



## MANIPUR TECHNICAL UNIVERSITY

[A University established under the Manipur Technical University Act, 2016]  
Takyelpat, Imphal West, Manipur-795004  
Website: [www.mtu.ac.in](http://www.mtu.ac.in) / [www.mtuonline.in](http://www.mtuonline.in)

Ref. No. 17/27/2019-MTU(AC-017)

### REGULATIONS (COURSES AND SYLLABI FOR BACHELOR OF TECHNOLOGY PROGRAM FOR FIRST YEAR, **GROUP-B**)

### NOTIFICATION

Imphal, the 8<sup>th</sup> October, 2019

**No. 17/27/2019-MTU:** In exercise of the powers conferred by Section 45 of the Manipur Technical University Act, 2016 and approved adoption of the curriculum of College of Engineering Pune by the Board of Management of the University, the following Regulation (Courses and Syllabi of Bachelor of Technology program for first year, **Group-B**) are hereby made in anticipation of the approval of the Academic Council of Manipur Technical University until further notice.

2. The Course Structure for the Bachelor of Technology program for first year is given at **Annexure-I**, with the detailed course contents given at **Annexure-II**.

(Dr. Th Chhatrajit Singh)  
Academic Coordinator

Resolution of Board of Management – 22<sup>nd</sup> June, 2019.

## Annexure-I

## Semester I [B-Group]

Sr. No.	Course Type	Course Code	Course Name	Teaching Scheme			Credits
				L	T	P	
1	SMC	MA-101	Linear Algebra	2	1	0	3
2	SMC	PH-101	Optics and Modern Physics	3	0	0	3
3	SMC	CH-101	Applied Chemistry	3	0	0	3
4	AEC	ME-101	Foundations of Mechanical Engineering	3	0	0	3
5	AEC	CS-101	Programming for Problem Solving	3	0	2	4
6	HMC	HS-101	Professional Communication	2	1	0	3
7	HMC	HS-102	Design Thinking	0	0	2	1
8	AEC	EC-102	Electronics and Computer Workshop	0	0	2	1
9	SMC	CH-102	Applied Chemistry Laboratory	0	0	2	1
10	SMC	PH-102	Optics and Modern Physics Laboratory	0	0	2	1
				16	2	10	23
			<b>Total Academic Engagement and Credits</b>	<b>28</b>			<b>23</b>

[MA-101] Linear Algebra

Credits: 3

**Teaching Scheme**

Lectures: 2 hrs / week

Tutorial: 1 hr / week

**Course Outcomes:**

**Students will be able to**

- Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)
- Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)
- Analyze the problem and apply the appropriate concept. ( To measure this outcome, questions will be based on applications of core concepts)
- Give reasoning. (To measure this outcome, questions may be of the type- true/false with justification, theoretical fill in the blanks, theoretical problems, prove implications or corollaries of theorems, etc.)
- Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

**Unit I:**

[10 Hrs]

Matrices and linear equations: basic properties of matrices, row operations and Gauss elimination, Determinants and their basic properties. Basic concepts in linear algebra: vector spaces, subspaces, linear independence and dependence of vectors, bases, dimensions. Row and Column spaces, rank. Applications to systems of linear equations.

**Unit II:**

[08 Hrs]

Linear mappings, representation by matrices, rank-nullity theorem, Eigen values, Eigen vectors and their basic properties.

**Unit III:**

[08 Hrs]

Inner product spaces, orthogonality, Gram-Schmidt process, Diagonalization of special matrices, Geometric applications of linear transformation, quadratic forms: positive definiteness.

**Text Book:**

- Introduction to Linear Algebra (2<sup>nd</sup> edition) by Serge Lang, Springer.

**References:**

- Linear Algebra (3<sup>rd</sup> edition) by Serge Lang, Springer.
- Elementary Linear Algebra (10<sup>th</sup> edition) by Howard Anton and Chris Rorres, John Wiley and sons.
- Schaum's outlines of Linear Algebra (5<sup>th</sup> edition) by Seymour Lipschutz, Marc Lipson, McGraw-Hill Education (India) Private Limited, New Delhi.
- Linear Algebra by Hoffman and Kunze, (2<sup>nd</sup> edition) Prentice Hall Publication, New Delhi.
- Advanced Engineering Mathematics (10<sup>th</sup> edition) by Erwin Kreyszig, Wiley eastern Ltd.

- Linear Algebra and its applications (4<sup>th</sup> edition) by Gilbert Strang, Cengage Learning (RS).
- Advanced Engineering Mathematics by Chandrika Prasad and Reena Garg, Khanna Publishing Company Private Limited, New Delhi.

## [PH-101] Optics and Modern Physics

**Credits: 3**

### Teaching Scheme

Lectures: 3hrs/week

Practical: 2hrs/week

### Course Outcomes: Student

**will be able to:**

- Analyze the intensity variation of light due to interference, diffraction and polarization.
- They will be able to implement these phenomena to design advanced optical instruments.
- Understand the principle, construction and working of lasers in order to implement Laser Technology in engineering field.
- Understand fundamentals of quantum mechanics and apply to one dimensional motion of particles.
- Understand the principle, production and transmission of ultrasonic waves and understand the working of various instruments based on ultrasonic.

### Unit 1

[6 Hrs]

#### Interference and Diffraction

Interference due to wedge shaped thin film (with derivation); conditions of minima maxima, Newton's rings, Applications of interference.

Fraunhofer diffraction at a single slit; condition of maxima and minima, Plane diffraction grating (Diffraction at multiple slits) and applications based on diffraction.

### Unit 2

[6 Hrs]

#### Polarization

Polarization of light, elliptical and circular polarization, quarter and half wave plate, Brewster's law, Polarization by double refraction, Nicol prism, Fresnel's theory of optical rotation, Applications of polarizations.

### Unit 3

[6 Hrs]

#### Laser Physics

Introduction to laser, Laser and ordinary light, Laser beam characteristics, Spontaneous and stimulated emission of radiations, Thermal equilibrium, Condition for Light amplification, Population inversion, Pumping (Three level and four level pumping), Optical resonator, Ruby laser, He-Ne Laser, Semiconductor Laser, Nd-YAG Laser, Engineering applications of Laser (Fibre optics, Laser material interaction).

### Unit 4

[6 Hrs]

#### Wave Mechanics

Matter waves, De-Broglie's concept of matter waves, Properties of matter waves, Heisenberg's uncertainty principle, Schrödinger's time dependent and time independent equations, Operators, Eigen values and Eigen functions, Expectation values, Physical significance of wave function.

