NEP-2020

Curriculum Structure & Syllabi

of

B. Tech.

In

Civil Engineering

(w.e.f. 2021-22)

Vision

Mission

Program Educational Objectives

Program Outcomes

Overall Credit Structure

Curriculum

Syllabus

Offered By

DEPARTMENT OF CIVIL ENGINEERING

M. M. M. UNIVERSITY OF TECHNOLOGY,

GORAKHPUR-273010, UP

ABOUT THE DEPARTMENT

The Civil Engineering was established in 1962, since the inception of erstwhile Madan Mohan Malaviya Engineering College, Gorakhpur. The department has, over the years, established its status as a centre for imparting high quality technical education to Undergraduate and Postgraduate students and extending consultancy services to industries and various government departments located in Eastern UP. Besides undergraduate course of (B.Tech.-Civil Engineering), the department offers 4 regular M. Tech. courses in Civil Engineering respectively in Hill Area Development Engineering, Environmental Engineering, Structural Engineering, and Seismic Design and Earthquake Engineering domains. The facilities of doctoral research are also available in the department under QIP/ TEQIP/ University schemes.

The department has experienced and highly qualified faculty members. Further, the strength of the department also lies in the strong linkages, it has with its alumni and various governments/private organizations located in the region. The alumni of the department are well placed in various government/private organizations and are in close contact with the department. The department is continuously interacting with the various government and private organization in the form of consultancy work, expert advice, design projects etc.

Vision: To become a premier centre of learning and research in Civil Engineering, nurturing sustainable development by the year 2025.

Mission:

1. To provide the quality education in the area of civil engineering to transform students into graduates with high professional values.

2. To share and disseminate expertise for use in the solution of problems faced by Civil engineering industry and by society.

3. To insure the continuous improvement in the quality of life of people in the society.

4. To conduct need based research base projects giving priority to the needs of industry.

Programme Educational Objectives (PEO) of B. Tech in Civil Engineering

PEO-1   To enrich the students with state-of-the-art knowledge in the field of Civil Engineering.

PEO-2   To keep abreast the students with the use of modern tools, equipment and software and inculcating the habit of life-long learning.

PEO-3   To foster teamwork and professional ethics among students towards devising feasible solutions to problems and project work.

Programme Outcome (POs)

PO-1   Broadening the horizon of the students in the field of Civil Engineering, increasing their ability to apply knowledge of mathematics, science, and engineering to solve

real world problems.

PO-2   Increasing the ability of students to identify, formulate and solve problems in a systematic way by appropriate collection, analysis, and interpretation of data.

PO-3   Increasing their ability to design a system, component, or process to meet the desired needs in an environment friendly and socially acceptable way.

PO-4   Enhancing their skills to analyze complex Civil Engineering problems and obtain the solution by synthesizing simple components.

PO-5   Increasing their ability to use the techniques, skills and modern engineering and Information Technology based tools (such as web-based applications and open-source software etc.) to increase the creativity of students.

PO-6   Enhancing awareness of students about the impact of engineering projects in a global and societal context (social, economic, legal and/or environmental implications).

PO-7   Enhancing their ability to practice environmental concerns and related sustainable measures and be capable of carrying out environmental impact of a civil engineering projects.

PO-8   Informing students about engineering ethics and professional responsibilities.

PO-9   Increasing their decision-making skills and innovative capability not only individually but also in a multi-disciplinary team.

PO-10   Increasing the ability to communicate effectively by enhancing their drawing and report writing skills and oral presentation skills.

PO-11   Increasing awareness of students about cost, time and quality issues in construction helping them to develop social and leadership skills.

PO-12   Providing the students with knowledge on contemporary issues in the field of civil engineering and recognizing the need for an ability to engage in continuous and life- long learning.

Credit Structure for B.Tech. (Civil Engineering)
(For newly admitted students from Session 2021-2022)

Category / Semesters	I	II	III	IV	V	VI	VII	VIII	Total
Basic Sciences & Maths (BSM)	9	12	0	3					**24**
Engineering Fundamentals (EF)	7	6	5						**18**
Professional Skill (PS)	2	2							**4**
Departmental Core (DC)			12	18	12	12	13		**67**
Management (M)					2	2			**4**
Humanities & Social Science (HSS)	2		2						**4**
Humanities & Social Science Elective (HSSE)		2							**2**
Project (P)						2	3		**5**
Seminar (S)						2			**2**
Industrial Practice (IP)/ Without Industrial Practices (Minor project +2 Industrial Elective (IE)#								12	**12**
Program link basic science and engineering courses (PLBSE)	0	0	5	5	4				**14**
Program Electives (PE)					4	4	3		**11**
Open Electives (OE)							3		**3**
Total	**20**	**22**	**24**	**26**	**22**	**22**	**22**	**12**	**170**

Curriculum for B.Tech. (Civil Engineering)

First Year, Semester I

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	BSM	BSM 101	Calculus and Linear Algebra	3	1	0	4
2.	EF	BCE 102	Mechanics of Structures	3	1	2	5
3.	PS	BCE 103	Computer Programming in Civil Engineering	1	0	2	2
4.	EF	BCE 101	Engineering Graphics	0	0	4	2
5.	BSM	BSM 143	Environmental Chemistry	3	1	2	5
6.	HSSE	BHM*	Humanities and Social Science (Electives)	2	0	0	2
			Total	**12**	**3**	**10**	**20**
1.	ECA-I	ECA 100	**Induction Program**	-	-	-	**0**

