1st Year Curriculum for B.Tech courses in Engineering & Technology

(Applicable from the academic session 2018-2019)

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
(Formerly West Bengal University of Technology)
1st Year Curriculum Structure for B.Tech courses in Engineering & Technology
(Applicable from the academic session 2018-2019)

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 Honours*, if he/she completes an additional 20 credits. These could be acquired through Massive Open Online Courses (MOOCs).

C. MOOCs for B. Tech Honours

The additional 20 credits (for obtaining B. Tech with Honours) are to be gained through MOOCs. The complete description of the MOOCs relevant for the first year course are given in *Annexure-I.* 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) 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.

F. Group division:

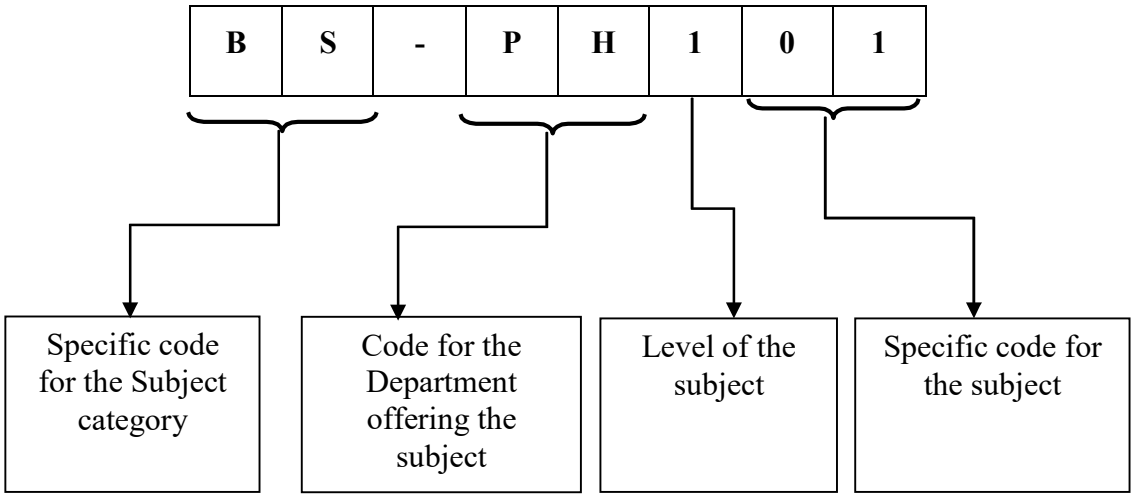
Group-A:

Chemistry based subjects: [Bio-Technology, Food Technology, Leather Technology, Textile Technology, Ceramic Technology, Chemical Engineering and any other Engineering that chooses to be Chemistry based] + Physics based subjects: [Mechanical Engineering, Production Engineering, Civil Engineering, Automobile Engineering, Marine Engineering, Apparel Production Engineering, Computer Science & Engineering, Information Technology.]

Group-B:

All Physics based subjects which are also Electrical & Electronics based [Electrical Engineering, Electronics & Communication Engineering, Applied Electronics & Instrumentation Engineering, Power Engineering, Electrical & Electronics Engineering, Bio-Medical Engineering, Instrumentation & Control Engineering]

G. Subject Numbering Scheme:



List of Codes for Subject Category	
Code	**Category Name**
BS	Basic Science Courses
ES	Engineering Science Courses
HM	Humanities and Social Sciences including Management courses
PC	Professional core courses
PE	Professional Elective courses
OE	Open Elective courses
MC	Mandatory courses
PW	Project

List of Codes for Departments			
Code	**Name of the Department**	**Code**	**Name of the Department**
APM	Apparel Production Engineering	ECE	Electronics & Communication Engineering
AEIE	Applied Electronics & Instrumentation Engineering	FT	Food Technology
AUE	Automobile Engineering	IT	Information Technology
BME	Bio-Medical Engineering	ICE	Instrumentation & Control Engineering
BT	Bio-Technology	LT	Leather Technology
CT	Ceramic Technology	MRE	Marine Engineering
CHE	Chemical Engineering	ME	Mechanical Engineering
CE	Civil Engineering	PWE	Power Engineering
CSE	Computer Science & Engineering	PE	Production Engineering
EEE	Electrical & Electronics Engineering	TT	Textile Technology
EE	Electrical Engineering		

