# MANIPUR UNIVERSITY

# CURRICULUM & SYLLABUS


## FOR

## BACHELOR OF ENGINEERING

(Effective from the Academic Session 2020-21)

## FIRST YEAR

### FIRST SEMESTER & SECOND SEMESTER

(COMMON TO ALL BRANCHES)

**CONTENTS**

# CURRICULUM

## B.E First Year (Common to all branches)

### FIRST SEMESTER

I. Mandatory Induction program
[Mandatory Induction Program for 3 weeks duration to be offered right at the start of first semester]

| **3 weeks duration** |
|---|
| Physical activity<br>Creative Arts<br>Universal Human Values<br>Literary<br>Proficiency Modules<br>Lectures by Eminent People<br>Visits to local Areas |

| SL. NO. | COURSE NO. | SUBJECT | HOURS/WEEK | | | MARKS | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | THEORY | SESS. | PRACT. | TOTAL | |
| 1. | PH 111*/ CH 111** | Physics*/Chemistry** | 3 | 1 | 0 | 70 | 30 | - | 100 | 4 |
| 2. | MA 111 | Mathematics -I | 3 | 1 | 0 | 70 | 30 | - | 100 | 4 |
| 3. | EE 111 | Basic Electrical Engineering | 3 | 1 | 0 | 70 | 30 | - | 100 | 4 |
| | | ***SUB-TOTAL*** | | | | | | | ***300*** | ***11*** |
| | | **PRACTICAL/DESIGN** | | | | | | | | |
| 4. | ME 111P | Engineering Graphics & Design | 1 | 0 | 4 | | 30 | 70 | 100 | *3* |
| 5. | PH 111P*/ CH 111P** | Physics Lab*/Chemistry Lab** | 0 | 0 | 3 | | 15 | 35 | 50 | 1.5 |
| 6. | EE 111P | Basic Electrical Engineering Lab | 0 | 0 | 2 | - | 15 | 35 | 50 | 1 |
| | | *SUB-TOTAL* | | | | | | | *200* | *5.5* |
| | | **TOTAL** | **10** | **3** | **9** | | | | **500** | **17.5** |

**Note: *-Group A & B, **-Group C & D**

### SECOND SEMESTER

| SL. NO. | COURSE NO. | SUBJECT | HOURS/WEEK | | | MARKS | | | | CREDIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | THEORY | SESS. | PRACT. | TOTAL | |
| 1. | PH 121**/ CH 121* | Physics**/Chemistry* | 3 | 1 | 0 | 70 | 30 | - | 100 | 4 |
| 2. | MA 121 | Mathematics -II | 3 | 1 | 0 | 70 | 30 | - | 100 | 4 |
| 3. | CS 121 | Programming for Problem Solving | 3 | 0 | 0 | 70 | 30 | - | 100 | 3 |
| 4. | HU 121 | English | 3 | 1 | 0 | 70 | 30 | - | 100 | 4 |
| | | ***SUB-TOTAL*** | | | | | | | ***400*** | ***15*** |
| | | **PRACTICAL/DESIGN** | | | | | | | | |
| 5. | PH 121P**/ CH 121P* | Physics Lab**/Chemistry Lab* | 0 | 0 | 3 | | 15 | 35 | 50 | 1.5 |
| 6. | CS 121P | Programming for Problem Solving Lab | 0 | 0 | 3 | | 30 | 70 | 100 | *1.5* |
| 7. | ME 121P | Workshop/Manufacturing Practices | 1 | 0 | 4 | - | 30 | 70 | 100 | *3* |
| | | *SUB-TOTAL* | | | | | | | *250* | *6* |
| | | **TOTAL** | **13** | **3** | **10** | | | | **650** | **21** |

**Note: *-Group A & B, **-Group C & D**

**PH 111 Physics**

| L | T | P | C | |
|---|---|---|---|---|
| **3** | **1** | **0** | **4** | **Full Marks: 100 (70 + 30)** |

**Module 1. Vector Analysis & Dynamics**: **(5 Hrs)**

Vector & Scalar quantities, Vector Product (upto triple Products), Scalar and Vector fields, Concept of Gradient, Divergence and Curl and their applications.

Survey of common forces in nature. Work-Energy Theorem, Conservative and non –conservative forces , Potential Energy. Angular momentum and its conservation.

**Module 2. Wave Optics: (6 Hrs)**

Interference: Coherent and non-coherent sources, fundamental conditions of interference, Interference of light, analytical treatment of interference, intensity distribution of fringe systems, Fresnel's Biprism, Newton's Ring, Michaelson interferometer.

Diffraction : Single Slit Diffraction, Theory of plane grating, Limit of Resolution, Resolving power of grating.

Polarization :Brewster's law, double refraction , Nicol prism, Specific rotation, Polarimeter.

**Module 3. Modern Physics:(6 Hrs)**

matter waves; group and phase velocities, Uncertainty principle and its application; The Compton effect; time independent and time dependent Schrödinger wave equation; Eigen values and Eigen functions; Born's interpretation and normalization of wave function, orthogonal wave functions; applications of Schrödinger wave equation (particle in a box and harmonic oscillator).

