

# **Complete Syllabus**

**(1<sup>st</sup> & 2<sup>nd</sup> Semester Common to all courses)**

**of**

**B. Tech.**

**2015**

**Tripura University**

**(A Central University)**

**Suryamaninagar, Tripura (W)**

## Curriculum Structure

### COMMON SYLLABUS- FIRST SEMESTER

Sl. No.	Subject Code	Subject Title	L	T	P	Contact Hours/week	Credit	Full Marks
<b>Theory Subjects:</b>								
1.	HS 101	English	3	0	0	3	3	100
2.	BS 101	Engineering Mathematics - I	3	2	0	5	4	100
3.	BS 102	Applied Physics- I	3	2	0	5	4	100
4.	BS 103	Chemistry- I	2	0	0	2	2	100
5.	ES 101	Engineering Graphics	2	2	0	4	3	100
<b>Practical/Sessional Subjects:</b>								
6.	BS 104	Applied Physics Laboratory- I	0	0	2	2	1	100
7.	ES 102	Engineering Graphics Practice	0	0	2	2	1	100
8.	ES 103	Engineering Workshop	0	0	6	6	3	100
Total :						29	<b>21</b>	800

## Curriculum Structure

### COMMON SYLLABUS- SECOND SEMESTER

Sl. No.	Subject Code	Subject Title	L	T	P	Contact Hours/week	Credit	Full Marks
<b>Theory Subjects:</b>								
1.	HS 202	Sociology & Elements of Indian History for Engineers	2	0	0	2	2	100
2.	ES 204	Object Oriented Programming	2	2	0	4	3	100
3.	BS 205	Engineering Mathematics-II	3	2	0	5	4	100
4.	BS 206	Applied Physics- II	2	2	0	4	3	100
5.	BS 207	Chemistry- II	3	0	0	3	3	100
6.	ES 205	Engineering Mechanics	2	2	0	4	3	100
<b>Practical Subjects:</b>								
7.	BS 208	Applied Physics Laboratory- II	0	0	2	2	1	100
8.	BS 209	Chemistry Laboratory	0	0	2	2	1	100
9.	ES 206	Object Oriented Programming Lab	0	0	2	2	1	100
Total :						28	<b>21</b>	900

# First Semester

## English (HS 101)

Course Outcome:

After completion of the course students would be able to

- 1) Identify different genres of communication
- 2) Learn English language through literature
- 3) Extend vocabulary
- 4) Develop writing skills &
- 5) Comprehend a given text.

### **Module 1 (Prose):**

1. Shooting an Elephant – George Orwell
2. Modern Improvements- John Ruskin

### **Module 2 (Poetry):**

1. The Solitary Reaper- William Wordsworth
2. The Road Not Taken- Robert Frost
3. In the Bazaars of Hyderabad – Sarojini Naidu

### **Module 3 (Short Stories):**

1. An astrologer's Day- R. K. Narayan
2. The Refugee- K. A. Abbas.

### **Module 4 (Practical English Grammar and composition):**

English communication skills, Pronunciation, Vocabulary Extension, Comprehension, Modes of Writing, sentence Formation and Types, Forms of Tense, Mode of Narration, Voice Change, Correction of Errors, antonyms and synonyms, Structures of Words/Word Order.

### **Prescribed Texts:**

1. *Phoenix: A text Book of compulsory English for Foundation Courses of BA/BSc/BCom-Orient Blackswan.*
2. *English for All- Nilanjana Gupta*

### **Reference:**

1. *John Eastwood, Oxford Practice Grammar, New Delhi: OUP*
2. *Advanced English Communication Skills Lab, K. R. Lakshminarayanan, SCITECH*
3. *Objective general English, S. P. Bakshi, Arihant.*
4. *Phoenix: A text Book of compulsory English for Foundation Courses of BA/BSc/BCom-Orient Blackswan.*

# **Engineering Mathematics-I**

(BS 101)

## **Course Outcomes:-**

After successful completion of this course, a student will be able to-

- 1] apply the MVTs in expansion of differentiable functions.
- 2] identify infinite series which occur in problems of signal transmission, chemical diffusion, vibration and heat flow etc.
- 2] create capability of translating a physical or other problem in to a mathematical model.
- 3] identify the nature of series and sequences.
- 4] analyse various types of series and sequences.
- 5] creates the ability to model, solve and interpret any physical or engineering problem.
- 6] evaluate Multiple Integrals , Laplace Transforms, Vector Calculus and Functions of a complex variable including contour integration and able to apply to all their Engineering problems.
- 7] solve the problems of electrical engineering, mechanical engineering, applied mechanics etc with the help of System of linear equations.
- 8] expand functions in a Fourier series and apply in Engineering problems.
- 9] apply series solution of certain special types of differential equations like Bessel's differential equations ,Legendre differential equations in the field of engineering and on study of complex variables.

