B.Tech.

(Civil Engineering)

UNDER

Faculty of Technology

DEPARTMENT OF CIVIL ENGINEERING

Bachelor of Technology (Civil)

B-Tech(CE) 1st Semester							
Subject Code	**Subject**	**L**	**T / P**	**Credits**	**End Semester Exam**	**Internal Marks**	**Total**
BTCE101	Programming for Problem Solving	3	0	3	70	30	100
BTCE102	Emerging Domain in Electronics Engineering	3	0	3	70	30	100
BTCE103	Engineering Chemistry	3	1	4	70	30	100
BTCE104	Engineering Mathematics- I	3	1	4	70	30	100
BTCE105	English	2	0	2	70	30	100
BTCE106-P	Engineering Chemistry -Lab	0	2	1	30	20	50
BTCE107-P	Emerging Domain in Electronics Engineering-Lab	0	2	1	30	20	50
BTCE108-P	Programming for Problem Solving-Lab	0	2	1	30	20	50
BTCE109-P	Mechanical Workshop- Lab	0	2	1	30	20	50
Total		**14**	**10**	**20**	**470**	**230**	**700**

B-Tech(CE) 2nd Semester							
Subject Code	**Subject**	**L**	**T/ P**	**Credi ts**	**End Semester Exam**	**Internal Marks**	**Total**
BTCE201	Fundamentals of Mechanical Engineering & Mechatronics	3	0	3	70	30	100
BTCE202	Basic Electrical Engineering	3	0	3	70	30	100
BTCE203	Engineering Physics	3	1	4	70	30	100
BTCE204	Engineering Mathematics- II	3	1	4	70	30	100
BTCE205	Artificial Intelligence for Engineers	2	0	2	70	30	100
BTCE206P	Engineering Physics -Lab	0	2	1	30	20	50
BTCE207P	Basic Electrical Engineering-Lab	0	2	1	30	20	50
BTCE208P	English Language-Lab	0	2	1	30	20	50
BTCE209P	Engineering Graphics & Design-Lab	0	2	1	30	20	50
Total		**14**	**10**	**20**	**470**	**230**	**700**
*The Mini Project or internship (3-4 weeks) conducted during summer break after II semester and will be assessed during III semester.							

B.Tech(CE)- Third Semester							
Subject Code	**Subject**	**L**	**T/ P**	**Credit s**	**End semester Exam**	**Internal Marks**	**Total**
BTCE301	Mathematics-III	3	1	4	70	30	100
BTCE302	Technical Communication	3	0	3	70	30	100
BTCE303	Engineering Mechanics	3	1	4	70	30	100
BTCE304	Surveying and Geomatics	3	1	4	70	30	100
BTCE305	Fluid Mechanics	3	1	4	70	30	100
BTCE306P	Building Planning & Drawing Lab	0	2	**1**	30	20	50
BTCE307P	Surveying and Geomatics Lab	0	2	1	30	20	50
BTCE308P	Fluid Mechanics Lab	0	2	1	30	20	50
BTCE309P	Mini Project or Internship Assessment*	0	2	2	30	20	50
Total		**15**	**12**	**24**	**470**	**230**	**700**

B.Tech(CE)- Fourth Semester							
Subject Code	**Subject**	**L**	**T / P**	**Credits**	**End semester Exam**	**Internal Marks**	**Total**
BTCE401	Engineering Geology	3	0	3	70	30	100
BTCE402	Universal Human Values	3	0	3	70	30	100
BTCE403	Materials, Testing & Construction Practices	3	0	3	70	30	100
BTCE404	Introduction to Solid Mechanics	3	1	4	70	30	100
BTCE405	Hydraulic Engineering	3	1	4	70	30	100
BTCE406P	Material Testing Lab	0	2	1	30	20	50
BTCE407P	Solid Mechanics Lab	0	2	1	30	20	50
BTCE408P	Hydraulics & Hydraulic Machine Lab	0	2	1	30	20	50
BTCE409P	Engineering Geology Lab	0	2	1	30	20	50
Total		**15**	**10**	**21**	**470**	**230**	**700**
*The internship (6 weeks) conducted during summer break after IV semester and will be assessed during V semester.							

B.Tech(CE)- Fifth Semester							
Subject Code	**Subject**	**L**	**T / P**	**Credits**	**End semester Exam**	**Internal Marks**	**Total**
BTCE501	Geotechnical Engineering	3	1	4	70	30	100
BTCE502	Structural Analysis	3	1	4	70	30	100
BTCE503	Concrete Technology	3	1	4	70	30	100
-	**Departmental Elective-I**	3	0	3	70	30	100
BTCE504A	Quantity Estimation and Construction Management						
BTCE504B	Modern Construction Materials						
BTCE504C	Open Channel Flow						
-	**Departmental Elective-II**	3	0	3	70	30	100
BTCE505A	Engineering Hydrology						
BTCE505B	Sensor and Instrumentation Technologies for Civil Engineering Applications						
BTCE505C	Air and Noise Pollution Control						
BTCE505D	GIS and Advance Remote Sensing						
BTCE506P	CAD Lab	0	2	1	30	20	50
BTCE507P	Geotechnical Engineering Lab	0	2	1	30	20	50
BTCE508P	Concrete Technology Lab	0	2	1	30	20	50
BTCE509P	Mini Project or Internship Assessment*	0	2	2	30	20	50
Total		**15**	**11**	**23**	**470**	**230**	**700**

B.Tech (CE)- Sixth Semester							
Subject Code	Subject	**Lecture**	**Tutorial/ Practical**	**Credits**	**End semester Exam**	**Internal Marks**	**Total**
BTCE601	Design of Concrete Structures	3	1	4	70	30	100
BTCE602	Transportation Engineering	3	1	4	70	30	100
BTCE603	Environmental Engineering	3	1	4	70	30	100
BTCE604	**Departmental Elective III**	3	0	3	70	30	100
BTCE604A	Advance Structural Analysis						
BTCE604B	River Engineering						
BTCE604C	Repair and Rehabilitation of Structures						
BTCE604D	Foundation Engineering						
-	**Open Elective-I**	3	0	3	70	30	100
BTOE605A	Real Time Systems						
BTOE605B	Embedded System						
BTOE605C	Introduction To Mems						
BTOE605D	Object Oriented Programming						
BTOE605E	Numerical Techniques						
BTOE605F	GIS & Remote Sensing						
BTOE605G	Understanding The Human Being Comprehensively- Human Aspirations And Its Fulfillment						
BTCE606P	Transportation Engineering Lab	0	2	1	30	20	50
BTCE607P	Environmental Engineering Lab	0	2	1	30	20	50

BTCE608P	Structural Detailing Lab	0	2	1	30	20	50
Total		**15**	**9**	**21**	**440**	**210**	**650**
*The internship (6weeks) conducted during summer break after VI semester and will be assessed during VIIsemester							

B.Tech (CE)- Seventh Semester							
Subject Code	**Subject**	**L**	**T/P**	**Credits**	**End Semester Exam**	**Internal Marks**	**Total**
BTCE701	Design of Steel Structures	3	1	4	70	30	100
	Departmental Elective-IV	3	0	3	70	30	100
BTCE702A	Rural Development Engineering						
BTCE702B	Structure Dynamics						
BTCE702C	Advanced Concrete Design						
BTCE702D	Environmental Impact Assessment & Life Cycle Analysis						
	Departmental Elective-V	3	0	3	70	30	100
BTCE703A	Water Resource Engineering						
BTCE703B	Ground Improvement Techniques						
BTCE703C	Earthquake Resistant Design of Structure						
-	**Open Elective-II**	3	0	3	70	30	100
BTCEOE704A	Digital & Social Media Marketing						
BTCEOE704B	Idea to Business Model						
BTCEOE704C	Machine Learning						
BTCEOE704D	Renewable Energy Resources						
BTCEOE704E	Operation Research						
BTCEOE704F	Value Relationship & Ethical Human Conduct – For A Happy & Harmonious Society						
BTCE705P	**Steel Structure Drawing**	0	2	1	30	20	50

	Lab						
BTCE706P	**Minor Project**	0	6	3	100	50	150
BTCE707P	**Internship Assessment**	0	2	2	30	20	50
Total		**12**	**11**	**19**	**440**	**210**	**650**

B.Tech(CE)- Eight Semester							
Subject Code	**Subject**	**L**	**T/P**	**Credits**	**End Semester Exam**	**Internal Marks**	**Total**
BTCE801	Project Management & Entrepreneurship	3	0	3	70	30	100
	Departmental Elective-VI	3	0	3	70	30	100
BTCE802A	Probability Methods in Civil Engineering						
BTCE802B	Solid Waste Management						
BTCE802C	Geosynthesis & Reinforced Soil Structures						
BTCE802D	Disaster Preparedness & Management						
BTCE802E	Sustainable Construction Methods						
	Open Elective-III	3	0	3	70	30	100
BTCEOE803A	Filter Design						
BTCEOE803B	Bio-economics						
BTCEOE803C	Design Thinking						
BTCEOE803D	Introduction to Women's & Gender Studies						
BTCEOE803E	Quality Management						
BTCEOE803F	Modeling of Field Effects Nano Devices						
BTCEOE803G	Computerized Process Control						
BTCE804P	Project	0	18	9	200	100	300
Total		**9**	**18**	**18**	**410**	**190**	**600**

SEMESTER I

Programming for Problem Solving

BTCE101

Course Objectives:

1. To understand the various steps in Program development.
2. To understand the basic concepts in C Programming Language.
3. To learn how to write modular and readable C Programs
4. To learn to write programs (using structured programming approach) in C to solve problems.

Course Outcomes:

1. To develop simple algorithms for arithmetic and logical problems.
2. To translate the algorithms to programs & execution (in C language).
3. To implement conditional branching, iteration and recursion.
4. To decompose a problem into functions and synthesize a complete program using divide and conquer approach.
5. To use arrays, pointers and structures to develop algorithms and programs.

Module – 1 : **(Introduction to Programming)** **[08]**

Introduction to components of a computer system: Memory, processor, I/O Devices, storage, operating system, Concept of assembler, compiler, interpreter, loader and linker.

Idea of Algorithm: Representation of Algorithm, Flowchart, Pseudo code with examples, From algorithms to programs, source code.

Programming Basics: Structure of C program, writing and executing the first C program, Syntax and logical errors in compilation, object and executable code. Components of C language. Standard I/O in C, Fundamental data types, Variables and memory locations, Storage classes.

Module – 2 : **(Arithmetic expressions & Conditional Branching)** **[08]**

Arithmetic expressions and precedence: Operators and expression using numeric and relational operators, mixed operands, type conversion, logical operators, bit operations, assignment operator, operator precedence and associativity.

Conditional Branching: Applying if and switch statements, nesting if and else, use of break and default with switch.

Module – 3 : **(Loops & Functions)**

Iteration and loops: use of while, do while and for loops, multiple loop variables, use of break and continue statements.

Functions: Introduction, types of functions, functions with array, passing parameters to functions, call by value, call by reference, recursive functions.

Module – 4 : **(Arrays & Basic Algorithms)** **[08]**

Arrays: Array notation and representation, manipulating array elements, using multi dimensional arrays.

Character arrays and strings, Structure, union, enumerated data types, Array of structures, Passing arrays to functions.

Basic Algorithms: Searching &Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, Notion of order of complexity.

Module – 5 :**(Pointer& File Handling) [08]**

Pointers: Introduction, declaration, applications, Introduction to dynamic memory allocation (malloc, calloc, realloc, free), Use of pointers in self-referential structures, notion of linked list (no implementation)

File handling: File I/O functions, Standard C preprocessors, defining and calling macros, command-line arguments.

Text books:

1. Schum‟s Outline of Programming with C by Byron Gottfried, McGraw-Hill.
2. The C programming by Kernighan Brain W. and Ritchie Dennis M., Pearson Education.
3. Computer Basics and C Programming by V.Rajaraman , PHI Learning Pvt. Limited,2015
4. Computer Concepts and Programming in C, R.S. Salaria, Khanna Publishing House
5. Computer Concepts and Programming in C, E Balaguruswami, McGraw Hill
6. Computer Science- A Structured Programming Approach Using C, by Behrouz
7. A. Forouzan, Richard F. Gilberg, Thomson, Third Edition , Cengage Learning – 2007.
8. Let Us C By Yashwant P. Kanetkar.
9. Problem Solving and Program Design in C, by Jeri R. Hanly, Elliot B. Koffman, Pearson.
10. Programming in C by Kochan Stephen G. Pearson Education – 2015.
11. Computer Concepts and Programming in C by D.S. Yadav and Rajeev Khanna, New AgeInternational Publication.
12. Problem Solving and Programming in C, R.S. Salaria, Khanna Publishing House

Programming for Problem Solving Lab
BTCE108P

Course Objectives:

1. To be familiarize with flowgorithm to solve simple problems
2. To develop programs to solve basic problems by understanding basic concepts in C like operators, control statements etc.
3. To develop modular, reusable and readable C Programs using the concepts like functions, arrays, strings, pointers and structures.

Course Outcomes:

1. To write programs for arithmetic and logical problems.
2. To translate the algorithms to programs & execution (in C language).
3. To write programs for conditional branching, iteration and recursion.
4. To write programs using functions and synthesize a complete program using divide and conquer approach.
5. write programs using arrays, pointers and structures.

Other Reference: - Use C Open Source Software referring Spoken Tutorial MOOC

1. WAP that accepts the marks of 5 subjects and finds the sum and percentage marks obtained by the student.
2. WAP that calculates the Simple Interest and Compound Interest. The Principal, Amount, Rate of Interest and Time are entered through the keyboard.
3. WAP to calculate the area and circumference of a circle.
4. WAP that accepts the temperature in Centigrade and converts into Fahrenheit using the formula C/5=(F-32)/9.
5. WAP that swaps values of two variables using a third variable.
6. WAP that checks whether the two numbers entered by the user are equal or not.
7. WAP to find the greatest of three numbers.
8. WAP that finds whether a given number is even or odd.
9. WAP that tells whether a given year is a leap year or not.
10. WAP that accepts marks of five subjects and finds percentage and prints grades according to the following criteria:
    Between 90-100% ---------- Print „A‟
    Between 80-90% ---------- Print „B‟
    Between 60-80% ---------- Print „C‟
    Between Below 60% ---------- Print „D‟
11. WAP that takes two operands and one operator from the user and perform the operation and prints the result by using Switch statement.
12. WAP to print the sum of all numbers up to a given number.
13. WAP to find the factorial of a given number.
14. WAP to print sum of even and odd numbers from 1 to N numbers.
15. WAP to print the Fibonacci series.
16. WAP to check whether the entered number is prime or not.
17. WAP to find the sum of digits of the entered number.

18. WAP to find the reverse of a number.
19. WAP to print Armstrong numbers from 1 to 100.
20. WAP to convert binary number into decimal number and vice versa.
21. WAP that simply takes elements of the array from the user and finds the sum of these elements.
22. WAP that inputs two arrays and saves sum of corresponding elements of these arrays in a third array and prints them.
23. WAP to find the minimum and maximum element of the array.
24. WAP to search an element in a array using Linear Search.
25. WAP to sort the elements of the array in ascending order using Bubble Sort technique.
26. WAP to add and multiply two matrices of order nxn.
27. WAP that finds the sum of diagonal elements of a mxn matrix.
28. WAP to implement strlen (), strcat (),strcpy () using the concept of Functions.
29. Define a structure data type TRAIN_INFO. The type contain Train No.: integer type Train name: string Departure Time: aggregate type TIME Arrival Time: aggregate type TIME Start station: string End station: string The structure type Time contains two integer members: hour and minute. Maintain a train timetable and implement the following operations:
   (i) List all the trains (sorted according to train number) that depart from a particular section.
   (ii) List all the trains that depart from a particular station at a particular time.
   (iii) List all he trains that depart from a particular station within the next one hour of a given time.
   (iv) List all the trains between a pair of start station and end station.
30. WAP to swap two elements using the concept of pointers.
31. WAP to compare the contents of two files and determine whether they are same or not.
32. WAP to check whether a given word exists in a file or not. If yes then find the number of times it occurs.

Emerging Domain in Electronics Engineering
(BTCE102)

Course Objectives:

1. Introduce basic building blocks of linear integrated circuits.
2. Use tools covering the back end design stages of digital integrated circuits.
3. Study the concept of waveform generation and some special function IC's

Course Outcomes:

1. Understand the concept of PN Junction and devices.
2. Understand the concept of BJT, FET and MOFET.
3. Understand the concept of Operational amplifier
4. Understand the concept of measurement instrument.
5. Understand the working principle of different type of sensor and their uses.
6. Understand the concept of IoT system & Understand the component of IoT system

Unit	Topics	Lectures
I	**Semiconductor Diode**: Depletion layer, V-I characteristics, ideal and practical Diodes, Diode Equivalent Circuits, Zener Diodes breakdown mechanism (Zener and avalanche)	**3**
	Diode Application: Diode Configuration, Half and Full Wave rectification, Clippers, Clampers, Zener diode as shunt regulator, Voltage-Multiplier Circuits	**3**
	Special Purpose two terminal Devices: Light-Emitting Diodes, Photo Diodes, Varactor Diodes, Tunnel Diodes, Liquid-Crystal Displays.	**2**
II	**Bipolar Junction Transistor:** Transistor Construction, Operation, Amplification action. Common Base, Common Emitter, Common Collector Configuration	**4**
	Field Effect Transistor: Construction and Characteristic of JFETs. Transfer Characteristic. MOSFET (MOS) (Depletion and Enhancement) Type, Transfer	**4**
III	**Operational Amplifiers:** Introduction, Op-Amp Basic, Practical Op-Amp Circuits (Inverting Amplifier, Non-inverting Amplifier, Unit Follower, Summing Amplifier, Integrator, Differentiator).Differential and Common-Mode Operation, Comparators.	**4**
	Introduction of IoT System, Components of IoT system: Microprocessor and Microcontroller, Bluetooth Technology, Wi-Fi Technology, Concept of Networking, Sensor Nodes, concept of cloud.	**4**
IV	**Digital Electronics:** Number system & representation. Introduction of Basic and Universal Gates, using Boolean algebra simplification of Boolean function. K Map Minimization upto 6 Variable.	**6**
	Introduction To IC Technology: SSI, MSI, LSI, VLSI Integrated Circuits.	**2**
V	**Fundamentals of Communication Engineering:** Basics of signal representation and analysis, Electromagnetic spectrum Elements of a Communication System, Need of modulation and typical applications, Fundamentals of amplitude modulation and demodulation techniques.	**4**
	Introduction to Data Communications: Goals and applications of Networks.	**4**

	General Model of Wireless Communication: Evolution of mobile radio communication fundamentals, GPRS, GSM, CDMA. Elements of Satellite & Radar Communication,	

Text Books:

1. Robert L. Boylestand / Louis Nashelsky "Electronic Devices and Circuit Theory", Pearson Education.
2. H S Kalsi, "Electronic Instrumentation", McGraw Publication
3. George Kennedy, "Electronic Communication Systems", McGraw Publication
4. David A. Bell, "Electronic Devices and Circuits", Oxford University Press.
5. Jacob Millman, C.C. Halkias, Staya brataJit, "Electronic Devices and Circuits", McGraw Hill
6. David A. Bell, Electronic Instrumentation and Measurements, Latest Edition, Oxford University Press India

Emerging Domain in Electronics Engineering-Lab
(BTCE107P)

Course Objectives: To design and analyze various Electronic circuits such as multi-vibrators, applications of operational amplifiers, RC coupled amplifiers, oscillators, digital circuits etc.

Course Outcomes:

1. Basic Electrical Engineering/ Emerging Domain in Electronics Engineering.
2. Identify various types of Printed Circuit Boards (PCB), Soldering Techniques and preparing PCBs.
3. Wind a Step-down transformer winding of less than 5VA.
4. Demonstrate the working of Lab Equipment.
5. Interpret the characteristics and applications of PN junction diode, Zener diode, BJT and op-amp.

Suggestive List of Experiments:

Part A

1. Study of various types of Active & Passive Components based on their ratings.
2. Identification of various types of Printed Circuit Boards (PCB) and soldering Techniques.
3. PCB Lab: a. Artwork & printing of a simple PCB. b. Etching & drilling of PCB
4. Winding shop: Step down transformer winding of less than 5VA.
5. Soldering shop: Soldering and disordering of Resistor in PCB. Soldering and disordering of IC in PCB. Soldering and disordering of Capacitor in PCB

Part B

1. Study of Lab Equipments and Components: CRO, Multimeter, and Function Generator, Power supply- Active, Passive Components and Bread Board.
2. P-N Junction diode: Characteristics of PN Junction diode - Static and dynamic resistance measurement from graph.
3. Applications of PN Junction diode: Half & Full wave rectifier- Measurement of Vrms, Vdc, and ripple factor.
4. Characteristics of Zener diode: V-I characteristics of zener diode, Graphical measurement of forward and reverse resistance.
5. Characteristic of BJT: BJT in CE configuration.
6. To study Operational Amplifier as Adder and Subtractor
7. Verification of Truth Table of Various Logic Gate.
8. Implementation of the given Boolean function using logic gates in both SOP and POS forms.

Engineering Chemistry
BTCE103

Course Objectives:

1. To appreciate the need and importance of engineering chemistry for industrial and domestic use.
2. To gain the knowledge on existing and future upcoming materials used in device fabrication.
3. To impart basic knowledge related to material selection and the techniques for material analysis.
4. To impart knowledge of green chemical technology and its applications.
5. To enhance the thinking capabilities in line with the modern trends in engineering and technology.

Course Outcomes:

1. Use of different analytical instruments.
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solution, chloride and iron content in water.
3. Measure hardness of water.
4. Estimate the rate constant of reaction.

Module-1 **[08]**

Atomic and Molecular Structure:

Molecular orbital's of diatomic molecules. Band theory of solids. Liquid crystal and its applications. Point defects in solids. Structure and applications of Graphite and Fullerenes. Concepts of Nanomaterials and its application.

Module-2 **[08]**

Spectroscopic techniques and Applications:

Elementary idea and simple applications of Rotational, Vibrational, Ultraviolet& Visible and Raman spectroscopy.

Module-3 **[08]**

Electrochemistry

Nernst Equation and application, relation of EMF with thermodynamic functions (ΔH, ΔF and ΔS). Lead storage battery. Corrosion; causes, effects and its prevention. Phase Rule and its application to water system.

Module-4 **[08]**

Water Analysis; Hardness of water, Techniques for water softening (Lime-soda, Zeolite, Ion exchange resin and Reverse osmosis method).

Fuels: classification of fuels, Analysis of coal, Determination of calorific value (Bomb calorimeterand Dulong'smethos).

Module-5 **[08]**

Polymer; Basic concepts of polymer-Blend and composites, Conducting and biodegradable polymers. Preparation and application of some industrially important polymers (Buna-S, Buna-N, Neoprene, Nylon-6, nylon-6,6 and Terylene) . General methods of synthesis of organometallic compounds (Grignard reagent) and their applications.

Reference Books:

1. University Chemistry By B.H. Mahan
2. University Chemistry By C.N.R. Rao
3. Organic Chemistry By I.L. Finar
4. Physical Chemistry By S. Glasstone
5. Engineering Chemistry By S.S. Dara
6. Polymer Chemistry ByFre W., Billmeyer
7. Engineering ChemistryBy Satya Prakash

Engineering Chemistry- Practical
BTCE106P

Course Objectives: The objective of this course is to acquaint the students with practical knowledge of the basic phenomenon/concepts of chemistry, the student face during course of their study in the industry and engineering field. The students will be able to understand and explain scientifically the various chemistry related problems in the industry/engineering and develop experimental skills for building technical competence.

Course Outcomes:

1. Use of different analytical instruments.
2. Measure molecular/system properties such as surface tension, viscosity, conductance of solution, chloride and iron content in water.
3. Measure hardness of water.
4. Estimate the rate constant of reaction.

List Of Experiments

1. Determination of alkalinity in the given water sample.
2. Determination of temporary and permanent hardness in water sample using EDTA.
3. Determination of iron content in the given solution by Mohr's method.
4. Determination of viscosity of given liquid.
5. Determination of surface tension of given liquid.
6. Determination of chloride content in water sample.
7. Determination of available chlorine in bleaching powder.
8. Determination of pH by pH-metric titration.
9. Preparation of Phenol-formaldehyde and Urea-formaldehyde resin.
10. Determination of Cell constant and conductance of a solution.
11. Determination of rate constant of hydrolysis of esters.
12. Verification of Beer's law.

NOTE: Choice of any 8 experiments from the above.

Engineering Mathematics-I
BTCE104

Course Objectives:

1. Content Objectives: Students should learn fundamental mathematical concepts and how to apply them.
2. Students should learn critical thinking, modeling/problem solving and effective use of technology.
3. Communication Objectives: Students should learn how to read mathematics and use it to communicate knowledge.

Course Outcomes:

1. Remember the concept of matrices and apply for solving linear simultaneous equations.
2. Understand the concept of limit, continuity and differentiability and apply in the study of Rolle,s , Lagrange,s and Cauchy mean value theorem and Leibnitz theorems .
3. Identify the application of partial differentiation and apply for evaluating maxima, minima, series and Jacobians.
4. Illustrate the working methods of multiple integral and apply for finding area, volume, centre of mass and centre of gravity.
5. Remember the concept of vector and apply for directional derivatives, tangent and normal planes. Also evaluate line, surface and volume integrals.

Module 1: Matrices **[08]**

Types of Matrices: Symmetric, Skew-symmetric and Orthogonal Matrices; Complex Matrices, Inverse and Rank of matrix using elementary transformations, Rank-Nullity theorem; System of linear equations, Characteristic equation, Cayley-Hamilton Theorem and its application, Eigen values and eigenvectors; Diagonalisation of a Matrix.

Module 2: Differential Calculus- I **[08]**

Introduction to limits, continuity and differentiability, Rolle's Theorem, Lagrange's Mean value theorem and Cauchy mean value theorem, Successive Differentiation (n^{th} order derivatives), Leibnitz theorem and its application, Envelope, Involutes and Evolutes, Curve tracing: Cartesian and Polar co-ordinates.

Module 3: Differential Calculus-II **[08]**

Partial derivatives, Total derivative, Euler's Theorem for homogeneous functions, Taylor and Maclaurin's theorems for a function of one and two variables, Maxima and Minima of functions of several variables, Lagrange Method of Multipliers, Jacobians, Approximation of errors.

Module 4: Multivariable Calculus-I **[08]**

Multiple integration: Double integral, Triple integral, Change of order of integration, Change of variables, **Application:** Areas and volumes, Center of mass and center of gravity (Constant and variable densities).

Module 5: Vector Calculus **[08]**

Vector differentiation: Gradient, Curl and Divergence and their Physical interpretation, Directional derivatives, Tangent and Normal planes.

Vector Integration: Line integral, Surface integral, Volume integral, Gauss's Divergence theorem, Green's theorem, Stoke's theorem (without proof) and their applications.

