Semester-1	Code	Course Name	L	T	P	Credits
	BSC-111	Engineering Mathematics-I	3	1	0	4
	BSC-112	Physics	3	1	2	5
	HSMC-111	English	3	0	2	4
	ESC-111	Programming for problem solving	3	0	2	4
	ESC-112	Engineering graphics & Design	1	0	4	3
	MC-111	Environmental Sciences	3	0	0	3
						23

Syllabus: B.Tech Mechanical Engineering

BSC111	MATHEMATICS 1 (Calculus and Linear Algebra)	3L:1T:0P	4 credits

Module 1: Calculus: (6 lectures)

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Module 2: Calculus: (6 lectures)

Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; indeterminate forms and L'Hospital's rule; Maxima and minima.

Module 3: Sequences and series: (10 lectures)

Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Module 4: Multivariable Calculus (Differentiation): (8 lectures)

Limit, continuity and partial derivatives, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl and divergence.

Module 5: Matrices (10 lectures)

Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation.

Suggested Text/Reference Books

G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi,

2008.
Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
A. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
(vii)B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

BSC-112	**Physics**	**3L:1T:2P**	**4 credits**

Physics (PH-101)

Basic Sciences (BS); 4 Credits (3-0-2)

Objective: The aim of the *Applied Physics Subject* is to provide an adequate exposure and develop insight about the basic principles of physics along with the possible applications. The familiarity with the basic principles of physics would help engineers to understand the tools and techniques used in the industry. The Subject provides the necessary foundations for inculcating innovative approaches. While creating awareness about the vital role played by science and engineering in the development of new technologies, the Subject would provide the necessary exposure to the practical aspects, which is an essential component for learning science.

Course outline

S. No.	Topic	Contact Hrs.
Unit 1	**Oscillations:** *Simple harmonic motion (SHM)*: Equation of motion and its solution. Conservation of energy in SHM. Simple pendulum, Physical Pendulum, Bar pendulum, Torsional Pendulum. Superposition of parallel and perpendicular SHMs and their comparison. [APF: Ch-1-3] *Damped Oscillation*: Equations of motion and its general solution, Energy in damped oscillation, Quality factor, Logarithm decrement, Relaxation time. . [APF: Ch-4] *Forced Damped Oscillation*: Equation of motion and its general solution, steady state behavior, Quality factor, amplitude and velocity resonance, Sharpness of resonance. *Examples of Resonance*: Mechanical resonance, Electrical Resonance, Optical resonance, Nuclear Resonance, Nuclear Magnetic Resonance (NMR). [APF: Ch-4]	17
Unit 2	**Physical Optics:** *Interference:* Young's double slit experiment, Production of coherent sources by division of wave front (Fresnel's Biprism) [AG 14.1-14.8], Interference in thin films (Parallel films) [AG 15.1-15.2], Interference in wedge-shaped layers [AG 15.8], Newton's rings [AG 15.10]. *Diffraction:* Types of diffraction, Fraunhofer diffraction due to a single slit [AG 18.1-18.2], Double slit and grating (qualitative) [AG 18.6 -18.7], Resolving Power, Limit of Resolution, Rayleigh Criterion [AG 18.5]. *Polarization:* Malus law, Brewster's law, Double refraction [AG 22.1-22.3].	14
Unit 3	**Electromagnetic Theory:** *Vector Calculus* (DG: Chapter-1: *No proof of theorems required, statements*	17