Humanities and Social Science (Electives)
1. Technical Writing- BHM 111 / 161
2. Industrial Sociology- BHM 112 / 162
3. Industrial Psychology- BHM 113 / 163
4. NCC – BHM 121 / 171

First Year, Semester II

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	BSM	BSM 152	Ordinary and Partial Differential Equations	3	1	0	4
2.	EF	BEE 152	Principles of Electrical Engineering	3	1	0	4
3.	BSM	BSM 191	Engineering Chemistry	3	1	2	5
4.	PS	BCE 152	Engineering Geology & Building Material	0	0	4	2
5.	EF	BCE 153	Building Planning and Drawing	1	0	2	2
6.	BSM	BSM 178	Physics of Engineering Materials	2	1	0	3
7.	HSS*	BHM 151	Professional Communication	0	0	4	2
			Total	**12**	**4**	**12**	**22**
1.	ECA-II	ECA 201*		-	-	-	**0**

SYLLABI

BCE 101		ENGINEERING GRAPHICS
Course category	:	Engineering Fundamentals (EF)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 0, Tutorial : 0 , Practical: 4
Number of Credits	:	2
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and External Practical Examination
Course Objectives	:	This course aims at the following educational objectives: Comprehend general projection theory, with emphasis on orthographic projection to represent three-dimensional objects in two-dimensional views (principal, auxiliary, sections). Dimension and annotate two-dimensional engineering drawings.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course 1.How Engineering Drawing helps to sketch the imagination? 2.Able to effectively practice the different scales for drawings. 3.Effectively analyze the geometrical shapes and to be able to draw. 4.Know about out solids and discuss about their classification. 5.How to implement the different views for a solid placed in 3dspace. 6.Construction of the object from different perspective. 7.Comparison and contrast between frustum and truncated solid. 8.Sketching of different sections for any 3D regular object. 9.Discussing the principles of Isometric Projection. 10.Sketching isometric projections for different geometrical shapes and solids.

Topics Covered

UNIT-I	

Conic Sections and Orthographic Projections Introduction

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.

Orthographic Projections

Orthographic Projections covering Principles of Orthographic Projections- Conventions Projections of Pointsand lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Plane

UNIT-II	

Projection of Regular Solids

Projections of Regular Solids covering those inclined to both the Planes- Auxiliary Views

UNIT-III	

Sections and Sectional Views of Right Angular Solids

Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone – AuxiliaryViews; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone

UNIT-IV	

Isometric Projections

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. Overview of computer graphics, demonstrating knowledge of the theory of CAD software.

Textbooks
1. Engineering Drawing-Bhat, N.D.& M. Panchal, Charotar Publishing House, 2008

Reference Books
1. Engineering Drawing and Computer Graphics- Shah, M.B. & B.C. Rana, Pearson Education, 2008
2. A Text Book of Engineering Drawing-Dhawan, R.K., S. Chand Publications, 2007
3. Text book on Engineering Drawing-Narayana, K.L. & P Kannaiah, Scitech Publishers, 2008

BCE 102		MECHANICS OF STRUCTURES
Course category	:	Engineering Fundamentals (EF)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 2
Number of Credits	:	5
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and Two Minor tests and One Major Theory & Practical Examination
Course Objectives	:	The aim is to introduce engineering students to the basic principles of equilibrium and the behaviour of structural elements and systems which include beams, struts, shafts and trusses under applied loads.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course 1. Able to compute the magnitude and direction of force and moment. 2. Know the conditions of equilibrium of rigid body and able to compute equivalent force. 3. Able to compute the centroids and centre of gravity. 4. Know the moment of inertia of mass and area, and also how to compute it. 5. Understand the principle of virtual work and able apply them to find out forces and reactions. 6. Know the different mechanism of friction and computation of frictional forces. 7. Understand the Newton's second law and apply them on system of particles.

	8. Develop ability to apply Newton's second law on rigid body.

Topics Covered

UNIT-I	9

Statics –Basics Concepts, Fundamental principles & concepts:

Introduction to Engineering Mechanics: Force Systems, Basic concepts, Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant Moment of Forces and its Applications; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems.

Friction:

Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack.

UNIT-II	9

Moment of Inertia:

Centroid and Centre of Gravity, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

UNIT-III	9

Analysis of structures- Trusses

Basic Structural Analysis, Equilibrium in three dimensions; Analysis of simple trusses by method of sections & method of joints, Zero force members, Simple beams and support reactions. Shear force and Bending Moment Diagram of Statically Determinate Beams.

Review of Particle Dynamics

Review of particle dynamics- rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).

UNIT-IV	9

Plane kinematics of rigid bodies- Rotation

Introduction to Kinetics of Rigid Bodies, Basic terms, general principles in dynamics; Types of motion, Instantaneous centre of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation.

Virtual Work and Energy Method:

Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, Applications of energy method for equilibrium, Stability of equilibrium.