## **Module 1: Calculus of Functions of One Variable:**

Successive differentiation, Libnitz's theorem (without proof). Rolle's theorem, Mean value theorem and Taylor's theorem. Fundamental theorems of integral calculus, elementary reduction formulae for integrals. Applications to length, area, volume, surface area of revolution, moments and centers of gravity. Infinite Series : Convergence, divergence, comparison test, ratio test, Cauchy Leibnitz's theorem, absolute and conditional convergence. Expansions of functions into Taylor and Maclaurin series. (10 Lectures)

## **Module 2: Calculus of Functions of Several Variables :**

Multivariate functions covering, limits, continuity and differentials, partial derivatives, maximum-minimum problems, Lagrangians, Chain rule; Double integrals, iterated integrals, triple integrals, line integrals, simple connected regions, Green's theorem; Path independence, surface integrals, Stokes theorem; Fourier series and integral, Dirichlet conditions, Parseval's identity. The convolution theorem. (10 Lectures)

**Module 3 : Differential equations :** of higher order, existence and uniqueness of solutions; Some engineering applications (mechanics and electric circuits); Numerical methods for solutions; General Linear Differential Equation of order n; Linear Operators; Fundamental theorem on linear differential equations; Solutions for constant coefficients; The nonoperator techniques; The complementary solution of homogeneous equation, the particular solution; Method of reduction of order and inverse operators; Linear equations with variable coefficients; Simultaneous differential equations; Applications. (12 Lectures)

**Module 4: Laplace Transforms:**

Transforms of elementary functions, transforms of derivatives and derivatives of transforms, inverse transforms, transforms of periodic functions, unit step function, shifting theorems, solutions of ODE's using Laplace transforms. (8 Lectures)

**Books & References:**

- 1) Advanced Engineering Mathematics- H. K. Dass, S. Chand & Comp.
- 2) Engineering Mathematics-B,S, Grewal, Khanna Publisher.
- 3) Engineering Mathematics- K.C. Das & B. K. Pal, U. N. Dhur & sons-Vol. I, II, III
- 4) Thomas G.B and Finney, R. L. “ Calculas and Analytic Geometry”, 6<sup>th</sup> Adition- Wesley/Narosa, 1985 Piskunov, “ Differential and Integral Calculus”, Vol-I & II, Mir Publishers, Moscow, 1979.

# **Applied Physics-I**

(BS-102)

Outcome: After completing the course in Applied Physics-I, the students will be able to,

1. Conceptualize the fundamentals of Mechanics, Properties of Matter and Acoustics , Kinetic Theory and thermodynamics and Physical Optics
2. Solve the numerical problems related to Mechanics, Properties of Matter and Acoustics , Kinetic Theory and thermodynamics and Physical Optics
3. Apply and relate the concepts of Mechanics, Properties of Matter and Acoustics, Kinetic Theory and thermodynamics and Physical Optics to Engineering problems
4. Analyze and solve problems of Engineering and Technology using the concepts of Mechanics, Properties of Matter and Acoustics , Kinetic Theory and thermodynamics and Physical Optics

## **Module-1: Mechanics-**

(Lecture Hours = 10)

Rectangular Cartesian Coordinate system, Plane Polar Coordinate System, Spherical Polar Coordinate system, Unit Vectors, Position Vectors, Velocity, Acceleration in Plane Polar and Spherical Polar Coordinate System, Frame of Reference, Inertial and Non Inertial frames including Rotating Frames, Pseudo Forces

Motion under Central Force, Law of Conservation of Energy in Central Motion, Nature of Orbital Motion under a Central Force Field, Application to attractive inverse square law of force.

## **Module-2: Properties of Matter & Acoustics-**

(Lecture Hours = 10)

Surface Tension and Surface Energy, Excess Pressure acting on curved liquid membrane, Capillary Rise and Capillary fall in a Capillary tube, Equation of Continuity, Bernoulli's Theorem and its application in Venturi Meter and Pitot's Tube, Stream Line and Turbulent Flow of Liquid and concept of critical velocity and Reynold's Number, Poiseuille's Equation and its applications, Stoke's Theorem and its Application

Elastic After effect, Elastic Hysterisis and Elastic fatigue, Working Stress and factor of Safety, Factors effecting Elasticity, Torsional Pendulum.

Superposition of two perpendicular SHM with different Phase, Damped SHM (Equation and its form in Critical damping, Light damping and Heavy damping), Amplitude Resonance, Velocity Resonance(Response) and energy Intake, Q- Factor and Sharpness of Resonance, Intensity and Loudness (Concept of bel, decibel, Phon, Intensity measurement scales ).

Sound Absorption and Reverberation, Sabine's Formula and its application, Auditorium acoustics, Properties of Ultrasonics, Production, Detection and Application of Ultrasonic Waves.

### **Module-3: Kinetic Theory & Thermodynamics-**

(Lecture Hours = 10)

Brownian Motion, Distribution of Brownian Particles in a Isothermal Column and determination of Avagadro's Number, Maxwell-Boltzmann's law of distribution of velocities, Derivation of r.m.s velocity and most probable velocity using Maxwell-Boltzmann's law.

Reversible, Irreversible, Quasi static and Cyclic Process, Carnot's reversible Heat Engine and its efficiency, Statement, proof and application of Carnot's Theorem, Heat Pump and Refrigerator (concept, working, efficiency), Thermodynamic application in Seebeck, Peltier & Thompson effect.

Physical and statistical interpretation of Entropy, Calculation of entropy change for reversible, irreversible and cyclic process, Third Law of Thermodynamics, Additive nature of entropy, Maxwell's thermo dynamical Relations (only mathematical form and application), Four fundamental Thermodynamic Potentials (Internal Energy, Helmholtz Free Energy, Gibb's Potential, Enthalpy) and their inter relationships

### **Module-4: Physical Optics-**

(Lecture Hours = 10)

Interference: Coherent Light sources, Conditions for Constructive and Destructive Interference, Fresnel's Biprism, Newton's ring, Interference on thin film, Natural Example

Diffraction: Fraunhofer and Fresnel's Diffraction. Zone plate. Plane transmission grating, Dispersive power, Resolving power, Rayleigh Criterion.

