First Year Course Booklet

Department of Electrical Engineering

श्रमम् बिना न किमपि साध्यम्

RCC Institute of Information Technology

Canal South Road, Beliaghata Kolkata – 700 015, West Bengal, India

RCC Institute of Information Technology

Approved by AICTE, New Delhi and Affiliated to MAKAUT, W.B.

An ISO 9001 - 2008 & ISO 14001 - 2004 Certified Institute A Unit of RCC Institute of Technology an autonomous Society of Department of Higher Education, Govt. of West Bengal

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About the Department

The Department of Electrical Engineering (which is now accredited by National Board of Accreditation (NBA), New Delhi) started its journey in the year 2009 under RCCIIT and the first batch of students graduated in the year 2013. It is situated in the ground floor of the new campus of the Institute. The department offers Electrical Engineering (EE) undergraduate program that augments the liberal education to undergraduates and imparts well understanding of the subject, Electrical Engineering and its different aspects built on a foundation of Science, Mathematics, Computation, Engineering and Technology. Admissions for UG program in this department require a valid rank of WBJEE/AIEEE which is monitored through the Institutional Admission Committee following the guidelines of the Maulana Abul Kalam Azad University of Technology, previously known as the West Bengal University of Technology. The department also take admission under lateral entry scheme from the merit list of JELET conducted by West Bengal Joint Entrance Examinations Board. The present intake of this department is 60. The department has highly qualified and experienced faculty and staff members. The Department has well modernized class rooms, Faculty rooms and possesses exclusive laboratories as per university course curriculum. Apart from the academics, students are also encouraged for different extra-curricular activities like quizzes, seminars, workshops etc.

Faculty Profile

Dr. Shilpi Bhattacharya (HoD)

Associate Professor

Power Electronics, Drives

Dr. Debasish Mondal

Professor

Control System, Field Theory

Dr. Alok Kole

Professor

AI ML, Control System

Dr. Dipankar Santra

Associate Professor

Measurement, Machine

Mr. Budhaditya Biswas (PC)

Assistant Professor

Power System

Mr. Nijam Uddin Molla

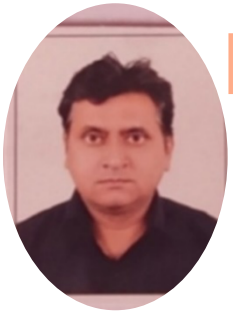
Assistant Professor

Electric Machine

Mr. Sarbojit Mukherjee

Assistant Professor

Power Electronics, Drives



Mr. Subhasish Banerjee

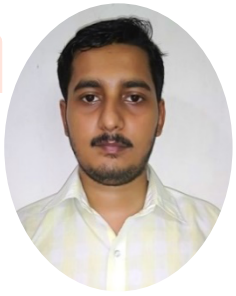
Assistant Professor

Non-Conventional Energy

Dr. Shilpi Bhattacharya (HoD)

Assistant Professor

Microcontroller, FPGA



Non Teaching Staff Profile

Mr. Ashim Biswas

Lab Technician

Basic Electrical, Machine

Mr. Soumitra Dey

Lab Technician

Thermal Power, Power System

Mr. Rajesh Mahato

Lab Technician

Control System, Circuit Theory

Mr. Sumit Mukherjee

Technical Assistant

Power Electronics, Drives

Mr. Abir Sen

General Assistant

Vision of the Program (Electrical Engineering)

To create world class professionals who are globally competitive, capable of using and developing state-of-the-art technologies along with research and innovation in EE and allied fields.

Mission of the Program (Electrical Engineering)

M1: To provide education to the students that will enable them to meet the current and future needs of EE and possess diverse capabilities to pursue their careers successfully.

M2: To be research and innovation oriented so as to investigate and develop new technologies.

M3: To remain constantly agile to the needs of industry, environment and society so as catered to the needs of the nation and the global community.

Program Outcome (POs)

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Educational Objectives (PEOs)

The graduate will posses:

- Basic understanding of core electrical engineering built on foundation of physical science, mathematics, computing, and technology so as to pursue successful career/higher studies in Electrical Engineering.
- Broad based knowledge of Electrical Engineering suitable for research, development and innovation to meet diverse and multidisciplinary needs of industry and society.
- Adequate professional skills, to be analytical and logical so that they can quickly adapt to new work environment, assimilate information and solve challenging problems.
- Self-learning capability, leadership qualities with strong communication skills and working in teams.
- Capacity to be productive with ethical values, conscious about social and environmental issues with lifelong learning attitude.

Program Specific Outcome (PSOs)

At the end of the program, the students

PSO1: Proficiency in use of software & hardware required to practice Electrical engineering profession.

PSO2: Proficiency in developing wind & solar hybrid power generating systems.