Text Books:-

1. B. V. Ramana, Higher Engineering Mathematics, Tata Mc Graw-Hill Publishing Company Ltd., 2008.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.
3. R K. Jain & S R K. Iyenger , Advance Engineering Mathematics, Narosa Publishing House 2002.

Reference Books-

1. E. Kreyszig, Advance Engineering Mathematics, John Wiley & Sons, 2005.
2. Peter V. O'Neil, Advance Engineering Mathematics, Thomson (Cengage) Learning, 2007.
3. Maurice D. Weir, Joel Hass, Frank R. Giordano, Thomas, Calculus, Eleventh Edition, Pearson.
4. D. Poole, Linear Algebra : A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
5. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
6. Ray Wylie C and Louis C Barret, Advanced Engineering Mathematics, Tata Mc-Graw-Hill; Sixth Edition.
7. P. Sivaramakrishna Das and C. Vijayakumari, Engineering Mathematics, 1st Edition, Pearson India
   Education Services Pvt. Ltd
8. Advanced Engineering Mathematics. Chandrika Prasad, Reena Garg, 2018.
9. Engineering Mathemathics – I. Reena Garg, 2018.

English
BTCE105

Course Objectives:

The objective is to help the students to become independent users of English language. Students should be able to understand spoken and written English language of varied complexity including some abstract topics; particularly the language of their chosen technical field. They must show awareness of appropriate format and a capacity for explaining their views in a rational manner. The students should be able to converse fluently, without strain with international speakers of English in an accent and lexis that is widely understood across the globe. They should be able to produce on their own texts which are clear and coherent.

Course Outcomes:

1. Students will be enabled to understand the basic objective of the course by being acquainted with specific dimensions of communication skills i.e. Reading, Writing, Listening, Thinking and Speaking.
2. Students would be able to create substantial base by the formation of strong professional vocabulary for its application at different platforms and through numerous modes as Comprehension, reading, writing and speaking etc.
3. Students will apply it at their work place for writing purposes such as Presentation/official drafting / administrative communication and use it for document/project/report/research paper writing.
4. Students will be made to evaluate the correct & error-free writing by being well-versed in rules of English grammar & cultivate relevant technical style of communication & presentation at their work place & also for academic uses.
5. Students will apply it for practical and oral presentation purposes by being honed up in presentation skills and voice-dynamics. They will apply techniques for developing inter-personal communication skills and positive attitude leading to their professional competence.

Module 1- Basics of Technical English [08]

Technical English: Definition; Extent& Coverage; Dimensions; Reading; Skimming: Scanning Churning & Assimilation; Writing: Methods: Inductive; Deductive; Exposition; Linear; Interrupted; Spatial & Chronological etc; Technical Communication; Approaches: Brevity; Objectivity; Simplicity; Utility & Clarity.

Listening: Active; Passive; Thinking strategies: Positive & Logical thinking; Speaking: Essentials Nuances & Modes of Speech Delivery.

Module 2- Components of Technical Writing [08]

Vocabulary Building: Select words; Concept of word formation; Word formation; Root words from foreign languages & their use in English; Prefixes & Suffixes: Derivatives; Synonyms; Antonyms; Abbreviations. Homophones. One word substitutes; Requisites of Sentences.

Module 3- Basic Technical Writing Skills [08]

Forms: Business writing: Principle; Purchase & Sales Letters; Drafts; Official Writing: Official Letter; D.O. Letter; Notices; Agenda; Minutes of Meeting; Sentence Structure; Phrases & Clauses in sentences; Coherence; Unity; Emphasis in Writing; Devices; Use of Writing methods in Documents; Techniques of writing.

Module 4- Common Grammatical Errors & Technical Style [08]

Subject-verb agreement; Correct usage: Noun; Pronoun; Agreement; Modifiers; Articles; Prepositions; Cliches; Redundancies; Technical Style: Features; Choice of words; Sentences: Descriptive; Narrative; Expository; Defining & Classifying; Length of paragraph; Writing of Introduction & Conclusion.

Module 5- Presentation Strategies & Oral Communications [08]

Analysis of locale; Audience; Modulating Style & Content; Speaking with confidence; Kinesics; Paralinguistic features of Voice-Dynamics: Pitch; Intonation; Stress & Rhythm; Conversation & dialogues; Communication at work-place; etc.

Text Books:

1. Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, NewDelhi.

Reference Books:

1. Word Power Made Easy by Norman Lewis, W.R.Goyal Pub. & Distributors, 2009, Delhi.
2. Manual of Practical Communication by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2013, Delhi.
3. English Grammar and Usage by R.P.Sinha, Oxford University Press, 2005, New Delhi.
4. English Grammar, Composition and Usage by N.K.Agrawal&F.T.Wood, Macmillan India Ltd., New Delhi.
5. Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House
6. English Grammar & Composition by Wren & Martin, S.Chand& Co. Ltd., New Delhi.
7. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt. Ltd, 2011, New Delhi.
8. Personality Development, Harold R. Wallace &L.Ann Masters, Cengage Learning, New Delhi
9. Personality Development & Soft Skills, BarunK.Mitra, Oxford University Press, 2012 New Delhi.
10. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
11. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.
12. Spoken English- A manual of Speech and Phonetics by R.K.Bansal&J.B.Harrison, Orient Blackswan, 2013, New Delhi.
13. Business English by Ken Taylor, Orient Blackswan, 2011, New Delhi.

Mechanical Workshop Lab
BTCE109P

Course Objectives:

1. Main objective of the course is to introduce the students to fundamentals involved in the inter-conversion of thermal energy into mechanical energy and vice versa
2. Familiarize the students about the common engineering materials finding vide application in Mechanical Engineering Industry.
3. Provide basic knowledge of design parameters of various mechanical components.

Course Outcomes

1. Use various engineering materials, tools, machines and measuring equipments.
2. Perform machine operations in lathe and CNC machine.
3. Perform manufacturing operations on components in fitting and carpentry shop.
4. Perform operations in welding, moulding, casting and gas cutting.
5. Fabricate a job by 3D printing manufacturing technique

S. No.	Mechanical Workshop	Duration
1	**Introduction to Mechanical workshop material, tools and machines** To study layout, safety measures and different engineering materials (mild steel, medium carbon steel, high carbon steel, high speed steel and cast iron etc) used in workshop. To study and use of different types of tools, equipments, devices & machines used in fitting, sheet metal and welding section. To determine the least count of vernier caliper, vernier height gauge, micrometer (Screw gauge) and take different reading over given metallic pieces using these instruments.	**3 Hours**
2	**Machine shop** Demonstration of working, construction and accessories for Lathe machine Perform operations on Lathe - Facing, Plane Turning, step turning, taper turning, threading, knurling and parting.	**3 Hours**
3	**Fitting shop** 1. Practice marking operations. 2. Preparation of U or V -Shape Male Female Work piece which contains: Filing, Sawing, Drilling, Grinding.	**3 Hours**
4	**Carpentry Shop** Study of Carpentry Tools, Equipment and different joints. Making of Cross Half lap joint, Half lap Dovetail joint and Mortise Tension Joint	**3 Hours**
5	**Welding Shop** Introduction to BI standards and reading of welding drawings.	

SEMESTER II

Fundamental of Mechanical Engineering and Mechatronics
BTCE201

Course Objectives:

1. Understand key elements of Mechatronics system, representation into block diagram.
2. Understand concept of transfer function, reduction and analysis.
3. Understand principles of sensors, its characteristics, interfacing with DAQ microcontroller.
4. Understand the concept of PLC system and its ladder programming, and significance of PLC systems in industrial application.
5. Understand the system modeling and analysis in time domain and frequency domain.

Course Outcomes:

1. Identification of key elements of mechatronics system and its representation in terms of block diagram.
2. Understanding the concept of signal processing and use of interfacing systems such as ADC, DAC, digital I/O.
3. Time and Frequency domain analysis of system model (for control application)
4. PID control implementation on real time systems
5. Development of PLC ladder programming and implementation of real life system.

Unit	Topics	Lectures
I	**Unit I: Introduction to Mechanics of Solid:** Normal and shear Stress, strain, Hookes' law, Poisson's ratio, elastic constants and their relationship, stress-strain diagram for ductile and brittle materials, factor of safety. Basic Numerical problems. Types of beams under various loads, Statically Determinate Beams, Shear force and bending moment in beams, Shear force and bending moment diagrams, Relationships between load, shear and bending moment. Basic Numerical problems.	8
II	**Introduction to IC Engines and RAC:** **IC Engine:** Basic Components, Construction and Working of Two stroke and four stroke SI & CI engine, merits and demerits, scavenging process; Introduction to electric, and hybrid electric vehicles. **Refrigeration:** Its meaning and application, unit of refrigeration; Coefficient of performance, methods of refrigeration, construction and working of domestic refrigerator, concept of heat pump. Formula based numerical problems on cooling load. **Air-Conditioning:** Its meaning and application, humidity, dry bulb, wet bulb, and dew point temperatures, comfort conditions, construction and working of window air conditioner.	10
III	**Introduction to Fluid Mechanics and Applications:** **Introduction:** Introduction: Fluids properties, pressure, density, dynamic and kinematic viscosity, specific gravity, Newtonian and Non-Newtonian fluid, Pascal's Law, Continuity Equation, Bernaulli's Equation and its applications, Basic Numerical problems. Working principles of hydraulic turbines & pumps and their classifications, hydraulic accumulators, hydraulic lift and their applications.	7
IV	**Measurements and Control System:** Concept of Measurement, Error in	8

	measurements, Calibration, measurements of pressure, temperature, mass flow rate, strain, force and torques; Concept of accuracy, precision and resolution, Basic Numerical problems. System of Geometric Limit, Fit, Tolerance and gauges, Basic Numerical problems. **Control System Concepts:** Introduction to Control Systems, Elements of control system, Basic of open and closed loop control with example.	
V	**Introduction to Mechatronics:** Evolution, Scope, Advantages and disadvantages of Mechatronics, Industrial applications of Mechatronics, Introduction to autotronics, bionics, and avionics and their applications. Sensors and Transducers: Types of sensors, types of transducers and their characteristics. **Overview of Mechanical Actuation System** – Kinematic Chains, Cam, Train Ratchet Mechanism, Gears and its type, Belt, Bearing. **Hydraulic and Pneumatic Actuation Systems:** Overview: Pressure Control Valves, Cylinders, Direction Control Valves, Rotary Actuators, Accumulators, Amplifiers, and Pneumatic Sequencing Problems.	10

Reference Books:

1 Basic Mechanical Engineering, G Shanmugam, S Ravindran, McGraw Hill
2 Basic Mechanical Engineering, M P Poonia and S C Sharma, Khanna Publishers
3 Mechatronics : Principles, Concepts and Applications, Nitaigour Mahalik, McGraw Hill
4 Mechatronics, As per AICTE: Integrated Mechanical Electronic Systems, K.P. Ramachandran, G.K. Vijayaraghavan, M.S.Balasundaram, Wiley India
5 Mechanical Measurements & Control, Dr. D. S. Kumar. Metropolitan Book Company
6 Fluid Mechanics and Hydraulic Machines, Mahesh Kumar, Pearson India

Basic Electrical Engineering
BTCE202

Course Objectives:

1. Be able to complete detailed study of Basic Electrical and Electronics Engineering.
2. Explain the working principle and parts of various electrical and electronic devices.
3. To impart the basic knowledge about the Electric and Magnetic circuits.
4. Discuss the nonstructural features and working of ac and dc machines.

Course Outcomes

1. Apply the concepts of KVL/KCL and network theorems in solving DC circuits.
2. Analyze the steady state behavior of single phase and three phase AC electrical circuits.
3. Identify the application areas of a single phase two winding transformer as well as an auto transformer and calculate their efficiency. Also identify the connections of a three phase transformer.
4. Illustrate the working principles of induction motor, synchronous machine as well as DC machine and employ them in different area of applications.
5. Describe the components of low voltage electrical installations and perform elementary calculations for energy consumption.

Module - 1: DC Circuits **[08]**

Electrical circuit elements (R, L and C), Concept of active and passive elements, voltage and current sources, concept of linearity and linear network, unilateral and bilateral elements, Kirchhoff's laws, Loop and nodal methods of analysis, Star-delta transformation, Superposition theorem, Thevenin theorem, Norton theorem.

Module - 2: Steady- State Analysis of Single Phase AC Circuits **[08]**

Representation of Sinusoidal waveforms – Average and effective values, Form and peak factors, Concept of phasors, phasor representation of sinusoidally varying voltage and current. Analysis of single phase AC Circuits consisting of R, L, C, RL, RC, RLC combinations (Series and Parallel), Apparent, active & reactive power, Power factor, power factor improvement. Concept of Resonance in series & parallel circuits, bandwidth and quality factor. Three phase balanced circuits, voltage and current relations in star and delta connections.

Module - 3 : Transformers **[08]**

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

Module –4 : Electrical machines **[08]**

DC machines: Principle & Construction, Types, EMF equation of generator and torque equation of motor, applications of DC motors (simple numerical problems)

Three Phase Induction Motor: Principle & Construction, Types, Slip-torque characteristics, Applications (Numerical problems related to slip only)

Single Phase Induction motor: Principle of operation and introduction to methods of starting, applications.

Three Phase Synchronous Machines: Principle of operation of alternator and synchronous motor and their applications.

Module –5 : Electrical Installations **[06]**

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Importance of earthing. Types of Batteries, Important characteristics for Batteries. Elementary calculations for energy consumption and savings, battery backup.

Spoken Tutorial (MOOCs):

1. AC DC Circuit Analysis using NgSpice, Open Source Software (http://spoken-tutorial.org)

Text Books:

1. Ritu Sahdev, "Basic Electrical Engineering", Khanna Publishing House.
2. S. Singh, P.V. Prasad, "Electrical Engineering: Concepts and Applications" Cengage.
3. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill.
4. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill.

Reference Books:

1. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
2. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press.
3. V. D. Toro, "Electrical Engineering Fundamentals", Pearson India.

Basic Electrical Engineering Lab
BTCE207P

Course Objectives:

1. Be able to complete detailed study of Basic Electrical and Electronics Engineering.
2. Explain the working principle and parts of various electrical and electronic devices.
3. To impart the basic knowledge about the Electric and Magnetic circuits.
4. To inculcate the understanding about the AC fundamentals.
5. Discuss the nonstructural features and working of ac and dc machines

Course Outcomes

1. Conduct experiments illustrating the application of KVL/KCL and network theorems to DC electrical circuits.
2. Demonstrate the behavior of AC circuits connected to single phase AC supply and measure power in single phase as well as three phase electrical circuits.
3. Perform experiment illustrating BH curve of magnetic materials.
4. Calculate efficiency of a single phase transformer and DC machine.
5. Perform experiments on speed measurement and reversal of direction of three phase induction motor and Identify the type of DC and AC machines based on their construction.

List Of Experiments

Note: A minimum of 8 experiments from the following should be performed.

1. Verification of Kirchhoff's laws
2. Verification of Superposition and Thevenin Theorem.
3. Measurement of power and power factor in a single-phase ac series inductive circuit and study improvement of power factor using capacitor
4. Study of phenomenon of resonance in RLC series circuit and obtain resonant frequency.
5. Connection and measurement of power consumption of a fluorescent lamp (tube light).
6. Measurement of power in 3- phase circuit by two wattmeter method and determination of its power factor for star as well as delta connected load.
7. Determination of parameters of ac single phase series RLC circuit
8. To observe the B-H loop of a ferromagnetic material in CRO.
9. Determination of (i) Voltage ratio (ii) polarity and (iii) efficiency by load test of a single phase transformer.
10. Determination of efficiency of a dc shunt motor by load test
11. To study running and speed reversal of a three-phase induction motor and record speed in both directions.
12. Demonstration of cut-out sections of machines: dc machine, three phase induction machine, single-phase induction machine and synchronous machine.

Engineering Physics

BTCE203

Course Objectives:

1. To understand the Importance of applications of Applied Physics in daily life.
2. To provide students with a basic understanding of the Physics that may be required by engineers in the course of their careers.
3. To impart knowledge related to the importance of EM waves and magnetic materials.
4. To enhance knowledge related to lasers and its different components to make it suitable for various purposes.
5. To introduce most important concepts of superconductivity, crystallography and fiber optics to the students

Course Outcomes:

1. To solve the classical and wave mechanics problems.
2. To develop the understanding of laws of thermodynamics and their application in various processes.
3. To formulate and solve the engineering problems on Electromagnetism & Electromagnetic Field Theory.
4. To aware of limits of classical physics & to apply the ideas in solving the problems in their parent streams.
5. Recognize the use of Laser, Magnetic materials, Superconductors and optical fibers in various fields.

Module - 1 Relativistic Mechanics: [8]

Frame of reference, Inertial & non-inertial frames, Galilean transformations, Michelson- Morley experiment, Postulates of special theory of relativity, Lorentz transformations, Length contraction, Time dilation, Velocity addition theorem, Variation of mass with velocity, Einstein‟s mass energy relation, Relativistic relation between energy and momentum, Massless particle.

Module- 2 Electromagnetic Field Theory: [8]

Continuity equation for current density, Displacement current, Modifying equation for the curl of magnetic field to satisfy continuity equation, Maxwell‟s equations in vacuum and in non conducting medium, Energy in an electromagnetic field, Poynting vector and Poynting theorem, Plane electromagnetic waves in vacuum and their transverse nature. Relation between electric and magnetic fields of an electromagnetic wave, Energy and momentum carried by electromagnetic waves, Resultant pressure, Skin depth.

Module- 3 Quantum Mechanics: [8]

Black body radiation, Stefan‟s law, Wien‟s law, Rayleigh-Jeans law and Planck‟s law, Wave particle duality, Matter waves, Time-dependent and time-independent Schrodinger wave equation, Born interpretation of wave function, Solution to stationary state Schrodinger wave equation for one-Dimensional particle in a box, Compton effect.

Module- 4 Wave Optics: [10]

Coherent sources, Interference in uniform and wedge shaped thin films, Necessity of extended sources, Newton‟s Rings and its applications. Fraunhoffer diffraction at single slit and at double slit, absent spectra, Diffraction grating, Spectra with grating, Dispersive power, Resolving power of grating, Rayleigh‟s criterion of resolution, Resolving power of grating.

Module- 5Fibre Optics & Laser: [10]

Fibre Optics**:** Introduction to fibre optics, Acceptance angle, Numerical aperture, Normalized frequency, Classification of fibre, Attenuation and Dispersion in optical fibres. Laser: Absorption of radiation, Spontaneous and stimulated emission of radiation, Einstein‟s coefficients, Population inversion, Various levels of Laser, Ruby Laser, He-Ne Laser, Laser applications.

Reference Books:

1. Concepts of Modern Physics - AurthurBeiser (Mc-Graw Hill)
2. Introduction to Special Theory of Relativity- Robert Resnick (Wiley)
3. Optics - Brijlal& Subramanian (S. Chand)
4. Engineering Physics: Theory and Practical- Katiyar and Pandey (Wiley India)
5. Applied Physics for Engineers- Neeraj Mehta (PHI Learning, New)
6. Engineering Physics-Malik HK and Singh AK (McGrawHill)

Engineering Physics Lab
BTCE206P

Course Objectives:

1. To impart physical measurement skills.
2. To make the students understand coherence between theoretical and practical measurement.
3. Develop the skills needed to set up the equipment required to test models or theory developed in the lecture course.
4. Be able to interpret results and develop correct conclusions.
5. Maintain a laboratory notebook and write formal reports of practical workout.

Course Outcomes:

1. To determine the wavelength of sodium light by Newton‟s ring experiment
2. To determine the wavelength of sodium light with the help of Fresnel‟s bi-prism
3. To determine the variation of magnetic field with the distance along the axis of a current carrying coil and estimate the radius of the coil.
4. To draw hysteresis (B-H curve) of a specimen in the form of a transformer and to determine its hysteresis loss.

List of Experiments

1. To determine the wavelength of sodium light by Newton‟s ring experiment.
2. To determine the wavelength of different spectral lines of mercury light using plane transmission grating.
3. To measure attenuation in an optical fiber.
4. To determine the wavelength of He-Ne laser light using single slit diffraction.
5. To determine the wavelength of sodium light with the help of Fresnel‟s bi-prism.
6. To determine the coefficient of viscosity of a given liquid.
7. To determine the value of acceleration due to gravity (g) using compound pendulum.
8. To determine the energy band gap of a given semiconductor material.
9. To study Hall effect and determine Hall coefficient, carrier density and mobility of a given semiconductor material using Hall effect setup.
10. To determine the variation of magnetic field with the distance along the axis of a current carrying coil and estimate the radius of the coil.
11. To study the resonance condition of a series LCR circuit.
12. To draw hysteresis (B-H curve) of a specimen in the form of a transformer and to determine its hysteresis loss.

Reference Books

1. Practical Physics- K. K. Dey & B. N. Dutta (Kalyani Publishers New Delhi)
2. Engineering Physics-Theory and Practical- Katiyar& Pandey (Wiley India)
3. Engineering Physics Practical- S K Gupta (KrishnaPrakashan Meerut)

Engineering Mathematics-II
BTCE204

Course Objectives:

1. Content Objectives: Students should learn fundamental mathematical concepts and how to apply them.
2. Skill Objectives: Students should learn critical thinking, modeling/problem solving and effective use of technology.
3. Communication Objectives: Students should learn how to read mathematics and use it to communicate knowledge.
4. The students are expected to understand the fundamentals of the mathematics to apply while designing technology and creating innovations.

Course Outcomes:

1. Understand the concept of differentiation and apply for solving differential equations.
2. Remember the concept of definite integral and apply for evaluating surface areas and volumes.
3. Understand the concept of convergence of sequence and series. Also evaluate Fourier series.
4. Illustrate the working methods of complex functions and apply for finding analytic functions.
5. Apply the complex functions for finding Taylor's series, Laurent's series and evaluation of definite integrals.

Module 1: Ordinary Differential Equation of Higher Order [10]

Linear differential equation of n^{th} order with constant coefficients, Simultaneous linear differential equations, Second order linear differential equations with variable coefficients, Solution by changing independent variable, Reduction of order, Normal form, Method of variation of parameters, Cauchy-Euler equation, Series solutions (Frobenius Method).

Module 2: Multivariable Calculus-II [08]

Improper integrals, Beta & Gama function and their properties, Dirichlet's integral and its applications, Application of definite integrals to evaluate surface areas and volume of revolutions.

Module 3: Sequences and Series [08]

Definition of Sequence and series with examples, Convergence of sequence and series, Tests for convergence of series, (Ratio test, D' Alembert's test, Raabe's test). Fourier series, Half range Fourier sine and cosine series.

Module 4: Complex Variable – Differentiation [08]

Limit, Continuity and differentiability, Functions of complex variable, Analytic functions, Cauchy-Riemann equations (Cartesian and Polar form), Harmonic function, Method to find Analytic functions, Conformal mapping, Mobius transformation and their properties

Module -5 Complex Variables – Integration [08]

Complex integrals, Contour integrals, Cauchy- Goursat theorem, Cauchy integral formula, Taylor's series, Laurent's series, Liouvilles's theorem, Singularities, Classification of Singularities, zeros of

analytic functions, Residues, Methods of finding residues, Cauchy Residue theorem, Evaluation of real integral of the type $\int_0^{2\pi} f(cos\theta, \sin\theta)d\theta$ and $\int_{-\infty}^{\infty} f(x)dx$.

Text Books:-

1. B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd., 2008.
2. B. S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.
3. R. K. Jain & S. R. K. Iyenger , Advance Engineering Mathematics , Narosa Publishing - House, 2002.

Reference Books:-

1. E. Kreyszig, Advance Engineering Mathematics, John Wiley & Sons, 2005.
2. Peter V. O'Neil, Advance Engineering Mathematics, Thomson (Cengage) Learning, 2007.
3. Maurice D. Weir, Joel Hass, Frank R.Giordano, Thomas, Calculus, Eleventh Edition, Pearson.
4. G.B Thomas, R L Finney, Calculus and Analytical Geometry, Ninth Edition Pearson, 2002.
5. James Ward Brown and Ruel V Churchill, Fourier Series and Boundary Value Problems, 8th Edition-Tata McGraw-Hill
6. D. Poole , Linear Algebra : A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
7. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
8. Charles E Roberts Jr, Ordinary Diffrential Equations, Application, Model and Computing, CRC Press T&F Group.
9. Ray Wylie C and Louis C Barret, Advanced Engineering Mathematics, 6th Edition, Tata McGraw-Hill.
10. James Ward Brown and Ruel V Churchill, Complex Variable and Applications, 8th Edition, Tata McGraw-Hill.
11. P. Sivaramakrishna Das and C. Vijayakumari, Engineering Mathematics, 1st Edition, Pearson India Education Services Pvt. Ltd.
12. Advanced Engineering Mathematics By Chandrika Prasad, Reena Garg Khanna Publishing House, Delhi

Artificial Intelligence for Engineers
(BTCE205)

Course Objectives:

1. Study the concepts of Artificial Intelligence.
2. Learn the methods of solving problems using Artificial Intelligence.
3. Learn the knowledge representation techniques, reasoning techniques and planning.
4. Introduce the concepts of Expert Systems and machine learning.

Course Outcomes

1. Understand the evolution and various approaches of AI
2. Understand data storage, processing, visualization, and its use in regression, clustering etc.
3. Understand natural language processing and chatbots
4. Understand the concepts of neural networks.
5. Understand the concepts of face, object, speech recognition and robots.

Course	Topics
Unit 1	**An overview to AI**
1.1	The evolution of AI to the present
1.2	Various approaches to AI
1.3	What should all engineers know about AI?
1.4	Other emerging technologies
1.5	AI and ethical concerns
Unit 2	**Data & Algorithms**
2.1	History Of Data
2.2	Data Storage And Importance of Data and its Acquisition
2.3	The Stages of data processing
2.4	Data Visualization
2.5	Regression, Prediction & Classification
2.6	Clustering & Recommender Systems
Unit 3	**Natural Language Processing**
3.1	Speech recognition
3.2	Natural language understanding
3.3	Natural language generation
3.4	Chatbots
3.5	Machine Translation
Unit 4	**Artificial Neural Networks**
4.1	Deep Learning
4.2	Recurrent Neural Networks
4.3	Convolutional Neural Networks

4.4	The Universal Approximation Theorem
4.5	Generative Adversarial Networks

Unit 5	Applications
5.1	Image and face recognition
5.2	Object recognition
5.3	Speech Recognition besides Computer Vision
5.4	Robots
5.5	Applications

Reference Books:

1. Artificial Intelligence: A Modern Approach by Stuart Russell and Peter Norvig, Prentice Hall
2. Artificial Intelligence by Kevin Knight, Elaine Rich, Shivashankar B. Nair, Publisher : McGraw Hill
3. Data Mining: Concepts and Techniques by Jiawei Han, Micheline Kamber, Jian Pei, Publisher: Elsevier Science.
4. Speech & Language Processing by Dan Jurafsky, Publisher : Pearson Education
5. Neural Networks and Deep Learning A Textbook by Charu C. Aggarwal, Publisher: Springer International Publishing
6. Introduction to Artificial Intelligence By Rajendra Akerkar, Publisher : PHI Learning

English Language Lab
BTCE208P

Course Objectives:

1. To facilitate software based learning to provide the required English Language proficiency to students.
2. To acquaint students with specific dimensions of communication skills i.e. Reading, Writing, Listening, Thinking and Speaking.
3. To train students to use the correct and error-free writing by being well versed in rules of English grammar.
4. To cultivate relevant technical style of communication and presentation at their work place and also for academic uses.
5. To enable students to apply it for practical and oral presentation purposes by being honed up in presentation skills and voice-dynamics.