	of theorems and some simple applications will suffice): *Vector Algebra* (DG: 1.1): Vector Operations, Vector Algebra in component form, Triple Products, Position, Displacement and Separation of vectors. *Differential Calculus* (DG: 1.2): Gradient, The Del Operator, Divergence, Curl, Product Rules, Second Derivatives. *Integral Calculus* (DG*:* 1.3): Line, Surface and Volume Integrals, Fundamental Theorems of Calculus, Fundamental Theorems for Gradients, Divergences and Curls. Integration by Parts. *Curvilinear Coordinates* (DG: 1.4): Spherical and Cylindrical Coordinates. *Electrostatics* (DG: Chapter-2): Coulomb's Law, Electric Field due to discrete and continuous charge distributions, Divergence and curl of electrostatic fields, Gauss's law and its Applications. Concept of electric potential, Relationship between **E** and V, Potential of localized charge distributions. Boundary Conditions, Work and Energy in Electrostatics. The Energy of a continuous charge distribution. Conductors, Induced Charges, Surface Charge and the Force on a conductor. *Magnetostatics* (DJ: Ch-5): Magnetic Fields, Lorentz Force Law [DG: 5.1.1-5.1.2], Currents, line, surface and volume current density, Equation of continuity [DG: 5.1.3], Biot-Savart Law [DG; 5.2], Divergence and Curl of **B** [DG: 5.3], Ampere's Law and its applications [5.3.3]. *Electrodynamics* (DJ: Ch-7, 8, 9): Electromagnetic Induction, Faraday's Law [DJ: 7.2.1], induced electric field [7.2.2], Inductance, mutual inductance, Neumann formula, Self inductance [DJ: 7.2.3]. Energy in magnetic fields [DJ: 7.2.4]. Maxwell's Equations [DJ: 7.3.1-7.3.3]. Poynting's Theorem [DJ: 8.1.2], Momentum and Angular Momentum of electromagnetic fields [DJ: 8.2.4]. Electromagnetic waves in vacuum [DJ: 9.2].	
	Total	48

Text Books:

1. A. P. French [**APF**], Vibrations and Waves, MIT Introductory Physics Series, 1st Ed. (CBS Publisher, 2003).
2. AjoyGhatak [**AG**], *Optics*, 5th Ed. (Tata McGraw Hill, 2013).
3. D.J. Griffiths [**DG**], *Introduction to Electrodynamics*, 4th Ed. (PHI Learning Pvt. Ltd., New Delhi, 2013)

Reference Books:

1. H. C. Verma, Concepts of Physics, Vol-I & II (BharatiBhawan P & D, New Delhi, 2012).
2. N. Subramanyam, BrijLal, M. N. Avadhanulu, A Textbook of Optics, 24th Revised Edition (S. Chand & Co Ltd., New Delhi, 2010).
3. F. S. Crawford, *Waves: Berkeley Physics Subject* (Vol-3) (Tata McGraw Hill Education).
4. S. Mani Naidu, Engineering Physics, (Pearson, New Delhi, 2014).
5. E. M. Purcell, *Electricity and Magnetism: Berkeley Physics Subject (Volume - 2)* (Tata McGraw Hill Education, 2011).
6. Mathew N.O. Sadiku, *Principles of Electromagnetics*, 4th Ed., International Version (OUP, New Delhi, 2014).

Physics Lab
List of Experiments

(Lab will be conducted during second semester)

Any ten experiments

Experiment No. 1: Use of measuring instruments
Experiment No. 2: Study of polarization of light by reflection and thus verify Brewster's law
Experiment No. 3: To determine speed of sound with the help of tuning fork.
Experiment No. 4: (a) Determination of the radius of a current carrying coil.
(b) Determination of the magnetic field with the variation of distance along the axis of current carrying coil
Experiment No. 5 :(a) Determination of the co-efficient of viscosity of glycerin by falling sphere method.
(b) Determination of the density of experimental liquid using Steel and Teflon spheres or Glass beads.
(c) To predict the fall time of different sizes spheres of same material.
Experiment No. 6: To study the twist of a wire and hence to determine the modulus of rigidity of the material of wire with the help of torsional pendulum.
Experiment No. 7: To determine the acceleration due to gravity with the help of a compound pendulum.
Experiment No. 8: To demonstrate Seebeck Effect with the help of thermoelectric module.
Experiment No. 9: Determining the value of specific charge e/m of an electron by Thomson Method.
Experiment No. 10: Study of Electronics instruments and law
Experiment No. 11: Study of Radar
Experiment No. 12: Determination of Young's Modulus of elasticity of the given sample material by bending.
Experiment No. 13: Verification of Inverse Square Law.
Experiment No. 14: Verification of Coulomb's Law.
Experiment No. 15: Determination of the moment of inertia of given body using inertia table.
Experiment No. 16: To determine the heat capacity of a bomb calorimeter

(English)Professional Communication I (HSMC-111)

4 Credits (3-0-2)

Objective:

To train students to acquire language skills this will enable them;

1. To acquire effective and appropriate communication skills
2. To understand and acquire the interdependent skills of reading and communication; and
3. To appreciate literature and develop an understanding of how it may contribute to personal growth and advancement

Course outline

S. No.	Topic	Contact Hrs.
Unit 1	**What is Language?** Definition - Components of Language - The Sounds of Language - Units of Meaning - Word Order and Sentence Structure - Meaning in Language – Learning English and Second Language Acquisition	**06**