Polarization: Polarized and Un polarized Light, Double Refraction, Nicol Prism, Quarter and Half wave Plate, Detection and Production of different types of polarized light, Optical and specific rotation.

Text/Reference Book:

1. D.S Mathur, Mechanics: by S.Chand.
2. C.L Arora(2015), Refresher Course in Physics, By S.Chand.
3. C.R. Dasgupta, Hand Book of Engineering Physics by Central Publisher.
4. Datta and Joshi, *Engg. Physics*, by .Mc Graw Hill



# Chemistry-I

(BS 103)

## Course Outcome:

After completion of the course, students will be able to

- Apply new emerging concepts of chemical science in the field of Engineering.
- Identify various analytical techniques for waste water treatment (Municipal / Industrial effect)
- Judge the quality of water sample from any locality.
- Analyse the rural and urban water sample.
- Synthesis various types of polymers by blending their properties.
- Apply the properties of surfactant in MoF- based polymers for active  $H_2$  –adsorption.
- Innovate various MoF- based adsorbants in the field of Research- work.
- Apply various spectroscopic techniques in detection of nature of bonds and functional groups in Organic / inorganic molecules.
- Design the structure of molecules (organic /inorganic) by the use of special study.

**Module 1:** Water conveying, Types of hardness- Units, Determination of hardness by EDTA method, Alkalinity of water and its significance, Numerical problems. Softening methods and Numerical problems based on these methods; Problems with Boiler feed water and its treatments, Specifications for drinking water (BIS and WHO standers), Chlorination of water; Sources and quality of drinking water, concept of water drainage systems; concept of water harvesting storage and recycling; Nature and uses of sludge obtained on treatment of municipal and industrial effluent water, role of a-forestation for eater recycling; toxicity of water; Sources of water pollutants, water pollution through analytical laboratories in schools, colleges and universities, measures for minimization and recycling of laboratory waste water. (12 Lectures)

**Module 2:** Polymers & Composites conveying, Basics of Polymer Chemistry, Methods of polymerization, Thermoplastics and Thermo-sets, Copolymerization, Elastomers-Structure, Applications, Advanced polymeric materials; Conducting polymers, Liquid crystal proprieties, degradable polymer materials, solubility of polymeric molecules. Physicochemical properties of polymers; Fabrication of polymers-Compression/ Injection/ Extrusion moulding.Synthesis, Properties and Uses of PE, PVC, PMMA, Formaldehyde resins; Melamine-formaldehyde-urea resins, adhesives and their adhesive mechanism; Composites- Basics of composites; Metallic and non-metallic fillers, molecular and oligomerization mechanism, nano-composites. ( 12 Lectures)

**Module 3 :** Surfactants and Lubricants covering, Surface active agents- Methods of Preparation of soap, Cleaning mechanism, Types and advantages of detergents; Critical miceller concentration, hydrophilic and hydrophilic interaction. Fricoohestiy of surfactant solutions, HLB values; Lubricants- Concept of tribology; Types of lubricants and Mechanism of lubrication,

Physical and Chemical properties of lubricants, Additives of lubricants, Selection of lubricants, freezing points of lubricants. (08 Lectures)

**Module 4** : Instrumental Techniques covering, Fundamentals of Spectroscopy; Principles and applications of UV-visible, IR & Atomic absorption Spectroscopy; Flame photometry; Principles and applications of chromatographic techniques Gas, Column, HPLC. NMR & DSC working. ( 08 Lectures).

**Text/ reference Books:**

1. Shashi Chawla , a Text Book of Engineering Chemistry, Dhanapat Rai Publishing Co.
2. Chemistry for Engineers, Dr. amsika singh, Dr. S. Vairam, Dr. s. Ramesh- publishers- Willey- India.
3. Jain and Jain (2006), Engineering chemistry, Dhanpat Rai Pulishing Co.
4. Engineering Chemistry, o. G. Palanna, Mc. Graw hill.
5. A text book of Engineering Chemistry, Dr. Sunita Ratan Prof. S. K. Katari & sons.
6. Engineering Chemistry with Laboratory Experiments. By. M. S. kaurav. PHI Learning private Limited.
7. International journal of Environment Analytical Chemistry, Vol. 91(3), 2011.pp.272-279
8. Chemistry education journal Vol. 13, No.2, 2009, reg. No. 13-12-28,

# Engineering Graphics

## (ES 101)

### Course Outcome: -

After the completion of the Engineering Graphics course, a student will be able to

1. Analyze plain, diagonal and vernier Scales.
2. Demonstrate projections of lines, planes & solids.
3. Develop sectional views of right angular solids like Prism, Cylinder, Pyramid & Cone.
4. Develop isometric views of Lines, Planes, Simple and Compound Solids.
5. Analyze the conversion of Isometric Views to Orthographic Views and Vice-versa,

**Module 1: Introduction to Engineering Drawing:-** Principles of Engineering Graphics and their significance, Usage of drawing instruments, Lettering, Conic sections including the Rectangular Hyperbola, Cycloid and Involute, Scale :- Plain ,Diagonal and Vernier Scales.

(6 Periods)

**Module 2: Orthographic Projections: -** Principles of Orthographic Projections, Conventions, Projections of Points and Lines (all types), Projections of Planes:- Inclined Planes & Auxiliary Planes, Projection of Solids (all types).