Course Outcomes:

1. Demonstrate an understanding of written English language of varied complexity on most topics including some abstract topics.
2. Write grammatically correct English in diverse situations.
3. Produce on their own texts which are clear and coherent. They must show awareness of appropriate format and a capacity for explaining their views in a rational manner.
4. Exhibit an ability to draft documents effectively to apply for various job Interviews and to conduct business in general.
5. Display the ability to analyze data and present it in the form of a concise written document

SYLLABUS: PROFESSIONAL COMMUNICATION LAB SHALL HAVE TWO PARTS:
Interactive and Communicative Practical with emphasis on Oral Presentation/Spoken Communication based on International Phonetic Alphabets (LP.A.)

List of Practicals

1. Group Discussion: Practical based on Accurate and Current Grammatical Patterns.
2. Conversational Skills for Interviews under suitable Professional Communication Lab conditions with emphasis on Kinesics.
3. Communication Skills for Seminars/Conferences/Workshops with emphasis on Paralinguistic /Kinesics.
4. Presentation Skills for Technical Paper/Project Reports/ Professional Reports based on proper Stress and Intonation Mechanics.
5. Official/Public Speaking based on suitable Rhythmic Patterns.
6. Theme Presentation/ Keynote Presentation based on correct methodologies argumentation.
7. Individual Speech Delivery/Conferencing with skills to defend Interjections/Quizzes.
8. Argumentative Skills/Role Play Presentation with Stress and Intonation.
9. Comprehension Skills based on Reading and Listening Practical's on a model Audio.

1. **Computer assisted software based Language Learning:** Software based self-guided learning to provide the required English language proficiency to students from an

employability and career readiness standpoint. The software should align to Common European Framework of Reference for Languages (CEFR) and deliver a CEFR level – B2 upon completion.

2. **Interactive Communication Skills:** Students should practice the language with variety of activities and exercises based on employability skills as startup presentations, GD, Mock interview, Video portfolio, Extempore, Role play, Just A Minute (JAM) etc.

Suggested software:

1. **Oxford Achiever** by Oxford University Press.
2. **Cambridge English Empower** by Cambridge University Press.
3. **MePro.** by Pearson India Education Services Pvt. Ltd.
4. **New Interactions** by McGraw-Hill India.

Reference Books:

1. Word Power Made Easy by Norman Lewis, W.R. Goyal Pub. & Distributors, 2009, Delhi.
2. Manual of Practical Communication by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2013, Delhi.
3. A Course in Phonetics and Spoken English, Sethi & Dhamija:, Prentice Hall
4. English Pronouncing Dictionary, Joans Daniel, Cambridge University Press, 2007.
5. English Grammar and Usage by R. P. Sinha, Oxford University Press, 2005, New Delhi.
6. English Grammar, Composition and Usage by N.K. Agrawal & F.T. Wood, Macmillan India Ltd., New Delhi.
7. Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House
8. English Grammar & Composition by Wren & Martin, S.Chand & Co. Ltd., New Delhi.
9. Communication Skills for Engineers and Scientists, Sangeeta Sharma et.al. PHI Learning Pvt. Ltd, 2011, New Delhi.
10. Personality Development, Harold R. Wallace & L. Ann Masters, Cengage Learning, New Delhi
11. Personality Development & Soft Skills, Barun K. Mitra, Oxford University Press, 2012 New Delhi.

Engineering Graphics and Design-Lab
(BTCE209P)

Course Objectives:

1. Main objective of the Engineering Drawing is to introduce the students to visual technique in the form of technical graphics.
2. Familiarize the students related to Theory of Orthographic Projection, Projection of points, lines, planes and solids as per the BIS codes prevalent to drawing practice.
3. Section of solids, intersection and development of surface will further elaborate the detailed concept of geometrical objects.
4. Isometric projection and orthographic projection of simple solids/blocks will enable to visualize the geometrical objects and to certain extent the machine parts.

Course Outcomes

1: Understanding of the visual aspects of engineering design
2: Understanding of engineering graphics standards and solid modelling
3: Applying modern engineering tools necessary for engineering practice
4: Apply the knowledge to visualize engineering objects.
5: Recognize the detailed concept of 3D isometric and orthographic projections. CO4. Develop competence with industry practice and standards.

Module 1: Introduction to Engineering Drawing, Orthographic Projections [08]

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Scales – Plain and Diagonal Scales

Principles of Orthographic Projections – Conventions – Projections of Points and Lines inclined to both planes; Projections of planes inclined Planes – Auxiliary Planes.

Module 2: Projections and Sections of Regular Solids [08]

Sections in lined to both the Planes – Auxiliary Views; Simple annotation, dimensioning and scale. Floor plans the include: windows, doors and fixtures such as WC, Both, sink, shower, etc.

Prism, Cylinder, Pyramid, Cone – Auxiliary Vies: Development of surfaces of Right Regular Solids – Prism, Pyramid, Cylinder and Cone.

Module 3: Isometric Projections [08]

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, Conversions.

Module 4: Computer Graphics [08]

Listing the computer technologies the impact on graphical communication, Demonstration knowledge of the theory of CAD software [such as: The Menu System, Tollbars (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];

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: 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 pater 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 modelling 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 5: Demonstration of a simple team design project [08]

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-modelling 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) Engineering Graphics & Design, A.P. Gautam & Pradeep Jain, Khanna Publishing House

(v) Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.

(Corresponding set of) CAD Software Theory and User Manuals

SEMESTER III

Mathematics –III (Integral Transform & Discrete Maths)
[BTCE301]
(To be offered to CE and Allied Branches)

Course Objective:

1 To develop logical understanding of the subject.
2 To develop mathematical skill so that students are able to apply mathematical methods & principals in solving problem from engineering fields.
3 To make aware students about the importance and symbiosis between Mathematics and Engineering.

Course Outcomes:

1 Student will demonstrate basic knowledge of L.D.E.,P.D.E.,Vector & F.T.
2 Student will show the understanding of impact of Engg. Mathematics on Engineering.
3 Student will demonstrate their understanding of mathematical ideas from multiple perspectives, such as by using the internal connections between geometry, algebra, and numerical computation.
4 Student will demonstrate their understanding of mathematical ideas from multiple perspectives, such as by applying the connections between theory and applications.
5 Student will demonstrate their understanding of mathematical ideas from multiple perspectives, such as by distinguishing between a formal proof and a less formal arguments and understanding the different roles these play in mathematics.

The students will learn:

- The idea of Laplace transform of functions and their application
- The idea of Fourier transform of functions and their applications
- The basic ideas of logic and Group and uses.
- The idea s of sets, relation, function and counting techniques.
- The idea of lattices, Boolean algebra, Tables and Karnaugh maps.

MODULE I

Laplace Transform **(8)**

Laplace transform, Existence theorem, Laplace transforms of derivatives and integrals, Initial and final value theorems, Unit step function, Dirac- delta function, Laplace transform of periodic function, Inverse Laplace transform, Convolution theorem, Application to solve simple linear and simultaneous differential equations.

MODULE II

Integral Transforms **(9)**

Fourier integral, Fourier Transform , Complex Fourier transform, Inverse Transforms, Convolution Theorems, Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensional heat transfer equations, wave equations and Laplace equations, Z- Transform and its application to solve difference equations.

Module- III (**8**)

Formal Logic ,Group, Ring and Field: Introduction to First order logic, Proposition, Algebra of Proposition, Logical connectives, Tautologies, contradictions and contingency, Logical implication, Argument, Normal form, Rules of inferences, semi group, Monoid Group, Group, Cosets, Lagrange's theorem , Congruence relation , Cyclic and permutation groups, Properties of groups, Rings and Fields (definition, examples and standard results only)

Module- IV (**10**)

Set, Relation, function and Counting Techniques - Introduction of Sets, Relation and Function, Methods of Proof, Mathematical Induction, Strong Mathematical Induction, Discrete numeric function and Generating functions, recurrence relations and their solution , Pigeonhole principle.

Module- V (**10**)

Lattices and Boolean Algebra: Introduction, Partially ordered sets, Hasse Diagram, Maximal and Minimal element, Upper and Lower bounds, Isomorphic ordered sets, Lattices, Bounded Lattices and , Distributive Lattices. Duality, Boolean Algebras as Lattices, Minimization of Boolean Expressions, prime Implicants, Logic Gates and Circuits, Truth Table, Boolean Functions, Karnaugh Maps.

Text Books

1. E. Kreyszig: Advanced Engineering Mathematics; John Wiley & Sons.

2. R.K. Jain & S.R.K. Iyenger: Adnanced Engineering Mathematics, Narosa Publishing House.

3. C.L.Liu: Elements of Discrete Mathematics; Tata McGraw- Hill Publishing Company Limited, New Delhi.

4. S. Lipschutz, M.L. Lipson and Varsha H. Patil: Discrete Mathematics; Tata McGraw- Hill Publishing Company Limited, New Delhi

5. B. Kolman , Robert C. Busby & S. C. Ross: Discrete Mathematical Structures' 5^{th} Edition, Perason Education (Singapore), Delhi, India. Reference Books

6. B.S. Grewal: Higher Engineering Mathematics; Khanna Publishers, New Delhi.

7. B.V. Ramana: Higher Engineering Mathematics; Tata McGraw- Hill Publishing Company Limited, New Delhi.

8. Peter V.O' Neil. Advanced Engineering Mathematics, Thomas (Cengage) Learning.

9. Kenneth H. Rosem: Discrete Mathematics its Application, with Combinatorics and Graph Theory; Tata McGraw- Hill Publishing Company Limited, New Delhi.

10. K.D. Joshi: Foundation of Discrete Mathematics; New Age International (P) Limited, Publisher, New Delhi.

Technical Communication
(BTCE302)

Course Objectives:

1. To understand the concept, process and importance of Technical Communication.
2. To enable students to acquire English Speaking and Writing Skills.
3. To enable students to develop Presentation Skills

Course Outcomes

1. Students will be enabled to **understand** the nature and objective of Technical Communication relevant for the work place as Engineers.
2. Students will utilize the technical writing for the purposes of Technical Communication and its exposure in various dimensions.
3. Students would imbibe inputs by presentation skills to enhance confidence in face of diverse audience.
4. Technical communication skills will **create** a vast know-how of the application of the learning to promote their technical competence.
5. It would enable them to **evaluate** their efficacy as fluent & efficient communicators by learning the voice-dynamics.

Unit -1 Fundamentals of Technical Communication:

Technical Communication: Features; Distinction between General and Technical Communication; Language as a tool of Communication

Dimensions of Communication: Reading & comprehension; Technical writing: sentences; Paragraph

Technical style: Definition, types & Methods; The flow of Communication: Downward; upward, Lateral or Horizontal; Barriers to Communication.

Unit - II Forms of Technical Communication:

Technical Report: Definition & importance;

Thesis/Project writing: structure & importance; synopsis writing: Methods

Technical research Paper writing: Methods & style; Seminar & Conference paper writing; **Key-Note Speech:** Introduction & Summarization; Expert Technical Lecture: Theme clarity; Analysis & Findings; 7 Cs of effective business writing: concreteness, completeness, clarity, conciseness, courtesy, correctness, consideration.

Unit - III Technical Presentation: Strategies & Techniques

Presentation: Forms; interpersonal Communication; Class room presentation; style; method;

Individual conferencing: essentials: Public Speaking: method; Techniques: Clarity of substance; emotion; Humour; Modes of Presentation;

Overcoming Stage Fear: Confident speaking; Audience Analysis & retention of audience interest

Methods of Presentation: Interpersonal; Impersonal; Audience Participation: Quizzes & Interjections.

Unit - IV Technical Communication Skills:

Interview skills, Group Discussion: Objective & Method; Seminar/Conferences Presentation **skills:** Focus; Content; Style; Argumentation skills; Devices; Analysis; Cohesion & Emphasis; Critical thinking;
Nuances: Exposition narration & Description; effective business communication competence; Grammatical;
Discourse competence: combination of expression & conclusion;
Socio-linguistic competence: Strategic competence: Solution of communication problems with verbal and non-verbal means.

Unit - V Kinesics & Voice Dynamics:
Kinesics: Definitions; importance; Features of Body Language; Voice Modulation: Quality, Pitch; Rhythm; intonation; Pronunciation; Articulation; stress & accent
Linguistic features of voice control: Vowel & Consonant Sounds.

Reference Books

1. Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2007, New Delhi.
2. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
3. Practical Communication: Process and Practice by L.U.B. Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2014, Delhi.
4. Modern Technical Writing by Sherman, Theodore A (et.al); Apprentice Hall; New Jersey; U.S.
5. A Text Book of Scientific and Technical Writing by S.D. Sharma; Vikas Publication, Delhi.
6. Skills for Effective Business Communication by Michael Murphy, Harward University, U.S.
7. Business Communication for Managers by Payal Mehra, Pearson Publication, Delhi

Technical Communication Laboratory Practicals

Course Objectives:

1. To understand the concept, process and importance of Technical Communication.
2. To enable students to acquire English Speaking and Writing Skills.
3. To enable students to develop Presentation Skills

Course Outcomes

1. Students will be enabled to **understand** the nature and objective of Technical Communication relevant for the work place as Engineers.
2. Students will utilize the technical writing for the purposes of Technical Communication and its exposure in various dimensions.
3. Students would imbibe inputs by presentation skills to enhance confidence in face of diverse audience.
4. Technical communication skills will **create** a vast know-how of the application of the learning to promote their technical competence.
5. It would enable them to **evaluate** their efficacy as fluent & efficient communicators by learning the voice-dynamics.

Interactive and Communicative Practical with emphasis on Oral Presentation / Spoken Communication based on International Phonetic Alphabets (I.P.A.)

List of Practicals

1. Group Discussion: Practical based on Accurate and Current Grammatical Patterns.
2. Conversational Skills for Interviews under suitable Professional Communication Lab conditions with emphasis on Kinesics.
3. Communication Skills for Seminars/Conferences/Workshops with emphasis on Paralinguistics/Kinesics.
4. Presentation Skills for Technical Paper/Project Reports/ Professional Reports based on proper Stress and Intonation Mechanics.
5. Official/Public Speaking based on suitable Rhythmic Patterns.
6. Theme- Presentation/Key-Note Presentation based on correct argumentation methodologies.
7. Individual Speech Delivery/Conferencing with skills to defend Interjections/Quizzes.
8. Argumentative Skills/Role Play Presentation with Stress and Intonation.
9. Comprehension Skills based on Reading and Listening Practicals on a model Audio- Visual Usage.

Reference Books

1. Bansal R.K. & Harrison: A manual of Speech & Phonetics, Orient Black Swan Pvt. Ltd. New Delhi, 2010.

2. Sethi & Dhamija: A Course in Phonetics and Spoken English, Prentice Hall, New Delhi, 2011.
3. L.U.B.Pandey: Practical Communication-Process & Practice, A.I.T.B.S. Pub. India Ltd. Krishan Nagar, Delhi, 2013.
4. Joans Daniel, English Pronouncing Dictionary, Cambridge Univ. Press. 2007.

Engineering Mechanics
(BTCE303)

Course Objectives:

The course begins with an introduction that covers the fundamental concepts and principles of Statics. The equilibrium of particles is then introduced along with the rules of adding and subtracting of force vectors. The course then proceeds to cover the equilibrium of rigid bodies in two and three dimensions and the analysis of different types of structures and machines. Determination of the moment of a force about an arbitrary point and/or axis, the equivalence of a system of forces and/or couples to the Resultant Force and/or Couple will also be introduced. The final part of the course will cover frictional forces and the structural properties of areas.

Course Outcomes:

1. Use scalar and vector analytical techniques for analyzing forces in statically determinate structures.
2. Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems.
3. Apply basic knowledge of mathematics and physics to solve real-world problems.
4. Understand basic dynamics concepts – force, momentum, work and energy.
5. Understand and be able to apply Newton's laws of motion;

UNIT - I

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; **[8 Hours]**

UNIT- II

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. **[8 Hours]**

UNIT - III

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. **[8 Hours]**

UNIT - IV

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). **[8 Hours]**

UNIT - V

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. **[8 Hours]**

Books and References

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. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press
5. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
6. Hibler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) by Pearson Education
7. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer's Engineering Mechanics
8. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications
9. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.
10. Tayal A.K. (2010), Engineering Mechanics, Umesh Publications
11. Strength of Materials by Timoshenko and Yσungs, East West Press.
12. Textbook of Applied Mechanics-Dynamics and Statics by Prasad I.B, Khanna Publications.

Surveying & Geomatics
[BTCE-304]

Course Objectives:

1. To provide basic knowledge about principles of surveying for location, design and construction of engineering projects.
2. Students develop skills using surveying instruments including measuring tapes, automatic levels, theodolites, and electronic distance measurement equipment.
3. The ability to identify error sources and the procedures to minimize errors.
4. Use standard survey tools.
5. Understand and apply measurement error, accuracy, precision and techniques to improve accuracy of surveys

Course Outcomes:

1. Describe the function of surveying and work with survey instruments, take observations, and prepare plan, profile, and cross-section and perform calculations.
2. Calculate, design and layout horizontal and vertical curves.
3. Operate a total station and GPS to measure distance, angles, and to calculate differences in elevation. Reduce data for application in a geographic information system.
4. Relate and apply principles of photogrammetry for surveying.
5. Apply principles of Remote Sensing and Digital Image Processing for Civil Engineering problems.

UNIT - I

Introduction to Surveying: Definition, Classification, Principles, Survey stations and Survey lines; Introduction to measurement of distance, direction and elevation; Ranging and it methods, Meridians and Bearings, Methods of leveling, Booking and reducing levels, Reciprocal leveling, distance of visible horizon, Profile leveling and cross sectioning, Errors in leveling; Introduction to methods of plane table surveying;

Contouring: Characteristics, methods, uses, computation of areas and volumes.

Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Methods of horizontal and vertical control,

Triangulation: Figures or systems, Signals, Satellite station, Baseline and its importance, corrections, Trigonometric leveling: Accessible and inaccessible objects. **[8 Hours]**

UNIT - II

Curves: Elements of simple circular curves, Theory and methods of setting out simple circular curves, Transition curves- types, characteristics and equations of various transition curves; Introduction to vertical curves. **[8 Hours]**

UNIT - III

Modern Field Survey Systems: Principle and types of Electronic Distance Measurement systems and instruments, Total Station- its advantages and applications; Global Positioning Systems- Segments, working principle, errors and biases. Geographic Information System: Concepts and data types, data models, data acquisition. GIS applications in civil engineering.

[8 Hours]

UNIT - IV

Photogrammetric Survey: Basic principles, aerial camera, scale of a vertical photograph, relief displacement of a vertical photograph, height of object from relief displacement, flight planning for aerial photography, selection of altitude, interval between exposures, crab and drift, stereoscope and stereoscopic views, parallax equations. Introduction to digital photogrammetric. **[8 Hours]**

UNIT - V

Remote Sensing: Concepts and physical basis of Remote Sensing, Electromagnetic spectrum, atmospheric effects, image characteristics. Remote sensing systems, spectral signatures and characteristics spectral reflectance curves. Salient features of some of Remote Sensing satellites missions. Digital image processing: Introduction, image rectification and restoration, image enhancement, image transformation, image classification. Applications of remote sensing to civil engineering. **[8 Hours]**

Books and References:

1. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.
2. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011
3. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010
4. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
5. Anji Reddy, M., Remote sensing and Geographical information system, B.S. Publications, 2001.
6. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House.
7. Punmia BC et al: Surveying Vol. I, II, Laxmi Publication
8. Chandra AM and Ghosh SK: Remote Sensing and Geographical Information System, Alpha Science
9. Ghosh SK: Digital Image Processing, Alpha Science
10. Lillesand T M et al: Remote Sensing & Image Interpretation, John Wiley & Sons
11. Bhatta B: Remote Sensing and GIS, Oxford University Press, 2008.

Fluid Mechanics
[BTCE305]

Course Objectives:

1. Be familiar with different fluids.
2. Be familiar with different fluids flow condition.
3. Learning different flow & losses in pipes.
4. Be familiar with flow in open channel & different sections.

Course Outcomes:

1. Understand the broad principles of fluid statics, kinematics and dynamics
2. Understand definitions of the basic terms used in fluid mechanics
3. Understand classifications of fluid flow
4. Apply the continuity, momentum and energy principles
5. Apply dimensional analysis

UNIT I

Fluid and continuum: Physical properties of fluids, Rheology of fluids. Pressure-density height relationship, manometers, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to linear acceleration and uniform rotation about an axis. **[8 Hours]**

UNIT II

Types of fluid flows: Continuum & free molecular flows. Steady and unsteady, uniform and non-uniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, subsonic, sonic and supersonic flows, sub-critical, critical and supercritical flows, one, two and three dimensional flows, streamlines, path lines, streak lines, stream tube, continuity equation for 1-D, 2-D and 3-D flows, circulation, stream function and velocity potential function.

[8 Hours]

UNIT III

Potential Flow: source, sink, doublet and half-body. Equation of motion along a streamline and its integration, Bernoulli's equation and its applications- Pitot tube, orifice meter, venturimeter and bend meter, notches and weirs, momentum equation and its application to pipe bends. resistance to flow, Minor losses in pipe in series and parallel, power transmission through a pipe, siphon, water hammer, three reservoir problems and pipe networks. **[8 Hours]**

UNIT IV

Equation of motion for laminar flow through pipes: Stokes' law, mixing length concept and

velocity distribution in turbulent flow over smooth and rough surfaces, Boundary layer thickness, boundary layer over a flat plate, displacement, momentum and energy thickness. Application of momentum equation. Laminar boundary layer, turbulent boundary layer, laminar sub-layer, separation and its control. Vortex Flow: Free & Forced. **[8 Hours]**

UNIT V

Drag and lift, drag on a sphere: aerofoil, Magnus effect, Similarity Laws; geometric, kinematics and dynamic similarity, undistorted and distorted model studies, Dimensional analysis, Buckingham's Pi theorem, important dimensionless numbers and their significance. Introduction to Computational Fluid Dynamics (CFD).

Hydraulic Machines - Turbines: Classification of turbines, draft tube, specific speed, unit quantities, and characteristics curves of turbines, and governing of turbine**.**

Pump: Classification of pumps, types, efficiencies, specific speed, selection, cavitations, characteristic curves. **[8 Hours]**

Books and References

1. Hibbler, "Fluid Mechanics in SI Units" 1/e Pearson Education, Noida.
2. Fox & Donald, "Introduction to Fluid Mechanics" John Wiley &Sons Pvt Ltd,
3. Cengel & Cimbala, "Fluid Mechanics" TMH, New Delhi.
4. Katz, "Introductory Fluid Mechanics" Cambridge University Press.
5. Pnueli & Gutfinger, "Fluid Mechanics" Cambridge University Press
6. Modi & Seth "Hydraulics & Fluid Mechanics" Standard Publications.
7. Gupta, "Fluid Mechanics & Hydraulic Machines" Pearson Education, Noida
8. Graebel, "Engineering Fluid Mechanics", CRC Press Taylor & Francis Group.
9. Janna, "Introduction to Fluid Mechanics" 4/e, CRC Press Taylor & Francis Group.
10. AK Jain "Fluid Mechanics" Khanna Publication.
11. White,F.M. "Fluid Mechanics" TMH, New Delhi.
12. Munsen et al , "Fundamental of Fluid Mechanics" Wiley Newyork Ltd
13. Garde, R.J., " Fluid Mechanics", SciTech Publications Pvt. Ltd
14. I.H. Shames, "Mechanics of Fluids", McGraw Hill, Int. Student.
15. RK Bansal "Fluid Mechanics and Hydraulic Machines" Laxmi Publication
16. Jagdish Lal "Fluid Mechanics"
17. N Narayan Pillai " Principles of Fluid Mechanics & Fluid Machines" Universities Press.
18. Esposito, Fluid Power & Applications" 7/e Pearson Education, Noida.
19. DR Malhotra & Malhotra, "Fluid Mechanics Hydraulics & Hydraulic Machines" Satya Prakashan, New Delhi.

Building Planning & Drawing Lab
[BTCE306P]

Course Objectives:

1. To understand the fundamental principles and concepts of planning and architecture for buildings.
2. To study about different views of layout.
3. To learn the development controls covered by building bye laws and national building code for buildings.

Course Outcomes:

1. Interpret the technical terminologies related to planning and various conventional signs and symbols used in drawing the plans.
2. Draw plan for building (Mass Composition, Residential, Industrial and Public) by making use of various aspects of principles of planning, architecture and as per standard bye laws.
3. Draw perspective, isometric, orthographic, cross-sectional and elevational drawing of the building by imagination.
4. Draw, edit and print the plan of the building by using computer application like AutoCAD

Drawing and drafting of following with CAD/BIM software:-

1. Introduction to the tools and commands of drafting software.
2. Working in layers, blocks, x-ref, drawing layout and print setup.
3. 3D drafting and rendering
4. Planning and drafting of elevation and cross section of door and window
5. Planning and drafting of plan and cross section of Dog legged and open well staircase.
6. Planning and Drawings of Residential building of 1 room set (plan and section).
7. Planning and drawing of 3 room residential building with staircase.
8. Preparation of details general arrangement drawing of 4 room duplex house including planning and drafting

Surveying & Geomatics Lab
[BTCE307P]

Course Objectives:

1. To provide basic knowledge about principles of surveying for location, design and construction of engineering projects.
2. Students develop skills using surveying instruments including measuring tapes, automatic levels, theodolites, and electronic distance measurement equipment.
3. The ability to identify error sources and the procedures to minimize errors.
4. Use standard survey tools.
5. Understand and apply measurement error, accuracy, precision and techniques to improve accuracy of surveys

Course Outcomes:

1. Describe the function of surveying and work with survey instruments, take observations, and prepare plan, profile, and cross-section and perform calculations.
2. Calculate, design and layout horizontal and vertical curves.
3. Operate a total station and GPS to measure distance, angles, and to calculate differences in elevation. Reduce data for application in a geographic information system.
4. Relate and apply principles of photogrammetry for surveying.
5. Apply principles of Remote Sensing and Digital Image Processing for Civil Engineering problems.