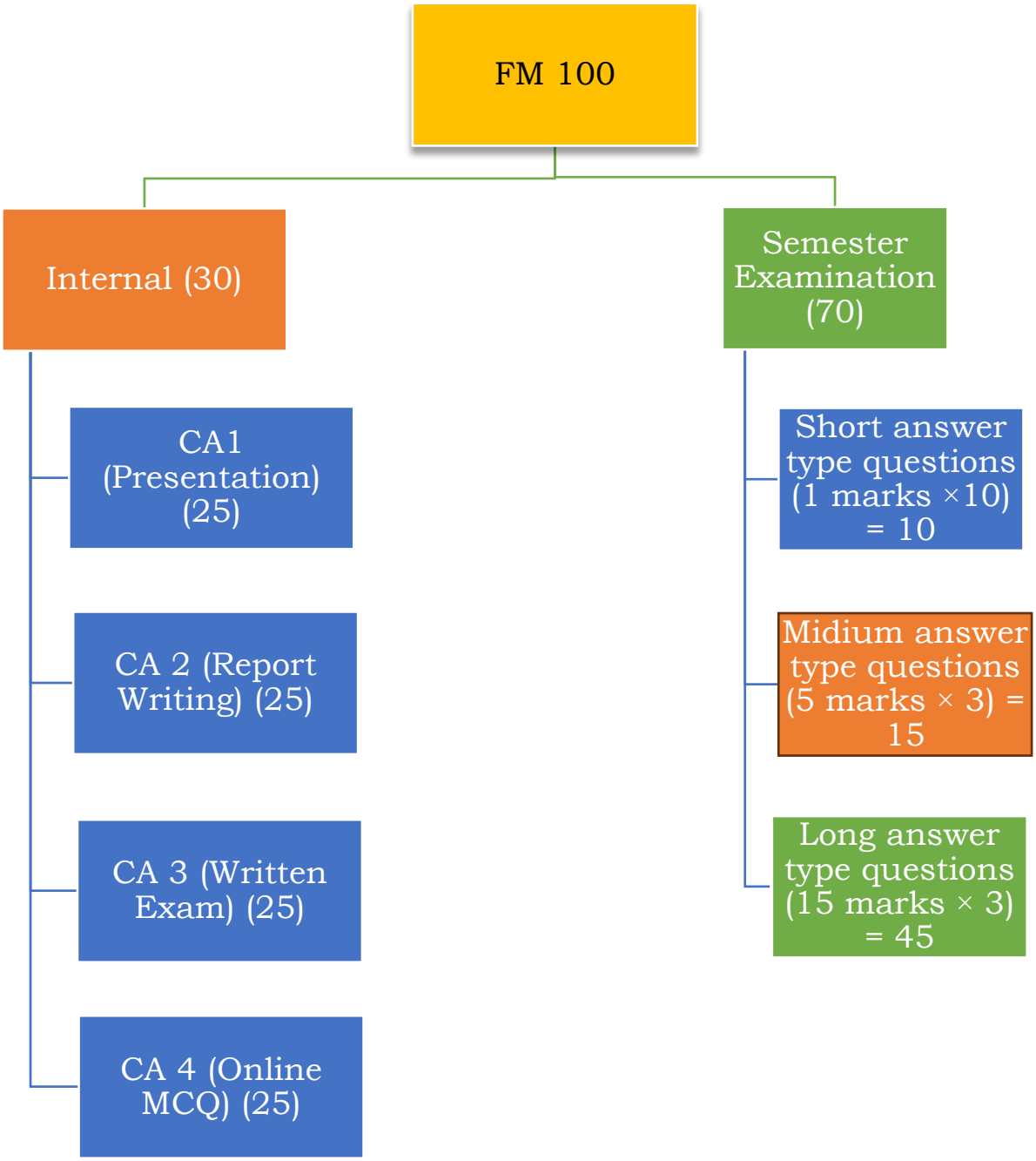
PSO3: Development of wireless control & automation and real time simulations for prototypes.

Correlation between Program Educational Objectives (PEOs) and Mission of the Department of Electrical Engineering, RCCIIT

PEO No.	Statement	M1	M2	M3
PEO 1	Basic understanding of core electrical engineering built on foundation of physical science, mathematics, computing, and technology so as to pursue successful career/higher studies in Electrical Engineering.	3	3	3
PEO 2	Broad based knowledge of Electrical Engineering suitable for research, development and innovation to meet diverse and multidisciplinary needs of industry and society.	3	3	3
PEO 3	Adequate professional skills, to be analytical and logical so that they can quickly adapt to new work environment, assimilate information and solve challenging problems.	2	3	3
PEO 4	Self-learning capability, leadership qualities with strong communication skills and working in teams.	3	3	2
PEO 5	Capacity to be productive with ethical values, conscious about social and environmental issues with lifelong learning attitude.	3	2	3