**Unit 5** **[6 Hrs]**

**Electrons in Potential Well**

Applications of Schrödinger's equation; Motion of a free particle, Electron in an infinite deep potential well (rigid box), Electron in a finite deep potential well (non-rigid box), concept of quantum tunnelling, Linear Harmonic oscillator,

**Unit 6** **[6 Hrs]**

**Ultrasonics**

Introduction to sound waves, Generation of sound waves, construction and working principle, types of ultrasound generators, Ultrasound transmission modes, Ultrasound imaging and instrumentation, Phonocardiograph, Echo ophthalmoscope, 2D echo, Ultrasound blood flowmeter Recording foetal heart movement.

**References:**

- Fundamentals of Optics – Francis A. Jenkins and Harvey E. White; Mc-Graw Hill, International Edition.
- A text book of Engineering physics by Avadhanulu and Kshirsagar, S. Chand Pub.
- A Text Book of Optics – N. Subramanyam & Brijlal; (Vikas Publishing House Pvt. Ltd).
- LASERS Theory and Applications – K. Thyagarajan, A. K. Ghatak; Macmillan India Ltd.
- Concepts of Modern Physics – Arthur Beiser ; Tata McGraw – Hill Edition.
- Modern Physics – Jeremy Bernstein, Paul M. Fish bane, Stephen Gasiorowics; Pearson Education.
- Quantum Mechanics – L. J. Schiff; Mc-Graw Hill International Edition.
- PHYSICS (Volume I & II) – Resnick Halliday and Krane; Willey India 5<sup>th</sup> Edition.

**[CH-101]**

**Applied Chemistry**

**Credits: 3**

**Teaching Scheme:**

Lectures: 3hrs / week

Practical: 2hrs/week

**Course Outcomes:**

**Student will able to**

- a. Appreciate the role and impact of chemistry in various engineering field
- b. Analyze engineering problems and also derive solution based on the knowledge of chemistry
- c. Select appropriate materials and processes for specific applications
- d. Select appropriate materials and processes for specific applications
- e. Consolidate theoretical knowledge into practical experience

**Unit 1: Material Chemistry**

**[9 Hrs]**

(A) Introduction to the basics of chemistry, Relevance of Chemistry to different Engineering specializations, Classification of Materials: Metals and alloys, Ceramics and glasses, refractories, cement ,polymers, composites, nanomaterials etc. and their properties.

**(B) Corrosion and corrosion control**

Electrochemistry of corrosion, Mechanism of dry corrosion& wet corrosion ,Factors affecting corrosion, Testing of corrosion- Weight-loss and weight-gain method, Microscopic exam, Methods of prevention of Corrosion- cathodic (Sacrificial, impressed current) and anodic protection, Proper selection of materials, Protective coatings- 2 examples of Metallic coatings, 2 examples of non-metallic coatings, paints

**Unit 2: Polymer Chemistry**

**[7Hrs]**

Introduction, Classification of polymers, Use and disposal of polymers, Polymer terminologies, commercially important polymers with synthesis and applications (plastics, fibres, adhesives, elastomers, conducting polymers), properties of polymers-Solubility, Molecular Weight, Crystallinity, Glass transition temperature, Role of additives in polymers, Reinforced plastics .

**Unit 3: Instrumental methods of Chemical Analysis**

**[7Hrs]**

Qualitative and quantitative analysis, Conventional methods of analysis: Titrimetry, gravimetry, Modern analytical techniques: an overview, electro-analytical, chromatography, thermoanalytical, Spectroscopy, XRD, TEM,SEM, nephelometry, turbidimetry, **Spectroscopy:** Principle, Basic instrumentation, Ultraviolet-Visible spectroscopy, Infra-Red Spectroscopy, Spectroscopy as an analytical tool, Accuracy, Precision, Reliability of Analytical data, confidence limits

**Unit 4: Energy Storage systems**

**[7Hrs]**

Introduction and overview, Basic principles &electrochemistry, batteries- characteristics, Li ion batteries  
Fuel cells- Principle of Fuel Cell, , Components of fuel cell. Various types of Fuel cell AFC, PEMFC, methanol based fuel cell and their applications. Hydrogen production; Hydrogen storage system

**Unit 5: Water Chemistry**

**[6 Hrs]**

Specifications for water, Impurities in water (Suspended, Biological & Dissolved chemical ), Water quality parameters, Analysis of water : alkalinity, hardness(boiler feed water), chloride content, methods & problems, DO, BOD, COD, ion transport, conductivity , Treatment of water and waste water-membrane filtration, RO

**Unit 6: Green Chemistry**

**[6 Hrs]**

12 principles of green chemistry ,Synthesis of chemicals by green chemistry routes, 3RsReduce,Reuse and Recycle, disposal of plastics, Biodegradable polymers-need, constituents required, factors ,properties, applications

**Text Books**

- A textbook of Engineering Chemistry: Jain and Jain, Dhanpatrai Publication.
- A textbook of Engineering Chemistry: S. S. Dara, S. Chand Publication 2010 edn.
- A textbook of Engineering Chemistry: Shashi Chawla, Dhanpatrai Publication.

## References

- Polymer Science: V.R.Gowariker, New Age International Publication □ Introduction to Nanotechnology: Charles P. Poole, Frank J. Owens.
- Fuel Cells- Shripad Revankar, Pradeep Majumdar
- Fuel Cell Fundamentals-Ryan O'Hayre, Suk-Won Cha, John Wiley & Sons
- Recent trends in Fuel Cell Science and Technology-Suddhasatwa Basu, Anamaya Publishers, New Delhi
- Instrumental Methods of Chemical analysis, Willard Dean, Merritree, Tata MacGrow Hill Limited.

## **[ME-101] Foundation of Mechanical Engineering**

**Credits: 3**

### **Teaching Scheme**

Lectures: 3 hrs/Week

### **Course Outcomes:**

#### **Student will be able to**

- Acquire basic knowledge about laws of Thermodynamics and apply them in energy conversion devices.
- Learn about the basic concept, modes of heat transfer and apply in heat exchanger devices.
- Learn the basics of power transmission elements and machine tools, their applications and apply that knowledge in real time industry scenario.
- Observe various elements of power transmission, understand their suitability for various industrial power transmitting applications.
- Develop understanding about the role and need of renewable energy sources.