1. To measure bearings of a closed traverse by prismatic compass and to adjust the traverse by graphical method.
2. To find out reduced levels of given points using Auto/dumpy level.
3. To study parts of a Vernier and electronic theodolite and measurement of horizontal and vertical angle.
4. To measure horizontal angle between two objects by repetition/reiteration method.
5. To determine the height of a vertical structure (e.g. chimney/ water tank etc.) using trigonometric leveling by taking observations in single vertical plane.
6. To set out a simple circular curve by Rankine's method.
7. Demonstration and working on Electronic Total Station. Measurement of distances, horizontal & vertical angles, coordinates and area of a land parcel.
8. Demonstration and working with Mirror stereoscopes, Parallax bar and Aerial photographs.
9. Visual Interpretation of standard FCC (False colour composite).
10. Digitization of physical features on a map/image using GIS software.
11. Coordinates measurement using GPS.

Fluid Mechanics Lab
[BTCE308P]

Course Objectives:

1. Be familiar with different fluids.
2. Be familiar with different fluids flow condition.
3. Learning different flow & losses in pipes.
4. Be familiar with flow in open channel & different sections.

Course Outcomes:

1. Understand the broad principles of fluid statics, kinematics and dynamics
2. Understand definitions of the basic terms used in fluid mechanics
3. Understand classifications of fluid flow
4. Apply the continuity, momentum and energy principles
5. Apply dimensional analysis

Note: Students will perform minimum 10 experiments from the following:

1. To verify the momentum equation using the experimental set-up on impact of jet.
2. To determine the coefficient of discharge of an orifice of a given shape. Also to determine the coefficient of velocity and the coefficient of contraction of the orifice mouth piece.
3. To calibrate an orifice meter and study the variation of the co-efficient of discharge with the Reynolds number.
4. To calibrate a Venturimeter and study the variation of the co-efficient of discharge with the Reynolds number.
5. To calibrate a bend meter and study the variation of the co-efficient of discharge with the Reynolds number.
6. Verification of Bernoulli's Theorem
7. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
8. To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.
9. To study the variation of friction factor, 'f' for turbulent flow in commercial pipes.
10. To study the boundary layer velocity profile over a flat plate and to determine the boundary layer thickness.
11. To determine Meta-centric height of a given ship model.
12. To determine the head loss for a sudden enlargement, sudden contraction and losses in bend.
13. Flow Visualization -Ideal Flow
14. To make studies in Wind Tunnel (Aerofoil and circular cylinder).

MINI Project or Internship Assessment
[BTCE309P]

Semester – IV

Engineering Geology
[BTCE401]

Course Objectives:

1. To understand fundamental concepts of engineering geology
2. To learn about the various types of rocks and their properties.
3. To study about the Earthquakes, its causes, classification etc
4. To gain knowledge about Landslides, Land subsidence and Geological Hazards
5. To learn about Geological investigations in Civil Engg

Course Outcomes:

1. Show the knowledge about engineering geology.
2. Show knowledge of the most important rocks and minerals and be able to identify them.
3. Analyze the Earthquakes and its various types.
4. Understand the characteristics of various Geological Hazards.
5. Do the Geological investigations; understand the geological conditions and geological maps.

UNIT- I Introduction to Engg. Geology -To understand fundamental concepts of engineering geology, engineering strength, physical & mechanical properties of minerals, rock forming minerals: A case study.

UNIT-II Rocks and its formations- Types of rocks and origins (structure, texture, agents), ternary diagrams, causes of metamorphism, Folds, Faults, Unconformity & joints: a case study.

UNIT- III Earthquakes - Earthquake, its causes, classification, seismic zones of India , seismotectanics of the Indian plate, earthquake problem and its preventive measures in construction of building , reservoir , dams , underground railway track & tunnels etc : A case study.

UNIT-IV Landslides, Land subsidence and Geological Hazards - Landslides, its causes, classification and preventive measures, land subsidence, its causes and preventive measures, major geological hazards & geological considerations in design of constructed facilities and infrastructure, mitigation of landslide hazard: A case study.

UNIT-V Geological investigations in Civil Engg -Geophysical techniques as aids in engineering geological investigations, geological conditions necessary for construction of bridges, dams, tunnels, building, road cuttings, concept of geological maps, important terminology used for map and making a section from the map: A case study

Text Books:

1. A Textbook of Geology – Mukherjee P.K. (World Press Publishers)
2. Engineering Geology – D.S. Arora (Mohindra Capital Publisher, Chandigarh)

Reference Books:

1. Geology and Engineering – Leggot, R.F. (Mc-Graw Hill, New York)
2. A Geology for Engineers – Blyth, F.G.M. (Arnold, London)
3. Civil Engineering Geology – Cyril Sankey Fox (C. Lockwood and son, U.K.)
4. Engineering and General Geology – Prabin Singh (Katson Publication House)

Universal Human Values and Professional Ethics

[BTCE402]

Course Objectives:

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession.
3. To help students understand the meaning of happiness and prosperity for a human being.
4. To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life

Course Outcome:

1. Understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society.
2. Distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body.
3. Understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society.
4. Understand the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.
5. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

UNIT-1

Course Introduction- Need, Basic Guidelines, Content and Process for Value Education Understanding the need, basic guidelines, content and process for Value Education, Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and Experiential Validation- as the mechanism for self exploration, Continuous Happiness and Prosperity- A look at basic Human Aspirations, Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority, Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario, Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

UNIT-2

Understanding Harmony in the Human Being- Harmony in Myself Understanding human being as a co-existence of the sentient 'I' and the material 'Body', Understanding the needs of Self ('I') and 'Body' - Sukh and Suvidha, Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer), Understanding the characteristics and activities of 'I' and harmony in 'I', Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of

Physical needs, meaning of Prosperity in detail, Programs to ensure Sanyam and Swasthya.

UNIT-3

Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship Understanding harmony in the Family- the basic unit of human interaction, Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti; Trust (Vishwas) and Respect (Samman) as the foundational values of relationship, Understanding the meaning of Vishwas; Difference between intention and competence, Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship, Understanding the harmony in the society (society being an extension of family): Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals, Visualizing a universal harmonious order in society- Undivided Society (AkhandSamaj), Universal Order (SarvabhaumVyawastha)- from family to world family!.

UNIT-4

Understanding Harmony in the Nature and Existence- Whole existence so-existence Understanding the harmony in the Nature, Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature, Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space, Holistic perception of harmony at all levels of existence.

UNIT-5

Implications of the above Holistic Understanding of Harmony on Professional Ethics Natural acceptance of human values, Definitiveness of Ethical Human Conduct, Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order, Competence in Professional Ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, technologies and management models, Case studies of typical holistic technologies, management models and production systems, Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers, b) At the level of society: as mutually enriching institutions and organizations.

Text Books:

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

References:

1. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and Harper Collins, USA
2. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
6. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
7. A N Tripathy, 2003, Human Values, New Age International Publishers.
8. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh,

Amravati.
9. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press.
10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
12. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Mode of Evaluation:
Assignment/ Seminar/Continuous Assessment Test/Semester End Exam

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.

Materials, Testing & Construction Practices
[BTCE-403]

Course Objectives:

1. In recognizing the good materials to be used for the construction work.
2. In investigation of soil condition, Deciding and design of suitable foundation for different structures.
3. In supervision of different types of masonry.
4. In selection of materials, design and supervision of suitable type of floor and roof.
5. To gain knowledge about doors, windows, plastering, painting, damp proofing, scaffolding, shoring, underpinning andto take suitable engineering measures.

Course Outcomes: At the end of this course the student will be able to-

1. Identify various building materials and to understand their basic properties.
2. Understand the use of non-conventional civil engineering materials.
3. Study suitable type of flooring and roofing in the construction process.
4. Characterize the concept of plastering, pointing and various other building services.
5. Exemplify the various fire protection, sound and thermal insulation techniques, maintenance and repair of buildings.

UNIT I **[8 Hours]**

Scope of Study of building Materials: building materials and their performance, economics of the building materials.

Stones: Requirement of good building stone, characteristics of building stone sand their testing. Common building stones.

Bricks: Manufacturing process of clay bricks, classification of clay bricks. Properties of clay bricks, testing methods for clay bricks. Problems of efflorescence & lime bursting in bricks & tiles. Different types of bricks.

Gypsum: properties of gypsum plaster, building products made of gypsum and their uses.

Cement: Raw materials used, Process of Manufacturing, Chemical composition, compounds formed and their effect on strength, Types of cement, Testing of cement properties, Uses of cement.

Cement Concrete: Constituent materials and their properties, Grades of concrete, Factors affecting strength, Properties of concrete at fresh and hardened stage, Testing of concrete, Methods of Curing of concrete.

Pozzolona: Chemical composition and requirements for uses, Natural and Artificial flyash, Surkhi(burnt clay pozzolona), rice husk and ash pozzolona, properties and specifications for use in construction.

Timber: Classification and identification of timber, Fundamental Engineering Properties of timber, Defects in timber, Factor affecting strength of timber, Methods of seasoning and preservation of timber. Wood based products.

Asphalt: Bitumen and Tar: Terminology, specifications and uses, Bituminous materials.

UNIT II **[8 Hours]**

Plastics: classification, advantages of plastics, Mechanical properties and use of plastic in

construction. Paints, varnishes and distempers: Common constituents, types and desirable properties, Cement paints.

Ferrous metals: Desirable characteristics of reinforcing steel. Principles of cold working. Strength, Telemechanical, physical Properties and chemical composition. Brief discussion on properties and uses of Aluminum and lead. Glass: Ingredients, properties types and use in construction.

Insulating Materials: Thermal and sound insulating material, desirable properties and types.

UNIT III **[8 Hours]**

Building Construction: Components of building area considerations, Construction Principle and Methods for layout, Damp proofing, anti termite treatment in buildings, Vertical circulation: stair cases and their types and planning. Different types of floors, and flooring materials .Bricks and stone masonry construction. Cavity wall & hollow block construction.

UNIT IV **[8 Hours]**

Doors and Windows: Construction details, types of doors and windows and their relative advantages & disadvantages. Types of roof and roof treatments, Lintel sand Chhajja, Principles of building Planning.

UNIT V **[8 Hours]**

Natural Ventilation, Water Supply and Sanitary fittings (Plumbing), Electric Fittings. Heating Ventilation & Air conditioning (HVAC), Mechanical Lifts and Escalators, Fire Fighting and Fire Protection of Buildings. Acoustics. Plastering and its types, pointing, Distempering, Colour washing, Painting etc. Principles & Methods of building maintenance.

Books and References

1. SK Duggal, “Building Materials” New Age International
2. Purushothama Raj, “Building Construction Materials & Techniques” Pearson Edu.
3. PC Varghese, “Building Materials” PHI
4. Rangwala, “Building Materials” Charotar Publishing House.
5. Sushil Kumar, “Building Construction” Standard Publisher.
6. Domone, “Construction Materials” 4/e, CRC Press Taylor & Francis Group.
7. Adams, “Adams’ Building Construction Adams” CRC Press Taylor & Francis Group.
8. BC Punmia, “Building Construction” Laxmi Publication.
9. Jha & Sinha, “Building Construction” Khanna Publishers
10. Sahu, “Building Materials and Construction” Mc Grew Hill Education
11. Deodhar, “Civil Engineering Materials” Khanna Publishers
12. Mehta, “Building Construction Principles, Materials & Systems” 2/e, Pearson Education Noida.
13. Sandeep Mantri, “Practical building Construction and its Management” Satya Publisher, New Delhi.
14. Khanna S. K., Justo C.E.G, & Veeraragavan A., “Highway Materials and Pavement Testing”, Nem Chand and Bros.
15. Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO etc.
16. Chudley, R. Greeno, Building Construction Handbook, Butterworth.

Introduction to Solid Mechanics
[BTCE404]

Course Objectives:

1. To understand the basic concepts of the stresses and strains for different materials and strength of structural elements.
2. To know the development of internal forces and resistance mechanism for one dimensional and two dimensional structural elements.
3. To analyse and understand different internal forces and stresses induced due to representative loads on structural elements.
4. To analyse and understand principal stresses due to the combination of two dimensional stresses on an element andfailure mechanisms in materials.
5. To evaluate the behavior of torsional members, columns and struts.

Course Outcomes:

1. Describe the concepts and principles of stresses and strains
2. Analyze solid mechanics problems using classical methods and energy methods
3. Analyze structural members subjected to combined stresses
4. Calculate the deflections at any point on a beam subjected to a combination of loads
5. Understand the behavior of columns, springs and cylinders against loads.

UNIT I **[8 Hours]**

Simple stress and strains: Concept of stress and strain, types of stresses and strains, Hook's law, stress and strain diagram for ductile and brittle metal. Lateral strain, Poission ratio, volumetric strain, elastic moduli and relation between them. Bar of varying cross section, composite bar and temperature stress. Strain energy for gradual, sudden and impact loading.

Compound stress and strains: Normal stress and strain, shear stress and strain, stresses on inclines sections, principal stress and strain, maximum shear stress, Mohr's stress circle, three dimensional state of stress & strain, equilibrium equations, generalized Hook's law-3D, Theories of failure and factor of safety.

UNIT II **[8 Hours]**

Shear force and bending moment diagrams: Shear force (SF) and Bending moment (BM) diagrams for simply supported, cantilevers, overhanging and fixed beams. Calculation of maximum BM and SF and the point of contra flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated loads (two or three) and uniformly distributed loads, uniformly varying loads.

UNIT III **[8 Hours]**

Flexural Stresses- Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.

Torsion- Derivation of torsion equation and its assumptions. Applications of the equation of the

hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion.

Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

UNIT IV **[8 Hours]**

Deflection of Beams: Slope and deflection- Relationship between moment, slope and deflection, Moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for determinant beams.

Short Columns and Struts: Buckling and stability, slenderness ratio, combined bending and direct stress, middle third and middle quarter rules.

UNIT V **[8 Hours]**

Helical and Leaf Springs: Deflection of springs by energy method, helical springs under axial load and under axial twist (respectively for circular and square cross sections) axial load and twisting moment acting simultaneously both for open and closed coiled springs.

Thin cylinders, Thick cylinders & Spheres: Introduction, difference between thin walled and thick walled pressure vessels, thin walled spheres and cylinders, hoop and axial stresses and strain, volumetric strain. Radial, axial and circumferential stresses in thick cylinders subjected to internal or external pressures, compound cylinders.

Books and References:

1. Mechanics of Materials by Hibbeler, Pearson.
2. Mechanics of material by Gere, Cengage Learning
3. Mechanics of Materials by Beer, Jhonston, DEwolf and Mazurek, MCGRAW HILL INDIA
4. Strength of Materials by Pytel and Singer, Harper Collins
5. Strength of Materials by Ryder, Macmillan.
6. Strength of Materials by Timoshenko and Yσungs, East West Press.
7. Introduction to Solid Mechanics by Shames, Pearson
8. Mechanics of material by Pytel, Cengage Learning
9. An Introduction to Mechanics of Solids by Crandall, MCGRAW HILL INDIA
10. Strength of Materials by Jindal, Pearson Education
11. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi.
12. Kazmi, S. M. A., "Solid Mechanics" TMH, Delhi, India.

Hydraulic Engineering & Machines
[BTCE-405]

Course Objectives:

1. Be familiar with different fluid flowing condition in pipe.
2. Determination of hydraulic parameters affecting flow of fluids by various Methods.
3. Learning different effects of pipe flow and their respective analysis.
4. Be familiar with hydraulic machines which has extensive application in Water Supply Civil Engineering Construction projects.

Course Outcomes:

1. Apply their knowledge of fluid mechanics in addressing problems in open channels.
2. Solve problems in uniform, gradually and rapidly varied flows in steady state conditions.
3. Have knowledge in hydraulic machineries like pumps and turbines.
4. Students are expected to understand & analyse transmission of pressure waves.
5. Students are expected to learn hydraulic properties of Turbine & Pumps.

UNIT I **[8 Hours]**

Introduction : Basic concepts of free surface flows, velocity and pressure distribution, Mass, energy and momentum principle for prismatic and non-prismatic channels critical, sub- critical and super-critical type of flows. Critical depth, concepts of specific energy and specific force. Chezy's and Manning's equations for uniform flow in open channel, Velocity distribution, most efficient channel section, compound sections.

UNIT II **[8 Hours]**

Energy-Depth relationship: Application of specific energy principle for interpretation of open channel phenomena, flow through vertical and horizontal contractions. Equation of gradually varied flow and its limitations, flow classification and surface profiles, integration of varied flow equation by analytical, graphical and numerical methods. Measurments of discharge & velocity – Venturi flume, Standing wave flume, Parshall flume, Broad crested weir, Current meter and Floats.

UNIT III **[8 Hours]**

Rapidly varied flow: Hydraulic jump; Evaluation of the jump elements in rectangular channels on horizontal and sloping beds, energy dissipater, open channel surge, celerity of the gravity wave, deep and shallow water waves.

UNIT IV **[8 Hours]**

Impulse momentum equation- Impact of Jets-plane and curved- stationary and moving plates. Pumps: Positive displacement pumps - reciprocating pumps , centrifugal pumps, operation, velocity triangles, performance curves, Cavitation, Multi staging, Selection of pumps.

UNIT V **[8 Hours]**

Rotodynamic Machines- Pelton Turbine, equations for jet and rotor size, efficiency, spear valve, reaction turbines, Francis and Kaplan type, Head on reaction turbine, unit quantities, similarity laws

and specific speed, cavitation, characteristic curves.

Books and References

1. Chow,V.T. “Open Channel hydraulics” McGraw Hill Publication
2. Subramanya, K., Flow through Open Channels, TMH, New Delhi
3. Ranga Raju, K.G., Flow through open channels, T.M.H. New Delhi
4. Rajesh Srivastava, Flow through Open Channels , Oxford University Press
5. Streeter, V.L.& White E.B., ”Fluid Mechanics” McGraw Hill Publication
6. Modi & Seth “Hydraulics & Fluid Mechanics” Standard Publications.
7. RK Bansal “Fluid Mechanics and Hydraulic Machines” Laxmi Publication
8. AK Jain “Fluid Mechanics” Khanna Publication.
9. Houghtalen, “Fundamentals of Hydraulics Engineering Systems” 4/e Pearson Education, Noida.

Material Testing Lab
[BTCE406P]

Course Objectives:

1. Ability to apply knowledge of mathematics and engineering in calculating the mechanical properties of structural materials.
2. Ability to function on multi-disciplinary teams in the area of materials testing.
3. Ability to use the techniques, skills and modern engineering tools necessary for engineering.
4. Understanding of professional and ethical responsibility in the areas of material testing.
5. Ability to communicate effectively the mechanical properties of materials.

Course Outcomes:

1. Learn the properties and characteristics of various building materials like stone, bricks, cement, cement concrete and their applications.
2. Understand the properties and characteristics of materials used in buildings like plastics, paints, ferrous metals and glass.
3. Understand the principles and methods of building construction and functional efficiency of buildings and their applications.
4. Understand different types of floors in building construction and their applications in construction.
5. Learn the various types of doors, windows and ventilators. KCE 401.6 learn water supply and sanitary fittings in buildings and their applications

Testing of various properties of following materials as per BIS specifications

I. Cement

1. Normal Consistency of cement.
2. Initial & final setting time of cement
3. Compressive strength of cement
4. Fineness of cement by air permeability and Le-chatalier's apparatus.
5. Soundness of cement.
6. Tensile strength

II. Coarse Aggregate

1. Water absorption of aggregate
2. Sieve Analysis of Aggregate
3. Specific gravity &bulk density
4. Grading of aggregates.

III. Fine Aggregate:

1. Sieve analysis of sand
2. Silt content of sand
3. Bulking of sand

IV. Bricks:

1. Water absorption.
2. Dimension Tolerances
3. Compressive strength

4. Efflorescence

Solid Mechanics Lab
[BTCE407P]

Course Objective:

The objective of this course is to make the students observe the response of the materials under different loads and measure various mechanical properties.

Course Outcomes:

1. Observe the behaviour of materials by conducting Tension, Compression & Shear tests.
2. Evaluate the Impact Strength of Material.
3. Determine the Hardness of a given material.
4. Determine Elastic constants of a given material using flexural and torsion tests.

Note: Students will perform minimum 10 experiments from the following:

1. Tension test on Mild Steel
2. Bending tests on simply supported beam and Cantilever beam.
3. Determination of torsion and deflection,
4. Measurement of forces on supports in statically determinate beam,
5. Determination of shear forces in beams,
6. Determination of bending moments in beams,
7. Measurement of deflections in statically determinate beam.
8. To determine Flexural Rigidity (EI) of a given beam
9. To find deflection of curved members.
10. To find Critical load in Struts with different end conditions.
11. Hardness Test (Brinnel's and Rockwell)
12. Impact test (Charpy and IZOD)

Hydraulics & Hydraulic Machine Lab
BTCE-408P

Course objective:

1. Introduce viscosity and show what Newtonian and non-Newtonian fluids are.
2. The purpose of this course is to learn the Fluid properties and fundamentals of Fluid statics and fluid flow.
3. To introduce the concepts of flow measurements and flow through pipes.
4. To introduce the flow measuring devices and velocity measuring devices.
5. To introduce the concepts of momentum principles.

Course Outcomes:

1. Student will be able to develop to gain basic knowledge on Fluid Statistics, Fluid Dynamics, closed conduit flows, hydro-electric power stations.
2. Student will be able to design various components of pumps and turbines and study their characteristics.

Note: Students will perform minimum 10 experiments from the following:

1. To determine the Manning's coefficient of roughness 'n' for the bed of a given flume.
2. To study the velocity distribution in an open channel and to determine the energy and momentum correction factors.
3. To study the flow characteristics over a hump placed in an open channel.
4. To study the flow through a horizontal contraction in a rectangular channel.
5. To calibrate a broad-crested weir.
6. To study the characteristics of free hydraulic jump.
7. To study centrifugal pump and their characteristics
8. To study characteristics of Pelton Turbine.
9. To study characteristics Francis Turbine.
10. To study characteristics of Kaplan Turbine.
11. To study the free over-fall phenomenon in an open channel and to determine the end depth
12. To determine coefficient of discharge for given rectangular notch.

Engineering Geology-Lab
[BTCE409P]

Course Objectives:

1. To understand fundamental concepts of engineering geology
2. To learn about the various types of rocks and their properties.
3. To study about the Earthquakes, its causes, classification etc
4. To gain knowledge about Landslides, Land subsidence and Geological Hazards
5. To learn about Geological investigations in Civil Engg

Course Outcomes:

1. Show the knowledge about engineering geology.
2. Show knowledge of the most important rocks and minerals and be able to identify them.
3. Analyze the Earthquakes and its various types.
4. Understand the characteristics of various Geological Hazards.
5. Do the Geological investigations; understand the geological conditions and geological maps.

List of Experiments: (At least Ten experiments are to be performed by each student)

1. Identification of granite, pegmatite, syenite megascopic observations.
2. Identification of basalt, gabbro, charnokite, dolerite.
3. Identification of limestone, sand - stone, shale.
4. Identification of conglomerate, breccias, clay.
5. Identification of slate, phyllite, marble.
6. Identification of quartzite, schist, gneiss.
7. A study on simple geological maps
8. To Draw a cross section, filling of geological data there in.
9. To make a sketch of faults, with identification of folds, faults and unconformity.
10. A case Study of structural folds, faults and unconformity.
11. A study of Talc, gypsum, calcite, fluorite apatite.
12. A study of feldspar, quartz, topaz, corundum.
13. A study of hornblende, garnet, tourmaline asbestos, olivine,.
14. A study of serpentine, barite, muscovite, biotite, arpiment, realgar, sulpher, amethyst & varieties of uartz, zeolite
15. A study of Hematite, magnetite, pyrite, chalespyrite, pyrolusite, psilomelane, beryl, magnesite, bauxite, zincite, galena etc.

Equipment/Machines/Instruments/Tools/Software Required:

- Crystallographic Model
- Wooden Cabinet
- Axis of symmetrical of 6 System
- Planes of symmetrical of 6 System
- Crystallographic Axis & Centre of System
- Mohr Scale of Hardness
- Streak Plates

- Hardness Testing Knife
- Model Showing Strike, Dip, Pitch
- Symmetrical Anticline Showing Axis-Axial Plane
- Asymmetrical Anticline Showing Axis-Axial Plane
- Isoclinals Anticline & Syncline
- Recumbent Fold
- Fan Fold
- Step Fault
- Rock Specimen
- Wooden Specimen Tray
- Polarizing Petrological Microscope
- Mineral Specimens

Recommended Books:

1. Geology and Engineering – Leggot, R.F. (Mc-Graw Hill, New York)
2. Engineering and General Geology – Prabin Singh (Katson Publication House)

Semester – V

Geotechnical Engineering
BTCE 501

Course Objectives:

1. To provide basic knowledge about Geotechnical Engineering, soil formation, index properties of soil, physical and engineering properties of soil.
2. To know about the types of soil according their classification, classification system, field identification, study of effective stress, capillary seepage force, etc.
3. How to measure the compaction and permeability of soil by lab experiments theoretically uses of Darcy law. Two dimensions flow and develop flow net and characteristics.
4. To know about stresses due to applied load a soil mass, consolidation and their factor one dimensional consolidation as per Terzaghi theory
5. To find shear strength in soil with the help of Mohr circle. How shear strength can be determine in laboratory, soil exploration

Course Outcomes:

1. Classify the soil and determine its Index properties.
2. Evaluate permeability and seepage properties of soil.
3. Interpret the compaction and consolidation characteristics & effective stress concept of soil.
4. Determine the vertical and shear stress under different loading conditions and explain the phenomenon of soil liquefaction.
5. Interpret the earth pressure and related slope failures.

Unit 1

Origin and classification: Preview of Geotechnical field problems in Civil Engineering, Soil formation, transport and deposit, Soil composition, Basic definitions, Weight volume relationships, Clay minerals, Soil structure, Index properties, sensitivity and thixotropy, Particle size analysis, Unified and Indian standard soil classification system. **[8]**

Unit 2

Soil Hydraulics: Stress conditions in soil- total, effective and neutral stresses and relationships. Permeability - Darcy's Law, hydraulic conductivity, equivalent hydraulic conductivity in stratified soil.

Seepage: flow nets, seepage calculation from a flow net, flow nets in anisotropic soils, seepage through earth dam, capillarity, critical hydraulic gradient and quick sand condition, uplift pressure, piping. **[8]**

Unit 3

Soil compaction, water content- dry unit weight relationships. Factors controlling compaction. Field compaction equipment; field compaction control; Proctor needle method.

Consolidation: Primary and secondary consolidation, Terzaghi's one dimensional theory of consolidation, Consolidation test, Normal and Over Consolidated soils, Over Consolidation Rato, determination of coefficient of consolidation. **[8]**

Unit 4

Stress Distribution in soil: Elastic constants of soils and their determination, Boussinesq equation for vertical stress, The Westergaard equation, Stress distribution under loaded areas, Concept of pressure bulb, contact pressure.