EXPERIMENTS	
Any 10 experiments are to be conducted from the following:	

1. To verify the law of parallelogram of forces
2. To study the equilibrium of a body under three forces.
3. To determine the coefficient of friction of a flat surface.
4. Friction experiment on screw-jack.
5. Experiment based on analysis of truss.
6. To determine the mass moment of inertia of rotating disc.
7. To conduct the tensile test and determine the ultimate tensile strength, percentage elongation for mild steel specimen.
8. To conduct the Impact (Izod/Charpy) on Impact-testing machine to find the impact Strength of specimen.
9. To determine the hardness of the given specimen using Vicker/Brinell/Rockwell hardness testing machine.
10. Simple & compound gear-train experiment.
11. Worm &Worm-wheel experiment for load lifting.
12. Belt-Pulley experiment

Textbooks

1. Vector Mechanics for Engineers: Statics and Dynamics – Johnston. R.E., Beer. F., Eisenberg. E. R,& Mazurek. D., McGraw Hill
2. Engineering Mechanics: Statics and Dynamics- Hibbler. R.C., Prentice Hall

Reference books

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
3. R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
5. Hibler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) by Pearson Education.

BCE 103		Computer Programming in Civil Engineering
Course category	:	Professional Skill (PS)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 1, Tutorial : 0 , Practical: 2
Number of Credits	:	2
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and Two Minor tests and One Major Theory & Practical Examination
Course Objectives	:	The students are expected to demonstrate their Basic programming knowledge and skills to solve the civil engineering problems with the use of C programming.

Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course 1. Read and understand C programs. 2. Discuss basic theory and practice of programming. 3. Design and implement practical programs using C language. 4. Use compiler and feel comfortable with Windows environment 5. Identify and fix common C errors. 6. To apply the C program for basic civil engineering problems.

Topics Covered

UNIT-I	3

Basics of Computer: Introduction to Digital Computer, Basic Operations of Computer, Functional Components of Computer, Classification of Computers. Introduction to Operating System: DOS, Windows, Linux, Function, Services and Types. Basics of Programming: Approaches to Problem Solving, Concept of Algorithm and Flow Charts, Types of Computer Languages:- Machine Language, Assembly Language and High-Level Language, Concept of Assembler, Compiler, Loader and Linker.

UNIT-II	3

Standard I/O in "C", Fundamental Data Types: Character, Integer, Short, Long, float, double, long double; Storage Classes, Automatic, Register, Static and External, Operators and Expressions: Using Numeric and Relational Operators, Mixed Operands and Type Conversion, Logical Operators, Bit Operations, Operator Precedence and Associativity, C Conditional Program Execution: Applying if and Switch Statements, Nesting if and else, Restrictions on switch Values, Use of Break, Program Loops and Iteration: Uses of while, do and for Loops, Multiple Loop Variables, Assignment Operators, Using Break and Continue keywords

UNIT-III	3

Functions: Designing Structured Programs, Functions in C, User Defined and Standard Functions, Formal vs. Actual Arguments, Function Category, Function Prototype, Parameter Passing, Recursive Functions. Storage Classes: Auto, Extern, Register and Static Variables

UNIT-IV	3

Arrays, Pointer and Character Strings, Pointers and Functions, Array of Pointers, Pointers to Pointers Dynamic Memory Allocation Structure and Union: Declaration and Initialization of Structures, Structure as Function Parameters, Structure Pointers, Unions. File Management: Defining and Opening A File, Closing A File, Input/Output Operations in Files, Pre-Processor Directives, Command Line Arguments.

EXPERIMENTS
    1. Write a program that finds whether a given number is even or odd.
    2. Write a program that tells whether a given year is a leap year or not.
    3. Write a program that accepts marks of five subjects and finds percentage and prints grades according to the following criteria:
    a. Between90-100%----------Print "A"
    b. 80-90% --------------------Print "B"
    c. 60-80% --------------------Print "C"
    d. Below60%----------------- Print "D"
    4. Write a program that takes two operands and one operator from the user and perform

the operation and prints the result by using Switch statement.
5. Write a program to print sum of even and odd numbers from 1 to N numbers.
6. Write a program to print the Fibonacci series.
7. Write a program to check whether the entered number is prime or not.
8. Write a program to find the reverse of a number.
9. Write a program to print Armstrong Numbers from 1 to 100.
10. Write a program to convert binary number into decimal number and vice versa.
11. Write a program that simply takes elements of the array from the user and finds the sum of these elements.
12. Write a program that inputs two arrays and saves sum of corresponding elements of these arrays in a third array and prints them.
13. Write a program to find the minimum and maximum element of the array.
14. Write a program to implement the concept of beam and truss.

Reference Books:

1. Jeri R. Hanly, Elliot B. Koffman, Problem Solving and Program Design in C, 7th edition, Pearson.
2. Childt, Herbert Complete reference with C Tata McGraw Hill
3. Kerninghan and Ritchie, The C programming language, Prentice Hall

BCE 152		Engineering Geology & Building Material
Course category	:	Mechanics of Structures (BCE-01)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 0, Tutorial : 0 , Practical: 4
Number of Credits	:	2
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and External Practical Examination
Course Objectives	:	This course aims at the following educational objectives: 1. To study and identify different types of natural materials like rocks and minerals. 2. To know the physical properties of rocks & building minerals. 3. To know the importance of geological maps and language helpful for Civil Engineering projects. 4. To understand the internal structure and composition of the earth.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course 1. Understanding of rocks and their minerals 2. Understanding of properties of building materials like cement, aggregates, concrete, lime, and bricks. 3. To perform several experiments to find out consistency, initial and final setting time of cement, workability of concrete,

crushing strength of aggregates etc.