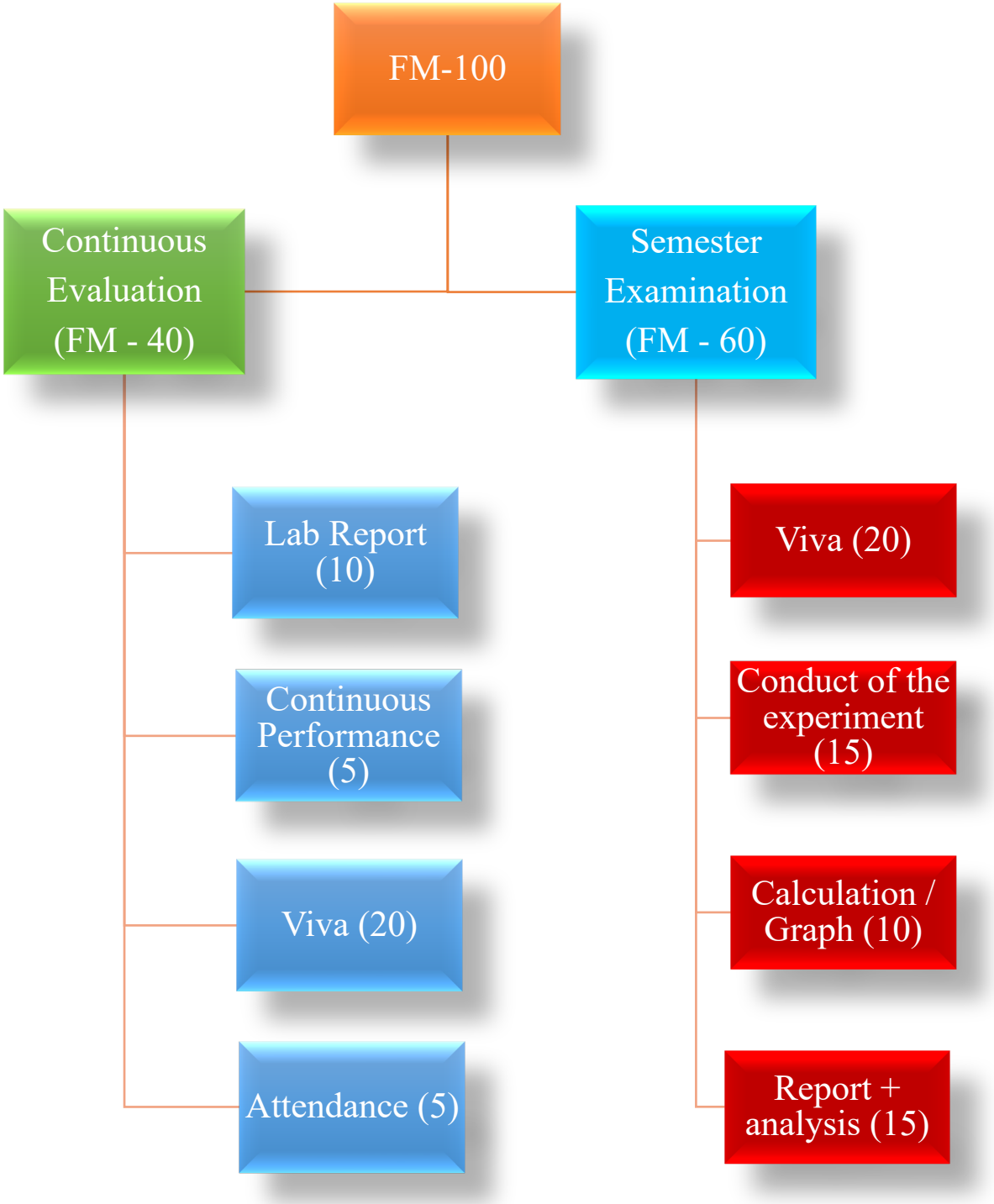
1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High)

Marks Division for Theory Examination



University takes 4 **Continuous Assessments (CA)** out of 25 and they scale it within 30 marks in the final result.

Marks Division for Practical Examination



University takes 2 **Practical Continuous Assessment (PCA)** during the semester.

Course Structure

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

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).

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.

Guidelines regarding Mandatory Induction Program for the new students:

All concerned are requested to follow the guidelines given in **Annexure-II** concerning Mandatory Induction Program. The colleges/ Institute may also refer to the AICTE Model Curriculum for Undergraduate Degree Courses in Engineering & Technology

Mandatory Additional Requirement for earning B. Tech Degree:

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

Group division:

Group-A:

Chemistry based subjects:

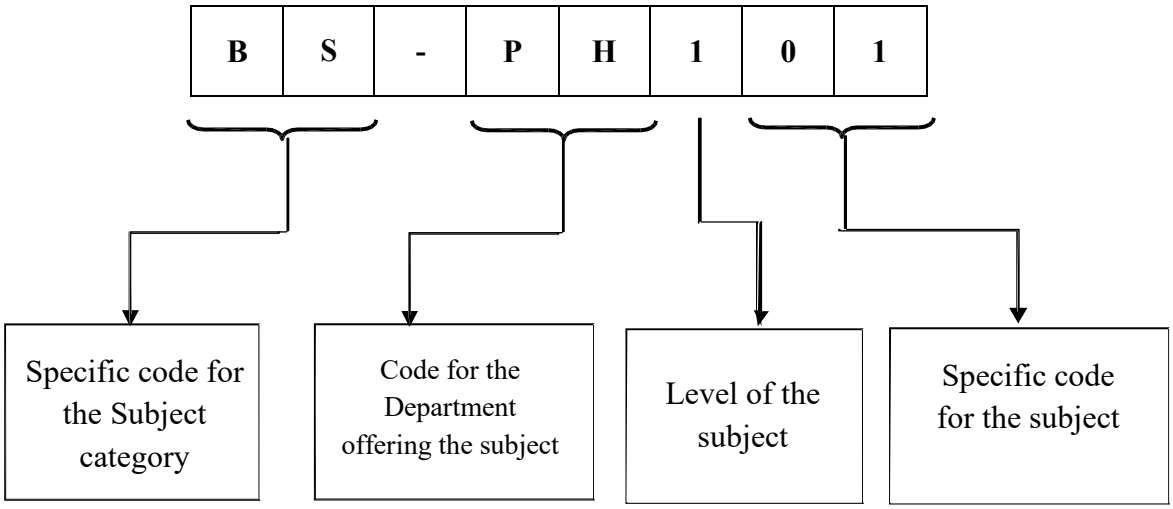
[Bio-Technology, Food Technology, Leather Technology, Textile Technology, Ceramic Technology, Chemical Engineering, and any other Engineering that chooses to be Chemistry based] + Physics based subjects: [Mechanical Engineering, Production Engineering, Civil Engineering, Automobile

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]

Subject Numbering Scheme:



List of Codes for Subject Category	
Code	**Category Name**
BS	Basic Science Courses
E	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

First Year First Semester							
Mandatory Induction Program- 3 weeks duration							
Sl No.	**Category**	**Subject Code**	**Subject Name**	**Total Number of contact hours**			**Credits**
				L	**T**	**P**	
Theory							
1	Basic Science course	BS-CH101	Chemistry-I	3	1	0	4
2	Basic Science course	BS-M102	Mathematics –IB	3	1	0	4
3	Engineering Science Courses	ES-EE101	Basic Electrical Engineering	3	1	0	4
	Total Theory			**9**	**3**	**0**	**1**
Practical							
1	Basic Science course	BS-CH191	Chemistry-I Laboratory	0	0	3	1.5
	Engineering Science Courses	ES-EE191	Basic Electrical Engineering Laboratory	0	0	2	1
3	Engineering Science Courses	ES-ME192	Engineering Graphics & Design	1	0	4	3
	Total Practical			**1**		**9**	**5.5**
	Total of First Semester			**10**	**3**	**9**	**17.5**

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	Physics-I	3	1	0	4
2	Basic Science courses	BS-M202	Mathematics –II	3	1	0	4
	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)	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	Workshop/ Manufacturing Practices	1	0	4	3
4	Humanities and Social Sciences including Management courses	HM-HU291	Language Laboratory	0	0	2	1
	Total Practical			**1**	**0**	**13**	**7.5**
	Total of Second Semester			**12**	**2**	**13**	**20.5**

First Year First Semester Articulation Matrix

Sl. No.	NBA Code	Subject Code	CO 1	CO 2	CO 3	CO 4	CO 5	CO 6	CO 7	CO 8	CO 9	CO 10	CO 11	CO 12	PSO 1	PSO 2	PSO 3
1	C101	BS-CH101	3.0	1.7	1.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	1.0	0.0
2	C102	BS-M102	3.0	2.5	1.3	1.0	0.0	0.0	1.0	0.0	0.0	0.0	1.0	2.7	1.3	1.7	1.8
3	C103	ES-EE101	2.8	2	2.75	2	2.6	0.0	0.0	0.0	0.0	0.0	0.0	1.25	2.67	2.80	2.33
4	C104	BS-CH191	1.0	1.5	1.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	C105	ES-EE191	1.8	2.0	2.5	1.0	2.4	0.0	0.0	0.0	2.4	0.0	0.0	0.0	2.7	2.8	2.3
6	C106	ES-ME191	1.5	1.8	1.3	1.0	0.0	1.0	0.0	0.0	0.0	1.8	0.0	0.0	2.0	1.0	0.0

First Year Second Semester Articulation Matrix

Sl. No.	NBA Code	Subject Code	CO 1	CO 2	CO 3	CO 4	CO 5	CO 6	CO 7	CO 8	CO 9	CO 10	CO 11	CO 12	PSO 1	PSO 2	PSO 3
1	C107	BS-PH201	1.8	2.33	1.83	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00
2	C108	BS-M202	2.8	2.3	2.5	2.2	0.0	0.0	0.0	0.0	0.0	0.0	1.7	3.0	2.3	1.5	0.0
3	C109	ES-CS201	2.8	2.3	2.5	2.2	0.0	0.0	0.0	0.0	0.0	0.0	1.7	3.0	2.0	1.3	0.0
4	C110	HM-HU201	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	3.0	0.0	2.0	1.4	1.7	2.4
5	C111	BS-PH291	1.7	2.5	1.8	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0	1.0
6	C112	ES-CS291	3.0	3.0	2.0	1.4	3.0	1.6	1.0	1.0	2.3	1.5	2.0	1.4	2.8	0.0	1.0
7	C113	ES-ME292	2.0	2.0	1.0	0.0	1.0	1.0	1.0	1.0	1.0	0.0	1.0	1.0	1.0	0.0	0.0
8	C114	HM-HU291	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	0.0	1.0	1.0	1.0