Shear Strength: Mohr-Coulomb failure criterion, shear strength parameters and determination; direct and tri-axial shear test; unconfined compression test; pore pressure, Skempton's pore pressure coefficients, and Soil liquefaction. **[8]**

Unit 5

Earth pressure: Classical theories, Coulomb and Rankine's approaches for frictional and c-soils, inclined backfill, Graphical methods of earth pressure determination. Stability of slopes - finite and infinite slopes, types of slope failure, Culmann's method & Method of slices, Stability number & chart, Bishop's method.

Expansive Soil and Contaminated Soil: Foundations on expansive soil, identification of expansive soil, problems associated with expansive soil, design consideration of foundation on expansive soil, Types and sources of sub surface contamination, contaminant transport, effects of sub surface contamination, detection of polluted zones. **[8]**

Text & References Books

1. V.N.S. Murthy – Soil Mechanics and Foundation Engineering (Fifth Edition)
2. K.R. Arora – Soil Mechanics and Foundation Engineering
3. Narasinga Rao, B.N.D, "Soil Mechanics & Foundation Engineering", John Wiley &Sons, Wiley India Pvt. Ltd., Daryaganj, New Delhi – 110 002.
4. Alam Singh – Modern Geotechnical Engineering
5. Brij Mohan Das – Geotechnical Engineering , CENGAGE Learning
6. I.H. Khan – Text Book of Geotechnical Engineering
7. C. Venkataramaiah – Geotechnical Engineering
8. Gopal Ranjan and A.S.R. Rao – Basic and Applied Soil Mechanics
9. G.V. Rao & G.V.S.S. Raju – Engineering with Geosynthetics
10. P. Purushottam Raj- Soil Mechanics and Foundation Engineering, Pearson Education in South Asia, New Delhi.
11. Shenbaga R Kaniraj- Design Aids in Soil Mechanics and Foundation Engineering
12. Gulati, S.K., "Geotechnical Engineering" McGraw Hill Education (India), Pvt. Ltd., Noida.

Structural Analysis
[BTCE502]

Course Objectives:

1. To learn the methods which are applied to analyse indeterminate structures.
2. To gain the expertise in analysis of indeterminate beams and rigid frames.
3. To develop professional skill in analyzing indeterminate pin jointed structures.
4. To learn to draw influence line diagrams for stress functions in indeterminate beams which may be useful for moving the maximum values of the stress functions.

Course Outcomes:

1. Explain type of structures and method for their analysis.
2. Analyze different types of trusses for member forces.
3. Compute slope and deflection in determinate structures using different methods.
4. Apply the concept of influence lines and moving loads to compute bending moment and shear force at different sections.
5. Analyze determinate arches for different loading conditions.

Unit 1

Classification of Structures, Determinate vs. Indeterminate structures Types of structural frameworks and Load transfer Mechanisms, stress resultants, degrees of freedom, Static and Kinematic Indeterminacy for beams, trusses and building frames. Analysis of cables with concentrated and continuous loadings, Effect of Temperature upon length of cable. **[8]**

Unit 2

Classification of Pin jointed determinate trusses, Analysis of determinate plane trusses (compound and complex). Method of Substitution, Method of tension coefficient for analysis of plane trusses. **[8]**

Unit 3

Strain Energy of deformable systems, Maxwell's reciprocal & Betti's theorem, Castigliano's theorems, Calculations of deflections: Strain Energy Method and unit load method for statically determinate beams, frames and trusses. Deflection of determinate beams by Conjugate beam method. **[8]**

Unit 4

Rolling loads and influence line diagrams for determinate beams and trusses, Absolute maximum bending moment and shear force. Muller-Breslau's principal & its applications for determinate structures. **[8]**

Unit 5

Arches, Types of Arches, Analysis of three hinged parabolic and circular Arches. Linear arch, Eddy's theorem, spandrel braced arch, moving load & influence lines for three hinged parabolic arch.
Method of three moments, Introduction to Method of Moment distribution, Introduction to Method of Slope deflection **[8]**

References

1. Hibbler, “Structural Analysis”, Pearson Education
2. Mau, “Introduction to Structural Analysis” CRC Press Taylor & Francis Group.
3. Ghali, “ Structural Analysis: A Unified Classical and Matrix Approach” 5/e, CRC Press Taylor & Francis Group.
4. T S Thandavmorthy, “Analysis of Structures”, Oxford University Press 5.Wilbur and Norris, “Elementary Structural Analysis”, Tata McGraw Hill.
5. Temoshenko & Young “Theory of Structure” Tata Mc Grew Hill.
6. Reddy, CS, “Basic Structural Analysis”, Tata McGraw Hill.
7. Jain, OP and Jain, BK, “Theory & Analysis of Structures ”. Vol.I & II Nem Chand.
8. Vazirani & Ratwani et al , “Analysis of Structures”, Khanna Publishers
9. Coates, RC, Coutie, M.G. & Kong, F.K., “Structural Analysis”, English Language Book Society & Nelson, 1980.
10. SP Gupta & Gupta “Theory of Structure Vol.1 & 2” TMH
11. DS Prakash Rao “Structural Analysis: A Unified Approach” Universities Press.
12. S Ramamurtham “Theory of Structure” Dhanpat Rai.
13. Devdas Menon “Advanced Structural Analysis” Narosa
14. Wang, CK, “Intermediate Structural Analysis”, Tata Mc-Graw Hill.
15. Hsieh, “Elementary Theory of Structures” 4/e, Pearson Education, Noida.
16. Mckenzie, “Examples in Structural Analysis” 2/e, CRC Press Taylor & Francis Group.
17. Bibek Kumar Mukherjee, “Theory and Analysis of Structures” Satya Prakashan, New Delhi.
18. Jacques Heyman, “Structural Analysis” Cambridge University Press.

Concrete Technology
[BTCE-503]

Course Objectives:

1. To develop Fundamental knowledge of properties of concrete and its ingredients.
2. To acquire an interest in concrete technology and admixture and its filled requirements.
3. Developing a good skill of various methods of concrete making, placing and special formwork.
4. Developing a professional skill of concrete mix design by IS Code Method.

Course Outcomes:

1. Understand the properties of constituent material of concrete.
2. Apply admixtures to enhance the properties of concrete.
3. Evaluate the strength and durability parameters of concrete.
4. Design the concrete mix for various strengths using difference methods.
5. Use advanced concrete types in construction industry.

Unit 1

Cement: types and cement chemistry. Aggregates: mineralogy, properties, test and standards. Quality of water for use in concrete. **[8]**

Unit 2

Introduction & study of accelerators, retarders, water reducers, air entrainers, water proofers, super plasticizers. Study of supplementary cementing materials like fly ash, silica fume , ground granulated blast furnace slag, metakaoline and pozzolana; their production, properties and effect on concrete properties . **[8]**

Unit 3

Concert production: batching, mixing and transportation of concrete. Workability test: slump test, compacting factor test and Vee Bee test. Segregation, bleeding and Laitance in concrete, curing of concrete and its methods. Determination of compressive and flexural strength as per BIS. Mechanical properties of concrete: elastic modules, poisson's ratio, creep, shrinkage and durability of concrete. **[8]**

Unit 4

Principle of mix proportioning, properties related to mix design, Mix design method (IS method and ACI method). Mix design of concrete, Rheology, mix design examples **[8]**

Unit 5

Study and uses of high strength concrete, self-compacting concrete, fibre reinforced concrete, ferro cement, ready Mix Concrete, recycled aggregate concrete and status in India. **[8]**

References

1. Neville, A.M. and Brooks, J.J.," CONCRETE TECHNOLOGY", ELBS .1990.
2. Shetty, M.S, "Concrete Technology, Theory and Practice", S. Chand and Company Ltd, New Delhi, 2008.
3. Gambhir, M.L, "Concrete Technology", Tata McGraw Hill Publishing Company Ltd, New Delhi, 2004.

4. Santhakumar, A.R; "Concrete Technology" , Oxford University Press, New Delhi, 2007.
5. Gupta B.L., Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.
6. Newman, K., "CONCRETE SYSTEMS in COMPOSITE MATERIALS".EDT BY L. Holliday. Elsevier Publishing Company. 1966.
7. Popovics. S., "FUNDAMENTALS OF PORTLAND CEMENT CONCRETE: A Quantitative Approach VOL 1 FRESH CONCRETE" JOHN WILEY & SONS.1982.
8. P.K. Mehta and Paulo J.M. Monteiro, "Concrete: microstructure, properties and materials", The Mc GrawHill Companies.
9. Jayant D. Bapat (2013),Mineral admixtures in cement and concrete, Taylor and Francis group.
10. Concrete mix proportioning as per IS 10262:2009 – Comparison with IS 10262:1982 and ACI 211.1-91 M.C. Nataraja and Lelin Das
11. IS10262-1982 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 1998.
12. IS456-2000 Plain and Reinforced Concrete- Code of Practice, Bureau of Indian Standards, New Delhi, 2000.

CAD Lab
[BTCE-506P]

Course Objectives:

1. To learn software like AutoCAD, Invertor/ Pro E/ Uni-graphics and to produce basic concepts to make 2D drafting.
2. To apply basic concept to drawing, edit, dimension, hatching etc. to develop 2D & 3D Modelling.
3. To make 3D modelling, Assembling, modification & manipulation along with detailing.
4. To prepare surface modelling and sheet metal operations through various exercises
5. To understand and resolve the one dimensional problem using open source software's.

Course Outcomes:

1. Able to use software like AutoCAD, Invertor/ Pro E/ Unigraphics.
2. Learned basic concept to drawing, edit, dimension, hatching etc. to develop 2&3D Modelling.
3. Able to make 3D modelling, Assembling, modification & manipulation along with detailing.
4. Able to prepare surface modelling and sheet metal operations through various exercises.
5. Able to understand and resolve the one dimensional problem using open source software's.

Description about lab work:

1. Introduction to Open Source Software's in Geotechnical Engineering
2. Study of Open Source Civil Engineering software's
3. Study of free Open Source CAD Software's
4. Study of Land Surveying open source application
5. Contouring in E-Survey CAD software
6. Study of Finite Element Program for Geo engineers using ADONIS/Open source software
7. Study of Software for Geotechnical and Civil Engineers
8. Study of Geotechnical software tools

Geotechnical Engineering Lab
BTCE-507P

Course Objectives:

6. To provide basic knowledge about Geotechnical Engineering, soil formation, index properties of soil, physical and engineering properties of soil.
7. To know about the types of soil according their classification, classification system, field identification, study of effective stress, capillary seepage force, etc.
8. How to measure the compaction and permeability of soil by lab experiments theoretically uses of Darcy law. Two dimensions flow and develop flow net and characteristics.
9. To know about stresses due to applied load a soil mass, consolidation and their factor one dimensional consolidation as per Terzaghi theory
10. To find shear strength in soil with the help of Mohr circle. How shear strength can be determine in laboratory, soil exploration

Course Outcomes:

6. Classify the soil and determine its Index properties.
7. Evaluate permeability and seepage properties of soil.
8. Interpret the compaction and consolidation characteristics & effective stress concept of soil.
9. Determine the vertical and shear stress under different loading conditions and explain the phenomenon of soil liquefaction.
10. Interpret the earth pressure and related slope failures.

PART -A (To be performed in lab)

1. Determination of water content of a given moist soil sample by (i) oven drying method, (ii) pycnometer method.
2. Determination of specific gravity of a given soil sample by (i) density bottle, (ii) pycnometer method.
3. Determination of in situ dry density of soil mass by (i) core-cutter method, (ii) sand replacement method.
4. Determination of relative density of a given soil sample.
5. Determination of complete grain size distribution of a given soil sample by sieve analysis and sedimentation (hydrometer) analysis.
6. Determination of consistency limits (liquid, plastic and shrinkage limits) of the soil sample used in experiment no. 5 (grain-size analysis).
7. Determination of shear strength of soil by Direct shear test.
8. Determination of compaction characteristics (OMC & MDD) of a given soil sample.
9. Determination of permeability of a remoulded soil sample by constant head &/or falling head method.
10. Determination of consolidation characteristics of a remoulded soil sample by an odometer test.
11. Determination of shear strength characteristics of a given soil sample by U/U test from Triaxial Compression Machine.
12. Retrieving soil samples and conducting SPT tests by advancing boreholes through hand-held auger.

Note: Any 8 experiments are to be performed from the list of experiments.

PART B

It is mandatory to perform experiments using virtual lab where ever applicable.

References:

1. Bowles, Joseph E., "Engineering Properties of Soil and Their Measurement" Fourth Edition, Indian Edition, McGraw Hill Education (India) Pvt. Ltd, New Delhi-110032.

Concrete Technology Lab
BTCE-508P

Course Objectives:

1. To develop Fundamental knowledge of properties of concrete and its ingredients.
2. To acquire an interest in concrete technology and admixture and its filled requirements.
3. Developing a good skill of various methods of concrete making, placing and special formwork.
4. Developing a professional skill of concrete mix design by IS Code Method.

Course Outcomes:

1. Understand the properties of constituent material of concrete.
2. Apply admixtures to enhance the properties of concrete.
3. Evaluate the strength and durability parameters of concrete.
4. Design the concrete mix for various strengths using difference methods.
5. Use advanced concrete types in construction industry.

1. Study of IS codes for (i) Aggregates (ii) Cements (iii) Admixtures (iv) Fly ash
2.Concrete Mix design computation by ACI 211.1-91 method, IS code method as per 10262-2019 & 456-2000, DOE method for given sample.
3. Preparation and testing of samples as per any one of the above mentioned computations (Minimum grade of concrete is M30)
4. Tests on Concrete- (a) Workability tests - Slump cone test, compaction factor test, Vee- bee consistometer test, flow table test. (b) Strength tests- compressive strength, flexural strength, split tensile strength.
5. Effects of Admixture - Accelerator, Retarder, Super Plasticizer.
6.Nondestructive Testing - Rebound Hammer test, Ultrasonic Pulse Velocity test.

References:

1. Concrete Technology – A.M. Neville & J. J. Brooks , Pearson
2. Concrete Technology Theory & Practice-M.S. Shetty, S. Chand Publishers
3. Concrete Technology Theory & Practice-M.L. Gambhir, TMH Publishers
4. IS:10262-2019-Concrete Mix Proportioning Guidelines

Internship Assessment
BTCE-509P

Quantity Estimation and Construction Management
[BTCE504A]

Course Objectives:
To provide the student with the ability to estimate the quantities of item of works involved in buildings, water supply and sanitary works, road works and irrigation works, and also to equip the student with the ability to do rate analysis, valuation of properties and preparation of reports for estimation of various items.

Course Outcomes:

1. Understand the importance of units of measurement and preliminary estimate for administrative approval of projects.
2. Understand the contracts and tender documents in construction projects.
3. Analyze and assess the quantity of materials required for civil engineering works as per specifications.
4. Evaluate and estimate the cost of expenditure and prepare a detailed rate analysis report.
5. Analyze and choose cost effective approach for civil engineering projects.

Unit 1
Quantity Estimation for Buildings Measurement units for various building materials, Centreline method, Long and short wall method of estimates, Types of estimates, PWD schedule of rate. **[8]**

Unit 2
Rate Analysis, Specification and Tenders Analysis of rates knowing cost of material, labour, equipment, overheads, profit, taxes etc, Specifications – Preparation of detailed and general specifications, Legal aspects of contracts, laws related to contracts, land acquisition, labour safety and welfare. Different types of contracts, their relative advantages and disadvantages. Elements of tender preparation, process of tendering, pre-qualification of contracts, Evaluation of tenders, contract negotiation and award of work, monitoring of contract extra items. **[8]**

Unit 3
Elements of Management & Network Techniques Project cycle, Organization, planning, scheduling**,** monitoring, updating and management system in construction, Bar charts, milestone charts, work break down structure and preparation of networks. Network Techniques like PERT & CPM in construction management. Project monitoring and resource allocation through network techniques. **[8]**

Unit 4
Equipment Management Productivity, operational cost, owning and hiring cost and the work motion study. Simulation techniques for resource scheduling. Construction Equipment for earth moving, earth compaction, Hauling Equipment, Hoisting Equipment, Conveying Equipment, Concrete Production Equipment, Tunnelling Equipment. **[8]**

Unit 5
Project Cost Management Budgeting, Cost planning, Direct Cost, Indirect cost, Total Cost Curve, Cost Slope. Time value of money, Present economy studies, Equivalence concept,

financing of projects, economic comparison, present worthmethod Equivalent annual cost method, discounted cash flow method, Depreciation and its type, depletion, Arbitration, and break even cost analysis. **[8]**

References:

1. Dutta, B.N., "Estimating and Costing in Civil Engineering", UBS Publishers & Distributors Pvt. Ltd., 2003
2. Srinath, L.S., "PERT and CPM Principals and applications" Affiliated East-West Press Pvt. Ltd., New Delhi.
3. Patil, B.S., "Civil Engineering Contracts and Estimates" University Press India, Pvt. Ltd. Hyderabad –500 004
4. Construction Management by Ojha
5. Srivastava, U.K., "Construction Planning and Management", Galgotia Publications Pvt. Ltd., New Delhi.
6. Construction Technology by Sarkar, Oxford
7. Delhi Schedule of Rates (latest version)

Modern Construction Materials
BTCE-504B

Course Objectives:
To study and understand the properties of modern construction materials used in construction such as special concretes, metals, composites, water proofing compounds, non-weathering materials, and smart materials.

Course Outcomes:
1. Understand the use of modern construction materials.
2. Use geosynthetics and bituminous materials in constructions.
3. Apply knowledge of modern materials in production of variety of concrete.
4. Apply knowledge of composites and chemicals in production of modern concrete.
5. Use modern water proofing and insulating materials in constructions.

Unit 1
Introduction, properties and uses of modern building materials: fly ash bricks, soil – cement blocks, calcium silicate bricks, red mud jute fibre polymer composite (RFPC) , glass reinforced gypsum. **[8]**

Unit 2
Introduction , properties and use of: geosynthetics, bituminous material, fire resistant materials (chemicals ,paints ,tiles ,bricks, glass),metals, light - weight concrete, mass concrete, waste material based concrete. **[8]**

Unit 3
Introduction , properties and use of: Ferro cement &fibre reinforced concrete, different types of fibres, high density concrete, Nuclear concrete, heat resisting & refractory concretes, prefabricated systems. **[8]**

Unit 4
Introduction , properties and use of: Polymers, fibre reinforced polymers, polymer concrete composites (PCCs), sulphur concrete and sulphur - infiltrated concrete. **[8]**

Unit 5
Introduction , properties and use of: Conventional and modern water proofing materials, Conventional and modern insulating materials(thermal, sound and electrical insulating materials).Concept of polymer floor finishes. **[8]**

Reference Book:

1. GhambhirM.L."Concrete Technology" Tata McGraw Hill education private Limited.
2. A.R. Santhakumar, Concrete Technology, Oxford University Press.
3. Building Materials, P.C. Varghese, Prentice-Hall India.
4. Shetty, M. S., "Concrete Technology" S. Chand Publication.
5. Krishnaraju .N., Advanced Concrete Technology, CBS Published.
6. Materials Science and Engineering: An introduction, W.D. Callister, John Wiley.
7. Nevile. A.M., Concrete Technology, Prentice Hall, Newyork.

8. Dr. U. K. Shrivastava, Building Materials Technology, Galgotia Publication pvt.ltd.
9. Materials Science and Engineering, V. Raghavan, Prentice Hall.
10. Properties of Engineering Materials, R.A. Higgins, Industrial Press.
11. Construction materials: Their nature and behaviour, Eds. J.M. Illston and P.L.J. Domone, 3rd ed., pon Press.
12. The Science and Technology of Civil Engineering Materials, J.F. Young, S. Mindess,R.J. Gray & A. Bentur, Prentice Hall.
13. Engineering Materials 1: An introduction to their properties & applications, M.F. Ashby and D.R.H. Jones, Butterworth Heinemann.
14. The Science and Design of Engineering Materials, J.P. Schaffer, A. Saxena, S.D. Antolovich, T.H. Sanders and S.B. Warner, Irwin.
15. Concrete: Microstructure, properties and materials, P.K. Mehta and P.J.M. Monteiro, McGraw Hill.
16. S K Sharma, "Civil Engineering and construction material," Khanna Publishing House.
17. Properties of concrete, A.M. Neville, Pearson.

Open Channel Flow
[BTCE-504C]

Course Objectives:
Course objective: To develop a basic knowledge of open channel flow relationships by applying fluid properties, hydrostatics, and the conservation equations for mass, momentum, and energy.

Course Outcomes:

1. Apply knowledge of fluid flow for designing of channel sections.
2. Analyze the gradually varied flow in channel section.
3. Analyze the rapidly varied flow in channel sections.
4. Apply numerical methods for profile computation in channels.
5. Design channels for sub critical and super critical flows.

Unit 1
Introduction: Basic concepts of free surface flows, velocity and pressure distribution, Mass, energy and momentum principle for prismatic and non-prismatic channels, Review of Uniform flow: Standard equations, hydraulically efficient channel sections, compound sections **[8]**

Unit 2
Gradually Varied Flow (GVF): Equation of gradually varied flow and its limitations, flow classification and surface profiles, Control sections,
Computation methods and analysis: Integration of varied flow equation by analytical, graphical and advanced numerical methods, Transitions of subcritical and supercritical flow, flow in curved channels **[8]**

Unit 3
Rapidly Varied Flow (RVF): Characteristics of rapidly varied flow, Classical hydraulic jump, Evaluation of the jump elements in rectangular and non-rectangular channels on horizontal and sloping beds, Hydraulic jump in gradually and suddenly expanding channels, submerged hydraulic jump, rolling and sky jump, use of jump as an energy dissipater,
Flow measurement: by sharp crested and broad crested weirs, critical depth flumes, sluice gate, Free over fall.
Rapidly varied unsteady flow: Equation of motion for unsteady flow, "Celerity" of the gravity wave, deep and shallow water waves, open channel positive and negative surge **[8]**

Unit 4
Spatially Varied Flow (SVF): Basic principles, Differential SVF equations for increasing and decreasing discharge, Classifications and solutions, Numerical methods for profile computation, low over side-weir and Bottom-rack. **[8]**

Unit 5
Flow in channel of non-linear alignment and non-prismatic channel sections, Design considerations for sub critical and super critical flows, Design of culvert.

References:

1. Chow, V.T., Open channel Hydraulics, McGraw Hill International
2. Henderson, F.M., Open Channel Flow, McGraw Hill International
3. Subramanya, K., Flow in Open Channels, Tata McGraw Hill
4. Ranga Raju, K.G., Flow through open channels, T.M.H.
5. M. Hanif Chaudhry, Open Channel Flow, PHI
6. French, R.H., Open channel Hydraulics, McGraw Hill International
7. Srivastava, Flow through Open Channels, Oxford University Press.
8. Open Channel Flow by Madan Mohan Das.

Engineering Hydrology
BTCE505A

Course Objectives:

1. To understand basic concepts of hydrology and hydrologic cycle.
2. To understand the concepts of precipitation and its measurement.
3. To learn about runoff and estimation of runoff.
4. Be familiar with the concepts of hydrograph.
5. To understand the concepts of ground water.

Course Outcomes:

1. Understand the basic concept of hydrological cycle and its various phases.
2. Understand the concept of runoff and apply the knowledge to construct the hydrograph.
3. Apply the various methods to assess the flood.
4. Assess the quality of various forms of water and their aquifer properties.
5. Understand the well hydraulics and apply ground water modelling techniques.

Unit 1

Introduction: hydrologic cycle, water budget equations, world water balance, Precipitation: Forms of precipitation, measurement. Introduction to characteristics of storm. Abstraction from Precipitation: Evaporation – process, measurement and estimation; Evapotranspiration-measurement and estimation; Initial Losses- Interception & Depression storage; Infiltration- process, capacities indices, measurement & estimation. **[8]**

Unit 2

Runoff and Hydrographs: Runoff characteristics of stream, mass curve. Hydrograph, Factors affecting flood hydrographs, unit hydrograph and its analysis, s-curve hydrograph, synthetic and instantaneous unit hydrographs. **[8]**

Unit 3

Flood: Rational method, empirical formulae, flood frequency studies, statistical analysis, regional flood frequency analysis, design storm & design flood, risk/reliability and safety factor; Flood Routing: Basic equation, hydrologic storage routing & attenuation, hydrologic channel routing, flood forecasting & control, hydraulic method of flood routing. **[8]**

Unit 4

Groundwater: Introduction, forms of subsurface water, aquifers & its properties, Occurrence of ground water, hydro-geology& aquifers, Ground water movement.

Steady and unsteady flow through confined and unconfined aquifers. Well Hydraulics: Single& Multiple well system, partially penetrating wells, Image wells, Mutual interference of wells, well losses, specific capacity. **[8]**

Unit 5

Water Wells: Introduction to Well construction, completion and Development. Pumping equipment for water wells, maintenance of wells.

Ground Water quality, Contamination of groundwater and its Control, Ground Water Modelling Techniques and exploration, artificial discharge and Recharge of Ground Water, Roof-top rainwater harvesting and recharge. **[8]**

Text Books:

1. 'Groundwater Hydrology' by Todd D. K., Wiley
2. 'Groundwater Resource Evaluation' by Walton W. C., McGraw Hill
3. 'Groundwater' by Raghunath H. M., New Age Publisher
4. 'Engineering Hydrology' by K. Subramanya, Mc Graw Hill Education
5. 'Hydrology: Principles. Analysis. Design' by Raghunath H. M., New Age Publisher
6. 'Handbook of Applied Hydrology' by Chow V. T., Mc Graw Hill Education

Reference:

1. 'Irrigation: Theory & Practice' by Michael A. M., Vikas Publication House
2. 'Groundwater' by S.Ramakrishnan, Scitech Publications
3. 'Irrigation: Theory & Practice' by Michael A. M., Vikas Publication House
4. 'Engineering Hydrology' by Ojha, Oxford University Press.
5. 'Introduction to Hydrology' by Viessman& Lewis by Pearson Publication.
6. 'Applied Hydrology' by Fetter, by Pearson Publication

Sensor and Instrumentation Technologies for Civil
[BTCE-505B]

Course Objectives:

1. Describe the operation of various smart sensors and their application.
2. Select an appropriate sensor for a given application.
3. Compare analogue and digital transducer.
4. Mathematically model a smart sensor.
5. Discuss the latest technology in sensor development.

Course Outcomes:

1. Summarize various performance characteristics of instruments and the quality of measurement
2. Analyze the errors during measurements.
3. Describe the measurement of electrical variables.
4. Describe the requirements during the transmission of measured signals Suggest proper sensor technologies for specific applications.
5. Design and set up measurement systems and do the studies.