**Module 4. Nuclear Energy: (6 Hrs)**

Mass defect, Nuclear binding energy, Radioactive Decay, Half-Life, Radiometric Dating, Radioactive Series, Alpha Decay, Beta Decay, Gamma Decay, Radiation Hazards; Uses of Radio-Isotopes; Nuclear Fission, Nuclear Fusion, Nuclear reactions, Laws of nuclear reactions, Nuclear energy. Different types of nuclear reactors.

**Module 5. LASER: (5 Hrs)**

Basic principle of laser action, induce absorption, Spontaneous and Stimulated emissions, population inversion and optical pumping; three and four-level lasers; Various types of lasers (RUBY, He-Ne LASER, $CO_2$, Semiconductor), Industrial and medical applications of lasers.

**Module 6. Solid State : (6 Hrs)**

Energy band in solids, classification of solids as conductor, insulator and semiconductor, bound and free Electrons, Holes, Electron and hole mobilities, Intrinsic and Extrinsic semiconductors, Fermi and impurity levels, Electron hole concentration i intrinsic semiconductor. P-N junction diode. Forward and reverse charactistics of P-N diode. Transistors, configuration (CB, CE, CC)

**Module 7. Magnetostatics and Electrodynamics: (5 Hrs)**

Lorentz Force Law; magnetic field of a steady current (Biot –Savart law); ampere's law and its applications; ampere's law in magnetized materials; electromotive force; Faraday's law; Maxwell's Equations, Wave Equation.

**Suggested Text Books & References:**


1. D. Kleppner, R.J. Kolen, " Introduction to Mechanics", McGraw Hill Int.
2. Optics, A Ghatak, Tata McGraw Hill.
3. Special Relativity, A.P. France, ELBS.
4. Upadhyaya J.C., Mechanics, Ram Prasad & Sons .
5. Dattu R. Joshi, *Engineering Physics*, Tata McGraw Hill .
6. K. Rajagopal, Engineering Physics. 2nd Ed., PHI Learning.
7. Griffiths, D "Introduction to Electrodynamics" 2nd Ed., Prentice Hall of India, New Delhi (1998).
8. Thyagarajan, K and Ghatak A.K., "Lasers, - Theroy and Applications", Macmilan India Ltd., New Delhi, (2000).
9. Beiser, "Perspective of Modem Physics" 5th Ed., McGraw Hill KOGAKUSHA Ltd., NewDelhi, (2002).
10. Rangwala and Mahajan " Electricity and Magnetism", Tata McGraw Hill,1998
11. Marikani,Engineering Physics, PHI Learning.
12. D.C. Tayal, " Nuclear Physics" Himalaya Publishing House.
13. B. Laud, " Lasers and Non-linear Optics, New age international.


**Course Outcome:** After the completion of the course the students will be able to

***CO1:*** *Apply the concepts of gradient, divergence and curl to formulate problems in physics.*

***CO2:*** *Formulate and solve the problems on dynamics*

***CO3:*** *Formulate and solve problems on wave optics*

***CO4:*** *Apply the knowledge of basic quantum mechanics, to set up one-dimensional Schrodinger's wave equation and its application to a matter wave system.*

***CO5:*** *Explain Nuclear fission and fission and its applications in nuclear reactors*

***CO6:*** *Explain the working p-n junction diode*

***CO7:*** *Explain basic principle of laser action and its industrial and medical applications.*

***CO8:*** *Explain Maxwell's equations of electromagnetism*

**CH 111 Chemistry**

| L | T | P | C | |
|---|---|---|---|---|
| **3** | **1** | **0** | **4** | **Full Marks: 100 (70 + 30)** |

**Module 1*:* Atoms and Molecules: ( 10 Lectures)**

Atomic Structure & Chemical bonding: Bohr's theory, Somerfield theory, Zeeman Effect, Quantum numbers, Orbital concepts/wave concepts and de-Brogile Probability concept, probability distributions of s, p, d and f. Aufbau Principle, Pauli's exclusion principle, Hund's rule, Electronic configuration, Covalent bonds, Ionic bonds and Electronegativity concept, Concept of hybridization and shape of molecules. VSEPR theory; Its application in H2O, H2S, NH3, PH3.

**Module 2*:* Solid State: (6 Lectures)**

Idea of spatial periodicity of lattices; Elements of band theory, Conductors, Semiconductors, Insulators, Experimental methods of structure determination using spectroscopic technique such as IR, UV-Vis, NMR.