### **Unit 1 Introduction to Thermodynamics**

**[7 hours]**

Basic Concepts, properties, equilibrium; Thermodynamic work and Heat, Laws of thermodynamics and their applications in Engineering, Concept of Heat Engine, Refrigerator and Heat pump, Carnot Principle. (Elementary treatment, Elementary Numericals)

### **Unit 2 Energy Conversion Devices (Elementary treatment only)**

**[8 hours]**

Steam generation process, Boiler: Mountings and accessories, Fire tube and Water tube boiler, Construction and working of Babcock & Wilcox, Cochran boiler, Introduction and Working principle of Steam Turbines, Gas turbine, Hydraulic turbines: Working of Pelton wheel and Francis turbine, Reciprocating Compressor, Reciprocating Pump, Working of Reciprocating I.C. engines (2 Stroke and 4 stroke), Vapour Compression Refrigeration Cycle, Study of household refrigerator, Window air conditioner

### **Unit 3 Heat Transfer**

**[7 hours]**

Statement and explanation of Fourier's law of heat conduction, Heat conduction in plane wall, Composite slab, Composite hollow cylinder (no derivation), Electrical analogy, Concept of thermal resistance, Overall heat transfer coefficient, Newton's law of cooling, Stefan Boltzman's law (Elementary Numericals), Concept of heat exchanger, types and concept of effectiveness

#### **Unit 4 Machine elements**

**[7 hours]**

Power transmission shafts, axles, keys (types and constructional features), Bearings: Purpose, Classification, Sliding contact bearing: Solid journal bearing, Bush bearing, rolling contact bearing: Ball bearing, Roller bearings

Power Transmission Devices (basic elements and constructional features): Belt drive: Flat and V belt drive, Open and Cross belt drive, Chain drive, Gear drives: Spur gear, Helical Gear, Spiral Gear, Bevel Gear, Worm and Worm Wheel, Rack and Pinion, Couplings: Rigid Coupling: Muff coupling, Flange Coupling, Flexible Coupling: Universal Coupling, Oldham's Coupling.

#### **Unit 5 Machine Tools**

**[7 hours]**

(Basic elements, Working Principle and operations) Lathe machine, Drilling Machine, Milling machine

Manufacturing processes:

Casting: Pattern making, Moulding, Types of castings, Forging, and metal joining processes: Welding, Soldering, Brazing

#### **Unit 6 Energy Sources**

**[6 hours]**

Concept of Conventional and non-conventional energy, Harnessing of Non-conventional energy source, Solar energy: Flat Plate Collector, Binary cycle solar thermal power plant, Wind turbine, Geothermal Power plant, Ocean thermal energy converter (OTEC), Fixed dome type biogas plant, Hydroelectric power plant, Nuclear reactor power plant. (construction and working)

#### **Text Books:**

- P. K Nag, "Engineering Thermodynamics", Tata McGraw-Hill Publishing Co. Ltd, 2005
- R. K. Rajput, "Heat transfer", S. Chand Publication, Delhi., 2008
- Hajra Choudhary, "Elements of Workshop Technology", Media Promoters and Publishers Pvt. Ltd, 2010
- V. B Bhandari, "Design of machine elements", 2017 **References:**
- Yunus A. Cengel and Boles, "Thermodynamics ", Tata McGraw-Hill Publishing Co. Ltd., 2001
- Arora and Domkunwar, "Thermal Engineering", Dhanpat Rai and Sons., 2009
- Basic Engineering Thermodynamics, "Rayner Joel", Pearson Education, 2008

**Teaching Scheme:**

Lectures: 3 Hrs/week

Laboratory: 2 Hrs/week

**Course outcomes**

**Students will be able to**

- a. Represent real life data using data types and variables provided by programming language.
- b. Write flow chart, using standard notation, for given problems.
- c. Solve a given problem using expressions, conditional statements, arrays and loops.
- d. Design a modular solution using functions, by breaking down the problem into parts, using programming language.

**Unit 1**

[4 hrs]

**Fundamental Operations of a Modern Computer**

Von Neumann Architecture. Design of a computer. Basic hardware components (RAM, disk, processor, keyboard, mouse). Basic Software components (applications, operating system, system software, compiler, etc.). Basics of I/O and data transfer between I/O devices and RAM/variables

**Unit 2**

[4 hrs]

**Basic programming constructs**

Basic Data types (Numerical, String). Variables. Expressions. statements. I/O statements for keyboard handling. Editing, compiling/interpreting/running programs. Syntax errors and runtime errors. Comparison of language model with Von Neumann architecture.

**Unit 3**

[8 hrs]

**Introduction to problem solving using computers**

Manual solutions to real life problems. Algorithmic representation of the solutions. **Basic Problems. Variables. Expressions. Conditional statements.** Multiplication. Exchange values of two variables. Finding maximum of three numbers. What is problem?, Identifying problem, Understanding a problem: Framing a problem in simple terms – mathematical, graphical, other abstractions. **Files.** Files as an alternative I/O medium. I/O functions to transfer data from file to variables. Comparison of keyboard and file I/O functions. operations to read, write, close, open files.

**Unit 4**

[8 hrs]

**Iterative problems.**

**Problems without arrays.** Introduction to iterative constructions in language. Find Sum, average of a given set of numbers. Loop design techniques: While loop - *body, iterative step, loop condition*. Emphasis on while loop against for loop. Factorial. Sine function computation.

Fibonacci sequence generation. Some problems to read data from files. **Array techniques.** Arrays as homogenous collection of elements. Array properties. Reversing elements of an array. Finding maximum. Finding second maximum. Algorithms for substring search. **Search problems.** linear search. linear search in sorted array. binary search.

## Unit 5

[8 hrs]

### Modular solutions

**Functions** Introduction to functions. Importance of design of functions. Rewriting earlier solutions using functions. Taking care of all possible values of arguments. Parameters, return values, signature, local and global scope. Modular code. Reusability. **Recursion.** Basic rules of recursion: recursive formulation, terminating case, handle all cases, recursion leading to terminating case. Factorial: iterative vs recursive. Recursive formulation for: multiplication, gcd, towers of Hanoi, binary search. Recursion vs iteration in general. When to use recursion.

## Unit 6

[8 hrs]

### Advanced Problems.

Convert a number into one with digits reversed. Convert decimal to binary. Generating prime numbers. Generating random numbers. Computing x power y. partitioning an array. Finding the kth smallest element of an array. **Sorting:** Selection sort. Insertion sort. bubble sort.

**Text Books:** □ R. G. Dromey, “How to solve it by Computer”, Pearson Education, ISBN 0-13-433995-9 □ Reema Thareja, “Python Programming: Using Problem Solving Approach”, Oxford University Press; First edition, 978-0199480173

### Reference Books:

- Stephen G. Krantz, “Problem Solving Techniques” , Universities Press. □
- Kernighan and Ritchie, “The ‘C’ programming language”, Prentice Hall □

[HS-101]

Professional Communication

Credit: 3

### Teaching Scheme:

**Lectures: 2 hrs/week**

**Tutorial: 1 hr / week**

#### 1. Fundamentals of Communication:

[7 hrs]

Language as a tool of communication: properties, levels of communication, flow of communication, communication networks, flow of communication; Barriers to communication; Professional communication: features, difference between general and professional communication; Importance of professional communication.