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-PH101/ BS-CH101	Physics-I (Gr-A)/ Chemistry-I(Gr-B)	3	1	0	4
2	Basic Science course	BS-M101/ BS-M102	Mathematics –IA*/ Mathematics –IB *	3	1	0	4
3	Engineering Science Courses	ES-EE101	Basic Electrical Engineering	3	1	0	4
	Total Theory			**9**	**3**	**0**	**12**
Practical							
1	Basic Science course	BS-PH191/ BS-CH191	Physics-I Laboratory (Gr-A)/ Chemistry-I Laboratory (Gr-B)	0	0	3	1.5
2	Engineering Science Courses	ES-EE191	Basic Electrical Engineering Laboratory	0	0	2	1
3	Engineering Science Courses	ES-ME191/ ES-ME192	Engineering Graphics & Design(Gr-B)/ Workshop/Manufacturing Practices(Gr-A)	1	0	4	3
	Total Practical			**1**		**9**	**5.5**
	Total of First Semester			**10**	**3**	**9**	**17.5**

* Mathematics –IA (BS-M101) - CSE & IT
Mathematics –IB (BS-M102) - All stream except CSE & IT

First Year Second Semester							
Sl No.	**Category**	**Subject Code**	**Subject Name**	**Total Number of contact hours**			**Credits**
				L	**T**	**P**	
Theory							
1	Basic Science courses	BS-PH201/ BS-CH201	Physics-I (Gr-B)/ Chemistry-I (Gr-A)	3	1	0	4
2	Basic Science courses	BS-M201/ BS-M202	Mathematics –IIA#/ Mathematics –IIB#	3	1	0	4
3	Engineering Science Courses	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**	**0**	**13**
Practical							
1	Basic Science courses	BS-PH291/ BS-CH291	Physics-I Laboratory (Gr-B)/ Chemistry-I Laboratory (Gr-A)	0	0	3	1.5
2	Engineering Science Courses	ES-CS291	Programming for Problem Solving	0	0	4	2
3	Engineering Science Courses	ES-ME291/ ES-ME292	Engineering Graphics & Design(Gr-A)/ Workshop/Manufacturing Practices(Gr-B)	1	0	4	3
4	Humanities and Social Sciences including Management courses	HM-HU291	Language Laboratory	0	0	2	1
	Total Practical			**1**	**0**	**13**	**7.5**
	Total of Second Semester			**12**	**2**	**13**	**20.5**

Mathematics –II (BS-M201) - CSE & IT
Mathematics –II (BS-M202) - All stream except CSE & IT

	Group-A	**Group-B**
1st Year 1st Semester	Physics-I (BS-PH101); Workshop/Manufacturing Practices (ES-ME192)	Chemistry-I (BS-CH101); Engineering Graphics & Design (ES-ME191)
1stYear 2nd Semester	Chemistry-I (BS-CH201); Engineering Graphics & Design (ES-ME291)	Physics-I (BS-PH201); Workshop/Manufacturing Practices (ES-ME292)

Course Code : BS-PH101/ BS-PH201	**Category :** Basic Science Courses
Course Title : Physics-I	**Semester** : First/ Second
L-T-P : 3-1-0	**Credit:4**
Pre-Requisites:	

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 (7L)

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 (5L)

- 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 (8L)

- 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, classificationof magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.

