – Simple programming exercises key board and display interface.	6
6	Architecture of Typical 16-Bit Microprocessors (Intel 8086): Introduction to a 16 bit microprocessor, Architecture and Register Organization, Memory address space and data organization.	6

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Details, Course Outcomes (COs) and, Learning Resources for Applied Electronics & Instrumentation Engineering (Applicable from Academic Session 2019-20)

Course Outcomes:

CO1: To construct and analyze assembly language program in 8085 and 8086 microprocessor to solve various complex engineering problem.

CO2: To evaluate processing time of program and devise technique to reduce execution time to improve microprocessor performance.

CO3: To design interfacing circuits to the microprocessor to communicate with external devices, which can be associated with public safety, health, security and other societal and environmental concerns.

CO4: To design memory devices using memory chips and utilize the knowledge in memory based devices used in academics and industry.

CO5: To study 8051 microcontroller for using it in real life applications.

CO6: To learn architecture and programming of programmable peripheral devices such as 8255, 8254, 8279 to use them in larger industrial and societal application.

Learning Resources:

Text Books:

1. Ramesh S. Gaonkar, Microprocessor Architecture, Programming and Applications with the 8085A /8080A, WILEY EASTERN LIMITED.
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, "The 8051 Microcontroller and Embedded Systems: Using Assembly and C", Second Edition, Pearson education, 2011.
3. A.H. Mukhopadhyay, Microprocessor, Microcomputer and Their Applications, 3rd Edition Alpha Science International, Ltd.

References:

1. Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085, 8086, 8051, McGraw Hill Edu, 2013.
2. M. Rafiquzzman: Microprocessors: Theory & Applications (Intel & Motorola), PHI. 2. Berry .B. Bray INTEL 8086/88, 80186, 286, 386, 486, Pentium Pro & Pentium IV.
3. Berry .B. Bray INTEL 8086/88, 80186, 286, 386, 486, Pentium Pro & Pentium IV.

Department of Applied Electronics & Instrumentation Engineering
Dr. B. C. Roy Engineering College, Durgapur – 713206
Affiliated to MAKAUT and approved by AICTE

Documentation of Course Details, Course Outcomes (COs) and, Learning Resources for Applied Electronics & Instrumentation Engineering (Applicable from Academic Session 2019-20)

Course Code: ES-CS401	**Category:** Engineering Science Courses
Course Name: Data Structure and Algorithm	**Semester:** Fourth
Programme: AEIE	**Course Coordinator:** Department of Computer Science
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hours: L-T-P:3-0-0	**Credit:** 3
Total Lectures: 45	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

Course Objectives:

In view of the notable advancement of data structure in recent few years, it is essential for the students to be familiar with various algorithmic approaches to write program thereby solving problems. The objectives of the course are mentioned below:

1. To represent the significance of algorithms with its properties for solving problems in different engineering domains
2. To provide the characteristics of various Abstract Data Type for creating the solution-strategies
3. To demonstrate the significance of non-linear data structures with respect to the access and organization of records
4. To clarify various sorting and searching algorithms
5. To expose merits and demerits of altered algorithms in terms of time-complexity
6. To enhance the ability of selecting appropriate data structure and algorithm for solving specific problems

Course content:

Module No.	Description of Topic	Contact Hrs.
1	Introduction of Data Structure: Necessity of data structure. Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type. Algorithms and programs, basic idea of pseudo-code. Properties of an Algorithm, Algorithm efficiency and analysis, time and space analysis of algorithms – order notations.	3
2	Array and Linked List : Array: Different representations – row major, column major. Sparse matrix - its implementation and usage. Array representation of polynomials. Linked List: Singly linked list, Insertion-Deletion-Display(also in reverse order) Operations of Linked List, circular linked list, doubly linked list, linked list representation of polynomial and applications.	7
3	Linear Data Structure: Stack and Queue: Stack and its implementations (using array, using linked list), applications. Queue, circular queue, dequeues. Implementation of queue-both linear and circular (using array, using linked list), applications. Recursion:	10