#### 2. Presentation Strategies and Soft Skills:

[8 hrs]

Defining purpose; audience and locale ; organising contents; preparing outline; audio visual aids; Nuances and Modes of Delivery; Body Language; Paralinguistic features and

Dimensions of Speech: Syllable, Accent, Pitch, Rhythm, Intonation ,etc., Group Discussions, Interview Skills, Role Play,etc. Listening Skills: Active Listening, Passive Listening, methods for improving listening skills.

**3. Constituents of written Professional Communication:**

**[7 hrs]**

Vocabulary building: Word formation by derivation; Synonyms and Antonyms; Homophones and Homonyms; One word substitutions; Idioms; Phrases; Paragraph writing: Techniques and Methods; Coherence and Unity, Inductive, Deductive, Chronological, Spatial, Linear, etc.; Parts of Speech; Precis Writing ; Note-making and Taking.

**4. Forms of Professional Communication:**

**[6 hrs]**

Business letters: Principles, Features, Layouts; Sales and Credit Letters, Claim and Adjustment letters, Job Application and Resumes, etc.,E-mails ; Reports, Technical Proposals: Significance, Types, Structure and writing of Reports and Proposals; Negotiation and Business Presentation Skills.

**Text books and Reference books:**

- 1) Professional Communication (Based on UPTU syllabus)- Meenakshi Raman & Sangeeta Sharma, Oxford University Press,ed.2014 New Delhi.
- 2) Technical Communication- Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford University Press, New Delhi.
- 3) Communication Skills for Engineers- Sunita Mishra & C. Muralikrishna, Pearson Education, New Delhi.
- 4) Business Correspondence and Report Writing by Prof. R.C.Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.

**[HS-102]**

**Design Thinking**

**Credit: 1**

**Teaching Scheme:**

Practical: 2hrs/week

**Course Outcomes:**

**Student will able to**

- a. Relate with and Compare the various learning styles and memory techniques and Apply them in their engineering education

- b. Analyze emotional experience and Experiment with emotional expressivity to better understand users while designing products
- c. Appreciate the importance of design thinking, Develop new ways of thinking and Learn the innovation cycle for creating innovative products
- d. Understand individual differences and its impact on everyday decisions so as to demonstrate frameworks, strategies, techniques while creating innovative products
- e. Develop skills for evaluating, articulating, refining, and creating an innovative engineering product that solves customer problems(s)

### **Unit 1: An Insight to Learning**

Understanding the Learning Process, Kolb's Learning Styles, Assessing and Interpreting

### **Unit 2: Remembering Memory**

Understanding the Memory process, Problems in retention, Memory enhancement techniques

### **Unit 3: Emotions: Experience & Expression**

Understanding Emotions: Experience & Expression, Assessing Empathy, Application with Peers

### **Unit 4: Basics of Design Thinking**

Definition of Design Thinking, Need for Design Thinking, Objective of Design Thinking, Concepts & Brainstorming, Stages of Design Thinking Process (explain with examples) – **Empathize, Define, Ideate, Prototype, Test**

### **Unit 5: Being Ingenious & Fixing Problem**

Understanding Creative thinking process, Understanding Problem Solving, Testing Creative Problem Solving,

### **Unit 6: Process of Product Design**

Process of Engineering Product Design, Design Thinking Approach, Stages of Product Design, Examples of best product designs and functions, **Assignment – Engineering Product Design**

### **Unit 7: Prototyping & Testing**

What is Prototype? Why Prototype? Rapid Prototype Development process, Testing, **Sample Example**, Test Group Marketing

### **Unit 8: Celebrating the Difference**

Understanding Individual differences & Uniqueness

Group Discussion and Activities to encourage the understanding, acceptance and appreciation of Individual differences

### **Unit 9: Design Thinking & Customer Centricity**

Practical Examples of Customer Challenges, Use of Design Thinking to Enhance Customer Experience, Parameters of Product experience, Alignment of Customer Expectations with Product Design

## **Unit 10: Feedback, Re-Design & Re-Create**

Feedback loop, Focus on User Experience, Address “ergonomic challenges, User focused design, rapid prototyping & testing, final product, **Final Presentation – “Solving Practical Engineering Problem through Innovative Product Design & Creative Solution”**

**[EC-102] Laboratory Course: Electronics and Computer Workshop      Credit: 1**

**Teaching Scheme:**    Lectures: 2 hrs/week

### **Course Outcomes:**

**Students will demonstrate the ability to:**

- a. Identify and use various electronic components and instruments.
- b. Develop basic electronic circuits on breadboard.
- c. Design and test the performance of OPAMP and IC555 circuits.

### **(Part A) Electronics**

#### **Activity I: Introduction to Basic Electronic Components and Devices**

Introduction to various electrical passive components such as Resistors, inductors and capacitors, introduction to active components, introduction to breadboard, Measurement of resistance using the colour code, series and parallel connection of the resistances and its implementation on breadboard.

#### **Activity II: Introduction to Electronics Instruments**

Exposure to usual electronic equipment/instruments such as Multi-meter, Oscilloscope, Function generator, Power supply, Information about their front panels, Demonstrations on their working, Hands-on for measurement of component values and DC voltage using multi-meter, measurement of amplitude, time period and frequency of the waveform Square wave/any small signal from function generator on Oscilloscope, Measurement of the voltage and current in the circuit implemented on breadboard using multimeter.

#### **Activity III: Operational amplifiers using IC-741**

Verification of distorted output for OPAMP in open loop configuration (without feedback) on CRO, Calculation and verification of the voltage gain using the virtual ground concept of Inverting and Non-inverting OPAMP, verification of phase shift between input and output on CRO.

#### **Activity IV: Application of OPAMP (IC-741)**

Verification of the output on CRO for OPAMP as an Integrator, differentiator and buffer.

#### **Activity V: Application of IC-555 as an A stable mode**

Calculation of duty cycle and frequency of IC 555 in a stable mode.

## **(Part B) Computer**

### **Activity I:**

- 1) Name and identify various PC hardware components: USB Mouse, PS/2 Mouse, Keyboard, LCD/LED Monitor, VGA, HDMI, CAT5, CAT6, server, routers, fiber cable, Hard disk, RAM, CMOS battery, SMPS, cache, ROM, BIOS
- 2) Type using all your fingers and achieve a speed of 30 words per minute

### **Activity II:**

Introduction to various important software: Ubuntu, Windows, Mac, Libreoffice and Microsoft Office; Firefox, Google Chrome, Tor; Linux Command Line (few basic commands); Photoshop, Gimp

Understand the broad structure and functioning of the Internet; Learn the following terms and concepts: LAN, DNS, Proxy, Router, Hub, Switch, Server, Client, Website, Webservice;

Understand basic networking commands, applications and services: ssh, telnet, ftp, winscp, ping, http, https, various search services (google, startpage, aggregator search services)

Prepare a working LAN cable by using crimping tools.