4. Quantum Mechanics (16L)

- 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 (8L)

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

Course outcomes:

Students will be familiar with

- Basic concepts of mechanics
- Bragg's Law and introduction to the principles of lasers, types of lasers and applications.
- Various terms related to properties of materials such as, permeability, polarization,etc.
- Some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials.
- Simple quantum mechanics calculations.
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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 Code : BS-CH101/ BS-CH201	**Category :** Basic Science Courses
Course Title : Chemistry-I	**Semester** : First/ Second
L-T-P : 3-1-0	**Credit:4**
Pre-Requisites:	

Detailed contents

i) Atomic and molecular structure (10 lectures)

Schrodinger equation. Particle in a box solutions and their applications for simple sample. Molecular orbitals of diatomic molecules (e.g.H_2). 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 lectures)

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 lectures)*

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

iv) Use of free energy in chemical equilibria (8 lectures)

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 Lectures)

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 lectures)

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 lectures)

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

Course Outcomes

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:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

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 Code : BS-M101	**Category :** Basic Science Course
Course Title : Mathematics – I A	**Semester** : First (CSE & IT)
L-T-P : 3-1-0	**Credit: 4**
Pre-Requisites: High School Mathematics	

Module No.	Description of Topic	Lectures Hours
1	***Calculus (Integration):*** 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.	8
2	***Calculus (Differentiation):*** Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	***Matrices:*** Matrices, Vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.	7
4	***Vector Spaces:*** Vector Space, linear dependence of vectors, Basis, Dimension; Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Rank-Nullity theorem, composition of linear maps, Matrix associated with a linear map.	9
5	***Vector Spaces (Continued):*** Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.	10

Course Outcomes:

The students will be able to:

- Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.
- Understand the domain of applications of mean value theorems to engineering problems.
- Learn different types of matrices, concept of rank, methods of matrix inversion and their applications.
- Understand linear spaces, its basis and dimension with corresponding applications in the field of computer science.
- Learn and apply the concept of eigen values, eigen vectors, diagonalisation of matrices and orthogonalization in inner product spaces for understanding physical and engineering problems

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.
7. S.K. Mapa, Higher Algebra: Abstract and Linear, Sarat Book House Pvt.Ltd.
8. Hoffman and Kunze: Linear algebra, PHI.

Course Code : BS-M102	**Category :** Basic Science Course
Course Title : Mathematics –I B	**Semester** : First (All stream except CSE & IT)
L-T-P : **3-1-0**	**Credit: 4**
Pre-Requisites: High School Mathematics	

Module No.	Description of Topic	Lectures Hours
1	***Calculus (Integration):*** 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.	8
2	***Calculus (Differentiation):*** Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	***Sequence and Series:*** 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.	11
4	***Multivariate Calculus:*** 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.	9
5	***Matrices:*** 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.	8

Course Outcomes:

After completing the course the student will be able to

- Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.
- Understand the domain of applications of mean value theorems to engineering problems.
- 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.
- 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.

- 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.

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 Code : ES-EE101	**Category :** Engineering Science Courses
Course Title : Basic Electrical Engineering	**Semester** : First
L-T-P : 3-1-0	**Credit: 4**
Pre-Requisites:	

Detailed contents:

Module 1: DC Circuits (8 hours)

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 hours)

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 hours)

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 hours)

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 hours)

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations (6 hours)

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.

Course Outcomes

- To understand and analyze basic electric and magnetic circuits
- To study the working principles of electrical machines and power converters.
- To introduce the components of low voltage electrical installations

Learning Recourses:

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 Code : BS-PH191/ BS-PH291	**Category :** Basic Science course
Course Title : Physics-I Laboratory	**Semester** : First/ Second
L-T-P : 0-0-3	**Credit:1.5**
Pre-Requisites:	

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

Course Code : BS-CH191/ BS-CH291	**Category :** Basic Science Courses
Course Title : Chemistry-I Laboratory	**Semester** : First/ Second
L-T-P : 0-0-3	**Credit:1.5**
Pre-Requisites:	

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. Saponification/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.

Course Code : ES-EE291	**Category :** Engineering Science Courses
Course Title : Basic Electrical Engineering Laboratory	**Semester** : First
L-T-P : 0-0-2	**Credit: 1**
Pre-Requisites:	

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.