4. To recognize the fundamentals of the Earth as a planet, earth's dynamic actions and their importance for civil engineering structures.

5. To appreciate the usefulness and utilization of natural materials in civil engineering works.

6. To analyze and interpret geological reports and information and the latest geological exploration methods for suitable site selection.

Topics Covered

UNIT-I	3

Physical and mechanical properties: reinforcing steel, bricks, lime, fine aggregate, cement, coarse aggregate, geology. Cement: Normal Consistency of cement, Initial & Final Setting time of cement, Compressive strength of cement, fineness of cement by air permeability and Le-chatalier's apparatus, Soundness of cement, Tensile strength of cement.

UNIT-II	3

Coarse Aggregate: Crushing value of aggregate, Impact value of aggregate, Water absorption of aggregate, Sieve Analysis and Grading of aggregate, Specific gravity, bulk density
Fine Aggregate: Sieve analysis of sand and Fineness Modulus, Silt content of sand, Bulking of sand
Lime: Fineness, Setting time and Soundness

UNIT-III	3

Physical and mechanical properties of reinforcing steel.
Bricks: Water absorption, Dimension Tolerance, Compressive Strength, Efflorescence.

UNIT-IV	3

Geology:
1. Megascopic study of minerals (physical properties and identification).
2. Determination of Specific Gravity of minerals.
3. Megascopic study of the following rocks with special reference to their suitability in Civil Engineering works– (a) Igneous rocks (b) Sedimentary rocks (c) Metamorphic rocks
4. Determination of strike and dip & completion of outcrop.
5. Preparation of geological section and study of geological maps with emphasis on the site selection for dams, tunnels, and highways.

Text Books:
1. Prabin Singh: Engg. and General Geology, Katson Publishing House.
2. F G Bell: Fundamentals of Engineering Geology, B S Publication.
Reference Books
1. Tony Waltham : Fundamentals of Engineering Geology ,SPON Press.
2. J.M. Treteth : Geology of Engineers, Princeton, Von. Nostrand.

BCE 153		**Building Planning and Drawing**
Course category	**:**	Engineering Fundamentals (EF)
Pre-requisite Subject	**:**	NIL

Contact hours/week	**:**	Lecture : 1, Tutorial : 0 , Practical: 2
Number of Credits	**:**	2
Course Assessment methods	**:**	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and Two Minor tests and One Major Theory & Practical Examination.
Course Objectives	**:**	This course aims at the following educational objectives: 5. To understand the fundamental principles and concepts of planning and architecture for buildings. 6. To study about different views of layout. 7. To learn the development controls covered by building bye laws and national building code for buildings.
Course Outcomes	**:**	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course 1. Apply the concepts of building planning considering climatic parameters, building bye laws, classification of buildings and design buildings. 2. Draw site plan, plans, elevations and sectional views of residential, commercial and public buildings, showing maximum details of various building components using the available construction area effectively according to codal provisions and standard units Effectively analyse the geometrical shapes and to be able to draw. 3. Prepare building services drawings How to implement the different views for a solid placed in 3dspace. 4. Apply his knowledge to evaluate existing projects, suggest economical modifications for sustainable development and strengthen his professional skills through self-employability and lifelong learning. 5. Able to prepare a water supply line diagram. 6. Able to prepare a fire fighting layout for buildings.

Topics Covered	
UNIT-I	3

Introduction

Building Planning- Factors Shape size and topography of site, Climatic conditions of the site, Functional requirements of the building, Local Bye laws requirements of size of different components, setbacks, neighborhood, Owner :– Status-Choices-Preferences, Economy. Building Planning- Principles Aspects, Prospects, roominess, furniture requirements, groupings, circulation, privacy, elegance, lighting & ventilation, sanitation, flexibility, economy, practical considerations.

UNIT-II	3

Building Bye Laws

Building Bye Laws Means of access, internal and external open spaces, floor area ratio, height of building, safety precautions. Building Sanction procedures, key plan (layout plan), site plan, building plan, working plan, validity of sanction, completion certificate.

UNIT-III		3

Site Plan &Planning of Buildings

Drawing of site plan showing setbacks, Floor Area Ratio, Height of Building, and Minimum Distance from Power line, as per National Building Code (NBC).

Given the floor area or carpet areas of rooms, plan the building and draw a Single line diagram of building. a) Residential building b) School Buildings c) Hostel Buildings d) Primary Health Centre Draw the Plan, Elevation and Sectional views for the following types of buildings. a) Residential buildings. b) School Buildings c) Hostel Buildings d) Primary Health Centre e) Canteen Building f) Two storied residential building g)Small work shop Building.

UNIT-IV		3

Building Basic Services

Preparation of water supply Layout for residential building.
Preparation of Electrical Layout for residential building.
Preparation of Sanitary Layout for residential building.
Preparation of Shallow Well Rain Water Harvesting Method for Building.
Preparation of Fire Fighting layout for buildings.