(10 Periods)

**Module 3: Sections and Sectional Views of Right Angular Solids:-** Prism, Cylinder, Pyramid, Cone in different views; Development of surface of Right Regular Solids- Prism, Pyramid, Cylinder and Cone.

(10 Periods)

**Module 4: Isometric Projections:-** Principles of Isometric projection, Isometric Scale, Isometric Views, Isometric views of Lines, Planes, Simple and Compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions.

(12 Periods)

### Text/ Reference Books:

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

# Applied Physics Laboratory- I

(BS 104)

## Course Outcome:

1. Determine the Least Count and Error of different Measuring Instruments and will be able to compensate the Instrumental error.
2. Take readings with the help of different Measuring Instruments.
3. Set up the experiment, record the experimental data, perform the calculations, perform error calculations and to obtain a conclusion for the performed experiment.
4. Represent experimental data graphically, interpret the nature of graph, obtain results graphically and compare it with theoretical/analytical results.
5. Recording and presentation of experimental data.
6. Design experiment for verification of theoretical laws/postulates/formulas etc.
7. Recording and presentation of experimental data.

## Course Details:

1. To determine Refractive Index of a transparent liquid using Traveling Microscope.
2. To determine combined focal length of lens combination using U-V method.
3. To determine Young's Modulus of a wire using Searle's method.
4. To determine Rigidity Modulus of a wire using Torsional Pendulum method.
5. To determine refractive index of the material of the prism using Spectrometer.
6. To draw  $i$  vs  $\delta$  curve for a prism, using spectrometer, and hence to determine position of minimum deviation for the same.
7. To determine Surface Tension of a liquid using Capillary rise method.

## Text/Reference Book:

1. D.Chattopadhyay, P.C. Rakshit, *An Advanced Course in Practical Physics Vol I* By Central Book Agency
2. C.R.Dasgupta, *Bsc Practical Physics Vol. I*, by Central Publisher.

## **Engineering Graphics Practice** **(ES 102)**

**Course Outcome: -**

After the completion of the Engineering Graphics Practice course, a student will be able to

1. Measure the distance with the help of plain, diagonal and vernier scales.
2. Draw the projections of lines, planes & solids.
3. Develop sectional views of right angular solids like Prism, Cylinder, Pyramid & Cone.
4. Represent isometric views of Lines, Planes, Simple and Compound Solids.
5. Convert from Isometric View to Orthographic View and Vice-versa.

**Course:** Related Graphics Practice in connection with the syllabi of Engineering Graphics (ES 101)

# **Engineering Workshop**

**(ES 103)**

**Course Outcome: -**

After the completion of the Engineering Workshop course, a student will be able to

1. Differentiate welding, brazing and soldering.
2. Identify Lathe, Drilling Machine, Shaper Machine, Planner Machine, Milling Machine and Grinding Machine.
3. Prepare joints like Half Lap Joint, Mortise & Tenon Joint, Single Bracket, Dovetail Joint and T-Lap joint.
4. Demonstrate concept of cold & hot working process.
5. Demonstrate the workshop safety rules.

**Welding Shop:** - Introduction to common welding instruments & equipments, Familiarization with different welding processes, Preparation of Single butt weld joint with Manual Metal Arc Welding process / Gas Welding process. Introduction to Soldering & Brazing. Safety awareness, rules & equipments.

**Machine Shop:** - Study of Different types of General Purpose Machines (Lathe, Drilling Machine, Shaper Machine, Planner Machine, Milling Machine, Grinding Machine) and their operation. Safety awareness, rules & equipments.

**Fitting Shop:** - Introduction to different types of fitting shop tools and equipments. Familiarization with metal cutting, dimensioning, marking, filing, thread cutting etc. Safety awareness, rules & equipments.

**Carpentry Shop:** - Introduction to different types of carpentry tools and equipments. Preparation of different joints like Half Lap Joint, Mortise & Tenon Joint, Single Bracket, Dovetail Joint, T-Lap joint, etc. Safety awareness, rules & equipments.

**Smithy Shop:** - Introduction to different types of Smithy tools and equipments. Concept of cold & hot working process. Safety awareness, rules & equipments.

References:-

1. Instruction sheet with sketch/drawing provided from shop – in- charge.
2. NPTEL web or video courses on related shop activities.

# Second Semester

## Sociology & Elements of Indian History for Engineers

(HS 202)

### Outcome:

- 1) To develop understanding of sociological concepts, structure and organization in engineering perspective.
- 2) To realize contemporary issues and problems in Indian Society.
- 3) To identify social changes in Indian with effect from modernization, globalization, secularism and communalism.
- 4) To understand Indian social divisions like Industrial, Urban, Agrarian, Tribal society.
- 5) To identify Archeology, Numismatic, Epigraphy & Archival research as forces of Indian history.
- 6) To understand periodization and evolution of urbanization process.
- 7) To identify issues and concern of post-colonial India.

### **Module-I**

Introduction to sociological concepts-structure, system, organization.

Understanding social structure and social processes. (8 Lectures)

### **Module-II**

Political economy of Indian society, Industrial, Urban, Agrarian and Tribal society.

Social change in contemporary India: Modernization and globalization, Secularism and communalism.  
(8 Lectures)

### **Module-III**

Introduction to Elements of Indian History: What is History?; History sources- Archaeology, Numismatics, Epigraphy & Archival research.