Course Code : ES-ME191/ ES-ME 291	**Category :** Engineering Science Courses
Course Title : Engineering Graphics & Design	**Semester** : First/ Second
L-T-P : 1-0-4	**Credit: 3**
Pre-Requisites:	

Sl. No.	Content	Lecture (L)	Practical (P)
1	**INTRODUCTION TO ENGINEERING DRAWING** Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes.	1	4
2	**LETTERING, DIMENSIONING, SCALES** Plain scale, Diagonal scale and Vernier Scales.	1	4
3	**GEOMETRICAL CONSTRUCTION AND CURVES** Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Archemedian Spiral.	1	4
4	**PROJECTION OF POINTS, LINES, SURFACES** 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.	1	4
5	**PROJECTION OF REGULAR SOLIDS** Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone).	1	4
6	**COMBINATION OF REGULAR SOLIDS, FLOOR PLANS** 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.	1	4
7	**ISOMETRIC PROJECTIONS** 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;	1	4

8	**SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS** 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)	1	4
9	**OVERVIEW OF COMPUTER GRAPHICS**, **CUSTOMISATION& CAD DRAWING** 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;	1	4
	ANNOTATIONS, LAYERING & OTHER FUNCTIONS applying dimensions to objects, applying annotations to drawings;		
10	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;	2	8

11	**DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT** 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).	2	8

Course Outcomes

The student will learn:

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling

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 Code : ES-ME192/ ES-ME 292	**Category :** Engineering Science Courses
Course Title : Workshop/ Manufacturing Practices	**Semester** : First/ Second
L-T-P : 1-0-4	**Credit:3**
Pre-Requisites:	

(i) Lectures & videos:

Detailed 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.

Laboratory Outcomes

- Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
- They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
- By assembling different components, they will be able to produce small devices of their interest.

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 McGrawHill House, 2017.

Course Code : BS-M201	**Category :** Basic Science Course
Course Title : Mathematics – II A	**Semester** : Second (CSE &IT)
L-T-P : **3-1-0**	**Credit: 4**
Pre-Requisites: High School Mathematics and BS-M101	

Module No.	Description of Topic	Lectures Hours
1	**Basic Probability:** Probability spaces, conditional probability, independence; 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, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.	11
2	**Continuous Probability Distributions:** Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma densities.	4
3	**Bivariate Distributions:** Bivariate distributions and their properties, distribution of sums and quotients, Conditional densities, Bayes' rule.	5
4	**Basic Statistics:** Measures of Central tendency, Moments, Skewness and Kurtosis, Probability distributions: Binomial, Poisson and Normal and evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.	8
5	**Applied Statistics:** Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	8
6	**Small samples:** Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.	4

Course Outcomes:

The students will be able to:

- Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment.

- Understand the basic ideas of statistics with different characterisation of a univariate and bivariate data set.
- Apply statistical tools for analysing data samples and drawing inference on a given data set.

Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
3. S. Ross, A First Course in Probability, Pearson Education India
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley.
5. John E. Freund, Ronald E. Walpole, Mathematical Statistics, Prentice Hall.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
7. N.G. Das, Statistical Methods (Combined Volume), Tata-McGraw Hill.

Course Code : BS-M202	**Category :** Basic Science Course
Course Title : Mathematics – II B	**Semester** : Second (All stream except CSE & IT)
L-T-P : **3-1-0**	**Credit: 4**
Pre-Requisites: High School Mathematics and BS-M102	

Module No.	Description of Topic	Lectures Hours
1	***Multivariate Calculus (Integration):*** 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.	11
2	***First order ordinary differential equations:*** 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.	5
3	***Ordinary differential equations of higher orders:*** Second order linear differential equations with constant coefficients, Use of D-operators, 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.	9
4	***Complex Variable – Differentiation*** 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.	6
5	***Complex Variable – Integration*** 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.	9

Course Outcomes:

The students will be able to:

- Learn the methods for evaluating multiple integrals and their applications to different physical problems.
- 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.
- Learn different tools of differentiation and integration of functions of a complex variable that are used with various other techniques for solving engineering problems.
- Apply different types of transformations between two 2- dimensional planes for analysis of physical or engineering problems.