**Module 3*:* Structure and Reactivity of Organic Molecules: (8 Lectures)**

Inductive effect, Resonance, Electrometric effect, hyperconjugate, Carbocation, Carbanion, Free radicals Brief study of some addition reactions – Halohydration and Markovnikoff's rule, Substitution reactions-SN1 & SN2 Elimination reactions-Sayfzeff & Hoffmann rules *Stereoisomersi:* Geometrical and Optical Isomerism, E/Z nomenclature, R/S nomenclature. Conformational Analysis(Acyclic/ Cyclic molecules)

**Module 5*:* Polymers : (8 Lectures)**

Definition – Classification of polymers with examples – Types of polymerization – addition (free radical addition) and condensation polymerization with examples.

**Plastics:** Definition and characteristics- thermoplastic and thermosetting plastics, compounding and fabrication of plastics (compression and injection moulding). Preparation, Properties and engineering applications of PVC and Bakelite.

**Fibers:** Characteristics of fibers – preparation, properties and applications of Nylon-6, 6 and Dacron. Fiber reinforced plastics (FRP) – Applications.

**Rubbers:** Natural rubber and its vulcanization – compounding of rubber.

**Elastomers:** Characteristics –preparation – properties and applications of Buna-S, Butyl and Thiokol rubber.

**Conducting polymers:** Characteristics and Classification with examples-mechanism of conduction in trans-polyacetylene and applications of conducting polymers.

**Biodegradable polymers:** Concept and advantages – Polylactic acid and poly vinyl alcohol and their applications.

**Module 5*:* Engineering Materials: (6 Lectures)**

***Cement:*** Composition and manufacture of Portland cement, harmful ingredients, Setting and hardening of cement.

***Fuel:*** Classification, Calorific value (Bomb calorimeter),

***Petroleum:*** Classification, different fractions and uses, Cracking of hydrocarbons, knocking and octane number, Synthetic patrols& petrochemicals.

**Text Books & References :**


1. Atext Book of Engineering Chemistry – Shashi Chawla – Dhanpal Rai and Co (Pvt.) Ltd.
2. Engineering Chemistry – Jain & Jain – Dhanpal Rai & Sons
3. Engineering Chemistry – P.R. Vijasarathy
4. Basic Inorganic Chemistry – Cotton & Wilkinson – Wiley
5. Inorganic Chemistry – Shriver, Atkins & Langford Oxford University Press
6. Inorganic Chemistry – Satya Prakash, Tuli, Basu and Madan
7. Physical Chemistry – IN Levine – McGrow Hill
8. Physical Chemistry – W. Moore – Prentice Hall
9. Physical Chemistry – Samuel Glasstone-Macmillan India td.
10. Organic Chemistry – Bahl and Bahl – S. Chand
11. Organic Chemistry – Organic Chemistry – Morrison and Boyed – Prentice Hall
12. A Guide Book to Mechanism of Organic Chemistry- P. Sykes- Longman
13. Principles of Polymerization – G.G. Odian – John Wiley & Sons.
14. University Chemistry – Brence, H. Mahan


**Course outcome:**

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

**CO1:** Explain the structure of atoms and bonding in molecules and apply different theories to determine the shape of molecules.

**CO2:** Identify the structures of solids and the defects that occur within them and know the experimental methods of structure determination using spectroscopic technique such as IR, UV-Vis, NMR and explain the properties of solids according to Band Theory.

**CO3:** Explain the organic reaction mechanisms, stereochemistry and various possible conformations in organic compounds.

**CO4:** Explain the chemistry of polymers and apply to some natural and commercial polymers

**CO5:** Demonstrate the understanding of the chemistry of various engineering materials.

**MA 111 Mathematics – I**

| L | T | P | C | |
|---|---|---|---|---|
| 3 | 1 | 0 | 4 | **Full Marks: 100 (70 + 30)** |

***Module 1: Infinite Series (8 lectures)***

Convergence, divergence and oscillation of an infinite series, Comparison test, p series, D'Alembert's ration test, Raabes's test and Cauchy's root test (all test without proof) for series of positive terms. Alternating series, Absolute and conditional convergence, Leibnitz's test (without proof). And their relationships.

***Module 2: Calculus of functions of One Variable (12 lectures)***

Successive differentiation, Leibnitz's theorem (without proof), Roll's theorem, MeanValue theorem and Taylor's theorem. Expansion of functions into Taylor's and Maclaurin's series (without proof). Reduction formulae for the integrals of $\sin^n x$, $\cos^n x$ , sin *mx* cos *nx* and evaluation of these integrals with standard limits – problems. Application to length, area, volume and surface area of revolutions.

***Module 3: Calculus of functions of Several variables (12 lectures)***

Partial derivatives, Homogeneous function-Euler's theorem, total derivative, differentiation of implicit functions, change of variables, Jacobians, Taylor's theorem of functions of two variables (without proof), maxima and minima of functions of two variables, Lagrange's method of undetermined multipliers with simple problems. Multiple integrals, evaluation of double and triple integrals, evaluation of double integrals over a given region, by change of order of integration, by change of variables, application to areas and volumes – illustrative examples*. Beta and Gamma functions, properties and relation between them (without proof).