Indian history & periodization, evolution of urbanization process: first, second & third phase of urbanization.  
(12 Lectures)

## **Module-IV**

From feudalism to colonialism- the coming of British; Modernity & struggle for independence.

Issues & concerns in post-colonial India (up to 1991); Issues & concerns in post-colonial India 2<sup>nd</sup> phase  
(LPG decade post 19+91) (12 Lectures)

### **Text/ Reference Books:**

Sociology:

1. Giddens, A(2009), Sociology, Polity, 6th edn.
2. Xaxa, V(2008), State, Society and Tribes Pearson.
3. Chandoke, Neera & Praveen Priyadarshi(2009), contemporary India: Economy, Society and Politics, Pearson.
4. Mohanty, M(ed.) (2004), Class, Caste & Gender-volume 5, Sage.
5. Ramaswamy, E.A. and Ramaswamy,U(1981), Industry & labour, OU Press.

History

1. Guha, Ramchandra(2007), India after Gandhi, Pan Macmillan.
2. Sharma R. S..(1965), Indian feudalism, Macmillan.
3. Gadgil, Madhab & Ramchandra Guha(1999)-This Fissured Land: An Ecological History of India, OU Press.



# Object Oriented Programming using C++

(ES 204)

## **Course Outcome:**

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

CO-1: Differentiate between class and object.

CO-2: To implement constructors and destructors in object oriented programming.

CO-3: Perform overloading of operators in object oriented programming using C++.

CO-4: Design the structure of inheritance and polymorphism in solving real life problems.

CO-5: Design generic templates for a given practical scenario.

CO-6: Understand the concept of exception handling mechanisms in C++.

CO-7: Handle file operations in object oriented programming concepts.

## **Module-1:**

**Introduction:** Basic features & concepts of Object Oriented Programming, (OOP), Benefits and applications of OOPs, Structure of a C++ Program.

**Tokens, Expressions and Control Structures :** Tokens, Keywords, Identifiers, Constants, Basic Data types, User-defined Data types, Derived Data Types, Symbolic Constants, Dynamic Initialization of variables, Reference Variables, Scope Resolution Operators, Memory Management Operators, Manipulators, Type Cast Operators, Expressions and their types, Operator Overloading, Control Structures.

**Functions in C++:** Main function, function prototyping, call by reference, inline functions, default functions, default and constant arguments, function overloading

## **Module-2:**

**Classes and Objects:** General Overview of class and objects, Specifying a class, defining member functions within a class, class implementation, Nesting member Function, private member functions, array within a class, local classes, interface class, abstract classes, Declaration of Objects, memory allocation for objects, arrays of objects, objects as function arguments, returning objects, pointers to members, accessing of members, Dynamic initialization of objects.

**Overview of C++ basic structures:** Main() function, C++ data types, expressions and statements, standard Input/Output, control statements in C++, functions and scope, structure. General overview of objects and classes, separate interface from Implementation, accessing of members, constructors, destructors, declaring Objects, friend function and friend class.

**Constructors & Destructors:** Constructors, Parameterized Constructors, Constructors with Default arguments, Dynamic Initialization of objects, Dynamic Constructors & Destructors, copy constructors.

**Operator Overloading & Type Conversion:** Definition & Rules of overloading Operators, Overloading Binary & Unary Operators, Type conversion, Data Abstraction, Data Encapsulation.

## **Module-3:**

**Inheritance:** General overview of inheritance, including base classes and derived classes, subclasses, public/protected/private inheritance, constructors and destructors in derived classes, and using member functions, Categories of inheritance, and abstract classes. Definition, single, multilevel, multiple, hierarchical and hybrid inheritance, virtual base classes, abstract classes

**Pointers, Virtual Functions and Polymorphism:** Introduction to Pointers, Significance of pointers in OOP, Pointers to Objects and derived classes, virtual functions, Pure virtual functions, free store allocation /de-allocation, Polymorphism in C++, Dynamic binding and abstract base class in C++, String characteristics in C++, creating string Objects, manipulating string objects.

#### **Module-4:**

**Generic Programming:** Introduction to Templates, Class Templates with multiple parameters, Function Templates, Overloading of Template Functions, Member Function Templates, namespaces.

**Exception Handling:** Exception handling Mechanisms, Throwing and catching mechanism in exception handling Re-throwing an exception, specifying exceptions, Design and Analysis of Object-Oriented Programming, prototyping paradigm.

**File handling:** File handling functions, classes and concepts, Types of files and their operations, classes for File Stream Operations, Opening and Closing a File, File Pointers and their Manipulations, Sequential Input and Output Operations, Error Handling During File Operations, Types of Error, Logical error, debugging, Command Line Arguments for C++.

#### **Books/References:**

1. *Programming: Principles and Practice using C++ - Bjarne Stroustrup.*
2. *C++ programming -Robert Leffore.*
3. *An introduction to Object Oriented Programming with C++ - Timothy Budd.*
4. *Object Oriented Programming with C++ - Balaguruswamy.*
5. *Thinking in C++: Introduction to standard C++ - Bruce Eckel.*
6. *The C++ Programming Language – Bjarne Stroustrup.*
7. *Accelerated C++ - Practical programming by example- Andrew Koenig.*

# Engineering Mathematics-II

(BS 205)

## Course Outcomes:-

After successful completion of this course, a student will be able to-

- 1] apply matrix in solution of linear equations, in computer graphics and cryptography .
- 2] apply vectors in higher dimensional space in experimental data, electrical circuits, graphical images, economics, mechanical systems and in physics.
- 3] use Eigen values and Eigen vector in Control theory, vibration analysis, electric circuits, advanced dynamics and quantum mechanics.
- 4] apply linear transformation in computer graphics, cryptography, thermodynamics etc.
- 5] analyse functions of complex variables which helps in solving many complex problems in heat conduction, fluid dynamics and electrostatics.
- 6] create application capability of mathematics in their respective branches of engineering and technology, inculcate the habit of mathematical thinking.