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 Code : ES-CS201	**Category :** Engineering Science Courses
Course Title : Programming for Problem Solving	**Semester** : Second
L-T-P : 3-0-0	**Credit:3**
Pre-Requisites:	

Detailed contents

Unit 1: Introduction to Programming **(4 lectures)**

- Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - **(1 lecture).**
- Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. **(1 lecture)**
- 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 lectures)**

Unit 2: Arithmetic expressions and precedence **(2 lectures)**

Unit 3: Conditional Branching and Loops **(6 lectures)**

- Writing and evaluation of conditionals and consequent branching **(3 lectures)**
- Iteration and loops **(3 lectures)**

Unit 4: Arrays **(6 lectures)**

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

Unit 5: Basic Algorithms **(6 lectures)**

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

Unit 6: Function **(5 lectures)**

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

Unit 7: Recursion **(4 -5 lectures)**

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

Unit 8: Structure **(4 lectures)**

- Structures, Defining structures and Array of Structures

Unit 9: Pointers **(2 lectures)**

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

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

Course Outcomes

The student will learn

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

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 Code : ES-CS291	**Category :** Engineering Science Courses
Course Title : Programming for Problem Solving	**Semester** : Second
L-T-P : 0-0-4	**Credit:2**
Pre-Requisites:	

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

Laboratory Outcomes

- To formulate the algorithms for simple problems
- To translate given algorithms to a working and correct program
- To be able to correct syntax errors as reported by the compilers
- To be able to identify and correct logical errors encountered at run time
- To be able to write iterative as well as recursive programs
- To be able to represent data in arrays, strings and structures and manipulate them through a program
- To be able to declare pointers of different types and use them in defining self-referential structures.
- To be able to create, read and write to and from simple text files.

Course Code : HM-HU201	**Category :** Humanities and Social Sciences including Management courses
Course Title : English	**Semester** : Second
L-T-P : 2-0-0	**Credit:2**
Pre-Requisites:	

Detailed contents

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
Mania	Kleptomania
Mega	Megaserial
Eu	Eulogy, euphoria
Geo	Geology
Graph	autograph, photograph
Hetero	Heterogeneous
Hyper	Hyperactive
Hypo	hypodermic, hypoglycemia
Macro	Macrocosm
Mega	megalomania
Micro	microcosm

Mono	Monarch
Pan	Panorama
Pathos	Pathetic
Phobia	Hydrophobia
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 Femina	Diction Feminine
Inter	Internet, interval
Magna	Magnificient
Mal Multi	Malnutrition 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

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) On 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 Outcomes

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

Course Code : HM-HU291	**Category :** Humanities and Social Sciences including Management courses
Course Title : Language Laboratory	**Semester** : Second
L-T-P : **0-0-2**	**Credit:1**
Pre-Requisites:	

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

Course Outcomes

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

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*).

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Applied Electronics and Instrumentation Engineering (AEIE)

(Applicable from the academic session 2018-2019)

SECOND YEAR 3rd SEMESTER PROPOSED SYLLABUS

Course Code : BS-M 301	**Category: Basic science Courses**
Course Name : Mathematics - III	**Semester : Third**
L-T-P :2-1-0	**Credit: 3**
Total Lectures: 45	
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 $\frac{f(t)}{t}$, LT of $t^n f(t)$, 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 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:

1. 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.
2. Find the Laplace transform of a function by definition and by use of a table and the inverse Laplace transform of a function.
3. Describing the techniques of Fourier transform and using them to transform a problem into one that can be more easily solved.
4. Apply numerical methods to obtain approximate solutions of mathematical problems.