***Module 4: Vector Calculus(8 lectures)***

Scalar and vector functions, gradient, divergence and curl- their geometrical interpretations with examples, Line and surface integrals with simple examples, Green's theorem, divergence theorem and Stoke's theorem (without proof) and their simple applications.

**Suggested Text / Reference Books**:


1. G.B. Thomas and R. K. Finney, Calculus and Analytic geometry, Addison/Narosa.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Plublication, 41st Edition, New, Delhi.
3. Vector Analysis, Spiegel Schaum Series.
4. Erwin Kreyszig, Advance Engineering Mathematics, 9th Edition, John wiley & Sons, 2006
5. Ramana B. V., Higher Engineering Mathematics, Tata McGraw Hill, New Delhi, 11th Reprint, 2010.

***Course Outcomes***

The objective of this course is to familiarize the prospective engineers with techniques in convergence of series, calculus and vector calculus. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

**The students will learn**:

**CO1:** The idea of applying differential and integral calculus. Apart from some applications it gives a basic introduction on Beta and Gamma functions.

**CO2:** The fallouts of Rolle's Theorem/Mean Value Theorem that is fundamental to application of analysis to Engineering problems.

**CO3:** The tool for convergence of series for learning advanced Engineering Mathematics.

**CO4:** The maxima and minima of functions of several variables that is essential in most branches of engineering.

**CO5:** The Beta and Gamma functions in a comprehensive manner.

**EE 111 Basic Electrical Engineering**

| **L** | **T** | **P** | **C** | |
|---|---|---|---|---|
| **3** | **1** | **0** | **4** | **Full Marks: 100 (70 + 30)** |

***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.

**Suggested Text / Reference Books**

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

***Course Outcome:***
On successful completion of the course, the student will be able to:

**CO1:** **Identify and analyze** network theorems / a. c fundamentals and apply them to the solution of electrical engineering problems.

**CO2**: Gain basic idea of electrical quantities, such as current, voltage, power, energy, phase, frequency etc. and co-relate these concepts in various fields of electrical engineering.

**CO3**: Understand the principle of operation of different types of electrical machines.

**CO4:** Understand the basic principle of operation and use of different types of measuring instruments.

**CO5:** Get concrete idea about electrical installations and importance of the safety measures to be taken in this regard.

**ME 111P Engineering Graphics & Design**

| L | T | P | C | |
|---|---|---|---|---|
| 1 | 0 | 4 | 3 | **Full Marks: 50 (15 + 35)** |

**MODULE 1: Introduction to Engineering Drawing (8 Lectures)**

i. Principles of Engineering Graphics and their significance, usage of Drawing instruments.
ii. Lettering: Single stroke letter – Vertical and inclined capital and small letter,
iii. Scales: Plain scale and Vernier scale.
iv. Curves: Conic sections – Ellipse, parabola, hyperbola, different methods of construction of conic sections, tangents and normal to conics.

**MODULE 2: Orthographic Projections (14 Lectures)**

i. Principles of Orthographic Projections- Conventions
ii. Projection of points: Introduction of projection, quadrants, 1st, 2nd, 3rd and 4th angle projection of points.
iii. Projection of lines (First angle only): Line parallel to one or both planes, line perpendicular to a plane, line inclined to one plane and parallel to other, line inclined to both plane.
iv. Projections of planes (First angle only): Plane perpendicular to one plane and parallel to other, plane perpendicular to both plane, plane inclined to one plane and perpendicular to other.
v. Projection of solids (First angle only): Axis perpendicular to one plane and parallel to other, axis parallel to both plane, axis inclined to one plane and parallel to other, axis inclined to both plane.

**MODULE 3: Sections and Sectional Views of Right Angular Solids (4 Lectures)**

Section of solids: Section plane parallel to one plane and perpendicular to other, section plane inclined to one plane and perpendicular to other.

**MODULE 4: Isometric Projections (4 Lectures)**

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.

**MODULE 5: Introduction of Computer Graphics (6 Lectures)**

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.; applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen). Drawing simple shapes such as circle, parabola, etc. Drawing geometric solids; Drawing annotation, solid, surface, and wireframe models.

**MODULE 6: Demonstration of simple team design (Students Project as group work) (4 Lectures)**

Creation of engineering models and their presentation in standard 2D blueprint form, 3D wire-frame and shaded solids; meshed topologies for engineering analysis. Drawing of floor plans, front elevation and sectional elevation showing floor level to ceiling of a simple two storied building with doors and windows.

**Text/Reference Books:**


1. Bhat, N.D.& M. Panchal (2008), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & B.C. Rana (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Dhawan, R.K. (2007), A Text Book of Engineering Drawing, S. Chand Publications
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.
5. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
6. User manual of CAD software.


**Course Outcome:**

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

**CO1:** Explain the basic principles of Engineering Graphics.
**CO2:** Apply the principles of orthographic and isometric problems to represent simple Engineering objects.
**CO3:** Apply the principle of sectioning to represent different views of Right Angular Solids.
**CO4:** Create simple shapes like Circle, parabola, geometric solids etc. using CAD software.
**CO5:** Demonstrate team work spirit through creation of Engineering models and their presentations.