### **Activity III:**

Assemble a Desktop PC from its components

Install any two operating systems on a PC making it dual boot, including latest version of Ubuntu Linux, Windows 7/8

Connect 2-4 computers together using a network hub to create a LAN

### **Activity IV:**

Setup a working desktop system using a Raspberry Pi board. Download the OS image from web. Try installing one of the various operating systems on the board: Raspbian, Ubuntu Mate, Openelec, OSMC, Pidora, RISC OS, Arch Linux ARM, etc.

### **Resources:**

#### **Electronics Workshop**

- Consumables such as passive components, devices, ICs, bread-boards, wires, solder metal, flux, displays, switches, relays, transformers, copper clad laminates, chemicals for PCB fabrications etc.
- Equipment such as Oscilloscope, function generators, power supplies, solder stations/guns, de-soldering pumps, PCB drilling and de-burring machines, Open source PCB design software hosted on Desktops.
- Data sheets, application notes, volumes of magazines such as Electronics For You etc.

## Computer Workshop

- PC Hardware components: Motherboard, processor, SMPS, RAM, DVD-RW drive, Hard disk drives, power cables, VGA/HDMI connectors, Keyboard, Mouse (PS2/USB), Cabinet, LED displays
- Raspberry Pi Complete Kit: Raspberry Pi 2, Micro SD Card, Plastic case, Power adapter, HDMI cable, RCA Video/Audio cable, Cat5 cable
- Network Hub (4/8 ports), CAT5 cables network tool kit (Network crimper, Cable Tester, Wire stripper)

## [CH-102] Laboratory Course-Applied Chemistry

Credits: 1

### Teaching Scheme:

2hrs/week

### Course Outcomes:

#### Student will able to

- a. Identify chemical, apparatus and instruments for chemical analysis
- b. Differentiate between the classical and instrumental method of analysis
- c. Select the appropriate method for analysis
- d. Consolidate theoretical knowledge into practical experience

### List of Experiments:

1. Preparation and Standardization of Analytical Reagents (importance of distilled water)
2. Determination of chloride content of water by Mohr's method
3. Estimation of copper from brass by iodometry
4. pH-metric titration of Acid/Base
5. Colorimetric determination of concentration of given inorganic sample.
6. Preparation of a polymer
7. Determination of molecular weight of a polymer using Ostwald's viscometer
8. Determination of temporary and permanent hardness of water sample by EDTA method.
9. Determination of total alkalinity of water sample.
10. Preparation of a nanomaterial
11. Preparation of a chemical compound using green chemistry pathway

**Teaching Scheme**

Practical: 2-hrs/week

**Course Outcomes:**

- a. Hands on experience over basic optical instruments
- b. Verification of Laws of optics
- c. Analyze interference pattern
- d. Measurement of Wavelength
- e. A basic foundation over quantum theory

**List of Experiments:**

1. Cosine square law of Malus
2. Brewster's Law
3. Polari meter
4. Wave length by Diffraction Grating
5. Newton's Rings
6. Diffraction experiment with Laser
7. Frank and Hertz
8. Planks Constant
9. Characteristic of GM counter
10. Numerical Aperture of Optical fiber

### Semester II [B-Group]

Sr. No.	Course Type	Course Code	Course Name	Teaching Scheme			Credits
				L	T	P	
1	SMC	MA-102	Univariate Calculus	2	1	0	3
2	SMC/AEC	PH-103	Semiconductor Physics and Electromagnetism	3	0	0	3
3	AEC/SMC	EE-101	Basic Electrical Engineering	3	0	0	3
4	AEC	ME-102	Engineering Graphics and Design	1	0	4	3
5	AEC	CE-101	Engineering Mechanics	3	1	2	5
6	AEC	ME-103	Mechanical Fab Shop	0	0	3	1
7	AEC	CT-101	Introduction to Scientific Computational Tools	0	0	2	1
8	AEC/SMC	EE-102	Basic Electrical Engineering Laboratory	0	0	2	1
9	AEC/SMC	PH-104	Semiconductor Physics and Electromagnetism Laboratory	0	0	2	1
				12	2	15	21
			<b>Total Academic Engagement and Credits</b>	<b>29</b>			<b>21</b>

## [MA-102] Univariate Calculus

Credits: 3

### Teaching Scheme

Lectures: 2 hrs / week

Tutorial: 1 hr / week

### Course Outcomes:

#### Students will be able to

- Know and recall core knowledge of the syllabus. ( To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)
- understand basic concepts. ( To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)
- analyze the problem and apply the appropriate concept. ( To measure this outcome, questions will be based on applications of core concepts)
- give reasoning. ( To measure this outcome, questions may be of the type- true/false with justification, theoretical fill in the blanks, theoretical problems, prove implications or corollaries of theorems, etc.)
- apply core concepts to new situations. ( To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

**Unit I:** Review of limits, continuity and differentiability of univariate functions, Mean value theorems, Taylor's theorem, local extrema, increasing and decreasing functions, concavity, points of inflection, Jensen's inequality. **[05 Hrs]**

**Unit II:** Integrals as limits of Riemann sums, fundamental theorem of calculus, logarithm and exponential functions through integrals, integrals by special techniques: reduction formulae, arc length, solids of revolution, surface area, improper integrals, Gamma and Beta functions, tests for convergence. **[07 Hrs]**

**Unit III:** Sequences, recursively defined sequences, limits, subsequences, monotone sequences, infinite series, tests for convergence (Geometric series, p-series test, Ratio test, Root test, Comparison test, Leibnitz's test for alternating series), absolute convergence, power series and its convergence. Fourier series: definition, full and half range expansions of functions of arbitrary period. **[14 Hrs]**

### Text Books:

- Thomas' Calculus (14<sup>th</sup> edition) by Maurice D. Weir, Joel Hass, Frank R. Giordano, Pearson Education.

- Advanced Engineering Mathematics (10<sup>th</sup> edition ) by Erwin Kreyszig, Wiley eastern Ltd.