Unit 1

Fundamentals of Measurement, Sensing and Instrumentation covering definition of measurement and instrumentation, physical variables, common types of sensors; Describe the function of these sensors; Use appropriate terminology to discuss sensor applications; and qualitatively interpret signals from a known sensor type, types of instrumentation, Sensor Specifics, Permanent installations, Temporary installations;

Unit 2

Sensor Installation and Operation covering to: i) Predict the response of sensors to various inputs; ii) Construct a conceptual instrumentation and monitoring program; iii) Describe the order and methodology for sensor installation; and iv) Differentiate between types of sensors and their modes of operation and measurement and v) Approach to Planning Monitoring Programs, Define target, Sensor selection, Sensor siting, Sensor Installation & Configuration, Advanced topic, Sensor design, Measurement uncertainty

Unit 3

Data Analysis and Interpretation covering a) Fundamental statistical concepts, b) Data reduction and interpretation, c) Piezometer, Inclinometer, Strain gauge, etc. d) Time domain signal processing, e) Discrete signals, Signals and noise and f) a few examples of statistical information to calculate are: Average value (mean), On average, how much each measurement deviates from the mean (standard deviation), Midpoint between the lowest and highest value of the set (median), Most frequently occurring value (mode), Span of values over which your data set occurs (range)

Unit 4

Frequency Domain Signal Processing and Analysis covering Explain the need for frequency domain analysis and its principles; Draw conclusions about physical processes based on analysis of sensor

data; Combine signals in a meaningful way to gain deeper insight into physical phenomena, Basic concepts in frequency domain signal processing and analysis,
Fourier Transform, FFT (Fast Fourier Transform), Example problems: Noise reduction with filters, Leakage, Frequency resolution

Text/Reference Books:

1. Alan S Morris (2001), Measurement and Instrumentation Principles, 3rd/e, Butterworth Hienemann
2. David A. Bell (2007), Electronic Instrumentation and Measurements 2nd/e, Oxford Press S. Tumanski (2006), Principle of Electrical Measurement, Taylor & Francis Ilya Gertsbakh (2010), Measurement Theory for Engineers, Springer

Air & Noise Pollution Control

[BTCE-505C]

Course Objectives:

The purpose of this course is to give the students an overview of air and noise pollution including methods for prevention, control, measures and management of the pollution.

Course Outcomes:

1. Understand air pollutants and their impacts.
2. Explain air pollution chemistry and meteorological aspects of air pollutants.
3. Demonstrate methods for controlling particulate air pollutants.
4. Demonstrate methods for controlling gaseous air pollutants.
5. Understand automotive emission standards.
6. Apply methods for controlling noise pollution.

Unit 1

Air pollution: composition and structure of atmosphere, global implications of air pollution, classification of air pollutants: particulates, hydrocarbon, carbon monoxide, oxides of sulphur, oxides of nitrogen and photochemical oxidants. Indoor air pollution. Effects of air pollutants on humans, animals, property and plants. **[8]**

Unit 2

Air pollution chemistry, meteorological aspects of air pollution dispersion; temperature lapse rate and stability, wind velocity and turbulence, plume behaviour, dispersion of air pollutants, the Gaussian Plume Model, stack height and dispersion. **[8]**

Unit 3

Ambient air quality and standards, air sampling and measurements. Control of particulate air pollutants using gravitational settling chambers, cyclone separators, wet collectors, fabric filters (Bag-house filter), electrostatic precipitators (ESP). **[8]**

Unit 4

Control of gaseous contaminants: Absorption, Adsorption, Condensation and Combustion, Control of sulphur oxides, nitrogen oxides, carbon monoxide, and hydrocarbons. Automotive emission control, catalytic convertor, Euro-I, Euro-II and Euro-II specifications, Indian specifications. **[8]**

Unit 5

Noise pollution: Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation; psychoacoustics and noise criteria, effects of noise on health, annoyance rating schemes; special noise environments: Infrasound, ultrasound, impulsive sound and sonic boom; noise standards and limit values; noise instrumentation and monitoring procedure. Noise indices. Noise control methods. **[8]**

References:

1. Peavy, Rowe and Tchobanoglous: Environmental Engineering.
2. Martin Crawford: Air Pollution Control Theory.
3. Wark and Warner: Air Pollution: Its Origin and Control.
4. Rao and Rao: Air Pollution Control Engineering.
5. Nevers: Air Pollution Control Engineering.
6. Mycock, McKenna and Theodore: Handbook of Air Pollution Control Engineering and Technology.Suess and Craxford: W.H.O. Manual on Urban Air Quality Management
7. C.S. Rao, Air pollution and control
8. Advanced Air and Noise Pollution Control by Lawrence K. Wang, Norman C. Pereira & Yung IseHung.
9. Noise Pollution and Control by S. P.Singhal , Narosa Pub House
10. Textbook of Noise Pollution and Its Control by S. C. Bhatia, Atlantic; Edition

GIS and Advance Remote Sensing
BTCE-505D

Course Objectives:

1. To introduce the student to the physical principles of Remote Sensing and image interpretation as a tool for mapping.
2. To provide exposure to fundamental data models and data structures in GIS.
3. To introduced principle of GPS , It's components, signal structure, and working procedure.

Course Outcomes:

1. Understand the concepts of Photogrametry and compute the heights of objects.
2. Understand the principles of aerial and satellite remote sensing, Able to comprehend the energy interactions with earth surface features, spectral properties of water bodies .
3. Understand the basic concept of GIS and its applications, know different types of data representation in GIS
4. Illustrate spatial and non-spatial data features in GIS and understand the map projections and coordinates systems.
5. Apply knowledge of GIS and understand the integration of Remote Sensing and GIS.

Unit 1

Introduction to photogrammetry Principles and types of aerial photographs, geometry of vertical and aerial photograph, Scale and Height measurement on single and vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of Stereoscopy, fiducial points, parallax measurement using fiducial line. **[8]**

Unit 2

Remote sensing Basic concepts and foundation of Remote Sensing elements, Data information, Remote sensing data collection, Remote sensing advantages and Limitations,

Remote sensing process. Electromagnetic spectrum, Energy interaction with atmosphere and with earth surface features (soil, water, and vegetation) Indian Satellites and Sensors characteristics, Map and Image false color composite, introduction to digital data, elements of visual interpretations techniques. **[8]**

Unit 3

Geographic Information Systems Introduction to GIS, Components of GIS, Geospatial data: Spatial Data – Attribute Data- Joining Spatial and Attribute Data, GIS Operations: Spatial Data input-Attribute Data Management-Data Display-Data Exploration-Data Analysis. COORDINATE SYSTEMS: Geographic Coordinate system; Approximation of Earth, Datum: Map Projections; Types of Map Projections-Map Projection Parameters-Commonly used Map Projections – Projected Coordinate Systems. **[8]**

Unit 4

Vector data model Representation of simple features- Topology and its importance: coverage and its data structure, shape file:, data models for composite features Object Based Vector

Data Model; Classes and their Relationships: The geobased data model: Geometric representation of Spatial feature and data structure: Topology rules. **[8]**

Unit 5

Raster data model Elements of Raster data model: Types of Raster data: Raster data structure: Data conversion, Integration of Raster and Vector data. Data Input: Metadata: Conversion of Existing data, Creating new data, Remote sensing data, Field data, Digitizing, Scanning, on screen digitizing, importance of source map, Data Editing. **[8]**

Text Books:

1. Remote Sensing of the environment- An earth resource perspective- 2nd edition- by John R. Jensen, Pearson Education.
2. Introduction to geographic information system- kang – Tsung Chang, Tata McGraw- Hill Education Private Limited.

References:

1. Concepts & Techniques of GIS by C.P.Lo Albert, K.W. Yonng, Prentice Hall (India) Publications.
2. Remote Sensing and Geographical Information systems by M.Anji Reddy JNTU Hyderabad 2001, B.S. Publications.
3. Principals of Geo physical Information System- Peter A Burragh and Rachael A. Mc Donnell, Oxford Publishers 2004
4. Basics of Remote Sensing and GIS by S. Kumar, laxmi Publications.

Semester- VI

Design of Concrete Structure
[BTCE 601]

Course Objectives:

1. To educate the student about the concept of reinforced cement concrete and different method of design of reinforced concrete.
2. To educate the student about concept of working stress method to analysis and design of beams.
3. To educate the student about concept of limit state method to analysis and design of beams, slabs and columns.
4. To educate the student about analysis and design of footings and staircases by limit state method.

Course Outcomes:

1. Analyze and Design RCC beams for flexure by IS methods.
2. Analyze and Design RCC beams for shear by IS methods.
3. Analyze and Design RCC slabs and staircase by IS methods.
4. Design the RCC compression members by IS methods.
5. Design various types of footings and cantilever retaining wall.

Unit 1

Introduction to Various Design Philosophies, Design of Rectangular Singly and Doubly Reinforced Sections by Working Stress Method. Assumptions in Limit State Design Method, Design of Rectangular Singly and Doubly Reinforced beams, T-beams, L-beams by Limit State Design Method**.** **[8]**

Unit 2

Behaviour of RC beam in Shear, Shear Strength of beams with and without shear reinforcement, Minimum and Maximum shear reinforcement, design of beam in shear.

Introduction to development length, Anchorage bond, flexural bond. (Detailed Examples by Limit State Design Method), Failure of beam under shear, Concept of Equivalent Shear and Moments. **[8]**

Unit 3

Design of one way, One way continuous and cantilever solid slabs by Limit State Design Method, Design of Dog-legged staircases.

Design of two way slabs by limit state method, Serviceability Limit States, Control of deflection, cracking and vibrations. **[8]**

Unit 4

Design of Columns by Limit State Design Method- Effective height of columns, Assumptions, Minimum eccentricity, Short column under axial compression, requirements for reinforcement, Column with helical reinforcement, Short column under axial load and uni-axial bending, Design of columns under bi-axial loading by Design Charts. **[8]**

Unit 5

Structural behavior of footings, Design of isolated footings, combined rectangular and trapezoidal footings by Limit State Method, Design of strap footings.

Structural behaviour of retaining wall, stability of retaining wall against overturning and sliding, Design of cantilever retaining wall by Limit State Method.

Prestressed Concrete

Basic concepts, classification and types of prestressing, Prestressing systems, Losses in Prestress, Properties of materials, merits and demerits of prestressed concrete. **[8]**

References

1. IS: 456 – 2000.
2. Reinforced Concrete Design by S. U. Pillai& D. Menon, Tata Mc.-Graw, New Delhi
3. Reinforced Concrete – Limit State Design by A. K. Jain, Nem Chand & Bros., Roorkee.
4. Reinforced Concrete Vol. - II by H.J. Shah, Charotar Publisher, Gujarat.
5. RCC Designs (Reinforced Concrete Structures) by B.C. Punmia, Ashoka Kumar Jain and Arun Kumar Jain, Laxmi Publishers, New Delhi.
6. Reinforced Concrete Structures by R. Park and Pauley.
7. Reinforced Concrete Design by P. Dayaratnam.
8. Reinforced Concrete Design by M.L. Gambhir
9. Reinforced Concrete Design by S.N. Sinha , TMH
10. Plain and Reinforced Concrete Vol. I & II by O.P. Jain & Jai Krishna, Nem Chand & Bros.
11. SP-16: Design Aid to IS- 456.

Transportation Engineering
[BTCE 602]

Course Objectives:

1. Be familiar with principles of Highway planning & Geometric design.
2. Fundamental Concepts of Traffic Engineering.
3. Learning different highway materials & their testing.
4. Learning pavement design & its Construction.

Course Outcomes:

1. Understand the history of road development, their alignment & Survey.
2. Design the various geometric parameters of road.
3. Study the traffic characteristics & design of road intersections & signals.
4. Examine the properties of highway materials & their implementation in design of pavements.
5. Learn methods to construct various types of roads.

Unit 1

Introduction: Role of Transportation, Modes of Transportation History of road development, Road types and pattern, Nagpur road plan, Bombay road plan & 3rd 20 Year Road Plan, Highway Alignment & Location Survey: Horizontal Profile, Vertical Profile, Factors Controlling the alignment, Survey for route location. **[8]**

Unit 2

Geometric Design(IRC:73-Latest revision): Cross sectional elements, camber, shoulder, sight distance, horizontal curves, super elevation, extra widening, transition curves and gradient, vertical curves, summit and valley curves. **[8]**

Unit 3

Traffic Engineering: Traffic Characteristics, Traffic studies on flow, speed, travel time - delay and O-D study, PCU, peak hour factor, accident study , traffic capacity, density, traffic control devices: signs, Island, signal design by Webster's and IRC method . Intersection at grade and grade separated intersections, design of roundabouts as per IRC:65-2017.Highway capacity and level of service of rural highways and urban roads as per latest IRC recommendation **[8]**

Unit 4

Highway Materials: Properties of Subgrade, Aggregates & Binding materials, Various tests and specifications, Design of Highway Pavement : Types of Pavements, Design factors,Design of bituminous paving mixes; Design of Flexible Pavement by CBR method (IRC : 37- Latest revision), Design of rigid pavement, Westergaard theory, load and temperature stresses, joints, IRC method of rigid pavement design (IRC:58-2015) **[8]**

Unit 5

Highway Construction: Construction of Subgrade, Water Bound Macadam (WBM), Wet mix macadam (WMM), Granular Sub Base (GSB),Tack Coat, Prime Coat, Seal Coat, Surface Dressing, Bituminous Macadam (BM), Semi dense bituminous concrete (SDBC) and Bituminous concrete, Dry lean concrete (DLC), Cement Concrete (CC) road construction, **[8]**

Note: All designs and procedure are to be done with reference to latest revision of IRC as given below in reference section

Text Book:

1. Khanna S. K., Justo C.E.G, & Veeraragavan, A. "Highway Engineering", Nem Chand and Bros., Roorkee- 247 667.
2. Khanna S. K., Justo C.E.G, & Veeraragavan A., "Highway Materials and Pavement Testing", Nem Chand and Bros., Roorkee- 247 667.

References:

1. Kadiyali L. R., & Lal, N.B. "Principles and Practices of Highway Engineering (including Expressways and Airport Engineering)", Khanna Publications, Delhi – 110 006
2. Saxena, Subhash C, A Textbook of Highway and Traffic Engineering, CBS Publishers & Distributers, New Delhi
3. Kumar, R Srinivasa, "A Text book of Highway Engineering", Universities Press, Hyderabad.
4. Kumar, R Srinivasa, "Pavement Design", Universities Press, Hyderabad.
5. Chakraborty Partha & Das Animesh., "Principles of Transportation Engineering", Prentice Hall (India), New Delhi,
6. IRC : 37- Latest revision, "Tentative Guidelines for the design of Flexible Pavements" Indian Roads Congress, New Delhi
7. IRC:58-2015 Guidelines for the Design of Plain Jointed Rigid Pavements for Highways (Fourth Revision) (with CD)
8. IRC:65-2017 Guidelines for Planning and Design of Roundabouts (First Revision)
9. IRC:73-1980 Geometric Design Standards for Rural (Non-Urban) Highways
10. IRC:106-1990 Guidelines for Capacity of Urban Roads in Plain Areas
11. IRC:93-1985 Guidelines on Design and Installation of Road Traffic Signals.
12. IRC:92-2017 Guidelines for Design of Interchanges in Urban Areas (First Revision)
13. IRC: SP: 68-2005, "Guidelines for Construction of Roller Compacted Concrete Pavements",
14. Indian Roads Congress, New Delhi.
15. IRC: 15-2002, "Standard Specifications and Code of Practice for construction of Concrete
16. Roads" Indian Roads Congress, New Delhi.
17. MORTH, "Specifications for Road and Bridge Works", Ministry of Shipping, Road
18. Transport & Highways, Published by Indian Roads Congress, New Delhi.

Environmental Engineering
[BTCE 603]

Course Objectives:

1. To provide fundamental awareness about the water sources, population forecasting, water quality.
2. To develop an interest in pursuing the subject for P.G. studies because environmental pollution and its management is a critical topic of the hour.
3. To develop skills of designing a water treatment plant.
4. Developing a professional skill for design of water distribution system and environmental problems related to civil engineering.

Course Outcomes:

1. Assess water demand and optimal size of water mains.
2. Layout the distribution system & assess the capacity of reservoir.
3. Investigate physical, chemical & biological parameter of water.
4. Design treatment units for water and waste water.
5. Apply emerging technologies for treatment of waste water.

Unit 1

Fresh water, water demands, variation in demands, population forecasting by various methods, basic needs and factors affecting consumption, design period.

Transmission of water: Various types of conduits, capacity and sizes including economical sizes of rising main, structural requirements; laying and testing of water supply pipelines; pipe materials, joints, appurtenances and valves; leakages and control. **[8]**

Unit 2

Storage and distribution of water: Methods of distribution, pressure and gravity distribution systems, Concept of service and balancing reservoirs. Capacity of distribution reservoirs: general design guidelines for distribution system. **[8]**

Unit 3

Physical, chemical and bacteriological examination of water and wastewater: Temperature, pH, colour and odour, solids, nitrogen and phosphorus, chlorides, toxic metals and compounds, BOD, COD etc. quality requirements, standards of water and waste water, disposal of wastewater on land and water bodies. **[8]**

Unit 4

Objectives of water treatment: unit operations, processes, and flow sheets.

Water treatment: screening, sedimentation, determination of settling velocity, efficiency of ideal sedimentation tank, design of settling tanks, grit chamber.

Primary sedimentation and coagulation, filtration: theory of filtration; hydraulics of filtration; slow sand, rapid sand and pressure filters, backwashing; design of slow and rapid sand filters. Disinfection:

requirements of an ideal disinfectant; various disinfectants, chlorination and practices of chlorination, water softening and ion-exchange process. **[8]**

Unit 5

Objectives of waste water treatment: unit operations, processes, and flow sheets.

Secondary and tertiary treatment: secondary sedimentation and theory of organic matter removal. Working of activated sludge process, trickling filters; aerated lagoons, waste stabilization ponds, oxidation ditches, rotating biological contactors (RBC).

Anaerobic digestion of sludge: design of low and high rate anaerobic digesters and septic tank. Working of up flow anaerobic sludge blanket (UASB) reactor and other emerging technologies for wastewater treatment **[8]**

Text Books:

1. Peavy, Howard S., Rowe, Donald R and Tchobanoglous, George, "Environmental Engineering" McGraw Hill Education (India) Pvt. Ltd., New Delhi.
2. Metcalf & Eddy "Wastewater Engineering: Treatment & Reuse", Tata Mc-Graw Hill.
3. Garg, S.K.: Water Supply Engineering (Environmental Engineering Vol. – I)
4. Garg, S.K.: Sewage Disposal and Air Pollution Engineering (Environmental Engineering Vol.–II).
5. Garg: Sewage Disposal and Air Pollution Engineering (Environmental Engineering Vol. – II).
6. Davis, M.L. & Cornwell, D.A.: Introduction to Environmental Engineering, Mc-Graw Hill.

References:

1. Manual on Water Supply and Treatment, C.P.H.E.E.O.,Ministry of Urban Development, Government of India, New Delhi
2. Manual on Sewerage and Sewage Treatment, C.P.H.E.E.O.,Ministry of Urban Development, Government of India, New Delhi
3. Steel and McGhee: Water Supply and Sewerage
4. Fair and Geyer: Water Supply and Wastewater Disposal
5. Hammer and Hammer Jr.: Water and Wastewater Technology
6. Raju: Water Supply and Wastewater Engineering
7. Rao: Textbook of Environmental Engineering
8. Davis and Cornwell: Introduction to Environmental Engineering
9. Kshirsagar: Water Supply and Treatment and Sewage Treatment Vol. I and II
10. Punmia: Water Supply and Wastewater Engineering Vol. I and II
11. Birdie: Water Supply and Sanitary Engineering
12. Ramalho: Introduction to Wastewater Treatment Processes
13. Davis Mackenzie L., Cornwell, David A., "Introduction to Environmental Engineering"
14. McGraw Hill Education (India) Pvt. Ltd., New Delhi.
15. Birdie: Water Supply and Sanitary Engineering
16. Ramalho: Introduction to Wastewater Treatment Processes
17. Parker: Wastewater Systems Engineering

Transportation Engineering Lab
[BTCE 606P]

Course Objectives:

1. Be familiar with principles of Highway planning & Geometric design.
2. Fundamental Concepts of Traffic Engineering.
3. Learning different highway materials & their testing.
4. Learning pavement design & its Construction.

Course Outcomes:

1. Understand the history of road development, their alignment & Survey.
2. Design the various geometric parameters of road.
3. Study the traffic characteristics & design of road intersections & signals.
4. Examine the properties of highway materials & their implementation in design of pavements.
5. Learn methods to construct various types of roads.

PART -A (To be performed in lab)

1. To Determine the Crushing Value of Coarse Aggregates.
2. To Determine the Impact Value of Coarse Aggregates.
3. To determine the Flakiness Index and Elongation Index of Coarse Aggregates.
4. To determine the Los Angeles Abrasion Value of Coarse Aggregates.
5. To determine the Stripping Value of Coarse Aggregates.
6. To determine the penetration Value of Bitumen.
7. To determine the Softening Point of Bituminous material.
8. To determine the Ductility Value of Bituminous material.
9. To determine the Flash and Fire Point of Bituminous material.
10. To determine the Stripping Value of Bituminous material.
11. Classified both directional Traffic Volume Study.
12. Traffic Speed Study. (Using Radar Speedometer or Enoscope).
13. Determination of CBR Value of soil sample in the Lab or in Field.

Note: A minimum of 8 experiments are to be performed from the list of Experiments.

PART B

1. It is mandatory to perform experiments using virtual lab where ever applicable.
2. Relevant IRC specifications and codes must be studied.

References:

1. Khanna S. K., Justo C.E.G, & Veeraragavan A., "Highway Materials and Pavement Testing",
2. Nem Chand and Bros., Roorkee- 247 667.
3. Gambhir, M.L., Jamwal, Neha," Lab Manual: Building and Construction Materials, Testing and Quality Control" McGraw Hill Education (India), Pvt.Ltd., Noida.

4. Duggal, Ajay K., Puri, Vijay P.," Laboratory Manual in Highway Engineering" New Age
5. International (P) Limited, Publishers, New Delhi.
6. Sood Hemant, Mittal, L.N., Kulkarni,P.D., " Laboratory Manual on Concrete Technology"
7. CBS Publishers & Distribiters Pvt. Ltd. New Delhi.

Environmental Engineering Lab
BTCE 607P

Course Objectives:

1. To provide fundamental awareness about the water sources, population forecasting, water quality.
2. To develop an interest in pursuing the subject for P.G. studies because environmental pollution and its management is a critical topic of the hour.
3. To develop skills of designing a water treatment plant.
4. Developing a professional skill for design of water distribution system and environmental problems related to civil engineering.

Course Outcomes:

1. Assess water demand and optimal size of water mains.
2. Layout the distribution system & assess the capacity of reservoir.
3. Investigate physical, chemical & biological parameter of water.
4. Design treatment units for water and waste water.
5. Apply emerging technologies for treatment of waste water.

PART -A (To be performed in lab)

1. Determination of turbidity and conductivity.
2. Determination of pH, alkalinity and acidity.
3. Determination of hardness and chlorides.
4. Determination of residual chlorine.
5. Determination of MPN (most probable number) of coliforms.
6. Measurement of SPM and PM10 with high volume sampler.
7. Measurement of sound level with sound level meter.
8. Determination of total , suspended and dissolved solids.
9. Determination of BOD.
10. Determination of COD.
11. Determination of kjeldahl nitrogen.
12. Determination of fluoride.
13. Determination of optimum dose of coagulants by Jar Test Apparatus.
14. Field Visit of Water/ Sewage Treatment Plant of a nearby area.

Note: 1. Experiment at S.NO. 14 is mandatory.
2. Any 8 Experiments out of the S.NO 1 to 13 are to be performed.

PART B

1. It is mandatory to perform experiments using virtual lab where ever applicable.
2. Relevant specifications and IS codes must be studied.

References:

1. A.P.H.A. “Standard Methods for the Examination of Water andWastewater”, American Public Health Association.
2. Sawyer, C.N., McCarty, P.L. & Parkin, G.F. “Chemistry for Environmental Engineering”, McGraw Hill.
3. Mathur, R.P. “Water & Wastewater Testing”, Lab Manual, Roorkee.
4. P Gupta, Environmental Chemistry, " Khanna Publishing house.

Structural Detailing Lab
BTCE 608P

Course Objectives:

1. To educate the student about the concept of reinforced cement concrete and different method of design of reinforced concrete.
2. To educate the student about concept of working stress method to analysis and design of beams.
3. To educate the student about concept of limit state method to analysis and design of beams, slabs and columns.
4. To educate the student about analysis and design of footings and staircases by limit state method.

Course Outcomes:

1. Analyze and Design RCC beams for flexure by IS methods.
2. Analyze and Design RCC beams for shear by IS methods.
3. Analyze and Design RCC slabs and staircase by IS methods.
4. Design the RCC compression members by IS methods.
5. Design various types of footings and cantilever retaining wall

PART -A (To be performed in lab)

1. To verify Maxwell’s Reciprocal theorem.
3. To find horizontal thrust in a three-hinged arch and to draw influence line diagrams for Horizontal Thrust end Bending moment.
2. To find horizontal thrust in a two hinged arch and to draw influence line diagrams for horizontal Thrust and bending moment.
3. Study of SP34/IS13920/IS456:2000 for detailing of structural elements.
4. Preparation of working hand sketches and soft drawings using BIM software (Open source/Commercial) for the following-
   a) Simply supported, Continuous and Cantilever RCC Beams(T-beam and l-Beam)
   b) RCC Slabs – (Simply supported, Continuous, One way and two way).
   c) RCC Columns –(Tied columns and Spirally reinforced columns)
   d) Isolated and combined footings for RC Columns.
5. Preparation of bar bending schedule.
6. Detailing of buildings with respect to Earthquake Resistant Design
7. Study of full set of structural drawing of a building as made available by Institute.

PART B

It is mandatory to perform experiments using virtual lab where ever applicable.

NOTE:-

1. For open source software the following link of FOSSEE may be used apart from other available resources:

https://fossee.in

References:

1. FOSSEE: (Free/Libre and Open Source Software for Education), National mission on education through ICT, MHRD, Govt. of India
2. Krishna Raju N., "Structural Design and Drawing" University Press (India), Pvt.Ltd., Hyderabad.

Advance Structural Analysis
[BTCE 604A]

Course Objectives:

1. To learn about the approximate methods of analysis of multistory frames.
2. To learn about the flexibility method of analysis of structures.
3. To learn about the stiffness method of analysis of structures.
4. To learn about the finite element method of analysis of structures.
5. To learn about the basics of plastic analysis and methods of plastic analysis of beams and frames

Course Outcomes:

1. Analyze indeterminate structure to calculate unknown forces, slope and deflections by different methods.
2. Apply principle of influence lines to analyze indeterminate beams and arches.
3. Analyze and design cable structure with their influence line diagram.
4. Apply basics of force and stiffness methods of matrix analysis for beams, frames and trusses.
5. Apply the basic of plastic analysis to analyze the structure by using different mechanism.