	Principles of recursion – use of stack, differences between recursion and iteration, tail recursion. Applications - The Tower of Hanoi, Eight Queens Puzzle.	
4	Nonlinear Data structures: Trees Basic terminologies, forest, tree representation (using array, using linked list). Binary trees - binary tree traversal (pre-, in-, post- order), threaded binary tree (left, right, full) - non-recursive traversal, algorithms using threaded binary tree, expression tree. Binary search tree- operations (creation, insertion, deletion, searching). Height balanced binary tree – AVL tree (insertion, deletion with	11
5	Nonlinear Data structures: Graphs Graph definitions and concepts (directed/undirected graph, weighted/un-weighted edges, sub-graph, degree, cut-vertex/articulation point, pendant node, clique, complete graph, connected components – strongly connected component, weakly connected component, path, shortest path, isomorphism).Graph representations/storage implementations – adjacency matrix, adjacency list, adjacency multi-list. Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) – concepts of	6
6	Searching, Sorting, Hashing: Sorting Algorithms: Bubble sort and its optimizations, insertion sort, shell sort, selection sort, merge sort, quick sort, heap sort (concept of max heap, application – priority queue), radix sort, bucket sort. Searching: Sequential search, binary search, interpolation search. Hashing: Hashing functions, collision resolution techniques	8

Course Outcomes:

Upon successful completion of this course, a student will be able to:

- **CO1:** Acquaint with the different properties of algorithm and recognize various types of data structure along with the relevance of their application for solving real world problems.
- **CO2:** Comprehend the concept of linked list along with its difference from array and its many applications for solving different problems.
- **CO3:** Know the concept of ADT (like stack, queue) and recognize its significance for mapping various real life problems to the programming ground to get the solutions of the
corresponding problems.
- **CO4:** Create the concept of non-linear data structure like graph, tree and their appliance in various problems in societal issues.
- **CO5:** Know different searching and sorting approaches and select proper data structure and algorithm by analyzing time complexity and space complexity for specific problems.
- **CO6:** Apply hashing techniques for minimizing searching time and have the knowledge of file organization.

Learning Resources:

Text Books:

1. "Data Structures And Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung.
2. "Fundamentals of Data Structures of C" by Ellis Horowitz, SartajSahni, Susan Anderson-freed.
3. "Data Structures in C" by Aaron M. Tenenbaum.
4. "Data Structures" by S. Lipschutz.

Reference Books:

1. "Data Structures Using C" by ReemaThareja
2. "Data Structure Using C", 2/e by A.K. Rath, A. K. Jagadev.
3. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.

Department of Applied Electronics & Instrumentation Engineering
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Documentation of Course Details, Course Outcomes (COs) and, Learning Resources for Applied Electronics & Instrumentation Engineering (Applicable from Academic Session 2019-20)

Course Code: BS-BIO401	**Category:** Basic Science course
Course Name: Biology	**Semester:** Fourth
Programme: AEIE	**Course Coordinator:** Department of Basic Science & Humanities
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hours: L-T-P :3-0-0	**Credit:** 3
Total lectures: 45	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

Objectives:

The syllabus of Environmental Engineering has been formulated for B. Tech. students by MAKAUT with an eye to

1. Convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry.
2. Provide basic knowledge about our environment and importance of different types of ecosystem and biodiversity on existence of life on Earth.
3. Convey that classification per se is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted.
4. Convey that "Genetics is to biology what Newton's laws are to Physical Sciences"
5. Convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine.
6. Convey that without catalysis life would not have existed on earth.
7. Understand the molecular basis of coding and decoding genetic information and information transfer from parent to offspring.
8. Analyze different biological processes.
9. Convey that the fundamental principles of energy transactions are the same in the physical and biological world.