**References:**

- Calculus for Scientists and Engineers by K.D Joshi, CRC Press.
- A Course in Calculus and Real Analysis (1<sup>st</sup> edition) by Sudhir Ghorpade and Balmohan Limaye, Springer-Verlag, New York.
- Advanced Engineering Mathematics by C.R. Wylie, McGraw Hill Publications, New Delhi.
- Advanced Engineering Mathematics (7<sup>th</sup> edition ) by Peter V. O' Neil, Thomson.Brooks / Cole, Singapore.
- Differential Calculus by Shanti Narayan, S. Chand and company, New Delhi.
- Applied Mathematics Vol. I (Reprint July 2014) by P.N. Wartikar and J.N. Wartikar, Pune Vidyarthi Griha Prakashan Pune.
- Advanced Engineering Mathematics by Chandrika Prasad and Reena Garg, Khanna Publishing Company Private Limited, New Delhi.

Note:

**[PH-103] Semiconductor Physics and Electromagnetism**

**Credits: 3**

**Teaching Scheme**

Lectures: 3hrs/week

**Course Outcomes:**

**Student will be able to:**

- Understand the band theory of solids and the carrier concentration in solids..
- They will be able to understand the charge distribution and charge transfer process in semiconductors.
- Understand the intrinsic and extrinsic conductivity to design semiconductor devices.
- Understand the fundamentals of electromagnetic.
- Understand the electric polarization and identify the dielectrics for device study.
- Understand the electrodynamics and use Maxwell's equations for solving problems coming under electrodynamics.

**Unit 1**

**[6 Hrs]**

**Band theory of Solids**

Band theory of solids, Classification of solids on the basis of band theory, Fermi-Dirac probability function, Position of Fermi level in intrinsic semiconductor, Electron and hole concentrations in semiconductors.

**Unit 2** **[8 Hrs]**

**Semiconductor conductivity**

Intrinsic density, Intrinsic conductivity, Extrinsic conductivity, Law of mass action, Fermi level in extrinsic semiconductors, Temperature variation of carrier concentration in extrinsic semiconductors. Electrical conduction in extrinsic semiconductors, Diffusion length and mean life time, Hall Effect.

**Unit 3** **[6 Hrs]**

**Semiconductor devices**

Formation of p-n junctions, position of Fermi level in equilibrium, forward and reverse bias, p-n junction diode: I-V characteristics in forward and reverse bias, Solar Cell.

**Unit 4** **[6 Hrs]**

**Dielectrics**

Introduction, Nonpolar molecules, Polar molecules, Polar and nonpolar molecules in an electric field, Electric polarization of matter, Electric polarization vector, Electric field in dielectrics, Gauss's law in dielectrics, Relation between three electric vectors D, E and P, Effect of dielectric on capacitance.

**Unit 5** **[10 Hrs]**

**Electromagnetics**

Differential and integral calculus: Operator, Concept of gradient, divergence and curl. Line, surface and volume integrals, Gauss-Divergence theorem, Stokes theorem, Equation of continuity, Divergence of magnetic induction, Biot Savart's law, Ampere's circuital law.

**Unit 6** **[6 Hrs]**

**Electrodynamics**

Faraday's law of electromagnetic induction, generalization of amperes law, Maxwell's equations, Electromagnetic wave equations, Maxwell's wave equation for free space, Velocity of electromagnetic wave.

**References:**

- Engineering Physics by Avadhanulu and Kshirsagar.
- Classical Electrodynamics by J. D. Jackson, Wiley Publishers.
- Introduction to Electrodynamics, D. J. Griffiths, Springer Publication.
- Concepts of Modern Physics – Arthur Beiser, Tata McGraw – Hill Edition.
- Solid State Physics – A. J. Dekkar, Mac Millan India Limited.
- Solid State Physics - Neil W. Ashcroft and N. David Mermin, Thomson Books Cole.
- Fundamentals of Magnetism- B. Cullity – Addison-Wesley Publishing.
- Semiconductor Devices, Physics and Technology, S. M. Sze Wiley.
- Solid State Physics, S O Pillai, New Age International.
- Introduction to Solid State Physics, Charles Kittel, Wiley.

**Teaching Scheme:**

Lectures: 3 Hrs/week

**Course Outcomes:**

**Student will be able to**

- a. Understand and analyze basic electric and magnetic circuits.
- b. Study the working principles of electrical machines and power converters.
- c. Introduce the components of low-voltage electrical installations.

**Unit I:**

**[8 Hrs]**

Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff 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.

**Unit II:**

**[8 Hrs]**

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.

**Unit III:**

**[8 Hrs]**

Magnetic materials, BH characteristics, series and parallel magnetic circuits, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

**Unit IV:**

**[6 Hrs]**

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic, loss components, efficiency and applications.

Construction, working, torque-speed characteristic and applications of separately excited dc motor. Construction and working of synchronous generators.

**Unit V:**

**[6 Hrs]** DC-DC buck and boost

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

**Unit VI:****[6 Hrs]**

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.

Lamps- fluorescent, CFL, LED. Electrical measuring instruments principle and applications- energy meter, megger, tong tester.

**Text Books:**

- D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010. □ D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009. □ L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.

**References:**

- E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
- Vincent Del Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.

**[ME-102]Engineering Graphics and Design****Credits: 3****Teaching Scheme:**

Theory : 1 Hr/week

Practical : 4 Hr/week

**Course Outcomes:****Students will be able to:**

- a. Familiar with its accepted conventions and abbreviations.
- b. Develop the ability to visualize and communicate three dimensional shapes by representing three-dimensional objects into two-dimensional views.
- c. Plan and prepare neat isometric drawings of regular planes and solids.
- d. Draw the representation of various machine features.

**Unit I : Orthographic Projections**

Principles of Orthographic Projections, types of orthographic projections–First angle and third angle projections, Obtaining orthographic projections of given pictorial views by using first angle projection method along with sectional views. **[5 hrs]**

**Unit II : Isometric Projections:**

Principles of Isometric projection – Isometric and natural Scale, Isometric views of simple and compound solids, drawing isometric views from given orthographic views. **[5 hrs]**

**Unit III : Missing Views:**

Interpretation of given views, visualization of given orthographic views, adding a missing/third view, adding a sectional view, to convert a given view in to a sectional view. **[4 Hrs]**

**Text Books:**

- N.D.Bhatt, Elementary Engineering Drawing, Charotar Publishing House, Anand(India) □  
M.L.Dabhade Engineering Graphics I, Vision Publications, Pune

**Reference Books:**

- Warren Luzzader, Fundamentals of Engineering Drawing, Prentice Hall of India, New Delhi.
- David A. Madsen, Engineering Drawing and Design, Cengage Publication
- Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
- Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication

**Engineering Graphics and Design (Laboratory)**

**Teaching Scheme:**

Practical: 4 hrs / week

**Course Outcomes:**

**Students will be able to**

- a. Familiarize with its accepted conventions and abbreviations.
- b. Dimension and annotate two-dimensional engineering drawings.
- c. Communicate ideas graphically.
- d. Be aware of drafting practices used in industry.
- e. Plan and prepare neat orthographic drawings of solids.
- f. Use surface and solid modelling techniques.
- g. Use parametric solid modelling for representation of various machine features and components.