Course Code: BS-CH101	**Category:** Basic Science
Course Title: Chemistry-I	**Semester**: First/ Second
L-T-P: **3-1-0**	**Credit:4**

Pre-requisites: Overall knowledge of basic concepts of Chemistry as covered in Std XI & XII, Analytical & mathematical approach towards Chemistry

COURSE OBJECTIVE:

BSCH101:COb1:- Be able to understand the use of free energy in chemical equilibrium and electrochemical reactions and apply in the field of water technology.

BSCH101:COb2:- Be able to apply the fundamental knowledge of spectroscopic techniques in the field of science and engineering

BSCH101:COb3:- Be able to understand the theoretical aspects of bonding and molecular structure of organic and inorganic molecules including drugs or macromolecules.

BSCH101:COb4:- Be able to solve scientific problem related to engineering chemistry.

Course Outcome:

CO1	Analyze microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
CO2	Apply periodic properties to explain nature of various ionic and covalent complexes.
CO3	Identify the structural feature of a molecule by using various spectroscopic techniques
CO4	Interpret bulk properties and processes using thermodynamic considerations.
CO5	Evaluate structure, colour and magnetic properties of coordination complexes
CO6	List major chemical reactions that are used in the synthesis of molecules and explain isomerism considering the stereo chemical aspect

Mapping with CO – PO – PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12		PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	0	0	0	0	0	0	0	0		0	1	0
CO2	3	2	1	0	0	0	0	0	0	0	0	0		1	1	0
CO3	3	2	1	1	0	0	0	0	0	0	0	0		0	1	0
CO4	3	2	1	1	0	0	0	0	0	0	0	0		1	1	0
CO5	3	1	1	0	0	0	0	0	0	0	0	0		0	1	0
CO6	3	1	1	1	0	0	0	0	0	0	0	0		0	1	0
Avg	**3.0**	**1.7**	**1.0**	**0.7**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**		**0.33**	**1.00**	**0.00**

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.H2). Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

ii) Spectroscopic techniques and applications (8 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.

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-M102	**Category:** Basic Science Course
Course Title: Mathematics –I B	**Semester**: First
L-T-P: **3-1-0**	**Credit: 4**
Pre-Requisites: High School Mathematics	

Course Objective

BSM 102:COb1: Be able to apply the concept and techniques of differential integral calculas to determine the curvature andevaluation of different types of improper integrals.

BSM 102:COb2: Be able to understand the domain of application of mean value theorem to engineeringproblems.

BSM 102:COb3: Be able to learn different types of matrices,concept of rank,method of matrix inversion and to know the application of sequence in human life.

BSM 102:COb4: Be able to understand the linear spaces,it'sdimension,basis and application to the field of computer science.

BSM102:COb5: Be able to learn the concept of eigen values, eigenvectors,diagonalisation of matrices for understanding physical and engineering problems.

BSM102:COb6: Be able to apply the knowledge of sequence and series in real life problems.

Course Outcome

CO1	Understand the domain of applications of mean value theorems and Maxima-Minima to engineering problems.
CO2	Learn different types of matrices, their eigen values, eigen vectors, rank, solution of system of equations and orthogonal transformations which are essential for understanding physical and engineering problems.
CO3	Demonstrate the real-life problem which comprises of several variables or attributes and extreme points of different surfaces of higher dimensions.
CO4	Interpret the concept of convergence of infinite series in many approximation techniques and the tools of power series and Fourier series to analyze engineering problems.
CO5	Apply the techniques of solving of different types of improper integrals.
CO6	Learn the concept and different methods of differential and integral calculus to determine curvature.

Mapping with CO – PO – PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	2	1	1			1					3	1	2	1
CO2	3	3	2								1	3	2	2	3
CO3	3	3	1	1			1					3	1	2	2
CO4	3	3	1									3	1	1	2
CO5	3	2	1									2		2	2
CO6	3	2	2									2		1	1
Avg	3.00	2.50	1.33	1.00			1.00				1.00	2.67	1.25	1.67	1.83

Detailed Syllabus

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

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
Course Title: Basic Electrical Engineering	**Semester**: First
L-T-P: **3-1-0**	**Credit: 4**
Pre-Requisites: Knowledge of Physics and Mathematics in XII standard	

Course outcome

CO1	To understand and analyze basic electric and magnetic circuits.
CO2	To study the working principles of electrical machines and power converters.
CO3	To introduce the components of low voltage electrical installations.
CO4	To understand the general structure of electrical power system.
CO5	To understand the construction and operation of single-phase transformer.
CO6	To explain the working principle of power converters.