**Module 1: Linear Mathematics :** Matrices (types and operations including elementary row and column operations), inverse; Determinants (rules of computation); Linear Equations and Cramer's rule; Vector space (concepts of span/basis/dimension); Eigen values and Eigen vectors; Linear Programming (Graphical and Simplex solution); First order Difference equation (First order equations and solution). (08 Lectures)

**Module 2: Complex Numbers :** Functions Analysis including limits and continuity, derivatives; Cauchy Riemann Equations; Integrals, Cauchy theorem and Cauchy integral formulae; Analytic Functions; Taylor's series, Singular points and poles; Laurent's Series, Residues, Residue Theorem; Conformal mapping, Riemann's mapping theorem; Some general transformations, mapping a half plane into a circle; The Schwarz-Christoffel transformation; The solution of Laplace equation by conformal mapping. (10 Lectures)

**Module 3: Beta, Gama and other Special Functions :** The Gama function, values and graph, asymptotic formula for the Beta function – Dirichlet integral; Other special functions – Error function, exponential integral, sine and cosine integrals, Bessel's differential equation and function (first and second kind), Legendre differential equation and polynomials; Some applications. (10 Lectures)

**Module 4: Vector Calculus:** Laws of vector algebra, operations- dot, cross, triple products; Vector function – limits, continuity and derivatives, geometric interpretation; Gradient, divergence and curl – formulae; Orthogonal curvilinear coordinates; Jacobians, gradient, divergence, curl and Laplacian in curvilinear coordinates; Special curvilinear coordinates. Gauss's divergent theorem, Green's theorem, Stoke's theorem. (12 Lectures)

## Books & References:

- 1) Advanced Engineering Mathematics- H. K. Dass, S. Chand & Comp.
- 2) Engineering Mathematics-B,S, Grewal, Khanna Publishers
- 3) Engineering Mathematics- K.C. Das & B. K. Pal, U. N. Dhur & sons-Vol. I, II, III
- 4) Thomas G.B and Finney, R. L. "Calculus and Analytic Geometry", 6<sup>th</sup> Edition- Wesley/Narosa, 1985 Piskunov, "Differential and Integral Calculus", Vol-I & II, Mir Publishers, Moscow, 1979

# **Applied Physics-II**

(BS 206)

**Course Outcome:** After completing the course in Applied Physics-II, the students will be able to,

1. Conceptualize the fundamentals of Classical Mechanics, Special Theory of relativity, Electronics, E M Theory, LASER and Fiber Optics
2. Solve the numerical problems related to Classical Mechanics, Special Theory of relativity, Electronics, E M Theory, LASER and Fiber Optics
3. Apply and relate the concepts of Classical Mechanics, Special Theory of relativity, Electronics, E M Theory, LASER and Fiber Optics to Engineering problems
4. Analyze and solve problems of Engineering and Technology using the concepts of Classical Mechanics, Special Theory of relativity, Electronics, E M Theory, LASER and Fiber Optics

## **Module-1: Classical Mechanics & Special Theory of Relativity-** (Lecture Hours = 10)

Lagrangian Formulation: Constraints, Degrees of Freedom, Generalised Coordinates, Principle of Virtual work, D' Alembert's Principle and its application, Lagranges Equation for Conservative system with applications, Cyclic Coordinates, Symmetries and Laws of Conservation, Hamilton's Principle: Statement and its deduction and application to simple cases, Hamiltonian Mechanics: Hamilton's Equation of Motion, Statement and simple derivation  
Michelson–Morley Experiment, Postulates of Special Theory of Relativity, Lorentz Transformations, Velocity transformation (velocity addition), Length contraction , Time Dilation, Relativity of Simultaneity, Relativistic variation of Mass , Mass Energy relation

## **Module-2: Electronics-** (Lecture Hours = 10)

Semiconductor theory: Energy Levels, Crystals, Formation of Energy Band, Conduction in crystals, Intrinsic semiconductor, Doping, Extrinsic Semiconductor (n-type & p-type)

PN junction diode: the unbiased diode, the energy hill, forward biased & reverse biased diode: the ideal forward biased & reverse biased diode curve, reverse resistance, diode capacitance, Zener & Avalanche breakdowns, the Zener diode

Diode Circuits: the Half- wave Rectifier, the Full- wave Rectifier, the Bridge Rectifier, the Choke input filter, the Capacitor input Filter, RC and LC filter, Voltage regulation, the Zener regulator, the Clipper, the Clamper

Bipolar Transistors: the NPN and PNP transistors, the unbiased transistor, transistor as combination of diode, FF and RR bias, forward-reverse bias, the CE configuration, transistor curves, simple voltage Amplifier

Transistor Biasing: Base Bias, Voltage divider Bias, the CE configuration, Collector feedback Bias, Emitter Bias.