**PH 111P Physics Lab.**

| L | T | P | C | |
|---|---|---|---|---|
| **0** | **0** | **3** | **1.5** | **Full Marks: 50 (15 + 35)** |

**List of laboratory experiments**

1. Determination of volume of different shapes by using Slide calliper.
2. Determination of cross-sectional area of rod, volume of sphere by using Screw gauge.
3. Determination of volume of different shapes by using Travelling Microscope.
4. To determine the surface tension of water.
5. Measurement of short time intervals using electronic timer.
6. To draw the ID of a prism using spectrometer.
7. To determine wavelength of light by diffraction grating.
8. Measurement of wavelength of light using (i) Sodium source(ii) Helium-Neon Source by using Fresnel biprism/Newton Ring method.
9. To determine specific rotation of sugar solution by using Polarimeter.

10 Characteristics of a Semiconductor diode
11. Characteristics of a Zener diode.
12. Characteristics of a Semiconductor transistor in different modes
13. Determination of e/m by J.J. Thomson Method
14. Charging and discharging of a capacitor.

**Suggested Text Books & References:**

1. Dr. R.S. Sirohi, Practical Physics, Wiley Eastern, New Delhi.
2. Maheshwari, L.K. &Anand , M.M.S, Laboratory Manual for Introductory Electronics Experiments, New Age.
3. Shukla, R.K. & Srivastava, Anchal, Practical Physics, New Age.

**Course Outcomes:**

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

**CO1:** Measure accurate distaces by using slide callipeer, screw gauge and travelling microscope.
**CO2:** Learn to use spectrometer and measurement of distances of spectral lines, knowledge of handling Polarimeter and measurement of specific rotation of sugar solution.
**CO3:** Learn the characteristics of P-N junction diode, Zener diode, PNP and NPN Transistors.
**CO4:** Learn knowledge of finding e/m by J.J Thomson method
**CO5:** Know the charging and discharging of capacitor.

**CH 111P Chemistry Lab.**

| **L** | **T** | **P** | **C** | |
|---|---|---|---|---|
| **0** | **0** | **3** | **1.5** | **Full Marks: 50 (15 + 35)** |

**Qualitative Analysis :**

Organic sample analysis
Detection of elements – Cl, Br, I, S, N.
Detection of functional groups – Carboxylic acids, phenolic- OH groups; Aldehyde, Ketone, Amino, Nitro, Amide etc.

**Detection of Acid radicals :**

$Cl^-$ , $Br^-$ , $I^-$ , $NO_3^-$ , $SO_4^{2-}$ , $F^-$ , $PO_4^{3-}$ , $SiO_3^{2-}$
Detection of basic radicals : $Cu^{2+}$, $Hg^{2+}$, $Pb^{2+}$, $Mo^{6+}$, $Bi^{3+}$, $Sn^{2+}$,$Fe^{3+}$,$Al^{3+}$, $Cr^{3+}$, $Co^{2+}$, $Mn^{2+}$ , Ca2+ , $Ba^{2+}$ , $Sr^{2+}$ , $Mg^{2+}$

**Quantitative Analysis :**

Redox titration (estimation of iron using permanganometry)
Acid base titration (estimation of commercial caustic soda)
Preparation and analysis of a metal complex (e.g. thiourea/ copper sulphate/ nickel chloride/ ammonium complexes)
Preparation of Urea formaldehyde and Phenol formaldehyde resin.
Determination of Total hardness of water using Ethylene diaminetetracetate (EDTA)

Conductometric titration (determination of the strength of a given HCl Solution by titration against a standard NaOH solution.
P Hmetric titration (determination of the strength of given HCl solution by using standard NaOH solution)

**Suggested Text Book & References :**

1. Vogel's qualitative Inorganic Analysis – Orient Longman
2. Practical Chemistry S. Chand.
3. Advance Experimental Chemistry a) Inorganic b) Organic c) Physical , J.N.Gurtu & Kapoor

**Course Outcome:** After the completion of the course the students will be able to:

**CO1:** Have the knowledge of different types of analysis in chemistry i.e. Qualitative and Quantitative.

**CO2:** Learn and apply basic techniques use in Chemistry Lab for preparation, purification and identification.

**CO3:** Learn safety rules in the practice of Laboratory investigations.

**EE 111P Basic Electrical Engineering Lab.**

| L | T | P | C | |
|---|---|---|---|---|
| 0 | 0 | 2 | 1 | **Full Marks: 50 (15 + 35)** |

**List of Laboratory Experiments/Demonstrations:**

1. Basic safety precautions, Introduction and use of measuring instruments.
2. Calibration of measuring instruments.
3. Verification of Thevenin's Theorem.
4. Verification of Maximum Power Transfer Theorem.
5. Measurement of power in a single phase AC circuit using Wattmeter.
6. Measurement of circuit parameters under steady-state condition for RLC circuits.
7. Demonstration of cut-out sections of Electrical Machines.
8. Characteristics of incandescent lamp.
9. Study of balanced three phase circuits.
10. Demonstration of layout of house wiring.
11. Demonstration of measurement of insulation resistance.