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

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Applied Electronics and Instrumentation Engineering (AEIE)

(Applicable from the academic session 2018-2019)

Course Code : PC-EI301	**Category: Professional Core Courses**
Course Name : Network Analysis	**Semester : Third**
L-T-P :3-0-0	**Credit: 3**
Total Lectures: 45	
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 Outcomes:

1. To apply the knowledge of various components in circuit analysis.
2. To solve and analyze the circuits using different network theorems.
3. To solve electrical circuits using graph theory.
4. To analyze the electrical circuits containing passive elements under resonance conditions.
5. To use mathematical tools to analyze electrical networks in time domain and frequency domain.
6. 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

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Applied Electronics and Instrumentation Engineering (AEIE)

(Applicable from the academic session 2018-2019)

Course Code : PC-EI302	**Category: Professional Core Course**
Course Name : Sensors and Transducers	**Semester : Third**
L-T-P :3-0-0	**Credit: 3**
Total Lectures: 45	
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 Outcomes:

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

1. Apply basic concepts to distinguish different sensors and transducers and also compare the methods of measurements
2. Identify suitable transducer by comparing different industrial standards and procedures for most complex measurement of several physical parameters
3. Estimate the performance of different transducers and interpret the data accurately
4. Develop the skill to identify and analyze the complex technical problems and also capable to give a socio-economic solution to that problem
5. Acquire the knowledge of independent thinking to design real life electronics and instrumentation measurement systems helpful for humanities
6. 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.

Course Code : PC-EI303	**Category: Professional Core Course**
Course Name : Analog Integrated Circuits	**Semester : Third**
L-T-P :3-0-0	**Credit: 3**
Total Lectures: 45	
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 Outcomes:

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

1. Apply the knowledge more effectively during the study of analog integrated circuits.
2. Analyze and design simple circuits containing non-linear elements such as Transistors using the concepts of load lines, operating points and incremental analysis.
3. Understand the Mid – band analysis of RC coupled amplifier circuits using small - signal equivalent circuits to determine gain, input impedance and output impedance.
4. Learn how operational amplifiers are modelled and analysed.
5. Design Op-Amp circuits to perform operations such as amplification, integration and differentiation on electronic signals
6. 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
7. Acquire experience in building and trouble-shooting simple analog electronic circuits.
8. 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

Course Code : PC-EI304	**Category: Professional Core Course**
Course Name : Digital Electronic Circuits	**Semester : Third**
L-T-P :3-0-0	**Credit: 3**
Total Lectures: 45	
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

	○ D/A conversion- R-2R ladder type, weighted resistor type. ○ Specification of A/D converter; A/D conversion- flash type. ○ A/D conversion- Flash type, successive approximation type and dual-slope type.	
6	**Memory and Programmable Logic Devices & Families:** ○ 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 ○ Memory decoding, Memory expansion ○ Design of combinational logic circuit using ROM PLA,PAL ○ Introduction to Digital Logic Families; classification of Digital Logic Families; characteristics of Digital ICs. ○ TTL: characteristics, Totem-Pole output, Open Collector output, Tri-state output, ○ ECL: characteristics, OR/NOR gate. ○ MOS: characteristics, PMOS, NMOS. CMOS: characteristics NAND, NOR, logic circuit realization.	8

Course Outcomes:

On completion of this course, the student will be able to
1. Apply different type of codes and number systems which are used in digital computing and communication systems.
2. Develop different types Logic circuit simplification using various mapping and mathematical methods.
3. Analyze, design and implement combinational including arithmetic logic circuits.
4. Analyze, design and implement sequential logic circuits.
5. Built the fundamental knowledge and analyze the operation of various A/D and D/A converters.
6. 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)

Course Code : MC-ES301	**Category: Mandatory Courses**
Course Name : Environmental Science	**Semester : Third**
L-T-P :2-0-0	**Credit: NIL**
Total Lectures: 30	
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, $L_{10}(18\,\text{hr Index})$, 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

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Syllabus for B. Tech in Applied Electronics and Instrumentation Engineering (AEIE)

(Applicable from the academic session 2018-2019)

Course Code : PC-EI391	**Category:** Professional Core Course
Corse Name : Circuits and Network Lab	**Semester : 3rd**
L-T-P :0-0-3	**Credit: 1.5**
Pre-Requisites: No-prerequisite	