**List of Assignments/ Drawing sheet (half Imperial size):**

Assignment No 1: Different types of lines used in drawing practice, Dimensioning – linear, angular, aligned system, unidirectional system, parallel dimensioning, chain dimensioning, location dimension and size dimension.

Five A2 (594X420mm) (Half imperial) size drawing sheets

Sheet No. 1 : ORTHOGRAPHIC VIEWS

Two problems on orthographic views one with principal views and another with sectional view.

Sheet No. 2 : ISOMETRIC VIEWS

Two problems only on Isometric views.

Sheet No. 3 : INTERPRETATION OF GIVEN VIEWS/MISSING VIEWS

Two problems on Interpretation of given views.

Sheet No. 4: ORTHOGRAPHIC VIEWS (Using CAD software/package)

Four problems on orthographic views. Two with principal views and two with sectional views.

Sheet No. 5 : ISOMETRIC VIEWS (Using CAD software/package) Four

problems only on Isometric views along with part modeling .

**[CE-101]Engineering Mechanics**

**Credits: 5**

**Teaching Scheme**

Lectures : 3 hrs/ week

Tutorial : 1 hr/ week

Laboratory: 2 hrs/ week

**Course Outcomes:**

**Students will be able to:**

- a. Solve real life engineering problems using principles of Statics
- b. Solve real life engineering problems using principles of Dynamics
- c. Verify principles of mechanics through experiments
- d. Solve simple engineering problems using computer programs

**Unit I: General force system**

**[7 hrs]**

Resultant and equilibrium of General force system (3D and 2D) . Moment about a point.  
Moment about an axis.

**Unit II: Engineering applications**

**[7 hrs]**

Engineering applications to Beams, Trusses, Frames and Cables.

**Unit III: Friction and Virtual work**

**[7 hrs]**

- 1) Laws of dry friction, applications to wedges, flat belt friction, inclined planes, ladder friction.
- 2) Principle of virtual work: Applications to beams

**Unit IV: Kinematics of particles**

**[7 hrs]**

Motion related to (1) Cartesian coordinates, (2) normal & tangential coordinates and, (3) polar coordinates. Relative motion. Dependent motion.

**Unit V: Kinetics of particles**

**[7 hrs]**

Newton's second law, Energy principles, Impulse momentum principle, Direct central impact.

**Unit VI: Rigid body dynamics**

**[7 hrs]**

Kinematics of rigid bodies, General Plane Motion, ICR. Kinetics of Rigid Bodies, Applications to Newton's Second law.

**Text Books:**

- Hibbeler R. C. , “ Engineering Mechanics - Statics ”, 14<sup>th</sup> Edition, Prentice Hall
- Hibbeler R. C. , “ Engineering Mechanics - Dynamics ” , 14<sup>th</sup> Edition, Prentice Hall

**Reference Books:**

- Meriam J. L., Kraige L. G., “Engineering Mechanics - Statics ”, John Wiley and Sons, 8<sup>th</sup> Edition
- Meriam J. L., Kraige L. G., “ Engineering Mechanics - Dynamics ”, John Wiley and Sons, 8<sup>th</sup> Edition
- Beer F. P. and Johnston E. R., “Vector Mechanics for Engineers - Statics and Dynamics”, 11<sup>th</sup> Edition, Tata McGraw Hill Publishing company Ltd., New Delhi.

**Lab Course Contents:**

**PART A: Experiments**

1. Verification of law of polygon of forces
2. Study of Space forces system
3. Determination of beam reactions
4. Belt friction
5. Curvilinear motion
6. Direct central impact

**PART B: Assignments**

There will be six assignments, one on each unit from the theory course, based on graphical and computer solutions of Engineering Mechanics problems. Each assignment shall have minimum two problems.

**[ME-103] Mechanical Fab Shop**

**Credit:1**

**Teaching Scheme**

Practical : 3 hrs/week

**Course Outcomes:**

**Students will be able to**

- a. Understand basic Manufacturing Processes used in the industry
- b. Fabricate components with their own hands.
- c. Make electrical circuits and assembly of components
- d. Understand importance of safety

**Contents:**

**Term work shall consist of three jobs and journal consisting of six assignments one on each of the following topics.**

**Carpentry - 1 job (Common for Electrical & Non electrical Group)**

Introduction to wood working, kinds of woods, hand tools & machines, Types of joints, wood turning. Pattern making, types of patterns, contraction, draft & machining allowances Term work includes one job involving joint and woodturning.

**Fitting- (1 Job for Non Electrical Group & Demonstration for Electrical Group)**

Types of Fits, concepts of interchangeability, datum selection, location layout, marking, cutting, shearing, chipping, sizing of metals, drilling and tapping.

Term work to include one job involving fitting to size, male-female fitting with drilling and tapping.

**Sheet Metal Practice– (1 Job for Electrical Group & Demonstration for Non Electrical Group)**

Introduction to primary technology processes involving bending, punching and drawing various sheet metal joints, development of joints. Term work to include a utility job in sheet metal.

**Joining – 1 job (Common for Electrical & Non electrical Group)**

Includes making temporary and permanent joints between similar and dissimilar material by processes of chemical bonding, mechanical fasteners and fusion technologies.

Term work includes one job involving various joining processes like riveting, joining of plastics, welding, brazing, etc.

**Assembly and Inspection. (Common for Electrical & Non electrical Group)**

Assembly and Disassembly of some products, tools used. Videos of advancement in manufacturing technology. Inspection of various components using different measuring instruments.

**Safety in Workshop (Demonstration Common for Electrical & Non electrical Group)**

Fire hazards, electric short circuit –causes and remedies, Machine protection, Human protection, Accident prevention methods, developing ability to observe safe working habits. Introduction to measuring equipments used in Quality Control.

**Forging (Demonstration Common for Electrical & Non electrical Group)**

Hot working, cold working processes, forging materials, hand tools & appliances, Hand forging, Power Forging.

**Moulding (Demonstration Common for Electrical & Non electrical Group)**

Principles of moulding, methods, core & core boxes, preparation of foundry sand, casting, Plastic moulding.