Course content:

Module No.	Description of Topic	Contact Hrs.
1	Introduction: Purpose: To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry. Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18^{th} Century that lead to major discoveries. Examples from Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.	4

2	Classification Purpose: To convey that classification per se is not what biology is all about. The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilisation -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitataacquatic or terrestrial (f) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae,	5
3	Genetics Purpose: To convey that "Genetics is to biology what Newton's laws are to Physical Sciences". Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics	6
4	Bio molecules Purpose: To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids. Enzymes Purpose: To convey that without catalysis life would not have existed on earth. Enzymology: How to monitor enzyme catalysed reactions. How does an enzyme catalyse reactions? Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand	11
6	Metabolism Purpose: The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO_2 + H_2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis).Energy yielding and energy consuming reactions. Concept of Energy charge	7

	Microbiology Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.	

Course Outcomes:

After studying the course, the student will be able to:

- **CO1:** Describe how biological observations of 18th Century that lead to major discoveries.
- **CO2:** Convey that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological.
- **CO3:** Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring.
- **CO4:** Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one canimagine.
- **CO5:** Classify enzymes and distinguish between different mechanisms of enzyme action.
- **CO6:** Identify DNA as a genetic material in the molecular basis of information transfer.
- **CO7:** Analyse biological processes at the reductionistic level.
- **CO8:** Apply thermodynamic principles to biological systems.
- **CO9:** Identify and classify microorganisms.

Learning Resources

1. Biology:Aglobalapproach:Campbell,N.A.;Reece,J.B.;Urry,Lisa;Cain,M,L.;Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2. OutlinesofBiochemistry,Conn,E.E;Stumpf,P.K;Bruening,G;Doi,R.H.JohnWileyandSons
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers.

Department of Applied Electronics & Instrumentation Engineering
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Documentation of Course Details, Course Outcomes (COs) and, Learning Resources for Applied Electronics & Instrumentation Engineering (Applicable from Academic Session 2019-20)

Course Code: HM-HU401	**Category:** Humanities and Social Sciences including Management Courses
Course Name: Values and Ethics in Profession	**Semester:** Fourth
Programme: AEIE	**Course Coordinator:** Department of Basic Science & Humanities
Nature of Course: Mandatory	**Type of Course:** Theory
Contact Hours: L-T-P:2-0-0	**Credit:** 2
Total Lectures: 30	**Full Marks:** 100
Pre-Requisites: No-prerequisite	

Objectives: To understand the ethical and moral problems faced in the corporate and wider philosophical settings along with social importance and their intellectual challenges are given its due placement.

Course content:

Module No.	Description of Topic	Contact Hrs.
1	Being good and responsible Gandhian values such as truth and non-violence – comparative analysis on leaders of past and present – society's interests versus self interests – Prevention of harassment, violence and	4
2	Profession and Human Values Values Crisis in contemporary society, Nature of values: Value Spectrum of a good life, Psychological values: Integrated personality; mental health, Dishonesty - Stealing - Malpractices in Examinations - Plagiarism – Abuse of technologies: Hacking and other Cyber Crimes, addiction to mobile phone usage, video	6
3	Corruption Corruption: ethical values, causes, impact, laws, prevention – electoral malpractices – white collar crimes - tax evasions – unfair trade practices.	2
4	Addiction and Health Peer pressure, Drug Abuse Alcoholism: ethical values, causes, impact, laws, prevention-ill effects of smoking-Prevention of suicides-Sexual Health: Prevention and impact of pre- marital pregnancy and Sexually Transmitted Diseases. Abuse of different types of legal and illegal drugs: ethical values, causes, impact, laws and prevention	4
5	Ethics of Profession Engineering profession: Ethical issues in Engineering practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies.	6
6	Effects of Technological Growth Rapid Technological growth and depletion of resources, Reports of the Club of Rome. Limits of growth: sustainable development, Energy Crisis: Renewable Energy Resources, Environmental degradation and pollution. Eco-friendly Technologies.	8

	Environmental Regulations, Environmental Ethics, Appropriate, Technology Movement of Schumacher; later developments, Technology and developing notions. Problems of Technology transfer, Technology assessment impact analysis. Human Operator in Engineering projects and industries. Problems of man, machine, interaction, Impact of assembly line and automation.	