Mapping with CO – PO – PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	-	-	2	0	-	-	-	-	-	-	3	3	3
CO2	2	3	3	2	2	0	-	-	-	-	-	-	3	2	
CO3	2	-	3	1	-	0	-	-	-	-	-	1		3	
CO4	2	-	2	2	3	0	-	-	-	-	-	2	2	3	2
CO5	2	2	-	2	3	0	-	-	-	-	-	1			
CO6	2	1	3	3	3	0	-	-	-	-	-	1		3	2
Avg	2.2	2.0	2.8	2.0	2.6	0.0						1.3	2.67	2.80	2.33

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.

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

Pre-requisites:

1. Overall Knowledge about the basic concepts of chemistry as covered in class 11th& 12th Standard.
2. Analytical & mathematical approach towards Chemistry.

COURSE OBJECTIVE:

BSCH191:COb1: Be able to understand basic principles of chemical analysis

BSCH191:COb2: Be able to apply the fundamental knowledge of science and engineering and skill to solve scientific problems

Course outcome:

CO1	Determine the strength of an acid using conductometric method
CO2	Determine the strength of an acid using pH-metric methods
CO3	Determine partition coefficient of a substance between two immiscible liquids and evaluate the amount of acetic acid absorbed by charcoal
CO4	Determine some physical property like surface tension and viscosity of different solutions at room temperature
CO5	Estimate the amount of an ion present in a given solution using argentometric methods and amount of dissolved oxyzen (in mg/l) present in a given water sample using volumetric method.
CO6	Determine the cell constant and conductance of solutions

Mapping with CO – PO – PSO

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
CO1	1	1	1	3	0	0	0	0	0	0	0	0	0	0	0
CO2	1	1	1	3	0	0	0	0	0	0	0	0	0	0	0
CO3	1	1	1	3	0	0	0	0	0	0	0	0	0	0	0
CO4	1	2	1	3	0	0	0	0	0	0	0	0	0	0	0
CO5	1	2	1	3	0	0	0	0	0	0	0	0	0	0	0
CO6	1	2	1	3	0	0	0	0	0	0	0	0	0	0	0
Avg	**1.0**	**1.5**	**1.0**	**3.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Detailed Syllabus:

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-EE191	**Category:** Engineering Science
Course Title: Basic Electrical Engineering Lab	**Semester**: First
L-T-P: **0-0-2**	**Credit: 1**
Pre-Requisites:	

Course outcome:

CO1	To calibrate Ammeter and Wattmeter
CO2	To demonstrate the measuring instrument and electrical machines
CO3	To conduct open circuit and short circuit test of single-phase transformer
CO4	To measure 3 phase power using two wattmeters
CO5	To identify the components of LT switchgear
CO6	To understand the characteristic of RLC series and parallel circuit

Mapping with CO – PO – PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	0	0	0	3	2	0	1	2	2	0	0	3	3	3
CO2	2	3	3	1	2	0	1	0	3	2	0	0	3	2	0
CO3	2	2	3	0	0	0	0	2	2	0	0	2	0	3	0
CO4	2	0	2	0	3	1	2	2	3	2	0	0	2	3	2
CO5	1	0	0	0	1	0	0	0	0	0	2	0	0	0	0
CO6	2	1	2	1	3	0	1	0	2	0	0	2	0	3	2
Avg	1.83	1.00	1.67	0.33	2.00	0.50	0.67	0.83	2.00	1.00	0.33	0.67	1.33	2.33	1.17

Detailed Syllabus:

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
Course Title: Engineering Graphics &	**Semester**: First/ Second
L-T-P: **1-0-4**	**Credit: 3**
Pre-Requisites:	

Course Outcome:

CO1	Understand the utility of drawing instruments, dimensions and lines in technical drawing.
CO2	Know the Standard conventions and Construction of various Scales and Engineering curves
CO3	Apply fundamentals of theory of projections and draw orthographic projections of points, lines and surfaces.
CO4	Sketch the orthographic projections of regular solids and their sectional views.
CO5	Comprehend and apply the theory of development of surfaces
CO6	Apply basic concepts of CAD to develop and construct accurate 2D geometry through creation of basic geometric constructions.

Mapping with CO – PO – PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	1	-	-		-	-	-	2	-	-	-	-	-
CO2	2	1	1	-	-	1	-	-	-	-	-	-	-	-	-
CO3	1	2	-	-	-	-	-	-	-	2	-	-	-	1	-
CO4	1	2	-	-	-	-	-	-	-	1	-	-	-	1	-
CO5	1	2	-	-	-	-	-	-	-	1	-	-	-	-	-
CO6	3	3	2	1	-	-	-	-	-	3	-	-	2	-	-
Avg	**1.50**	**1.83**	**1.33**	**1.00**	**0.00**	**1.00**	**0.00**	**0.00**	**0.00**	**1.80**	**0.00**	**0.00**	**2.00**	**1.00**	**0.00**

Detailed Syllabus

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

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
3. AutoCAD software.
4. The problems for home assignments are to be prepared on drawing copy/ using AutoCAD software.
5. Print out of every assignment is to be taken for CAD Drawings on Drawing sheets (A4 Sheets).
6. 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: BS-PH201	**Category:** Basic Science Courses
Course Title: Physics-I	**Semester**: 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.