	(SLA)	
Unit 2	**Lend me your Ear*** Why to listen? – How to listen? – What to listen? - Importance of Active Listening – Constraints on listening in SLA	**08**
Unit 3	**The Talking Ape*** Importance of imitation – Internal monologue to global communication – Power-point presentation skills - Quantity versus quality	**08**
Unit 4	**Step-by-step to Grammar** The sentence – Tenses – Punctuation - Reported speech – Voices	**08**
Unit 5	**Read & write your way up** Reading for Comprehension – Dictionary work – Difference between speech and writing – structure your thoughts- Opening and the end game	**10**
Unit 6	**Belles Lettres (Part one)** Literature and language relationship – Social function of literature – Role of good literature in enriching one's language	**08**
	Total	**48**

Course Outcomes

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. 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:

To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions.

The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.

The tool of power series and Fourier series for learning advanced Engineering Mathematics.

To deal with functions of several variables that are essential in most branches of engineering.

The essential tool of matrices and linear algebra in a comprehensive manner.

ESC-111	Programming for problem solving	3	0	2	4

Programming for Problem Solving **([L : 3; T:0; P : 2 (4 credits)] [contact hrs : 40]**

Detailed contents

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

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - **(1 lecture).**
Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. **(1 lecture)**
From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- **(2 lectures)**
Unit 2:Arithmetic expressions and precedence **(2 lectures)**
Unit 2: Conditional Branching and Loops **(6 lectures)**

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

Unit 3Arrays **(6 lectures)**

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

Unit 4Basic Algorithms **(6 lectures)**

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

Unit 5Function **(5 lectures)**

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

Unit 6Recursion **(4 -5 lectures)**

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

Unit 7Structure **(4 lectures)**

Structures, Defining structures and Array of Structures

Unit 8Pointers **(2 lectures)**

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

Unit 9File handling (only if time is available, otherwise should be done as part of the lab)

Suggested Text Books

(i) Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
(ii) E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Suggested Reference Books

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

Course Outcomes

The student will learn

- To formulate simple algorithms for arithmetic and logical problems.
- To translate the algorithms to programs (in C language).
- To test and execute the programs and correct syntax and logical errors.

- To implement conditional branching, iteration and recursion.
- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
- To use arrays, pointers and structures to formulate algorithms and programs.
- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.
- To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

(ii) Laboratory - Programming for Problem Solving[L : 0; T:0 ; P : 4 (2credits)]

[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.]

Tutorial 1: Problem solving using computers:

Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:

Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:

Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:

Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:

Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings

Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:

Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls

Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation

Lab 11: Pointers and structures

Tutorial 12: File handling:

Lab 12: File operations

Laboratory Outcomes

- To formulate the algorithms for simple problems
- To translate given algorithms to a working and correct program
- To be able to correct syntax errors as reported by the compilers
- To be able to identify and correct logical errors encountered at run time

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- To be able to write iterative as well as recursive programs
- To be able to represent data in arrays, strings and structures and manipulate them through a program
- To be able to declare pointers of different types and use them in defining self- referential structures.
- To be able to create, read and write to and from simple text files.

ESC-112	**Engineering graphics & Design**	**1**	**0**	**4**	**3**

Engineering Graphics & Design [A total of 10 lecture hours & 60 hours of lab.]

[[L : 1; T:0; P : 4 (3 credits)]

Detailed contents

Traditional Engineering Graphics:

Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.

Computer Graphics*:*

Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM)

Module 1: Introduction to Engineering Drawing ***covering,***

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

Module 2: Orthographic Projections covering,

Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

Module 3: Projections of Regular Solids ***covering,***

those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

Module 4:Sections and Sectional Views of Right Angular Solids ***covering,***

Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

Module 5: Isometric Projections **covering,**

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 6: Overview of Computer Graphics ***covering,***

listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

Module 7: Customisation& CAD Drawing

consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

Module 8: Annotations, layering & other functions***covering***

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); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

Module 9: Demonstration of a simple team design project *that illustrates*

Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Suggested Text/Reference Books:

(i) Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
(ii) Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
(iii) Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
(iv) Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
(v) (Corresponding set of) CAD Software Theory and User Manuals

Course Outcomes

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed to address:

- to prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- to prepare you to communicate effectively
- to prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice

The student will learn :

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