**Module-3: EM Theory and Radio Communication-**

(Lecture Hours = 10)

E.M Theory: Gauss's Law, Displacement current and equation of continuity, Maxwell's Equations, Concept of Polarization; Dipole moment, Electric Field due to dipole, Lorentz Relation. Basics of Radio communication (Ground Wave, Space wave, Radio Horizon, Shadow zone, Duct Propagation, Antenna Height), Layers of Ionosphere and variation of electron density, Virtual Height and critical frequency of an ionosphere layer

**Module-4: Laser and Fiber Optics-**

(Lecture Hours = 10)

Laser : Fundamentals, Energy level in atoms, Absorption, Spontaneous and Stimulated emission, Population Inversion. Einstein's A,B Coefficients, Metastable state, Lasing Action.

Different types of Laser:-He-Ne Laser, Ruby Laser, Semiconductor Laser, Application of Laser in CD writing , printers, Holography, Surgery, Optical Signal Processing.

Fiber optics: Introduction, Optical fibre as a dielectric wave guide- total internal Reflection, Various Optical fibre parameters, step index, graded index, loss in Optical Fiber, Application of Optical fiber.

**Text/Reference Book:**

1. Datta and Joshi, *Engg. Physics*, by .Mc Graw Hill
2. Devraj Singh, *Engg. Physics*, Vol. I, by Danpat Rai And Co.
3. Vishwakarma, *Applied. Physics*, by Wiley
4. A.Bhattacharjee, *Undergraduate Physics Vol. II* by New Central Publisher.
5. C.L Arora(2015), *Refresher Course in Physics Vol II*, By S.Chand.

# Chemistry-II

(BS 207)

## Course Outcome:

- Apply various chromatographic techniques in separation of components from Organic / Inorganic mixtures.
- Detect new organic molecules in the field of Research- work by chromatographic – separation techniques & spectral study.
- Identify various corrosion-protection methods.
- Apply various corrosion methods to stop natural corrosion.
- Design various energy cells.
- Apply the properties of various nano materials in the field of catalysis, medicine & Energy Science.
- Design models related pollution control.

**Module 1:** Electrochemistry and corrosion: Conductance, cell constant and its determination; Single electrode potentials, Electrolytic and galvanic cells, EMF series, Nernst equation, Cell emf measurement, Reversible and irreversible cells; definition of corrosion, direct chemical corrosion, Electrochemical corrosion and its mechanism; Different types of electrochemical corrosion. Factors affecting corrosion, Protection of corrosion, Applications with few practical problems of corrosion. ( 12 lectures)

**Module 2:** Fuels: Types of fuels, Calorific value, determination of calorific value, numeric problems based on it. Analysis of coal, refining of petroleum, Liquid fuels, Knocking and antiknock agents, octane and cetane values, cracking of oils, Alternative sources of Energy- Limitation of fossil fuels, nonconventional sources of energy- Solar, hydropower and biomass. Advantages and disadvantages: Nuclear Energy production from nuclear reactions. Nuclear waste disposal, Safety measures of nuclear reactors. Fundamentals of primary cells, Ni-Cd , Ni-hydride, Li-ion batteries; Fuel cells principles, applications, advantages/ disadvantages. (12 lectures )

**Module-3:** Nanomaterials: Introduction, Fullerenes, carbon nanotubes, nanowires, Electronic and mechanical properties, synthesis and characterization techniques of nanomaterials, Top down and bottom up approach; Applications of Nanomaterials- catalysis, medicines, Energy sciences. (08 lectures)

**Module 4:** Environmental chemistry: Air pollution, Noise pollution, Water pollution, Determination and Significance of COD and BOD Solid waste treatment and collection of NKP, Greenhouse effect and Global warming, e-waste and radioactive pollution: Role of electromagnetic radiation in global warming. (08 lectures)

**Text/ reference Books:**

1. Shashi Chawla , a Text Book of Engineering Chemistry, Dhanapat Rai Publishing Co.
2. Chemistry for Engineers, Dr. amsika singh, Dr. S. Vairam, Dr. s. Ramesh- publishers- Willey- India.
3. Jain and Jain (2006), Engineering chemistry, Dhanpat Rai Pulishing Co.
4. Engineering Chemistry, o. G. Palanna, Mc. Graw hill.
5. A text book of Engineering Chemistry, Dr. Sunita Ratan Prof. S. K. Katari & sons.
6. Engineering Chemistry with Laboratory Experiments. By. M. S. kaurav. PHI Learning private Limited.
7. Intrnational journal of Environment Analytical Chemistry, Vol. 91(3), 2011.pp.272-279
8. Chemistry education journal Vol. 13, No.2, 2009, reg. No. 13-12-28,

# **Engineering Mechanics**

**(ES 205)**

## **Course Outcome: -**

After the completion of the Engineering Mechanics course, a student will be able to

1. Differentiate Coplanar, Concurrent & Non-concurrent forces and their resultants.
2. Analyze simple truss, compound truss, frame & virtual work.
3. Explain centroid of simple figures, centre of gravity, moment of inertia of composite sections & mass moment of inertia of Circular plates, Cylinder, Cone, Sphere & Hook.
4. Analyze D'Alembert's principle, its application & kinetics of rigid body rotation.
5. Differentiate Longitudinal, Transverse, Torsional and Damped vibrations.

**Module-1 Fundamentals of Engineering Mechanics :-** System of Forces, Coplanar, Concurrent & Non-concurrent forces and their resultants, Components in space, Moment of Forces and its application, Couples, Free body diagrams, Equilibrium of system of forces for Coplanar and Spatial systems of forces. Friction - Laws of friction and related definitions, Surface contact problems, Motion of bodies, Wedges, Sliding friction and Rolling resistance.