Course Outcomes:

On completion of the course, the students will be able to solve the day-to-day problems and their allied alternative decision making towards social impact.
Analyse and give solution to business environment.
Expected this course meets the following student outcomes:

Outcomes:

- **CO1:** An understanding of professional, ethical, legal, security and social issues and responsibilities g) An ability to communicate effectively with a range of audiences.
- **CO2:** An ability to address contemporary issues and analyze the local and global impact of computing and engineering solutions on individuals, organizations and society
- **CO3:** Recognition of the need for and an ability to engage in continuing professional learning (lifelong learning)

Learning Resources

Textbook:

1. Human Values- A.N Tripathi.
2. Christine E. Gudorf, James Edward Huchingson, 'Boundaries: A Casebook in Environmental Ethics', Georgetown University Press, 2010

References:

1. Ethics- S. Balachandran, K.C.R.Raja& B.K Neir
2. Values and Ethics in Profession-SisirMazumder (Everest)
3. Ethics in Engineering- Martin Schinzinge
4. Mike W Martin & Ronald Schnizinger, Engineering Ethics, New Delhi: Tata Reference McGraw Hill, Latest Edition
5. OC Ferrell, John Paul Frederich, Linda Ferrell; Business Ethics – Ethical Books Decision making and Cases- 2007 Edition, Biz Tantra, New Delhi
6. L.H. Newton & Catherine K.D., "Classic cases in Environmental Ethics", Belmont: California Wadsworth, 2006

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Documentation of Course Details, Course Outcomes (COs) and, Learning Resources for Applied Electronics & Instrumentation Engineering (Applicable from Academic Session 2019-20)

Course Code: PC-EI491	**Category:** Professional Core Course
Course Name: Electrical & Electronic Measurement Lab	**Semester:** 4th
Programme: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Practical
Contact Hours: L-T-P:0-0-3	**Credit:** 1.5
Pre-Requisites: No pre-requisites	

Laboratory Experiments :	
1	Calibration of dynamometer type Ammeter and voltmeter by Potentiometer.
2	Measurement of Low Resistance using Kelvin Double Bridge.
3	Measurement of frequency by Wien Bridge.
4	Measurement of inductance by Anderson Bridge.
5	Measurement of capacitance by De Sauty Bridge.
6	Study the Static Characteristics of a Measuring Instrument.
7	Study the Dynamic Characteristics of a Measurement System.
8	Acquaintance with basic Structure of Digital Multi Muter and Measurement of Different Electrical Parameters.
9	Wave and Spectrum Analysis using Q – Meter.
10	Study the static and dynamic characteristics of VCO.
11	Mandatory Design and Implementation of Mini Project

Course Outcomes:

At the end of the course a student will be able to –

- **CO1:** Identify different analogue & digital instruments both AC and DC, source and sink devices, their specifications, constructions using basic knowledge of electrical measurement.
- **CO2:** Perform the experiments, interpret measured data and compare the measured value with the true value of a quantity, calculate error in measurement, draw calibration & error curve using appropriate techniques.
- **CO3:** Develop the concept of calibration and understand the limitations of the different measuring instruments.
- **CO4:** Review and analyse different methods of measurement of frequency, self-inductance, Capacitance and resistance using AC and DC bridges and provide valid concluding remarks.
- **CO5:** Learn the necessity of safety measures of using different instruments and handling of high voltage AC.
- **CO6:** Work as a member in a team, communicate with each other, and share their independent thinking to perform the experiment successfully.