**Text / References:**

1. D. P. Kothari and I. J. Nagrath, —Basic Electrical Engineering‖, Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, —Basic Electrical Engineering‖, McGraw Hill, 2009.
3. L. S. Bobrow, —Fundamentals of Electrical Engineering‖, Oxford University Press, 2011.
4. E. Hughes, —Electrical and Electronics Technology‖, Pearson, 2010.
5. V. D. Toro, —Electrical Engineering Fundamentals‖, Prentice Hall India, 1989.
6. B. L. Theraja, A. K. Theraja, —A Text Book of Electrical Technology Vol I, II, IV‖, S. Chand & Co., 2015.
7. Abhijit Chakrabarti, Sudipta Nath and Chandan Kumar Chanda, —Basic Electrical Engineering‖, Tata McGraw-Hill, 2017

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

**CO1:** be familiar with switching on and taking precautionary measures while handling electrical equipment.

**CO2:** apply knowledge of different types of electrical circuits, components and instruments to relate theoretical concepts with experimentation.

**CO3:** organize and write an engineering report including graphs and tables after performing an experiment.

**SECOND SEMESTER**

**PH 121 Physics**

| L | T | P | C | |
|---|---|---|---|---|
| **3** | **1** | **0** | **4** | **Full Marks: 100 (70 + 30)** |

**Syllabus same as PH 111**

**CH 121 Chemistry**

| L | T | P | C | |
|---|---|---|---|---|
| **3** | **1** | **0** | **4** | **Full Marks: 100 (70 + 30)** |

**Syllabus same as CH 111**

**MA 121 Mathematics - II**

| L | T | P | C | |
|---|---|---|---|---|
| **3** | **1** | **0** | **4** | **Full Marks: 100 (70 + 30)** |

***Module 1: Linear Algebra (10 lectures)***

Rank of a matrix, solution of linear simultaneous equations and inverse of a matrix, by elementary transformations, characteristic equation-Eigen values and eigen vectors of a real matrix, properties of eigen values, Caley-Hamilton's theorem (without proof), Linear Transformation, Similarity of matrices and diagonalisation of matrices, Quadratic forms and reduction into canonical forms, nature of quadratic forms.

***Module 2: Ordinary Differential Equations(10 lectures)***

Solutions of ODE's of $1^{st}$ order and $1^{st}$ degree – *Review of the method of separable of variables with illustrative examples, homogeneous and reducible to homogeneous equations, exactness and reducible to exact by integrating factors, linear equation and reducible to linear equation. Solutions of linear homogeneous and non-homogeneous ODE's of $2^{nd}$ and higher order with constant coefficients- operator method, method of undetermined coefficients and method of variation of parameters. Solutions of Cauchy's and Legendre's linear equations, Solutions of simple simultaneous ODE's.

### *Module 3: Laplace Transforms (12 lectures)*

Transforms of elementary functions, Basic properties, derivatives and integrals of transform, transform of derivatives and integrals, transforms of unit step function and unit impulse function, transforms of periodic functions, inverse Laplace transform, convolution theorem (statement only), solutions of linear ODE's of $2^{nd}$ order with constant co-efficient and first order simultaneous equations with constant co-efficient using Laplace transform.

### *Module 4: Partial Differential Equations (8 lectures)*

Formation of partial differential equations (PDE) by elimination of arbitrary constants and functions, solution of non-homogeneous PDE by direct integration, solution of homogeneous PDE involving derivative with respect to one independent variable only, solution of Lagrange's linear PDE, solution of PDE by method of separation of variables (First and second order equations)

Note:- * In case of illustrative examples, questions are not to be set.

**Suggested Text/Reference Books**


1. E. Kreyszig, "Advanced Engineering Mathematics", $5^{th}$ Ed., Wiley Eastern, 1985.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Plublication, $41^{st}$ Edition, New Delhi.
3. Ramana B. V., Higher Engineering Mathematics, Tata McGraw Hill, New Delhi, 11th Reprint, 2010.
4. N. O. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.


### *Courses Outcomes*

The objective of this course is to familiarize the prospective engineers with techniques of solving system of linear equations , Eigen values and eigen vectors of a real matrices, 1st and higher order ODE's, simple simultaneous ODE's, partial differential equations and Laplace transforms.

***The students will learn***:

**CO1:** The mathematical tools needed for solving system of linear simultaneous equations and evaluation of Eigen-value and Eigen vectors of matrices.

**CO2:** The effective mathematical tools for the solutions of differential equations (ordinary and partial).

**CO3:** The effective tools using Laplace Transform to determine solutions of linear and simultaneous ODEs.

**CS 121 Programming for Problem Solving**

| L | T | P | C | |
|---|---|---|---|---|
| 3 | 0 | 0 | 3 | **Full Marks: 100 (30 + 70)** |

**MODULE 1: Introduction to Programming (3 Lectures)**

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, system software, application software, compilers, interpreter etc. Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudo code with examples. From algorithms to programs; source code, compilation, object and executable code, Syntax and Logical Errors in compilation, storage of data inside program using variables, data types, modular programming, structure of a C program.