Reference Books:

1. Civil Engg: Drawing Balagopal and RS Prabhu – Spades.
2. Time Savers standards for Building types – Joseph Deciara and john Callender Tata Mc Graw hill

BSM-101	Calculus and Linear Algebra		
Course category	:	Basic Sciences & Maths (BSM)	
Pre-requisite Subject	:	NIL	
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0	
Number of Credits	:	4	
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and Two Minor tests and One Major Theory Examination	
Course Objectives	:	The course is aimed to develop the basic mathematical skills of engineering students that are imperative for effective understanding of engineering subjects.	
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course	

1. Use of basic differential operators in various engineering problems.
2. Understand the concepts of limit theory and nth order differential equations and their applications to our daily life
3. Solve linear system of equations using matrix algebra.
4. Know about qualitative applications of Gauss , Stoke's and Green's theorem.
5. To know the applications of double and triple integration in finding the area and volume.
6. To inculcate the habit of mathematical thinking and lifelong learning.

Topics Covered

UNIT-I	9
Differential Calculus: Limit, Continuity and Differentiability, Mean value theorems. Leibnitz theorem, Partial derivatives, Euler's theorem for homogenous function, Total derivative, Change of variable. Taylor's and Maclaurin's theorem. Expansion of function of two variables, Jacobian, Extrema of function of several variables.	
UNIT-II	9
Linear Algebra: Symmetric, Skew-symmetric matrices, Hermitian, Skew Hermitian Matrices, orthogonal and unitary matrices and basic properties, linear independence and dependence of vectors, Rank of Matrix, Inverse of a Matrix, Elementary transformation, Consistency of linear system of equations and their solution, Characteristic equation, Eigenvalues, Eigen-vectors, Cayley-Hamilton theorem, Diagonalization of matrices.	
UNIT-III	9
Multiple Integrals: Double and triple integrals, change of order of integration, change of variables. Application of multiple integral to surface area and volume. Beta and Gamma functions, Dirichlet integral.	
UNIT-IV	9
Vector Calculus: Gradient, Divergence and Curl. Directional derivatives, line, surface and volume integrals. Applications of Green's, Stoke's and Gauss divergence theorems (without Proofs).	
Books & References 1. B.S. Grewal: Higher Engineering Mathematics; Khanna Publishers 2. Erwin kreyszig: Advanced Engineering Mathematics, John Wiley & Sons. 3. R. K. Jain and Iyenger: Advanced Engineering Mathematics, Narosa Publications. 4. B.V. Ramana: Higher Engineering Mathematics, Tata Mc. Graw Hill Education Pvt. Ltd.,	

BSM-143:	**Environmental Chemistry (CE)**
Course category:	Basic Sciences & Maths (BSM)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture : 2, Tutorial : 1, Practical: 0
Number of Credits:	3
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes, Minor and Major Theory Examination
Course Objectives	➢ Solve environmental engineering problems and persue higher studies using solid foundation in Chemistry and environmental science. ➢ Design and operate various environmental systems in industries as well as higher studies through interactive education.
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Students will acquire basic knowledge about Environment, which allows students to gain qualitative and quantitative skills.
 2. Students will aware of environmental pollution and control methods along with quality standards of air, water etc along with waste management.
 3. Students will able to give systematic account of natural resources their use and environmental problems due to overexploitation.
 4. Students will acquire basic knowledge about the chemical reactions taking place in the environment.
     5.   To acquire awareness for ethical principle of environment.
     6. To gain knowledge as a leader in multidisciplinary areas.	

Topics Covered	
UNIT-I Basic concept of environmental chemistry, Introduction to atmospheric chemistry, Layers of the atmosphere and their chemical composition, chemistry of gaseous and particulate pollutants, Ozone and its control, Green House Effect. Concept of green and sustainable chemistry.	6
UNIT-II Chemical and solar light chemical reactions in the atmosphere. The Chemistry of Natural Waters, Oxidation-Reduction Chemistry in Natural Waters, Ion Concentrations in Natural and potable Water, Water Pollution and Purification of Water, Water Disinfection, Ground water: Its Supply, Chemical Contamination, and Remediation The Chemical Contamination and Treatment of Wastewater and Sewage.	6
UNIT-III Chemical properties–Cation Exchange Capacity and Anion Exchange Capacity. The Recycling of Household and Commercial Waste, Hazardous Wastes and methods of disposal, Toxic Heavy Metals, Mercury, Lead, Arsenic and cadmium. Soil pollution, Domestic and Commercial Garbage: solid waste management.	6
UNIT-IV Polynuclear Aromatic Hydrocarbons Chemistry of food additives, Toxic Organic Compounds, Pesticides, Insecticides, Herbicides, Dioxins, Furans, and PCBs, dyes, detergents and bleaching agents, Hazardous waste and their environmental effects.	6
Books & References	
1. Environmental Chemistry - Colin Baird and Michael Cann, W. H. Freeman 2. Environmental Chemistry - Stanley E. Manahan, CRC Press; 9th edition. 3. Sonja Krause, Herbert M. Clark, James P. Ferris, Robert L. Strong Chemistry of the Environment,Elsevier Science & Technology Books. 4. Eugene R. Weiner Applications of Environmental Chemistry, CRC Press, LLC. 5. By Clair N.Sawyer,Perry L. McCarty, Gene F.Parkin Chemistry for environmental engineering and science (5th edition), McGraw-Hill Professional.	