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Documentation of Course Details, Course Outcomes (COs) and, Learning Resources for Applied Electronics & Instrumentation Engineering (Applicable from Academic Session 2019-20)

Course Code: PC-EI492	**Category:** Professional Core Course
Course Name: Microprocessor and Microcontroller Lab	**Semester:** 4th
Programme: AEIE	**Course Coordinator:** Departmental Course
Nature of Course: Mandatory	**Type of Course:** Practical
Contact Hours: L-T-P :0-0-3	**Credit:** 1.5
Pre-Requisites: Digital Electronics	

Laboratory Experiments :	
1	a) Familiarization with 8085 trainer kit components. b) Familiarization with 8085 simulator on PC.
2	a) Study of prewritten programs using basic instruction set (data transfer, Load/Store, Arithmetic, Logical) on the simulator. b) Assignments based on above
3	PROGRAMMING USING KIT/SIMULATOR FOR i)Table look up ii) Copying a block of memory iii) Shifting a block of memory iv) Packing and unpacking of BCD numbers v) Addition of BCD numbers vi) Binary to ASCII conversion vii) String Matching etc
4	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 through 8255.
5	INTERFACING WITH I/O MODULES: a) ADC b) Speed control of mini DC motor using DAC c) Stepper motor d) Temperature sensor and display temperature e) Relay
6	Mandatory Design and Implementation of Mini Project

Course Outcomes:

CO1: To construct and apply the assembly level programming of microprocessor and microcontroller.
CO2: To develop the programming logic and concept with the help of algorithm or flowchart.
CO3: To troubleshoot assembly language program along with interactions between software and hardware.
CO4: To practice the interfacing of microprocessor with peripheral devices for various applications.
CO5: To develop the ability to communicate effectively with fellow group members for dividing and sharing the assignments among themselves.

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Documentation of Course Details, Course Outcomes (COs) and, Learning Resources for Applied Electronics & Instrumentation Engineering (Applicable from Academic Session 2019-20)

Course Code: ES-CS491	**Category:** Engineering Science Courses
Course Name: Data Structure and Algorithm	**Semester:** 4th
Programme: AEIE	**Course Coordinator:** Department of Computer Science
Nature of Course: Mandatory	**Type of Course:** Practical
Contact Hours: L-T-P :0-0-3	**Credit:** 1.5
Pre-Requisites: No pre-requisites	

Laboratory Experiments :	
1	Array Addition & Multiplication of Arrays Implementation of Sparse Matrices
2	Abstract Data Type Stacks and Queues: Implementation of Stack using Array, Conversion of infix notation into its corresponding prefix & postfix forms along with the evaluation of postfix expression Addition, Deletion of elements of Linear Queue & Circular Queue Implementation of Stack using Queue and vice-versa
3	Recursion Tail-Recursion, Tower of Hanoii
4	Linked List Implementation of linked lists: inserting, deleting, and inverting a linked list. Implementation of stacks & queues using linked list Polynomial addition, Polynomial multiplication
5	Searching & Sorting Operations Searching: Linear Search, Binary Search Sorting: Bubble Sort, Selection Sort, Insertion Sort, Quick Sort, Merge Sort & Heap Sort
6	Nonlinear Data structures Tree Traversal of Binary Search Tree, Threaded binary tree traversal Height balanced binary tree – AVL tree (insertion, deletion) & B- Trees – operations (insertion, deletion)
7	Hashing Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.
8	Mandatory Design and Implementation of Mini Project

Department of Applied Electronics & Instrumentation Engineering
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Documentation of Course Details, Course Outcomes (COs) and, Learning Resources for Applied Electronics & Instrumentation Engineering (Applicable from Academic Session 2019-20)

Course Outcomes:

CO1: To know the concept of linear data structure like array along with its applications for solving various mathematical problems concerned with different topics like the operations of matrices.

CO2: To recognize the various types of ADT like stack & queue with their operations and also their applications in the conversion among infix, prefix & postfix notations.