**MODULE 2: Expressions and precedence (2 Lectures)**

Writing C expressions using operators (arithmetic, relational, logical, dereferencing, arrow operator, period operator, conditional operator, subscript operator etc.), identifiers and literals, precedence of operators, evaluation of expressions using precedence and associatively rules.

**MODULE 3: Conditional Branching and Loops (4 Lectures)**

Writing and evaluation of conditionals and consequent branching using if..else and switch.. case statements, Iteration and loops using for loop, while loop and do..while loop.

**MODULE 4: Arrays (2 Lectures)**

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

**MODULE 5: Basic Algorithms (4 Lectures)**
Searching (sequential and binary), Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definitions for asymptotic analysis required).

**MODULE 6: Function (3 Lectures)**
User defined functions and built in libraries, function prototype, parameter passing in functions, call by value, passing arrays to functions: idea of call by reference (1-D and 2-D), scope rules for C language.

**MODULE 7: Recursion (2 Lectures)**
Recursion, as a different way of solving problems, example programs, such as Finding Factorial, Fibonacci series.

**MODULE 8: Structure (2 Lectures)**
Structures, defining structures, Accessing members, Array of Structures.

**MODULE 9: Preprocessor Directives (1 Lecture)**
#define, #include, #ifdef etc., conditional compilation.

**MODULE 10: Pointers (4 Lectures)**
Idea of pointers, defining pointers, pointer and arrays, pointer to structure, pointer to function, passing addresses of variables to functions (elementary and user defined), double indirection, Use of Pointers in self-referential structures, dynamic allocation/deallocation of memory blocks data types like elementary data types, arrays, structures, accessing elements of dynamically allocated memory, notion of linked list (no implementation).

**Text Books:**

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. Yashavant Kanetkar, Let us C, BPB Publication
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill
4. Yashavant Kanetkar, Understanding Pointers in C, BPB Publication

**Reference Books:**

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

**Course Outcome**

**CO1** To design, represent and analyze algorithms for logical and numerical problems
**CO2** To develop modular programs using functions and recursion
**CO3** To create programs using static built-in and user defined data types for storage and processing of data
**CO4** To develop programs for dynamic storage and processing of data
**CO5** To develop solution for a computing problem through team work

**HU 121 English**

| L | T | P | C | |
|---|---|---|---|---|
| **3** | **1** | **0** | **4** | **Full Marks: 100 (30 + 70)** |

**1. Vocabulary Building**

1.1 The concept of Word Formation
1.2 Root words from foreign languages and their use in English
1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
1.4 Synonyms, antonyms, and standard abbreviations.

**2. Basic Writing Skills**

2.1 Sentence Structures
2.2 Use of phrases and clauses in sentences
2.3 Importance of proper punctuation

2.4 Creating coherence
2.5 Organizing principles of paragraphs in documents
2.6 Techniques for writing precisely

**3. Identifying Common Errors in Writing**
3.1 Subject-verb agreement
3.2 Noun-pronoun agreement
3.3 Misplaced modifiers
3.4 Articles
3.5 Prepositions
3.6 Redundancies
3.7 Clichés

**4. Nature and Style of sensible Writing**
4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence
4.5 Writing introduction and conclusion

**5. Writing Practices**
5.1 Comprehension
5.2 Précis Writing
5.3 Essay Writing

**6. Oral Communication**
(This unit involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

**Suggested Readings:**

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Remedial English Grammar. F.T. Wood. Macmillan.2007
3. On Writing Well. William Zinsser. Harper Resource Book. 2001
4. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
5. Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

**Course Outcomes**

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

**PH 121P Physics Lab.**

| L | T | P | C | |
|---|---|---|---|---|
| **0** | **0** | **3** | **1.5** | **Full Marks: 50 (15 + 35)** |

**Syllabus same as PH 111P**

**CH 121P Chemistry Lab.**

| L | T | P | C | |
|---|---|---|---|---|
| **0** | **0** | **3** | **1.5** | **Full Marks: 50 (15 + 35)** |

**Syllabus same as CH 111P**

**CS 121P Programming for Problem Solving Lab**

| L | T | P | C | |
|---|---|---|---|---|
| **0** | **0** | **3** | **1.5** | **Full Marks: 100 (30 + 70)** |