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 Outcomes:

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

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Syllabus for B. Tech in Applied Electronics and Instrumentation Engineering (AEIE)

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Course Code : PC-EI392	**Category: Professional Core Course**
Corse Name : Sensors and Transducers Lab	**Semester : Third**
L-T-P :0-0-3	**Credit: 1.5**
Pre-Requisites: No-prerequisite	

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 Outcomes:

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

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

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Course Code : PC-EI393	**Category: Professional Core Course**
Corse Name : Analog Circuits Design Lab	**Semester : Third**
L-T-P :0-0-3	**Credit: 1.5**
Pre-Requisites: No-prerequisite	

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 Outcomes:

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

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

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Syllabus for B. Tech in Applied Electronics and Instrumentation Engineering (AEIE)

(Applicable from the academic session 2018-2019)

Course Code : PC-EI394	**Category: Professional Core Course**
Corse Name : Digital Circuits Design Lab	**Semester : Third**
L-T-P :0-0-3	**Credit: 1.5**
Pre-Requisites: No-prerequisite	

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 Outcomes:

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

1. Identify the operation of various basic logic gates ICs to implement different digital circuits.
2. Implement logic circuits for various code conversion, magnitude comparator and parity bit generator.
3. Demonstrate the basic operation of different combinational circuits including arithmetic circuits.
4. Demonstrate the basic operation of different flip-flops as a basic element of sequential circuits.
5. Evaluate the applications of flip-flops as binary registers and counters used in large digital integrated circuits.
6. Design mini digital electronic circuit based systems.

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SECOND YEAR 4th SEMESTER PROPOSED SYLLABUS

Course Code : PC-EI401	**Category: Professional Core Course**
Course Name : Electrical and Electronic Measurement	**Semester : Fourth**
L-T-P :3-0-0	**Credit: 3**
Total Lectures: 45	
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 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 measurement with	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:

1. Identify various types of errors which may occur during measurement and take necessary steps to minimize them.
2. 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.
3. 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.
4. Analyze and solve the varieties of problems and issues in the field of electrical and electronic measurements.
5. Calibrate and standardize various measuring instruments.
6. 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.

Course Code : PC-EI402	**Category: Professional Core Courses**
Course Name : Industrial Instrumentation	**Semester : Fourth**
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. **Radiation Methods of Temperature Measurement:** Radiation fundamentals, general form of radiation measurement system. Total radiation & selective radiation pyrometers, Optical pyrometer.	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, installation.	
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

Course Outcomes:

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

1. Acquire the knowledge of use of temperature, pressure, flow and level sensors and transducers in the field of Instrumentation.
2. Explain the operation of transducers for temperature, pressure, fluid flow and level measurement.
3. Describe the specification of different process instruments and advantages and disadvantages.
4. Identify, formulate and solve engineering problems related to measurement of process parameters.
5. Select and design suitable instruments to meet the requirements of industrial applications.
6. 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.

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Syllabus for B. Tech in Applied Electronics and Instrumentation Engineering (AEIE)

(Applicable from the academic session 2018-2019)

Course Code : PC-EI403	**Category: Professional Core Courses**
Course Name : Microprocessor and Microcontroller	**Semester : Fourth**
L-T-P :3-1-0	**Credit: 4**
Total Lectures: 60	
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

Course Outcomes:

1. To construct and analyze assemble language program in 8085 and 8086 microprocessor to solve various complex engineering problem.
2. To evaluate processing time of program and devise technique to reduce execution time to improve microprocessor performance.
3. 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.
4. To design memory devices using memory chips and utilize the knowledge in memory based devices used in academics and industry.
5. To study 8051 microcontroller for using it in real life applications.
6. 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.