BSM-191	Engineering Chemistry
Course category:	Basic Sciences & Maths (BSM)
Pre-requisite Subject:	NIL
Contact hours/week	Lecture : 3, Tutorial : 1 , Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through attendance, assignments, quizzes, practical work, record, viva voce, minor and major theory & practical Examination
Course Objectives	➢ Solve industrial problems and persue higher studies using solid foundation in Chemistry. ➢ Design and operate various research and development in industries as well as higher studies through interactive education.
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. Students will acquire basic knowledge in Engineering Chemistry, which allows students to gain qualitative and quantitative skills.
2. Make good scientific observations and develop experimental method of evaluation of different systems at industrial or research level.
3. Students will develop Interdisciplinary skills which can help them to thrive in the life-long changing environment in various fields of Industry.
4. Students will acquire practical knowledge and will be able to analyze data constructively and formulate new ideas.
5. To acquire knowledge for chemical process and methods.
6. To gain knowledge as a leader in multidisciplinary areas.

Topics Covered	
UNIT-I Molecular theory of hetero-mono and diatomic molecules, Band theory of bonding in metals, Hydrogen bonding. Order and molecularity of reactions. First and second order reactions. Energy of activation. Phase Rule, its application to one component system (water). One and Two Dimensional solids, Graphite as two dimensional solid and its conducting properties. Fullerene and its applications.	9
UNIT-II Stability of reaction intermediates, e.g. Carbanions, Carbocations and free radicals. Types of organic reactions: Addition, Substitution, Elimination and Rearrangement reaction. Organic Name reactions and their mechanism. Configurational and conformational isomerism. Conformation and energy level diagram of n-butane.	9

UNIT-III	9
Polymerization: Introduction, Mechanism of polymerization, Types of polymerization. Classification of polymers, Biodegradable and Conducting polymers. Cement Chemistry and its applications. Paint Chemistry and its applications. Classification of Fuels, calorific value of fuel, gross & net calorific value, determination of calorific value using Bomb calorimeter	
UNIT-IV	9
Basic principles of spectroscopic methods. The use of UV-Visible, Infra red spectroscopy (IR), ^{1}HNMR, for the determination of structure of simple organic compounds. Hardness and Softening of water by different techniques. Determination of metals in water.	

EXPERIMENTS

1. Determination of iron content in the given sample using K3[Fe(CN)6] as an external indicator. Determination of temporary and permanent hardness in water sample using EDTA as standard solution.
2. Determination of alkalinity in the given water sample.
3. Determination of chloride content in the given water sample by Mohr's method.
4. Determination of percentage of available chlorine in bleaching powder sample.
5. pH-metric titration between strong acid and strong base.
6. Viscosity of a polymer like polystyrene by Viscometric method.
7. Element detection & functional group identification in organic compounds
8. Preparation of a polymer like Bakelite or PMMA. 10. Preparation of Sodium Cobaltinitrite salt.

Books & References

1. Engineering Chemistry, Wiley India
2. Engineering Chemistry, Tata McGraw Hill
3. Concise Inorganic Chemistry - J.D. Lee; Wiley India
4. Organic Chemistry- Morrison & Boyd, 6th edition, Pearson Education
5. Physical Chemistry - Gordon M. Barrow; McGraw Hill
6. Physical Chemistry - Peter Atkins & Julio De Paula, Oxford University Press

BSM-102/BSM-152		Ordinary and Partial Differential Equations
Course category	:	Basic Sciences & Maths (BSM)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and Two Minor tests and One Major Theory Examination
Course Objectives	:	The course is aimed to develop the basic mathematical skills of engineering students that are imperative for effective understanding of engineering subjects.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. To solve the ordinary differential equations.	
2. To solve the partial differential equations using Lagrange and charpit's method.	
3. To solve and understand the properties of Bessel`s and Legendre`s differential equation.	
4. Application of partial differential equation in real life problems	
5. To solve Wave, Heat and Laplace equation upto two dimensions.	
6. To inculcate the habit of mathematical thinking and lifelong learning.	

Topics Covered	
UNIT-I	9
Ordinary Differential Equations I: Linear differential equations with constant coefficients ($n^{th} order$), complementary function and particular integral. Simultaneous linear differential equations, solution of second order differential equations by changing dependent and independent variables, Method of variation of parameters, Applications of differential equations to engineering problems	
UNIT-II	9
Ordinary Differential Equations II: Series solution of second order differential equations with variable coefficient (Frobeneous method). Bessel and Legendre equations and their series solutions, Properties of Bessel function and Legendre polynomials.	
UNIT-III	9
Partial Differential equations I: Partial differential equations of the first order, Lagrange's solution, Charpit's general method of solution, Partial differential equations of the second order: Constant coefficient and reducible to constant coefficient, Classification of linear partial differential equations of second order.	
UNIT-IV	9
Partial Differential Equations II: Method of separation of variables for solving partial differential equations, Wave equation up to two-dimensions, Laplace equation in two dimensions, Heat conduction equations up to two dimensions	
Books & References	
1. B.S. Grewal: Higher Engineering Mathematics; Khanna Publishers 2. Erwin kreyszig: Advanced Engineering Mathematics, John Wiley & Sons. 3. R. K. Jain and Iyenger: Advanced Engineering Mathematics, Narosa Publications. 4. B.V. Ramana: Higher Engineering Mathematics, Tata Mc. Graw Hill Education Pvt. Ltd.. 5. M.D. Raisinghania, Ordinary and Partial Differential Equations. S Chand Publications.	