Course Outcomes:

CO1	Apply basic concepts of mechanics
CO2	Discuss Physical optics and interpret principles of lasers with applications
CO3	Categorize di electric and magnetic properties of materials
CO4	Differentiate between Classical Physics and Quantum Physics by introducing Planck's law
CO5	Evaluate simple quantum mechanical problems
CO6	Discriminate classical and Quantum statistical mechanics

Mapping with CO – PO – PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	-	0	0	0	0	0	0	0	0	1	0	1
CO2	1	3	2	-	0	0	0	0	0	0	0	0	1	1	0
CO3	3	2	1	1	0	0	0	0	0	0	0	0	1	1	0
CO4	1	3	2	-	0	0	0	0	0	0	0	0	0	0	1
CO5	1	3	2	0	0	0	0	0	0	0	0	0	1	0	0
CO6	-	1	3	2	0	0	0	0	0	0	0	0	1	0	0
Avg	1.80	2.33	1.83	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00

Detail Syllabus:

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.

Learning Resources:

1. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India
2. 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-M202	**Category:** Basic Science Course
Course Title: Mathematics – II B	**Semester**: Second (All stream except CSE
L-T-P: **3-1-0**	**Credit: 4**
Pre-Requisites: High School Mathematics and BS-M102	

Course Outcomes:

CO1	Learn the methods for evaluating multiple integrals and their applications to different physical problems and also evaluating the problems related to Gauss and Stoke's theorem.
CO2	To apply multiple integral for finding C.G., moment of inertia, areas and volumes of sphere, cubes and rectangular parallelepipeds and different fields of Engineering sciences
CO3	To know first order differential equation, exact, linear and Bernoulli's equation with its formulation to address the modelling of systems and problems of engineering sciences.
CO4	Learn to solve 2nd order differential equation with D operators method and learn about power series solution, Bessel's function, Legendre's function etc.
CO5	Learn different tools of differentiation and integration of functions of a complex variable that are used with various other techniques for solving engineering problems.
CO6	Apply different types of transformations between two 2- dimensional planes for analysis of physical or engineering problems.

Mapping with CO – PO – PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	3	3								3	3	2	-
CO2	3	3	3	3								3	2	1	-
CO3	3	3	3	2								3	2	1	-
CO4	3	1	2	1							1	3	2	2	-
CO5	2	2	2	2							2	3	3	2	-
CO6	3	2	2	2							2	3	2	1	-
Avg	2.83	2.33	2.50	2.17	0.00	0.00	0.00	0.00	0.00	0.00	1.67	3.00	**2.33**	**1.50**	**0.00**

Detail Syllabus:

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

Learning Resources:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley
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
Course Title: Programming for Problem Solving	**Semester**: Second
L-T-P: **3-0-0**	**Credit:3**
Pre-Requisites:	

Course Outcomes:

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

Mapping with CO – PO – PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	1	-	-		-	-	-	2	-	-	-	-	-
CO2	2	1	1	-	-	1	-	-	-	-	-	-	-	-	-
CO3	1	2	-	-	-	-	-	-	-	2	-	-	-	1	-
CO4	1	2	-	-	-	-	-	-	-	1	-	-	-	1	-
CO5	1	2	-	-	-	-	-	-	-	1	-	-	-	-	-
CO6	3	3	2	1	-	-	-	-	-	3	-	-	2	-	-
Avg	**1.50**	**1.83**	**1.33**	**1.00**	**0.00**	**1.00**	**0.00**	**0.00**	**0.00**	**1.80**	**0.00**	**0.00**	**2.00**	**1.00**	**0.00**

Detail Syllabus:

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

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

Learning Resources:

1. R. S. Salaria, Computer Concepts and Programming in C, Khanna Publishers
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Course 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:	

CO1	Observe and read data in slide calliper's, screw gauge. Calculate different modulus of elasticity to apply basic knowledge Physics of Elasticity and apply viscosity principle of streamline motion of water to calculate its viscosity coefficient required in fluid mechanics
CO2	Arrange sequential connection in electrical experiment to verify principles of Kirchhoff's law to verify passive elements of electrical circuit
CO3	Operate optical instruments to illustrate physical properties of light and to observe spectral lines of light to verify medium specific characteristics. Calculate Rydberg constant by studying Hydrogen spectrum to visualize visible spectra and to assess this empirical fitting parameter as a fundamental physical constant
CO4	Determine Band Gap and Hall coefficient of a given intrinsic semiconductor and distinguish between different intrinsic semiconductors. Determine the dielectric constant of different capacitors to correlate their usage like insulator and limitation of their usage as a dielectric material.
CO5	Apply concepts of quantum mechanics to verify Bohr's atomic orbital theory
CO6	Determine Planck's constant and Stefan's constant applying modern Physics