**Electrical Board Wiring (Demonstration Common for Electrical & Non electrical Group)**

Electric power utilization, energy audit, Types of wiring - House wiring, stair case wiring, twoway switch wiring, Types of fuses and their uses, circuit breaker, Three phase wiring for electrical motors, earthing, minor fault finding.

**Plumbing (Demonstration Common for Electrical & Non electrical Group)** Types of pipe joints, threading dies, Pipe fittings.

**PCB Making (Demonstrations Common for Electrical & Non electrical Group)** Layout drawing, positive & negative film making, PCB etching and drilling

**References:**

- K.C. John, Mechanical Workshop Practice, PHI learning Pvt. Ltd., 2010
- Hajra Choudhury & A.K. Hajra Choudhury & Nirjhar Roy S.K, “Elements Of Workshop Technology - Volume I - Manufacturing Processes, Media Promoters and Publishers Pvt Ltd, 2010

**[CT-101] Introduction to Scientific Computational Tools**

**Credit: 1**

**Teaching Scheme:**

Laboratory : 2 hours/week

**Course Outcomes:**

**Student will be able to:**

- a. Demonstrate the use of various scientific computational tools for the purpose of numeric computations, plotting, and visualization.
- b. Demonstrate the ability to solve real life problems using computational tools.

### **Course Topics:**

Spreadsheets (e.g. sCalc (LibreOffice), gNumeric, Excel, etc.), Numerical computational frameworks (Scilab, Matlab, etc.), Plotting tools (E.g. GNUPlot), Programming language tools for computational purpose (e.g. Numpy in Python, R, etc. )

### **Course Resources:**

- Excel Exercises <http://web.utk.edu/~dhouston/excel/exercise.html>
- Introduction to Scilab <https://wiki.scilab.org/Tutorials>, Introduction to Matlab <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-094introduction-to-matlab-january-iap-2010/assignments/>
- Introduction to GNUPlot <http://people.duke.edu/~hpgavin/gnuplot.html>, <http://gnuplot.info/docs/tutorial.pdf>
- Introduction to Numpy <https://sites.engineering.ucsb.edu/~shell/che210d/numpy.pdf>

### **Illustrative List of Assignments:**

1. Design a spreadsheet using formulas to calculate following statistical parameters for a list of students with their marks: total, average, standard deviation, minimum, maximum.
2. Design a spreadsheet to facilitate grading of students, given their names and marks as two columns. The user should be able to enter grade ranges, and the spreadsheet should enter the grades automatically in front of each student, prepare a detailed chart showing grade ranges, number of students in each range and also create a line-chart for the same.
3. Demonstrate use of a plotting tool like gnuPlot to plot a a given set of functions with a given domain, a given set of data on X-Y axis and save the result to a file format as specified.
4. Demonstrate the use of matrix computational framework (e.g. Scilab, or matlab) to solve a set of linear simultaneous equations.
5. Demonstrate the use of matrix computational framework (e.g. Scilab, or matlab) to find Eigen vectors for a given data.
6. Demonstrate the use of a programming language like Python to compute multiplication of a sequence of matrices.
7. Demonstrate the use of a programming language like Python to compute various statistics about given set of data and plot the data as instructed.
8. Demonstrate the use of NumPy in Python for code optimization
9. Demonstrate file handling using NumPy in Python for performing indexing and slicing required for effective data retrieval

The Instructor is encouraged to update the list of assignments on a regular basis.

## **[EE- 102] Basic Electrical Engineering Laboratory**

**Credit: 1**

### **Teaching Scheme:**

Lectures: 2 Hrs/week

### **Course Outcomes:**

#### **Student will be able to**

- a. Get an exposure to common electrical components and their ratings
- b. Understand the usage of common electrical measuring instruments
- c. Understand the basic characteristics of transformers and electrical machines
- d. Get an exposure to the working of power electronic converters

Student must perform minimum eight experiments from the following list

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multimeter, oscilloscope. Real-life resistors, capacitors and inductors
2. Verification of Kirchoff's laws for a given circuit
3. Verification of Thevenin's and Norton's theorems
4. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope)
5. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in RL-C circuits.
6. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor)
7. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor
8. Determine efficiency and regulation of a single phase transformer by direct loading. To plot the characteristics at various loading conditions.
9. To perform open circuit and short circuit test on a single phase transformer and to evaluate its performance indices.
10. Speed control of a DC shunt motor by different approaches
11. Measurement of insulation resistance of an electrical system using megger.
12. Measurement of power in three phase circuit by two wattmeter method

### **Laboratory Course Outline**

The course involves writing code for solved, unsolved and practice programming problems given in the lab manual.

### **List of suggested experiments**

- Write a program to enter two numbers and perform all arithmetic operations.
- Program to find area of a triangle using Heron's Formula
- Take two integers as input and divide the first by the second. Prevent division by zero.
- Write a program to print 'n' terms of an Arithmetic series, with the first term 'a' and a constant difference 'd'. Take 'a,d,n' from user.
- Take a real value 'x' from the user and find the value of  $\tan(x)$ ,  $\log(x)$ , square root of x
- Write a program to display all the prime numbers between 1 and 100
- Write a program to take as input, 10 integers and put them in an array and display their values. Then, find the sum of all elements in the array and the position of the largest element. (Hint: use the logic of the algorithm to find maximum)
- Declare a 3x3 matrix. Initialise it to zero using nested loops. Then fill some user-given values into it. Print the matrix in proper format to make sure the inputs are correctly taken.
- Write your own function to find the minimum element of an array of integers. (Input to the function is integer array, output is the position number of the minimum element )
- Declare an array of 10 integers. Declare a pointer and point it to the base of the array. Print all the elements of the array using this pointer and not using the original name of the array.
- Write a program which is a copy of the terminal program 'cat'. It should take the name of the input file from the user and display the entire file on the terminal.
- Write a recursive function to raise a number to a given power.
- Write a function to carry out insertion sort of a set of strings given in a file, and write the data back to the file.

□

The instructors are encouraged to update the list of assignments from time to time

**[PH-104] Semiconductor physics and Electromagnetism Laboratory**

**Credit: 1**

### **Teaching Scheme**

Practical: 2 hrs/week

### **Course Outcomes:**

- a. Measurement of resistivity and band gap of Semiconductors
- b. Parameters for classification of magnetic materials
- c. Basic understanding of electromagnetic force

### **List of Experiments:**

1. Measurement of  $e/m$  of an electron by Thomson's method
2. Band gap of a semiconductor by four probe methods
3. Structural study of crystalline material

4. Hall effect in Semiconductor
5. Magneto resistance measurement of semiconductor
6. Dielectric Constant
7. Measurement of magnetic susceptibility by Quince's method
8. PN junction diode
9. Study of Biot-Savart's law
10. Faraday Effect