CO3: To comprehend the significance of recursion for solving problems like Tower of Hanoi.

CO4: To be acquainted with the concept of linked list with its classification and the relevance of the usage of such concepts according to the nature of the problems.

CO5: To be aware with various algorithms applied for searching and sorting purposes with the differences regarding their working principles.

CO6: To understand the significance of non-linear data structures by the implementations of operations done by Binary Search Tree(BST) etc. and also find the importance of hashing in case of any searching problems.

Department of Applied Electronics & Instrumentation Engineering
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Documentation of Course Details, Course Outcomes (COs) and, Learning Resources for Applied Electronics & Instrumentation Engineering (Applicable from Academic Session 2019-20)

Course Code: HM-HU481	**Category:** Humanities and Social Sciences including Management Courses
Course Name: Advanced Language Lab	**Semester:** 4th
Programme: AEIE	**Course Coordinator: :** Department of Basic Science & Humanities
Nature of Course: Mandatory	**Type of Course:** Practical
Contact Hours: L-T-P:0-0-2	**Credit:** 1
Pre-Requisites: No pre-requisites	

Objective: The overall aim of this course is to inculcate a sense of confidence in the students and help them to become good communicators in their social as well as professional lives.

Detailed Course Outlines:

Introductory lecture is to be given to the students so that they get a clear idea of the syllabus and understand the need for having such a practice lab in the first place (3 hours)

Listening Skills: Audios & Videos related to current affairs will be shown from sources like British Council, BBC, NDTV, TOEFL, IELTS etc to hone the listening skills of students so that they may identify important points and effective strategies in preparation for their speaking skills

Speaking Skills:

1. Prerequisite for Speaking Activities: Mastering Linguistic, Paralinguistic features, Pronunciation, Body Language Voice modulation Stress, Intonation, Pitch & Accent of connected speech

2. One Minute Speech: Students will be taught to organize their thoughts and ideas and present them in a coherent manner in front of an audience on any given topic. While giving the speech they will be taught to demonstrate correct body language, voice modulation and appropriate pronunciation

3. Group Discussion: The students are made to understand proper language, etiquette and strategies for group discussion. Audio -Visual aids as pre-requisite for group discussion will be used to hone listening skills. After wards the class is divided into groups and the students have to discuss on given topic.

4. Mock Interview: Students are taught the strategies of a successful interview. They then have to face rigorous practices of mock-interviews.

Reading Skills:

- News Paper Reading: Students are advised to how to read current affairs from leading newspapers, comprehend and summaries the news articles and express their opinion in their
  own words. This activity will help the students immensely to speak during one minute speech and group discussion.

Writing Skills:

- Resume Writing: Students will be taught how to write a professional resume for campus placement & future career.

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Course Outcomes:

CO1: To distinguish between various contexts of human communication, e.g., one-to-one, small group, organizational, formal, informal, media, family, intercultural communication, technologically mediated communication, etc.

CO2: To use knowledge of interview processes in answering typical HR questions and to demonstrate proper interview etiquette.

CO3: To analyze a given topic, enumerate main points and deliver a structured speech with proper introduction and conclusion.

CO4: To utilize the key skills like active listening, managing conflict, collaborative communication, and proper body language successfully while discussing any given topic in a group.

CO5: To defend opinions with evidence and argument while speaking to an audience or discussing a topic in a group.

CO6: To employ effective presentation skills to speak about general and academic topics in front of an audience and transfer this skill successfully to higher semester seminars and future career.

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Documentation of Course Content, Learning Resources and, Course Outcomes (COs) for Applied Electronics & Instrumentation Engineering (Applicable from Academic Session 2020-21)

THIRD YEAR FIFTH SEMESTER PROPOSED SYLLABUS

NOTE: WE WILL UPDATE THIS DOCUMENTATION AS SOON AS SYLLABUS FROM FIFTH SEMESTER ONWARDS BECOME AVAILABLE AT MAKAUT WEBSITE.