BSM-128**/178**	: **PHYSICS OF ENGINEERING MATERIALS** (**for Civil Engineering**)	
Course category	:	Basic Sciences & Maths (BSM)
Pre-requisite Subject	:	Physics at 12th standard
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 2
Number of Credits	:	5

Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and Three Minor tests and One Major Theory & Practical Examination
Course Objective:		Understanding of the principle and concepts of Crystal Structure, Waves and Oscillations, architectural acoustics and smart materials for their applications in Civil Engineering.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course
.	:	1. Basics of crystallography and its applications in civil engineering 2. Oscillation and waves and their applications in civil engineering. 3. Basic principles of Architectural Acoustics applied in civil Engineering. 4. Principles of Non-destructive Testing applied in civil Engineering. 5. Basic principles of mechanical properties of materials and its application in civil engineering. 6. Nano materials and their applications in civil engineering.

Topics Covered

UNIT-I

Crystal Structures and X-ray Diffraction: Space lattice, basis, Unit cell, Lattice parameter, Seven crystal systems and Fourteen Bravais lattices, Crystal-System Structure, Packing factor (cubic, body and face), Lattice planes and Miller Indices, Diffraction of X-rays by crystal, Bragg's Law, Bragg's spectrometer.

UNIT-II : Oscillation and Waves

Oscillation and Waves: Simple harmonic motion, differential equation for SHM, Potential and Kinetic Energy, Damped harmonic motion, differential equation for DHM, Forced Oscillator, differential equation for Forced Oscillator, equation of motion of force oscillation.

Ultrasonics: Production of ultrasonics by Piezo-electric and magnetostriction; Detection of ultrasonics, measurement of wavelength of ultrasonic waves, properties of ultrasonic waves, applications of ultrasonic waves.

UNIT-III: Architectural Acoustics and Non-destructive Testing:

Architectural Acoustics: Sound waves, intensity, loudness, reflection of sound, echo; Reverberation, reverberation time, Sabine's formula, remedies over reverberation; Absorption of sound, absorption coefficient, absorbent materials; Conditions for good acoustics of a building; Noise, its effects and remedies, sound insulation.
Non-destructive Testing: Objectives of non-destructive testing, Methods of non-destructive testing, Liquid penetration method, ultrasonic inspection method and pulse echo method.

UNIT-IV: Mechanical Properties of Materials

Stress, Strain, Longitudinal or Tensile Strain, Shear or Shearing Strain, Volumetric Strain, Behaviour of a Wire Under Increasing Load, Hooke's Law, Young's Modulus (Y), Bulk Modulus (K), Modulus of

Rigidity or Shear Modulus, Poisson's Ratio, Determination of Young's Modulus (Y), Determination of Moment of Inertia

EXPERIMENTS

1. To determine the moment of inertia of a flywheel.
2. To determine the velocity of Ultrasonic waves
3. To determine the Young Modulus by Searl's method
4. To determine the height of Tower by Sextant.
5. To determination the velocity of sound wave.
6. To measure liquid and plastic limit of clay composites.

Books & References

1. Introduction to Solid State Physics- Kittel , 7th edition, Wiley Eastern Ltd.
2. Solid State Physics - S. O. Pillai, 5th edition, New Age International.
3. Master Hand book of Acoustics - F. Alton Everest and Ken Pohlmann, 5th edition, McGraw Hill
4. Elements of Properties of Matter by D.S. Mathur, S. Chand an Company, India
5. Engineering Physics by B. K. Pandey and S. Chaturvedi, Cengage Learning Pvt. Limited India.
6. Introduction to Nano Technology - Poole Owens, Wiley India
7. Master Hand book of Acoustics - F. Alton Everest and Ken Pohlmann, 5th edition, McGraw Hill

BEE-102/ 152		**Principles of Electrical Engineering**
Course category	:	Engineering Fundamentals (EF)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and One Minor tests and One Major Theory & Practical Examination.
Course Objective	:	**1.** To demonstrate and understand the basic concepts of Alternating current and voltage such as Amplitude, frequency, Average and RMS values, phasors, analysis of R, L, C series and parallel circuits. **2.** Apply the basic concepts in Electrical engineering for multi-disciplinary tasks.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course:
1. Recall basic concepts of Electrical Engineering.
2. Understand the basic properties of electrical elements, and solve problem based on basic electrical circuits & DC network theorems.
3. Understand the fundamental behaviour of AC circuits and solve AC circuit problems.
4. Apply the knowledge gained to explain the behaviour of the circuit at series & parallel resonance of circuit & the effect of resonance.
5. Understand the basic concepts of measurements and magnetic circuits.
6. Explain construction and working principle of transformer.