**Lab1:** Familiarization with programming environment (editors, compilation, debugging etc.) **(2 hours)**
**Lab2:** Simple computational problems using expressions and precedence **(2 hours)**
**Lab3:** Problems involving using if-then-else and switch statements (**2 hours)**
**Lab4:** Iterative problems e.g., sum of series, factorial, Fibonacci series etc. **(2 hours)**
**Lab5:** 1D, 2D Array manipulation: summation, finding odd/even in a set, string handling etc. **(4 hours)**
**Lab6:** Matrix problems (addition, multiplication etc.), String operations (finding length, concatenation, comparing etc.)**(4 hours)**
**Lab7:** Simple function illustrating the concepts, call by value **(2 hours)**
**Lab8:** Recursive functions for summation, Fibonacci series, and factorial **(2 hours**)
**Lab9:** Pointers, call by reference, passing arrays to functions, passing address of structure to function, passing array of structure to function, pointers and arrays, function pointer, dynamic allocation of block of memory and accessing the elements (**4 hours**)
**Lab10:** File operations on text files, binary files (**2 hours)**

**Course Outcomes**

**CO1:** To translate a given algorithm to C program and become familiarized with programming environments

**CO2:** To build programs using modular programming and recursion

**CO3:** To build programs using built-in and user defined data types for data processing

**CO4:** To build programs for data processing using dynamic memory management

**CO5:** To solve a computational problem through team work

**CO6:** To exhibit self-learning by writing programs for solving problems in differentiation and integration by numerical methods

**ME 121P Workshop/Manufacturing Practices**

| L | T | P | C | |
|---|---|---|---|---|
| **1** | **0** | **4** | **3** | **Full Marks: 100 (30 + 70)** |

**(i) Lectures & videos: (10 hours)**

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

**(ii) Workshop Practice:(60 hours)**

1. Machine shop **(10 hours)**
2. Fitting shop **(8 hours)**
3. Carpentry **(6 hours)**
4. Electrical & Electronics **(8 hours)**
5. Welding shop **[8 hours (Arc welding 4 hrs + gas welding 4 hrs)]**
6. Casting **(8 hours)**
7. Smithy **(6 hours)**
8. Plastic moulding& Glass Cutting **(6 hours)**

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

**Suggested Text/Reference Books:**


1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., “Elements of Workshop Technology”, Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. 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 Outcomes**

**CO1:** The students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.
**CO2:** Fabricate components with their own hands.
**CO3:** They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
**CO4:** By assembling different components, they will be able to produce small devices of their interest.

**A Guide to Induction Program**

**1. Introduction**

Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his study. However, he must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he would understand and fulfil his responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed. There is a mad rush for engineering today, without the student determining for himself his interests and his goals. This is a major factor in the current state of demotivation towards studies that exists among UG students.

The success of gaining admission into a desired institution but failure in getting the desired branch, with peer pressure generating its own problems, leads to a peer environment that is demotivating and corrosive. Start of hostel life without close parental
supervision at the same time, further worsens it with also a poor daily routine. To come out of this situation, a multi-pronged approach is needed. One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character.

**2. Induction Program**

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Precious little is done by most of the institutions, except for an orientation program lasting a couple of days. We propose a 3-week long induction program for the UG students entering the institution, right at the start. Normal classes start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature. The time during the Induction Program is also used to rectify some

critical lacunas, for example, English background, for those students who have deficiency in it.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

## 2.1 Physical Activity

This would involve a daily routine of physical activity with games and sports. It would start with all students coming to the field at 6 am for light physical exercise or yoga. There would also be games in the evening or at other suitable times according to the local climate. These would help develop team work. Each student should pick one game and learn it for three weeks. There could also be gardening or other suitably designed activity where labour yields fruits from nature.

## 2.2 Creative Arts

Every student would chose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, flow into engineering design later.

## 2.3 Universal Human Values

It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting staff in the hostel and department, be sensitive to others, etc. Need for character building has been underlined earlier. A module in Universal Human Values provides the base.

Methodology of teaching this content is extremely important. It must not be through do’s and dont’s, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. The role of group discussions, however, with clarity of thought of the teachers cannot be over emphasized. It is essential for giving exposure, guiding thoughts, and realizing values. The teachers must come from all the departments rather than only one department like HSS or from outside of the Institute. Experiments in this direction at IIT(BHU) are noteworthy and one can learn from them.

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It is to open thinking towards the self. Universal Human Values discussions could even continue for rest of the semester as a normal course, and not stop with the induction program.

Besides drawing the attention of the student to larger issues of life, it would build relationships between teachers and students which last for their entire 4-year stay and possibly beyond.

## 2.4 Literary

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

## 2.5 Proficiency Modules

This period can be used to overcome some critical lacunas that students might have, for example, English, computer familiarity etc. These should run like crash courses, so that when normal courses start after the induction program, the student has overcome the lacunas substantially. We hope that problems arising due to lack of English skills, wherein students start lagging behind or failing in several subjects, for no fault of theirs, would, hopefully, become a thing of the past.

## 2.6 Lectures by Eminent People

This period can be utilized for lectures by eminent people, say, once a week. It would give the students exposure to people who are socially active or in public life.

## 2.7 Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

## 2.8 Familiarization to Dept./Branch & Innovations

The students should be told about different method of study compared to coaching that is needed at IITs. They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.