Unit 1

Analysis of fixed beams, Continuous beams and simple frames with and without translation of joint by Slope-Deflection method, Moment Distribution method and Strain Energy method. **[8]**

Unit 2

Muller-Breslau's Principle and its applications for drawing influence lines for indeterminate beams, Analysis of two hinged and fixed arches, Influence line diagrams for maximum bending moment, Shear force and thrust in two hinge arches. Analysis of two and three hinged stiffening girders **[8]**

Unit 3

Introduction to Suspension Bridges, Analysis of two and three hinged stiffening girders, Influence line diagrams for maximum bending moment and shear force for stiffening girders. **[8]**

Unit 4

Basic Force and Displacement Matrix method for analysis of beams, frames and trusses. **[8]**

Unit 5

Basics of Plastic Analysis. Applications of Static and Kinematic theorem for Plastic Analysis of Beams and Single Storied Frames.

References: **[8]**

1. Jain, A. K., "Advanced Structural Analysis ", Nem Chand & Bros., Roorkee.

2. Hibbeler, R.C., “Structural Analysis”, Pearson Prentice Hall, Sector - 62, Noida 201309
3. C. S. Reddy “Structural Analysis”, Tata Mc Graw Hill Publishing Company Limited,
4. New Delhi.
5. Timoshenko, S. P. and D. Young, “ Theory of Structures” , Tata Mc-Graw Hill Book Publishing Company Ltd., New Delhi.
6. Dayaratnam, P. “ Analysis of Statically Indeterminate Structures”, Affiliated East West
7. Press.
8. Wang, C. K. “ Intermediate Structural Analysis”, Mc Graw-Hill Book Publishing Company Ltd.
9. Thandavamoorthy, T.S., “Structural Analysis” Oxford University Press, New Delhi.
10. Martin, H. C.” Introduction to Matrix Methods of Structural Analysis”, Mc-Graw Hill Book Publishing Company Ltd, New Delhi.
11. Mau, “Introduction to Structural Analysis” CRC Press Taylor & Francis Group.
12. Ghali, “ Structural Analysis: A Unified Classical and Matrix Approach” 5/e, CRC Press Taylor & Francis Group.
13. Wilbur and Norris, “Elementary Structural Analysis”, Tata McGraw Hill.
14. Vazirani & Ratwani et al , “Analysis of Structures”, Khanna Publishers
15. Coates, RC, Coutie, M.G. & Kong, F.K., “Structural Analysis”, English Language Book
16. Society & Nelson, 1980.
17. SP Gupta & Gupta “Theory of Structure Vol.1 & 2” TMH
18. DS Prakash Rao “Structural Analysis: A Unified Approach” Universities Press.
19. S Ramamurtham “Theory of Structure” Dhanpat Rai.
20. Devdas Menon “Advanced Structural Analysis” Narosa
21. Hsieh, “Elementary Theory of Structures” 4/e, Pearson Education, Noida.
22. Mckenzie, “Examples in Structural Analysis” 2/e, CRC Press Taylor & Francis Group.
23. R Agor, Structural Analysis, " Khanna Book Publishing.
24. Jacques Heyman, “Structural Analysis” Cambridge University Press.

River Engineering
[BTCE-604B]

Course Objectives:

1. To understand the behavior of alluvial rivers, morphological processes, sediment movement.
2. To assess channel instability.
3. To analyze flood management techniques

Course Outcomes:

1. Explain river morphology and its classification.
2. Explain hydraulic geometry and behavior of river.
3. Explain socio-cultural influences and ethics of stream restorations.
4. Analyze flow and sediment transport in rivers and channels.
5. Design guide band, embankments and flood protection systems.

Unit 1

Introduction, classification of Rivers, Mechanics of alluvial rivers including channel and flood plain features, Sediment transport and budgets, River morphology any various classification schemes. **[8]**

Unit 2

Behavior of Rivers: Introduction, River Channel patterns, Straight river channels, causes, characteristics and shapes of meanders and control, cutoff, Braided Rivers, Bed forms, Instability of rivers, Hydraulic geometry, Delta formation and control. **[8]**

Unit 3

Mechanics of Alluvial Rivers, Rivers and restoration structures, Socio-cultural influences and ethics of stream restoration. **[8]**

Unit 4

Bio-engineering Techniques, Classification review, Natural Channel Design Analysis, Time Series, Analysis of flow, Sediment and channel geometry data. **[8]**

Unit 5

River Training and Protection Works: Introduction, Classification of River Training, Types of training works, Protection for Bridges with reduced waterway, Design of Guide Band, embankment and spurs/dampners and other river/ flood protection works. **[8]**

Text book:

1. River Behavior Management and Training (Vol. I & II), CBI&P, New Delhi.
2. Irrigation & Water Power Engineering- B. C. Punmia and Pande B. B. Lal.
3. River Engineering by Margeret Peterson
4. Principles of River Engineering by (the non tidel alluvial) PH Jameen

Repair and Rehabilitation of Structures
BTCE 604C

Course Objectives:
The course seeks to recognize the mechanisms of degradation of concrete structures, provide the students with the knowledge of available techniques and their application for strengthening or upgrading existing structural systems. It also provides how to conduct field monitoring and non-destructive evaluation of concrete structures.

Course Outcomes:

1. Understand the fundamentals of maintenance and repair strategies.
2. Identify for serviceability and durability aspects of concrete.
3. Know the materials and techniques used for repair of structures.
4. Decide the appropriate repair and retrofitting techniques.
5. Use appropriate health monitoring technique and demolition methods.

Unit 1
Maintenance: Repair and rehabilitation, facts of maintenance, importance of maintenance various aspects of inspection, assessment procedure for evaluating damaged structure, causes of deterioration. Repair Strategies: Causes of distress in concrete structures, construction and design failures, condition assessment and distress-diagnostic techniques, assessment procedure for inspection and evaluating a damaged structure. **[8]**

Unit 2
Serviceability and Durability of Concrete: Quality assurance for concrete construction, concrete properties – strength, permeability, thermal properties and cracking. effects due to climate, temperature, chemicals, corrosion. **[8]**

Unit 3
Materials and Techniques for Repair: Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, fibre reinforced concrete, bacterial concrete, rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, gunite and shotcrete, epoxy injection, mortar repair for cracks, shoring and underpinning. **[8]**

Unit 4
Repair, Rehabilitation and Retrofitting Techniques: Repairs to overcome low member strength, deflection, cracking, chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure.
Repair of structure: Common types of repairs, repair in concrete structures, repairs in under water structures. Strengthening of Structures: Strengthening Methods, retrofitting, jacketing. **[8]**

Unit 5

Health Monitoring and Demolition Techniques: Long term health monitoring techniques, engineered demolition techniques for dilapidated structures, use of sensors for building instrumentation. **[8]**

References

1. Concrete Technology by A.R. Santakumar, Oxford University press
2. Defects and Deterioration in Buildingts, E F & N Spon, London
3. Non-Destructive Evaluation of Concrete Structures by Bungey - Surrey University
4. Maintenance and Repair of Civil Structures, B.L. Gupta and Amit Gupta, Standard Publications.
5. Concrete Repair and Maintenance Illustrated, RS Means Company Inc W. H. Ranso, (1981)
6. Building Failures : Diagnosis and Avoidance, EF & N Spon, London, B .
7. Mehta, P.K and Montevic. P.J., Concrete- Microstructure, Properties and Materials, ICI.

Foundation Engineering
[BTCE 604D]

Course Objectives:
The primary objective of this course is to equip the student with the knowledge of how to explore the soil, design the foundations for different conditions and check the stability of structures.

Course Outcomes:

1 Understand various methods of Soil Exploration and its importance.
2 Analyze bearing capacity and settlement of soil for shallow foundation.
3 Design the various types of shallow foundation and understand the basics of deep foundation.
4 Understand the characteristics of well foundations and retaining wall.
5 Understand the concept of soil reinforcement.

Unit 1
Introduction to soil exploration, methods of boring and drilling, soil sampling and sampler, in-situ tests, SPT, CPT, DCPT, geophysical methods; soil resistivity methods seismic refraction methods. **[8]**

Unit 2
Bearing capacity of shallow foundation, design criteria, factors affecting bearing capacity, factors influencing selection of depth of foundation, modes of shear failures, types of shallow foundations, contact pressure under rigid and flexible footings, Terzaghi's, Meyerhof, Hansen's bearing capacity theories, IS code method
Settlement of shallow foundations: components of settlement & its estimation, immediate, consolidation, & differential settlements.
[8]

Unit 3
Design of shallow foundation; principles of design of footing, design of isolated footings and strip footing.
Deep foundation; introduction, necessity of deep foundations, pile installation, pile groups, group action of piles in sand and clay, group efficiency of piles, settlement of piles, negative skin friction, single and double under reamed piles. **[8]**

Unit 4
Introduction, shapes and characteristics of wells, components of well foundation, forces acting on well foundation, sinking of wells, causes and remedies of tilts and shifts.
Retaining walls: introduction, types of retaining structures, support systems for flexible retaining walls (struts, anchoring), construction methods, introduction and uses of sheet piles. **[8]**

Unit 5

Geotechnical properties of reinforced soil, use of soil reinforcement, shallow foundation on soil with reinforcement, design considerations, idealized soil, foundation and interface behaviour, elastic models of soil behaviour. **[8]**

Reference Books:

1 Alamsingh; Soil Mechanics & Foundation Engineering; CBS Publishers & Distributors, Delhi
2 Taylor D.W.; Fundamentals of Soil Mechanics; Asia Publishing House, Mumbai
3 Das Braja M; Principles of Geotechnical Engineering; Thomson Asia Pvt. Ltd.
4 Joseph E. Bowles: Foundation analysis and design.McGraw-Hill Higher Education
5 Gopal Ranjan, Rao A.S.R.; Basic and applied soil mechanics; New age int. (p) ltd.
6 Arora K.R.; Soil Mechanics & Foundation Engineering; Standard Pub., Delhi
7 B.C. Punamia; Soil Mechanics & Foundation Engineering; Laxmi Pub. Pvt. Ltd., Delhi.
8 N. S. Murthy; Soil Mechanics & Foundation Engineering; Sai Kripa Technical Consultants, Banglore
9 P. Purushothama Raj; Soil Mechanics and Foundation Engineering; Pearson Education.
10 I.H. Khan – Text Book of Geotechnical Engineering
11 C. Venkataramaiah – Geotechnical Engineering
12 Shenbaga R Kaniraj- Design Aids in Soil Mechanics and Foundation Engineering
13 Gulati, S.K., "Geotechnical Engineering" McGraw Hill Education (India), Pvt. Ltd.,Noida.

Real Time Systems
BTOE-605A

Course Objectives:

1. Introduction of the real-time systems.
2. Computing required for the real-time embedded systems.
3. Communication required for the real-time embedded systems

Course Outcomes:

1. Describe concepts of Real-Time systems and modeling.
2. Recognize the characteristics of a real-time system in context with real time scheduling.
3. Classify various resource sharing mechanisms and their related protocols.
4. Interpret the basics of real time communication by the knowledge of real time models and protocols.
5. Apply the basics of RTOS in interpretation of real time systems.

Unit	Topics	Lectures
I	**Introduction** Definition, Typical Real Time Applications: Digital Control, High Level Controls, Signal Processing etc., Release Times, Dead-lines, and Timing Constraints, Hard Real Time Systems and Soft Real Time Systems, Reference Models for Real Time Systems: Processors and Resources, Temporal Parameters of Real Time Workload, Periodic Task Model, Precedence Constraints and Data Dependency.	**8**
II	**Real Time Scheduling** Common Approaches to Real Time Scheduling: Clock Driven Approach, Weighted Round Robin Approach, Priority Driven Approach, Dynamic Versus Static Systems, Optimality of Effective-Deadline-First (EDF) and Least-Slack-Time-First (LST) Algorithms, Rate Monotonic Algorithm, Offline Versus Online Scheduling, Scheduling Aperiodic and Sporadic jobs in Priority Driven and Clock Driven Systems.	**8**
III	**Resources Sharing** Effect of Resource Contention and Resource Access Control (RAC), Non-preemptive Critical Sections, Basic Priority-Inheritance and Priority-Ceiling Protocols, Stack Based Priority- Ceiling Protocol, Use of Priority-Ceiling Protocol in Dynamic Priority Systems, Preemption Ceiling Protocol, Access Control in Multiple-Module Resources, Controlling Concurrent Accesses to Data Objects.	**8**
IV	**Real Time Communication**	**8**

	Basic Concepts in Real time Communication, Soft and Hard RT Communication systems, Model of Real Time Communication, Priority- Based Service and Weighted Round-Robin Service Disciplines for Switched Networks, Medium Access Control Protocols for Broadcast Networks, Internet and Resource Reservation Protocols.	
V	**Real Time Operating Systems and Databases** Features of RTOS, Time Services, UNIX as RTOS, POSIX Issues, Characteristic of Temporal data, Temporal Consistency, Con-currency Control, Overview of Commercial Real Time databases.	**8**

Text Books:

1. Real Time Systems – Jane W. S. Liu, Pearson Education Publication.

Reference Books:

1. Real Time Systems – Mall Rajib, Pearson Education
2. Real-Time Systems: Scheduling, Analysis, and Verification – Albert M. K. Cheng, Wiley.

Embedded System
BTOE-605B

Course Objectives:

1. Attain the knowledge of embedded system and its development environment.
2. Gain the knowledge of RTOS based embedded system design and its applications.

Course Outcomes:

1. Understand the basics of embedded system and its structural units.
2. Analyze the embedded system specification and develop software programs.
3. Evaluate the requirements of the programming embedded systems, related software architecture.
4. Understand the RTOS based embedded system design.
5. Understand all the applications of the embedded system and designing issues.

Unit	Topic	Lectures
1	Introduction to Embedded Systems: Introduction to Embedded Systems – The build process for embedded systems- Structural units in Embedded processor , selection of processor & memory devices- DMA – Memory management methods- Timer and Counting devices, Watchdog Timer, Real Time Clock, In circuit emulator, Target Hardware Debugging. Embedded Networking: Embedded Networking: Introduction, I/O Device Ports &	8
2	Buses– Serial Bus communication protocols – RS232 standard – RS422 – RS485 – CAN Bus -Serial Peripheral Interface (SPI) – Inter Integrated Circuits (I2C) –need for device drivers. Embedded Firmware Development Environment: Embedded Product Development	8
3	Life Cycle objectives, different phases of EDLC, Modelling of EDLC; issues in Hardware-software Co-design, Data Flow Graph, state machine model, Sequential Program Model, concurrent Model, object oriented Model. RTOS Based Embedded System Design: Introduction to basic concepts of RTOS- Task, process & threads, interrupt routines in RTOS, Multiprocessing and Multitasking, Preemptive and non preemptive scheduling, Task communication	8
4	shared memory, message passing-, Inter process Communication – synchronization between processes-semaphores, Mailbox, pipes, priority inversion, priority inheritance, comparison of Real time Operating systems: Vx Works, чC/OS-II, RT Linux. Embedded System Application Development: Design issues and techniques Case	8
5	Study of Washing Machine- Automotive Application- Smart card System Application.	8

Text Books:

1. Wayne Wolf, “Computers as Components: Principles of Embedded Computer System Design” Elsevier, 2006.
2. Michael J. Pont, “Embedded C”, Pearson Education , 2007.
3. Steve Heath, “Embedded System Design”, Elsevier, 2005.
4. Muhammed Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay, “The 8051.
5. Microcontroller and Embedded Systems”, Pearson Education, Second edition, 2007.

Introduction to Mems
BTOE-605C

Course Objectives:

1. Understand the Basic concept of MEMS, Mechanics of Beam and Diaphragm Structures, Air Damping and Electrostatic Actuation.
2. Know the knowledge of Thermal Effects and the Applications of MEMS in RF.

Course Outcomes:

1. Understand the Basic concept of MEMS Fabrication Technologies, Piezoresistance Effect, Piezoelectricity, Piezoresistive Sensor.
2. Explain Mechanics of Beam and Diaphragm Structures.
3. Understand the Basic concept of Air Damping and Basic Equations for Slide-film Air Damping, Couette-flow Model, Stokes-flow Model.
4. Know the concept of Electrostatic Actuation.
5. Understand the applications of MEMS in RF

Unit	Topic	Lectures
1	**Introduction to MEMS:** MEMS Fabrication Technologies, Materials and Substrates for MEMS, Processes for Micromachining, Characteristics, Sensors / Transducers, Piezoresistance Effect, Piezoelectricity, Piezoresistive Sensor.	8
2	**Mechanics of Beam and Diaphragm Structures:** Stress and Strain, Hooke's Law. Stress and Strain of Beam Structures: Stress, Strain in a Bent Beam, Bending Moment and the Moment of Inertia, Displacement of Beam Structures Under Weight, Bending of Cantilever Beam Under Weight.	8
3	**Air Damping:** Drag Effect of a Fluid: Viscosity of a Fluid, Viscous Flow of a Fluid, Drag Force Drag Effect of a Fluid: Viscosity of a Fluid, Viscous Flow of a Fluid, Drag Force Damping, The Effects of Air Damping on Micro-Dynamics. Squeeze-film Air Damping: Reynolds' Equations for Squeeze-film Air Damping, Damping of Perforated Thick Plates. Slide-film Air Damping: Basic Equations for Slide-film Air Damping, Couette-flow Model, Stokes-flow Model.	8
4	**Electrostatic Actuation:** Electrostatic Forces, Normal Force, Tangential Force, Fringe Effects, Electrostatic Driving of Mechanical Actuators: Parallel-plate Actuator, Capacitive sensors. Step and Alternative Voltage Driving: Step Voltage Driving, Negative Spring Effect and Vibration Frequency.	8
5	**Thermal Effects:** Temperature coefficient of resistance, Thermo-electricity, Thermocouples, Thermal and temperature sensors. **Applications of MEMS in RF** MEMS Resonator Design Considerations, One-Port Micromechanical Resonator Modeling Vertical Displacement Two-Port Micro resonator	8

	Modeling, Micromechanical Resonator Limitations.	

Text & Reference Books:

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalakrishnan, K. N. Bhat and V. K. Atre, "Micro and smart systems", Wiley India, 2010.
2. S.M. Sze, "Semiconductor Sensors", John Wiley & Sons Inc., Wiley Interscience Pub.
3. M.J. Usher, "Sensors and Transducers", McMillian Hampshire.
4. RS Muller, Howe, Senturia and Smith, "Micro sensors", IEEE Press.

Object Oriented Programming
BTOE-605D

Course Objectives:
1. Understand object-oriented programming features by JAVA,
2. Apply these features to program design and implementation,
3. Understand object-oriented concepts and how they are supported by JAVA,
4. Understand implementation issues related to object-oriented techniques,
5. Build good quality software using object-oriented programming technique

Course Outcomes:
1. Apply Java in developing Object Oriented code.
2. Apply the knowledge of Multi-threading and Streams in developing Java applications.
3. Design and implement applications using GUI and Networking in Java.
4. Apply the knowledge of Collections and Generics for building Java applications.
5. Design and develop Java based applications for solutions to real world problems.

UNIT- I
Introduction & Fundamentals of JAVA, Background of JAVA, About Java Technology, Java's architecture, Reading console inputs, Arrays, Constructors, Finalize method, final, this method and reference, static members.

UNIT-II
Concrete class, Abstract class, Interface, Inner classes. Aggregation, Composition and Inheritance, super method and reference. Method overloading and overriding. Singleton classes. Package concepts. Exception Handling: Inbuilt, User defined, Checked and Unchecked.

UNIT- III
String class. Wrapper classes (Integer, Boolean, Character, etc.). Multi-threading: Thread concept, Thread class, Runnable interface, Creating customized threads, Thread synchronization, Thread class methods. Java I/O: Use of Input Stream, Output Stream, Reader and Writer classes for reading from and writing data into disk files.

UNIT-IV
AWT & SWING: Frame, Panel, Dialog, CheckBox, Choice, List, JComboBox, JFrame, JPanel, JRadioButton, JScrollPane, JTabbedPane, Using Listeners: ActionListener, ContainerListener, FocusListener, ItemListener, KeyListener, MouseListener, TextListener, WindowListener. Applets. JDBC: Type1 to Type4 drivers. Java Networking: Server Socket, Socket, RMI.

UNIT-V
Collections Frameworks: HashSet, TreeSet, ArrayList, LinkedList, Vector, HashMap, TreeMap, Hashtable classes. Generics in Java: Creating instances of generic classes, generic types, Declaring (and invoking) methods that take generic types. Creating and running executable JAR (Java ARchives).

Text Books:
1. Herbert Schildt: "Java A Beginner's Guide, 7th edition",Oracle Press.
2. Maurice Naftalin, Philip Wadler, "Javas Generics and Collections", O'Reilly Media, Inc.

3. Benjamin J Evans, David Flanagan., "Java in a Nutshell", O'Reilly Media, Inc.

Numerical Techniques
BTOE-605E

Course Objective:

Understand about the basics of numerical techniques and its applications to Engineering Problems.

Course Outcomes:

1. Understand about the basics of Ordinary Differential Equations, Separable equations, Equations made separable by change of variables.
2. Retrieve the information content of Power series method.
3. CO3: Apply problem specific Bessel's equation, Bessel Functions to engineering applications.
4. Understand about the basics of matrix, Eigen values and eigen vectors.
5. Analysis of Stage wise Processes by the Calculus of Finite Differences, Countercurrent Liquid- Liquid Extraction.

Unit	Topic	Lectures
1	Ordinary Differential Equations, Separable equations, Equations made separable by change of variables, Homogeneous Equations, Equations with first order and first degree with linear coefficients, Exact equations, Linear equation of first order, Bernoulli's equation, Other degree, Clairaut's equation, Singular solutions, Equations with missing terms, General properties of Linear equations, Linear equations with constant coefficients, Determination of the complementary function, exponential functions, Determination of the particular integral, the Euler equation, Simultaneous Linear Differential equations.	8
2	Power series method, theory of the power series method, Legendre's equation, Legendre's Polynomials, Frobenius Method.	8
3	Bessel's equation, Bessel Functions Jv(x), Bessel Functions Jv(x) for any v≥0. Gamma Function, Solution J-v(x) of the Bessel Equation, Backbones of Bessel's Theory, Jv(x) with v= ±1/2, ±3/2, ±5/2.	8
4	Definition of matrix, Some special definitions and operations involving matrices, Determinants, Theorems on determinants, Inverse of a matrix, Orthogonal and unitary matrix. Orthogonal vectors, System of linear equations, Systems on n equations with n unknowns, Cramer's Rule, Eigen values and eigen vectors.	8
5	Analysis of Stage wise Processes by the Calculus of Finite Differences, Countercurrent Liquid- Liquid Extraction, Solution of Difference Equations, Stirred-Tank Reactor System Distillation in a Plate Column, Unsteady-state Operation, Starting a Stirred-tank Reactor, Rate at which a Plate Absorber Approaches Steady State.	8

Text & Reference books:

1. Mickley, Reid and Sherwood, "Applied Mathematics in Chemical Engineering", Tata McGraw Hill, New Delhi (1981).
2. E. Kreyszig, "Advanced Engineering Mathematics", 8th edition, John Wiley and Sons (1999).

3. M. R. Spiegel, “Advanced Mathematics for Engineers and Scientists”, Schaum Outline Series, McGraw Hill, (1971).
4. Chandrika Prasad, Reena Garg, "Advanced Engineering Mathematics", Khanna Publishing house

Gis & Remote Sensing
BTOE-605F

Course Objective:
Understand about the principles of GIS, Remote Sensing, Spatial Systems, and its applications to Engineering Problems.

Course Outcomes:

1. Understand about the principles of Remote Sensing and its advantages and limitations.
2. Retrieve the information content of remotely sensed data.
3. Apply problem specific remote sensing data for engineering applications.
4. Analyze spatial and attribute data for solving spatial problems.
5. Create GIS and cartographic outputs for presentation

Unit	Topic	Lectures
1	Basic component of remote sensing (RS), advantages and limitations of RS, possible use of RS techniques in assessment and monitoring of land and water resources; electromagnetic spectrum, energy interactions in the atmosphere and with the Earth's surface; major atmospheric windows; principal applications of different wavelength regions; typical spectral reflectance curve for vegetation, soil and water, spectral signatures.	**8**
2	Different types of sensors and platforms; contrast ratio and possible causes of low contrast; aerial photography; types of aerial photographs, scale of aerial photographs, planning aerial photography- end lap and side lap; stereoscopic vision, requirements of stereoscopic photographs; air-photo interpretation-interpretation elements;	**8**
3	Photogrammetry- measurements on a single vertical aerial photograph, measurements on a stereo-pair- vertical measurements by the parallax method; ground control for aerial photography; satellite remote sensing, multispectral scanner- whiskbroom and push-broom scanner; different types of resolutions; analysis of digital data- image restoration; image enhancement; information extraction, image classification, unsupervised classification, supervised classification, important consideration in the identification of training areas, vegetation indices.	**8**
4	Microwave remote sensing. GI Sand basic components, different sources of spatial data, basic spatial entities, major components of spatial data, Basic classes of map projections and their properties. .	**8**
5	Methods of data input into GIS, Data editing, spatial data models and structures, Attribute data management, integrating data (map overlay) in GIS, Application of remote sensing and GIS for the management of land and water resources.	**8**

Text & Reference Books:

1. Reddy Anji, M. 2006. Textbook of Remote Sensing and Geographical Information Systems. BS Publications, Hyderabad.
2. Elangovan, K. 2006. GIS Fundamentals Applications and Implementations. New India Publication Agency, New Delhi.

3. George Joseph. 2005. Fundamentals of Remote Sensing. 2nd Edition. Universities Press (India) Private Limited, Hyderabad.
4. Jensen, J.R. 2013. Remote Sensing of the Environment: An Earth Resource Perspective. Pearson Education Limited, UK.
5. Lillesand, T., R.W. Kiefer and J. Chipman. 2015. Remote Sensing and Image Interpretation. 7th Edition, John Wiley and Sons Singapore Pvt. Ltd., Singapore.
6. Sabins, F.F. 2007. Remote Sensing: Principles and Interpretation. Third Edition, Waveland Press Inc., Illinois, USA.

Understanding the Human Being Comprehensively – Human Aspirations and its Fulfillment
BTOE-605G

Course Objectives:

1. To help the students having the clarity about human aspirations, goal, activities and purpose of life.
2. To facilitate the competence to understand the harmony in nature/existence and participation of human being in the nature/existence.
3. To help the students to develop the understanding of human tradition and its various components.

Course Methodology:

1. The methodology of this course is exploration and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. It is free from any dogma or set of do's and don'ts related to values.
3. It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated and encouraged to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.
4. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self-evolution.
5. This self-exploration also enables them to critically evaluate their preconditioning and present beliefs.