9

Topic Covered	
UNIT I **D C Circuit Analysis and Network Theorems:** Circuit Concepts: Concepts of network, Active and passive elements, Voltage and current sources, Concept of linearity and linear network, Unilateral and bilateral elements, R, L and C as linear elements, Source transformation, Kirchhoff's laws, Loop and nodal methods of analysis, Star-delta transformation, Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem.**9**	
UNIT II **Steady- State Analysis of Single-Phase AC Circuits:** AC fundamentals: Sinusoidal, square, and triangular waveforms – Average and effective values, Form and peak factors, Concept of phasor, phasor representation of sinusoidally varying voltage and current, Analysis of series, parallel and series-parallel RLC Circuits, Resonance in series and Parallel circuit Three Phase AC Circuits: Three phase system-its necessity and advantages, Star and delta connections, Balanced supply and balanced load, Line and phase voltage/current relations, three-phase power, and its measurement	9
UNIT III **Measuring Instruments & Magnetic Circuit:** Types of instruments, Construction and working principles of PMMC and Moving Iron type voltmeters & ammeters, Use of shunts and multipliers. Magnetic circuit, concepts, analogy between electric & magnetic circuits, B-H curve, Hysteresis, and eddy current losses.	9
UNIT IV **Single-Phase Transformers:** Single Phase Transformer: Principle of operation, Construction, EMF equation, Power losses, Efficiency, O.C & S.C Test and Introduction to auto transformer.	9
.		

Textbooks:
1. Fundamentals of Electric Circuits, C.K. Alexander and M.N.O. Sadiku; TATA McGraw-Hill.
2. Principles of Electrical Engineering, V. Del Toro; Prentice Hall International.
3. Electrical and Electronics Technology, Edward Hughes; Pearson.
4. Basic Electrical Engineering, D P Kothari, I.J. Nagarath; Tata McGraw Hill
5. Electrical Technology, B. L. Thareja and A. K. Thareja; S. Chand.

BHM-101/151 PROFESSIONAL COMMUNICATION (L-T-P: 2-0-0)	
Course Category:	Humanities & Social Science (HSS)
Pre-requisite Subject:	None
Contact hours/week:	2 Credit

No of Credits:	Lecture: 2, Tutorial:0, Practical: 0(Total Credit: 02)

Course Assessment Methods: Continuous assessment through tutorials, Attendance, home assignments, quizzes, Two Test and one Major Theory Exam.

Course Objective: The course aims:
1) To sensitize the students to understand the role& importance of communication for personal & professional success.
2) To enable learners to exhibit knowledge, skills, and judgment in and around human communication that facilitates their ability to work collaboratively with others in an interpersonal environment.
3) To develop awareness and understanding of applying appropriate communication strategies resulting into the enhancement of learners' employability skills.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course.
1) Use of various facets of communication skills, such as, Reading, Writing, Listening and speaking skills.
2) To identify, formulate and solve the real life problems with positive attitude.
3) To inculcate the habit of learning and developing the communication and soft skills by practice.
4) To enhance effortless speaking and writing skills with the help of rich word power.
5) To develop personality by introducing and inculcating effective presentation strategies.
6) To focus on audio, visual aids for effective oral communication skills

UNIT – I VERBAL COMMUNICATION:	6 Hours

Received Pronunciation; how to activate passive vocabulary; Technical/non-technical and Business Presentations; questioning and answer skills; soft skills for professionals; role of body postures, movements, gestures, facial expressions, dress in effective communication; Information/ Desk/ Front Office/ Telephone conversation; how to face an interview/press conference; Group discussions, debates, elocution.

UNIT – II: READING COMPREHENSION	6 Hours

Skimming and Scanning; factual and inferential comprehension; prediction; guessing meaning of words from context; word reference; use and interpretation of visuals and graphics in technical writing.

UNIT – III: WRITTEN COMMUNICATION:	6 Hours

Note Making and Note Taking; summarizing; invitation, advertisement, agenda, notice and memos; official and commercial letters; job application; resume and curriculum vitae; utility, technical, project and enquiry reports; paragraph writing: General – Specific, Problem – Solution, Process – Description, Data – Comment.

UNIT – IV: SHORT ESSAYS:	6 Hours

Description and Argument; comparison and contrast; illustration; using graphics in writing: tables and charts, diagrams and flow charts, maps and plans, graphs; how to write research paper; skills of editing and revising; skills of referencing; what is a bibliography and how to prepare it.

Text & Books:

1) Bansal, R.K. & Harrison J.B., (1972)*Spoken English*, Orient Longman, India.
2) Chauhan, Narender Kr. & Singh, Sudhir N., (2013) *Formal Letters,* Pankaj Publication International, New Delhi.
3) Chhabra T.N., (2019) *Business Communication*, Sun India Publication, New Delhi.
4) Dixon Robert J., (1986)*Complete Course in English,* Prentice Hall of India, New Delhi.
5) Jones, Daniel.(2012) *Cambridge English Pronouncing Dictionary*, 18th Edition, Paperback, CUP, India.
6) Lewis, Norman, (2015) *Word Power Made Easy*, Penguin India.
7) Sethi J. & Jindal, (1993)*Handbook of Pronunciation of English Words - D.V.A*, Prentice Hall of India, New Delhi.
8) Sharma R.C. & Mohan Krishna, (2017)*Business Correspondence and Report Writing*, Tata McGraw Hill.
9) Thomson, A. J. & and Martinet A. V., (1997)*A Practical English Grammar*,Paperback,Ed. IV th, Oxford.