Course Code : ES-CS401	**Category:** Engineering Science Courses
Course Name : Data Structure and Algorithm	**Semester : Fourth**
L-T-P :3-0-0	**Credit: 3**
Total Lectures: 45	
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 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 forward-edge), applications. Minimal spanning tree – Prim's algorithm (basic idea of greedy methods).	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:

1. 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.
2. Comprehend the concept of linked list along with its difference from array and its many applications for solving different problems.
3. 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.
4. Create the concept of non-linear data structure like graph, tree and their appliance in various problems in societal issues.
5. Know different searching and sorting approaches and select proper data structure and algorithm by analyzing time complexity and space complexity for specific problems.
6. 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.

Maulana Abul Kalam Azad University of Technology, West Bengal

(Formerly West Bengal University of Technology)

Syllabus for B. Tech in Applied Electronics and Instrumentation Engineering (AEIE)

(Applicable from the academic session 2018-2019)

Course Code : BS-BIO401	**Category: Basic Science course**
Course Name : Biology	**Semester : Fourth**
L-T-P :3-0-0	**Credit: 3**
Total lectures: 45	
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, D.Melanogaster, C.elegance, A. Thaliana, M.musculus	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.	

Course Outcomes:

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

1. Describe how biological observations of 18th Century that lead to major discoveries.
2. Convey that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical and ecological.
3. Highlight the concepts of recessiveness and dominance during the passage of genetic material from parent to offspring.
4. Convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one canimagine.
5. Classify enzymes and distinguish between different mechanisms of enzyme action.
6. Identify DNA as a genetic material in the molecular basis of information transfer.
7. Analyse biological processes at the reductionistic level.
8. Apply thermodynamic principles to biological systems.
9. 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.

Course Code : HM-HU401	**Category:** Humanities and Social Sciences including Management Courses
Course Name : Values and Ethics in Profession	**Semester : Fourth**
L-T-P :2-0-0	**Credit: 2**
Total Lectures: 30	
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 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** 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. Human centred Technology.	

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:

1. An understanding of professional, ethical, legal, security and social issues and responsibilities g) An ability to communicate effectively with a range of audiences.
2. An ability to address contemporary issues and analyze the local and global impact of computing and engineering solutions on individuals, organizations and society
3. 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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Syllabus for B. Tech in Applied Electronics and Instrumentation Engineering (AEIE)

(Applicable from the academic session 2018-2019)

Course Code : PC-EI491	**Category: Professional Core Course**
Corse Name : Electrical & Electronic Measurement Lab	**Semester : 4th**
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 –

1. Identify different analogue & digital instruments both AC and DC, source and sink devices, their specifications, constructions using basic knowledge of electrical measurement.
2. 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.
3. Develop the concept of calibration and understand the limitations of the different measuring instruments.
4. Review and analyse different methods of measurement of frequency, self-inductance, Capacitance and resistance using AC and DC bridges and provide valid concluding remarks.
5. Learn the necessity of safety measures of using different instruments and handling of high voltage AC.
6. 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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Syllabus for B. Tech in Applied Electronics and Instrumentation Engineering (AEIE)

(Applicable from the academic session 2018-2019)

Course Code : PC-EI492	**Category: Professional Core Course**
Corse Name : Microprocessor and Microcontroller Lab	**Semester : 4th**
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:

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

Course Code : ES-CS491	**Category: Engineering Science Courses**
Corse Name : Data Structure and Algorithm Lab	**Semester : 4th**
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

Course Outcomes:

1. 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.
2. 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.
3. To comprehend the significance of recursion for solving problems like Tower of Hanoi.
4. 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.
5. To be aware with various algorithms applied for searching and sorting purposes with the differences regarding their working principles.
6. 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.

Course Code : HM-HU481	**Category: Humanities and Social Sciences including Management Courses**
Corse Name : Advanced Language Lab	**Semester : 4th**
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.

Course Outcomes:

1. 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.
2. To use knowledge of interview processes in answering typical HR questions and to demonstrate proper interview etiquette.
3. To analyze a given topic, enumerate main points and deliver a structured speech with proper introduction and conclusion.
4. 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.
5. To defend opinions with evidence and argument while speaking to an audience or discussing a topic in a group.
6. 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.