Mapping with CO – PO – PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12		PSO 1	PSO 2	PSO 3
CO1	2	3	1	1	0	0	0	0	0	0	0	0		1	0	1
CO2	1	2	3	-	0	0	0	0	0	0	0	0		1	1	0
CO3	2	3	2	-	0	0	0	0	0	0	0	0		1	1	0
CO4	-	2	3	1	0	0	0	0	0	0	0	0		0	0	1
CO5	-	2	1	3	0	0	0	0	0	0	0			1	0	0
CO6	-	3	1	2	0	0	0	0	0	0	0	0		1	0	0
Avg	1.67	2.50	1.83	1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		1.00	1.00	1.00

Detail Syllabus:

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

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

Course Outcomes:

CO1	To be able to correct syntax errors as reported by the compilers
CO2	To be able to identify and correct logical errors encountered at run time
CO3	To be able to write iterative as well as recursive programs
CO4	To be able to represent data in arrays, strings and structures and manipulate them through a program
CO5	To be able to declare pointers of different types and use them in defining self-referential structures.
CO6	To be able to create, read and write to and from simple text files.

Mapping with CO – PO – PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	0	0	0	3	2	0	1	2	2	0	0	3	3	3
CO2	2	3	3	1	2	0	1	0	3	2	0	0	3	2	0
CO3	2	2	3	0	0	0	0	2	2	0	0	2	0	3	0
CO4	2	0	2	0	3	1	2	2	3	2	0	0	2	3	2
CO5	1	0	0	0	1	0	0	0	0	0	2	0	0	0	0
CO6	2	1	2	1	3	0	1	0	2	0	0	2	0	3	2
Avg	1.83	1.00	1.67	0.33	2.00	0.50	0.67	0.83	2.00	1.00	0.33	0.67	1.33	2.33	1.17

Detail Syllabus:

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

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

Course Outcomes:

CO1	Demonstrate the hand tools and machine tools used in workshops
CO2	Discuss the safety measures required to be taken while using the tools.
CO3	Select the appropriate machine tools required to manufacture an object of predetermined shape and size considering least wastage and cost.
CO4	Students will be able to fabricate components with their own hands.
CO5	Confident on practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes
CO6	Assembling of different components, able to produce small devices for project or research purpose

Mapping with CO – PO – PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0
CO2	2	2	0	0	0	0	0	1	0	0	0	0	0	0	0
CO3	2	2	0	0	1	1	0	0	0	0	0	0	1	0	0
CO4	2	2	1	0	0	1	1	1	1	0	1	1	1	0	0
CO5	2	2	0	0	1	0	0	0	0	0	0	0	0	0	0
CO6	2	2	1	0	1	1	1	1	1	0	1	1	1	0	0
Avg	**2.00**	**2.00**	**1.00**	**0.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**0.00**	**1.00**	**1.00**	**1.00**	**0.00**	**0.00**

Detail Syllabus:

(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.

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: 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:	

Course Outcomes:

CO1	Comprehend Spoken variety of English Language
CO2	Apply Rules of English Grammar Skill for Speaking English correctly
CO3	Apply Rules of English Grammar Skill for Correct Usage
CO4	Apply Rules of English Grammar Skill for Presenting Technical Report
CO5	Apply English Language Skill for Responding in Spoken English
CO6	Demonstrate English Language Skill for Technical and Non-Technical Speaking

Mapping with CO – PO – PSO

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	0	0	0	0	0	0	0	2	2	3	1	2	1	1	1
CO2	0	0	0	0	0	0	0	2	2	3	1	2	1	1	1
CO3	0	0	0	0	0	0	0	2	2	3	1	2	1	1	1
CO4	0	0	0	0	0	0	0	2	2	3	1	2	1	1	1
CO5	0	0	0	0	0	0	0	2	2	3	1	2	1	1	1
CO6	0	0	0	0	0	0	0	2	2	3	1	2	1	1	1
Avg	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**3.00**	**0.00**	**0.00**	**1.00**	**1.00**	**1.00**

Detail Syllabus:

Honing 'Listening Skill' and its sub skills through Language Lab Audio 3P
Honing 'Speaking Skill' and its sub skills 2P
Helping them master Linguistic/Paralinguistic features
Voice modulation/ Stress/ Intonation/ Pitch &Accent) of connected 2P
Honing 'Conversation Skill' using Language Lab Audio –Visual input;
Conversational Practice Sessions (Face to Face / via Telephone, Mobile
Role Play Mode) 2P
Introducing 'Group Discussion' through audio –Visual input and

with key strategies for success	2P
G D Practice Sessions for helping them internalize basic Principles (turn- taking, creative intervention, by using correct body language, other soft skills) of GD	4P
Honing 'Reading Skills' and its sub skills using Visual / Graphics/ Diagrams /Chart Display/Technical/Non Technical Passages Learning Global / Contextual / Inferential Comprehension;	2P
Honing 'Writing Skill' and its sub skills by using Language Lab Audio –Visual input; Practice Sessions	2P