(10 Periods)

**Module-2 Trusses, Frames & Virtual Work :-** - Rigid & Non-rigid trusses, Analysis of by method of joints and by method of sections, Compound truss (statically determinate), Analysis of Frames. Virtual Work- Virtual displacements, Principle of virtual work for particles and ideal system of rigid bodies, Degrees of freedom.

(8 Periods)

**Module-3 Centre of Gravity & Moment of Inertia:-** Centroid of simple figures and composite sections, Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections, Theorems of moment of inertia, Moment of inertia of Standard Sections and Composite Sections; Mass moment of inertia of Circular plates, Cylinder, Cone, Sphere, Hook.

(10 Periods)



**Module-4 Dynamics & Mechanical Vibrations :-** Dynamics - Basic terms & General principles of dynamics, Types of motion, Instantaneous centre of rotation in plane motion, D'Alembert's principle and its application, Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation. Vibration - Basic concepts of Longitudinal, Transverse and Torsional vibrations, Free & Forced vibration, Resonance and its effects, Damped vibration. (12 Periods)

**Text/Reference Books:**

1. Hibler and Gupta (2010), Engineering Mechanics (Statics, Dynamics) by Pearson Education.
2. Bansal R.K. (2010), A Text Book of Engineering Mechanics by Laxmi Publications.
3. Irving, H.Shames, Engineering Mechanics-Statics and Dynamics, by Prentice-Hall of India.
4. Khurmi R. S. (2010), Engineering Mechanics, S. Chand & Co.
5. NPTEL web or video courses on Engineering Mechanics.
6. Timoshenko & D.H.Young, Engineering Mechanics, Tata McGraw-Hill publishing Co. Ltd.

## Applied Physics Laboratory- II

(BS 208)

### Course Outcome:

1. Determine the Least Count and Error of different Measuring Instruments and will be able to compensate the Instrumental error.
2. Take readings with the help of different Electrical Measuring Instruments.
3. Make circuits on Bread Board/ with the help of Meter Bridge.
4. Read Color Code of Resistance.
5. Use Transistor and Diode manuals functionally.
6. Connect CRO to the circuit and to study the output and input analytically.
7. Set up the experiment, record the experimental data, perform the calculations, perform error calculations and to obtain a conclusion for the performed experiment.
8. Represent experimental data graphically, interpret the nature of graph, obtain results graphically and compare it with theoretical/analytical results.

### Course Details:

1. To convert a given galvanometer into Ammeter and Voltmeter of desired range.
2. To determine unknown resistance using Meter Bridge.
3. To verify Laws of Series combination and Laws of parallel combination of resistors using Post Office Box.
4. To draw the characteristic curve of a PN junction Diode.
5. To draw the characteristic curve of a Zener Diode.
6. To determine Horizontal component of Earth's Magnetic field using Deflection and Vibration Magnetometer.
7. To draw the characteristic curve of semiconductor diode, when it is forward biased, and hence to determine its AC and DC resistance for a given current.
8. To study the performance of Half Wave rectifier and Full Wave rectifier using semiconductor diode.

### Text/Reference Book:

1. D. Chattopadhyay, P.C. Rakshit, *An Advanced Course in Practical Physics Vol II*, By Central Book Agency
2. C.R.Dasgupta, *Bsc Practical Physics Vol. II*, by Central Publisher.

# **Chemistry Laboratory**

(BS 209)

## **Course Outcome:**

- Analyse the rural and urban water sample.
- Synthesis various types of polymers by blending their properties.
- Apply various spectroscopic techniques in detection of nature of bonds and functional groups in Organic / inorganic molecules.
- Apply various chromatographic techniques in separation of components from Organic / Inorganic mixtures.
- Detect new organic molecules in the field of Research- work by chromatographic – separation techniques & spectral study.

Total Hardness of water; Determination of carbonate and non carbonate hardness of water sample; Determination of alkalinity of water sample; Chloride Content in water; Saponification Value of an Oil; Acid value of an Oil; Flash Point by Abel's apparatus; Flash Points by Pensky-Marten's Apparatus; Demonstration of TLC/ Paper chromatographic.

(10 session)

# **Object Oriented Programming Laboratory**

## **(ES 206)**

### **Course Outcome:**

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

CO-1: Implement constructors and destructors in OOP using C++.

CO-2: Design and implement different types of inheritances for any given problem using C++.

CO-3: Demonstrate the effects of different access specifiers in inheritance using C++.

CO-4: Create and manipulate different String Objects using C++.

CO-5: Demonstrate Dynamic binding using the concept of Virtual Function using C++.

CO-6: Tests the use of Command Line arguments in C++ environment.

### **List of topics for Experiments:**

1. Assignments on class, constructor, overloading, overriding with implementation.
2. Assignments on, Pointers, Virtual Functions and Polymorphism, string functions.
3. Assignments on single, multilevel, multiple, hierarchical and hybrid inheritance, virtual base classes, abstract classes.
4. Implementation of Public / Protected / Private Inheritance.
5. Assignments on virtual functions, pure virtual functions, dynamic binding.
6. Assignments on templates, error handling functions.
7. Assignments on creating and manipulating string objects.
8. Assignment on File handlings, different operations on files.
9. Assignment on different Command Line Arguments.