Unit	Topic	Lectures
1	**Introduction:** The basic human aspirations and their fulfillment through Right understanding and Resolution; All-encompassing Resolution for a Human Being, its details and solution of problems in the light of Resolution.	**8**
2	**Understanding Human being and its expansion:** The domain of right understanding starts from understanding the human being (the knower, the experience and the doer); and extends up to understanding nature/existence – in interconnectedness and co-existence; and finally understanding the role of human being in ence (human conduct).	**8**
3	**Activities of the Self:** Understanding the human being comprehensively is the first step and the core theme of this course; human being as co-existence of the self and the body; the activities and potentialities of the self; Reasons for harmony/contradiction in the self.	**8**
4	**Understanding Co-existence with other orders:** The need and the process of inner evolution (through self-exploration, selfawareness and self-evaluation)- particularly awakening to activities of the Self: Realization, Understanding and Contemplation in the Self (Realization of Co-Existence, Understanding of Harmony in Nature and Contemplation of Participation of Human in this harmony/ order leading to comprehensive knowledge about the existence).	**8**
5	**Expansion of harmony from self to entire existence:**	**8**

Unit	Topic	Lectures
	Understanding different aspects of All-encompassing Resolution (understanding, wisdom, science etc.), Holistic way of living for Human Being with All-encompassing Resolution covering all four dimensions of human endeavour viz., realization, thought, behavior and work (participation in the larger order) leading to harmony at all levels from self to Nature and entire Existence.	

Reference Books:

1. A Foundation Course in Human Values and Profession Ethics (Text Book and Teachers' Manual), R. R. Gaur, R. Sangal, G. P. Bagaria (2010), Excel Books, New Delhi [ISBN 978-8-174-46781-2]
2. Avartansheel Arthshastra, A. Nagraj, Divya Path Sansthan, Amarkantak, India
3. Economy of Permanence – (a quest for social order based on non-violence), J. C. Kumarappa (2010), Sarva-Seva-Sangh-Prakashan, Varansi, India
4. Energy and Equity, Ivan Illich (1974), The Trinity Press, Worcester & Harper Collins, USA
5. Ishandi Nau Upnishad, Shankaracharya, Geeta press, Gorakhpur,
6. Manav Vyavahar Darshan, A. Nagraj, Divya Path Sansthan, Amarkantak, India
7. Manaviya Sanvidhan, A. Nagraj, Divya Path Sansthan, Amarkantak, India

Semester- VII

Design of Steel Structures
[BTCE701]

Course Objectives:

1. To know about the merits of steel structures.
2. To know about shapes and grades of structural steel available.
3. To understand the behavior of structural steel under tension, compression and flexure.
4. Understand the behavior of plate girders.
5. Understand the behavior of column bases and gantry girders.

Course Outcomes:

1. To develop ability to select adequate shape and grade of structural steel.
2. To understand the basis of economical and safe design of steel structures.
3. To develop the ability to design structural steel elements by Limit State Method.
4. Capable of designing Plate Girders.
5. Capable of designing Column bases & Gantry Girders.

UNIT 1:

Materials and Methods of Analysis

Properties of Structural Steel, I. S. Rolled Sections, I. S. Specifications, Elastic Analysis, Plastic Analysis for steel beams and frames - plastic hinges, Introduction to working stress method and Limit state method of design of steel structures, types of loads and stresses. **[8]**

UNIT II:

Tension & Compression Members

Built-up sections Design of tension members subjected to axial tension and bending, splicing of tension member, Design of compression members. **[8]**

UNIT III:

Beams

Design Procedure, laterally supported and laterally unsupported beams, Built-Up Sections, Web Crippling, Web Buckling, Curtailment of Flange Plates. **[8]**

UNIT IV:

Plate Girders with solid webs

Components of a Plate Girder, Typical sections, Proportioning of the section, Design bending strength, minimum web thickness, bearing stiffeners, load carrying stiffeners, intermediate stiffeners, stiffener design. **[8]**

UNIT V:

Column Bases and Gantry Girders

Types of column bases, slab base, gusset base, moment resisting base plates. Loads and load combinations, Typical sections, Design of gantry girders. **[8]**

Text Books:

1. Design of Steel Structures – Arya, A.S., Ajmani, J.I. (Nem Chand & Bros., Roorkee,U.P.)

2. Design of Steel Structures – Punmia, Jain & Jain (LaxmiPublications)

Reference Books:

1. code of practice on steelstructures
2. Design of Steel Structures – Duggal S.K. (Tata McGrawHill)
3. Design of Steel Structures (Vol. - I &II) – Ram Chandra (Standard Book House, New Delhi)
4. Design of Steel Structures – Dayaratnam (Wheeler Publishing, NewDelhi)
5. Design of Steel Structures – E.H.Gaylord and C.N. Gaylord (McGraw Hill, NewYork)
6. SteelStructures:DesignandBehaviour–C.G.SalmonandJ.E.Johnson(HarperandRow,NewYork)

Steel Structure Drawing Lab
(BTCE705P)

Course Objectives:

1. To know about the merits of steel structures.
2. To know about shapes and grades of structural steel available.
3. To understand the behavior of structural steel under tension, compression and flexure.
4. Understand the behavior of plate girders.
5. Understand the behavior of column bases and gantry girders.

Course Outcomes:

1. To develop ability to select adequate shape and grade of structural steel.
2. To understand the basis of economical and safe design of steel structures.
3. To develop the ability to design structural steel elements by Limit State Method.
4. Capable of designing Plate Girders.
5. Capable of designing Column bases & Gantry Girders.

Experiments to be performed (Min 08 experiments):

1. Preparation of a working drawing (elevation, plan, details of joints as ridge, eaves and other connections) for a riveted steel roof truss
2. Drawing of Earth dam section showing details of different types of earth dam.
3. Drawing of different types of steel section.
4. Drawing of riveted connection .
5. Drawing of welded connection
6. Drawing of beam to beam connections
7. Drawing of beam to column connections.
8. Drawing of column base connections.
9. Drawing of column splices
10. Detailed drawing showing plan and elevation for a riveted plate girder.

Rural Development Engineering
(BTCE702A)

Course Objectives:
To prepare professionals for understanding sustainable development and the present problems of rural areas basing on knowledge relating to agriculture, economic management as well as regional and rural development, for cooperating in the determination of the possible directions of development, defining special development programs, managing their realizations and carrying out the monitoring of the processes.

Course Outcomes:
1. Undertake surveys to decide the status of socio-economic significance.
2. Identify the need of watershed management in rural areas.
3. Suggest relevant government schemes for construction of roads, housing and energy conservation. .
4. Suggest the relevant cottage and agro based industries for the rural areas.
5. Select the relevant schemes of Central/State Government for the rural areas.
6. Apply the principles of rural development in rural areas.

UNIT- I
Rural Development Planning and Concept of Appropriate Technology: Scope; development plans; various approaches to rural development planning; concept of appropriate technology. Rural development programme/ projects. **[8]**

UNIT- II
Rural Housing: Low cost construction materials for housing; Architectural considerations for individual and group housing; Composite material - ferro-cement & fly ash, autoclaved calcium silicate bricks and soil-stabilized un-burnt brick; Plinth protection of mud walls; design consideration and construction of: non-erodable mud plaster, Water-proof and fire-retardant roof treatment for thatch roofs. Pre-cast stone masonry; rat-trap bond for walls; Panels for roof, ferro-cement flooring / roofing units, Earthquake resistant measures for low cost houses. **[8]**

UNIT- III
Water Supply and Rural Sanitation: Sources of water. BIS & WHO water standards. Quality, Storage and distribution for rural water supply works; basic design principles of treatment-low cost water treatment technologies; conservation of water; rainwater harvesting; drainage in rural areas, low cost waste disposal systems; septic tank ; Biogas technology; low cost community & individual Garbage disposal systems, Ferro-cement water storage tanks. **[8]**

UNIT- IV
Low Cost Roads and Transport: Broad categories of Pavement Layers, types of Granular Sub-Bases and Bases, Bituminous Construction, Surface Treatments for roads in rural areas. Soil Stabilization, Lime, Lime Flyash and Cement Treated Course. Crusher-run-Macadam. Use of local materials.

Flexible Pavement: Design factors, Basic Principles, Guidelines for Surfacing for Rural Road.

[8]

UNIT- V

Low Cost Irrigation: Consideration of low cost irrigation techniques , drip & sprinkler irrigation systems. Watershed and catchments area development - problems and features of watershed management, watershed structures. **[8]**

Reference Books:

1. A.G.Madhov Rao, D.S.Ramachandra Murthy, Appropriate Technologies for low cost Housing Oxfordand IBH Publishing Co. Pvt .Ltd.
2. CBRI, Roorkee, Advances in Building Mat erials and Construction.
3. C. Satyanarayana Murthy, Design of Minor Irrigation and Canal Structures. Wiley Eastern Ltd.,
4. Document on Rural Road Development in India Volume1& 2; Central Road Research Institute, New Delhi.
5. Water supply and sanitary engineering by Rangwala, .Charotar publication
6. Rural Infrastructure by P.Nair, SBS Publication
7. Rural Infrastructure by Samalia Bihari Verma, Gyaneshwar Prasad & Sahib Kumari Singh, Sarup & Sons.
8. Rural Development by Katar Singh, SAGE Publication

Structure Dynamics
(BTCE702B)

Course Objectives:
The objective is to provide the fundamental understanding of the structural dynamics and the problem solving ability for dynamic response in civil engineering design, analysis and research. Introduce students to analytical and numerical methods in structural dynamics with emphasis on vibration and to opportunities to optimize system for desired dynamic response.

Course Outcomes:

1. Analyze and Interpret dynamics response of single degree freedom system using fundamental theory and experiments
2. Analyze and Interpret dynamics response of Multi degree freedom system using fundamental theory and experiments
3. Differentiate the effects of various types of dynamic loads
4. Use structural engineering software for dynamic analysis
5. Perform & interpret the results of various experiments on models to understand structural behavior of symmetrical & un-symmetrical structures in plan & elevation

UNIT- I Introduction of Structural Dynamics, differential equations in civil engineering, types of analysis/static and dynamic load, degree of freedom ,generation of stiffness matrix), dynamic equilibrium equation, solution of equilibrium equation, Undamped free vibration solution, natural period/frequency ,energy in free vibration, damped free vibration, types of damping, logarithmic decrement equation. **[8]**

UNIT - II Undamped forced vibration , amplitude & phase angle , dynamic amplification factor for deflection($R_{d)}$, damped forced vibration, relationship between R_d, R_v, & R_a , Resonant frequency and half power band width, force transmission and Isolation, Introduction of vibration measuring Instruments. **[8]**

UNIT – III Response to Unit Impulse , response to arbitrary force (duhamel's Integral), response to step and ramp forces, response to rectangular pulse, half sinusoidal wave, time stepping methods, central difference method, Newmark's Method , Concept of response spectrum, uses of response spectrum, response of structure in frequency domain. **[8]**

UNIT – IV Equation of Motion for MDOF System , Solution of equation, natural frequencies and mode shapes, modal orthogonality, approximate method for finding natural frequency , Time History Analyis, Response spectrum Analysis, 3 D dynamic Analysis , Vibration of continuous systems, shear behavior and bending behavior, generalized SDOF. **[8]**

UNIT – V Dynamics of rigid blocks, Non structural elements, floor response spectrum, Introduction to vibration control, active control, passive control, design of tuned mass damper by displacement and energy perspectives. **[8]**

References Books:

1. "Dynamics of structures" by Anil K Chopra, Pearson Education Limited.
2. "Structural Dynamics" by Clough & Penzin, McGraw-Hill Education .
3. "Theory of Vibrations" by Thompson, Pearson Education Limited.
4. "Elements of vibration analysis" by Leonard Mirovitch , McGraw-Hill Education .
5. "Structural dynamics" by Madhujit Mukhopadyay ,Ane Books India.

Advanced Concrete Design
(BTCE702C)

Course Objectives:

To give graduates with a sound background of the design of reinforced concrete structures, an understanding of selected advanced topics in the field including the use of new concepts, construction techniques and materials. The course also provides a revision of some of the fundamental principles of reinforced concrete design. In particular, the course addresses short and long-term deflections, creep, shrinkage, ductility, section analysis, prestressing, shear and cracking.

Course Outcomes:

1. Estimate the crack width and deflection with regard to the serviceability.
2. Analyse and design a grid floor system.
3. Analyse and design a flat slab system.
4. Discuss fire and seismic resistance of concrete structures.
5. **A**nalyse and design bunkers, silos and chimneys.

UNIT – I Introduction to liquid retaining structures, design criteria, material specifications and permissible stresses for tanks, design concept of circular and rectangular tanks situated on the ground and underground. **[8]**

UNIT - II Design of over-head tanks: design of RC domes and beams curved in plan, design of cylindrical and rectangular tanks with different end conditions using IS: 3370 tables, Intze tank design based on membrane analysis with mention of continuity effects. **[8]**

UNIT - III Introduction to prestressing, assumptions, general principles ,advantages of prestressing, Axially placed tendons, bent tendons, parabolic tendons, load balancing concept, pressure line , systems of prestressing, pretensioning and post tensioning, Hoyer system, Freyssinet system ,Le-Mccall system, Magnel-Blaton system, Gifford-Udall system, C.C.L standard system. **[8]**

UNIT - IV Losses in prestress, IS 1343 recommendations for prestressed concrete, stages of loading to be considered in design, handling and transportation of precast prestressed concrete beams , analysis and design of simple prestressed beams, Lever arm conception, kern distance**.** **[8]**

UNIT - V Introduction to deep beams, minimum thickness, design of deep beams by IS 456, check for local failures, detailing of deep beams, Introduction to Corbels, Shear friction, Corbel dimensions, design of a corbel. design of a corbel. **[8]**

Text Books & References

1. IS : 456 – 2000, " Code of Practice for Plain and Reinforced Concrete", Bureau of Indian Standards, New Delhi.

2. IS 3370-2009, “Indian Standard concrete structures for storage of liquids - code of practice”, Bureau of Indian Standards, New Delhi
3. IS 1343-2012, “Indian Standard prestresed concrete - code of practice”, Bureau of Indian Standards, New Delhi
4. Shah. H.J.., “Reinforced Concrete Vol : 2”, Charotar publishing house pvt. Ltd.
5. Varghese P.C. “ Advanced Reinforced concrete design”, PHI learning pvt. Ltd.
6. Ramamrutham S. and Narayan R. ,”Design of Reinforced Concrete Structures”, Dhanpat Rai Publishing company pvt. Ltd.
7. Jain, A.K., “Reinforced Concrete: Limit State Design”, Nem Chand & Bros., Roorkee.
8. Punmia B.C. ,Jain A.K.,” Limit State Design of Reinforced Concrete”, Laxmi Publications pvt. Ltd.

Environmental impact assessment and life cycle analyses.
(BTCE702D)

Course Objectives:

1. be aware of basic life cycle methods as well as tools for evaluating environmental impact and making classifications of buildings;
2. have knowledge of the LCC analysis concept and how it can be used for optimisation;
3. have understanding of the LCA concept;
4. have knowledge of major environmental certification systems for buildings;
5. understand and be able to discuss different actors' needs and goals;

Course Outcomes:

1. Articulate the value of a Life Cycle Analysis (LCA) and its relationship to total costaccounting and carbon pricing.
2. Describe the theory of an LCA and how carbon foot printing relates to LCA.
3. Outline the steps to conduct an ISO compliant LCA.
4. Define a goal and scope statement of an LCA. Conduct a life cycle inventory of aproduct from cradle to grave.
5. Describe common environmental impacts associated with a life cycle inventory ofprocesses.
6. Conduct a screening-level and ISO compliant life cycle assessment with LCAsoftware.
7. Conduct a consequential LCA. Interpret, critique, and communicate LCA results.

UNIT-I:
Evolution of EIA: Concepts of EIA methodologies, Screening and scoping; Rapid EIA and Comprehensive EIA

UNIT II:
General Framework for Environmental Impact Assessment, Characterization and site assessment.

UNIT III:
Environmental Risk Analysis, Definition of Risk, Matrix Method. Checklist method, Fault tree analysis, Consequence Analysis

UNIT IV:
Socioeconomic aspects, measures of effectiveness of pollution control activities; Environmental Legislation; Introduction to Environmental Management Systems; Environmental Statement - procedures;

UNIT V:
Environmental Audit: Cost Benefit Analysis; Life Cycle Assessment; Resource Balance, Energy Balance & Management Review; Operational Control; Case Studies on EIA.

Text Books & References

1. Barrow, C.J. 2000. Social Impact Assessment: An Introduction. Oxford University Press.
2. Glasson, J., Therivel, R., Chadwick, A. 1994. Introduction to Environmental Impact Assessment. London, Research Press, UK.
3. Judith, P. 1999. Handbook of Environmental Impact Assessment. Blackwell Science.
4. Marriott, B. 1997. Environmental Impact Assessment: A Practical Guide. McGraw-Hill, New York, USA.
5. Westman W.E. 1985, Ecology, Impact Assessment and Environmental Planning, John Wiley, New York

Water Resources Engineering
(BTCE703A)

Course Objectives:

1. To understand basic concepts of irrigation and water requirements of crops.
2. To understand the concepts of design of canal.
3. To learn about water logging
4. Be familiar with the concepts of river training.
5. To understand the concepts of reservoir planning.

Course Outcomes:

1. Students are able to understand the different types of irrigation.
2. Students should be able to design the canal.
3. Students can explain the effects of water logging.
4. Students should be able to understand the behavior of river.
5. Students can plan the reservoir for different demands.

UNIT – I

Hydrology: Hydrological Cycle and its components; Water Budget Equation, Precipitation: Types, measurements and analysis, Evaporation and consumptive use: estimation and measurement techniques**.**

Irrigation: Necessity and types, Advantages & disadvantages of irrigation; Functions of water in plant growth, Methods of Irrigation, Water requirement of crops, Duty and Delta relationship; Irrigation frequency; Irrigation efficiencies; Principal crops and crop season, crop rotation.

Canal irrigation: Classes and alignment, Parts of a canal system, Command area, curves in channels, channel losses.

Introduction to Sediment Transportation: Suspended and Bed load and its estimation **[08]**

UNIT – II

Irrigation channels and Design: Types: lined and unlined, silt theories: Kennedy's and Lacey's Design procedure for irrigation channels, longitudinal cross section, Schedule of area statistics and channel dimensions, cross sections of an Irrigation channel,

Lining of Irrigation Canals: Advantages and types; factors for selection of a particular type, design of lined channels, cross section of lined channels, Economics of canal lining. Water Logging and Drainage Design: effects, causes and anti-water logging measures, Drainage of water logged land. **[8]**

UNIT – III

Regulation and control of canal system: Purpose, Types of canal regulation works and their functional aspects

Irrigation Outlets: Requirements, types, non-modular, semi-module and rigid module, selection criterion

River Training: Objective and need, classification of rivers, and river training works, meandering, stages, methods of river training, bank protection, Methods for measurement of discharge.

Types of Head works: Component parts of a diversion headwork, Failure of hydraulic structures founded on permeable foundations, Principles of design, Bligh's theory, Khosla's theory for determination of pressure and exit gradient.

Regulation Works: Falls, Classification; Introduction to design principle of falls, Design of Sarda type and straight glacis tall. Principle and design of Distributory head regulator and cross regulator, canal escape, Bed bars **[8]**

UNIT – IV

Canal head works: Functions, Location, Layout of head works. Weir and Barrage, Canal head Regulator, Introduction to the design principles of Weirs on permeable foundations, Design of vertical drop and sloping glacis weir.

Cross drainage works: Necessity and types; Aqueduct, Siphon Aqueduct, super passage, canal siphon, level crossing, Introduction to design principles of cross drainage works. Investigation and planning of dams and Reservoirs: Zones of storage, Estimation of storage capacity, Reservoir losses, Reservoir sedimentation and its control, life of a reservoir. **[8]**

UNIT – V Dams: classification and selection criteria.

Earth Dams: Classification, causes of failure, Phreatic line, and its determination Introduction to stability analysis

Gravity dams: Forces method of analysis, modes of failure and factor of safety, Elementary profile, stability analysis, galleries, joints, control of cracks.

Spillways: Spillway capacity, types of spillways, Design of ogee spillway, Energy dissipation below spillway, Design criteria for Hydraulic Jump type stilling basins with horizontal and sloping aprons, spillway gates.

Hydro-Electric Power: assessment of potential in reference to India, classification of power plants, important terms, types of turbines and their suitability; Power House layout and important structures of a powerhouse. **[8]**

Text Books

1. Water Resources Engg. By Larry W Mays, John Wiley India
2. Water resources Engg. By Wurbs and James, John wiley India
3. Water Resources Engg. By R.K. Linsley, McGraw Hill
4. Irrigation and Water Resources Engg. By G L Asawa, New age International Publishers
5. Irrigation Engg. and Hydraulic Structures by S.K. Garg, Khanna Publishers.

References

1. Fundamental of Hydraulic Engineering System by Houghalen, Pearson Publication.
2. Irrigation and water Power engineering by B.C. Punmia, Laxmi Publications.
3. Engineering Hydrology by K. Subramanya, TMH.
4. Irrigation Water Power and Water Resource Engg. by K.R. Arrora.
5. Water resource engineering by Ralph A. Wurbs & Wesley P. James, Pearson Publication.

Ground Improvement Techniques
(BTCE703B)

Course objectives:

1. Understand the fundamental concepts of ground improvement techniques
2. Apply knowledge of mathematics, Science and Geotechnical Engineering to solve problems in the field of modification of ground required for construction of civil engineering structures.
3. Understand the concepts of chemical compaction, grouting and other miscellaneous methods.
4. Impart the knowledge of geosynthetics, vibration, grouting and Injection.

Course Outcomes:

1. Identify the problematic soil Suggest the appropriate ground improvement technique as per the requirement of the project (dewatering, densification, stabilization, swelling control etc)
2. Analyse and design the technique for ground improvement

UNIT -I Introduction, Review of compaction theory, effect of compaction on surface behaviour, Field methods of compaction, Quality Control, Design of soil-lime, soil-cement, soil-bitumen and soil-lime-flyash mixes. **[8]**

UNIT -II In-situ densification methods in granular soils, Deep compaction: Introduction, Terra-Probe, Vibroflotation techniques, Ground Suitability for Vibroflotation, Advantages, Mueller Resonance Compaction, Dynamic Compaction, Depth of Improvement. **[8]**

UNIT -III In-situ densification methods in cohesive soil: Introduction, Pre-loading and de-watering, Vertical drains, Electrical method, Thermal method. **[8]**

UNIT – IV Grouting: introduction, suspension grout, solution grout, grouting equipments and methods, Grouting design and layout Granular Piles: Ultimate bearing capacity and settlement, method of construction, load test. **[8]**

UNIT -V Underpining of foundations: importance and situations for underpinning, methodology, typical examples. Geotextiles: types, functions, specifications, precautions in transportation and storage. **[8]**

Recommended:

1. S. K. Garg – Soil Mechanics & Foundation Engineering.
2. Purshotham Raju – Ground Improvement.
3. Gopal Ranjan and A. S. R. Rao – Basic and Applied Soil Mechanics
4. J. N. Mandal – Geosynthetics World
5. Bergado et. al. – Soft Ground Improvement
6. Koerner, R. M. - Designing with geosynthetics
7. Ground Improvement Techniques by Dr. P Purushothama Raj

Earthquake Resistant Design of Structure
(BTCE703C)

Course Objectives:

To expose the students to the analysis and design principles of Earthquake resistant structures using code provisions.

Course Outcomes:

1. To explain the basic concepts in seismology and correlate to earthquake engineering.
2. To construct response spectrum of an earthquake and correlate to the construction of design spectra.
3. To formulate analytical model of MDOF systems subjected to earthquake loading for a given time history and analyze using response spectrum methods.
4. To apply the code procedures for seismic analysis, design and detailing of RC building frames.
5. To explain and suggest a suitable seismic resistant measure for masonry load bearing structures.

UNIT-I

Internal structure of earth, Causes of earthquakes, Seismic waves, Magnitude, Intensity and Energy released, Characteristics of Earthquakes. **[8]**

UNIT-II

Response of Structure to Earthquake motion, Modeling of structures, Dynamics of single degree of freedom system. **[8]**

UNIT-III

Dynamics of multi degree of freedom system, Idealization of structures, seismic response. **[8]**

UNIT-IV

Introduction to earthquake resistant design, Equivalent lateral force method, Response spectrum method, Time history method, Introduction to earthquake resistant brick and masonry buildings. **[8]**

UNIT-V

Reinforced Concrete framed buildings, Code provisions. Introduction to machine foundation & its design. Degrees of freedom of a block foundation. **[8]**

References:

1. Introduction to Structural Dynamics - J.M. Biggs
2. Elements of Earthquake Engineering - Jai Krishna an A.R. Chandrasekaran
3. IS: 1983 - 1984 Criterion for Earthquake Resistant Design.
4. Structural Dynamics - Theory & computation - Mario Paz.

5. Dynamics of Structures Theory and Applications to Earthquake Engineering - Anil K. Chopra.
6. Earthquake Resistant of Design of structures, Agarwal and Srikhande.
7. Earthquake Resistant of Design of structures, S.K.Duggal

8.

Digital and Social Media Marketing
(BTCEOE704A)

Course Objective:

1. Introduce current and core practices of Digital and Social Media Marketing that will allow learners to analyses, plan, execute and evaluate a digital marketing strategy.
2. Introduce core tools currently used in Digital and Social Media Marketing that will allow learners to analyses, plan, execute and evaluate a digital marketing strategy.
3. Develop an understanding of Search Engine Optimization (SEO), Social Media Optimization, Affiliate and other relevant communication channels for engagement of digital communities.

Course Outcomes:

1 Understand what social media is, the various channels through which it operates, and its role in marketing strategy.
2 Use principles of consumer and social psychology to develop social media content and campaigns that engage consumers.
3 Draw on knowledge about word-of-mouth marketing to develop effective approaches for propagating ideas, messages, products, and behaviors across social networks.
4 Measure the impact of a social media campaign in terms of a specific marketing objective.

UNIT-I

Introduction to Digital Marketing: The new digital world - trends that are driving shifts from traditional marketing practices to digital marketing practices, the modern digital consumer and new consumer's digital journey. Marketing strategies for the digital world-latest practices. **[8]**

UNIT-II

Social Media Marketing -Introduction to Blogging, Create a blog post for your project. Include headline, imagery, links and post, Content Planning and writing. Introduction to Face book, Twitter, Google +, LinkedIn, YouTube, Instagram and Pinterest; their channel advertising and campaigns **[8]**

UNIT-III

Acquiring & Engaging Users through Digital Channels: Understanding the relationship between content and branding and its impact on sales, search engine marketing, mobile marketing, video marketing, and social-media marketing. Marketing gamification, Online campaign management; using marketing analytic tools to segment, target and position; overview of search engine optimization (SEO). **[8]**

UNIT-IV

Designing Organization for Digital Success: Digital transformation, digital leadership principles, online P.R. and reputation management. ROI of digital strategies, how digital marketing is adding value to business, and evaluating cost effectiveness of digital strategies **[8]**

UNIT-V

Digital Innovation and Trends: The contemporary digital revolution, digital transformation framework; security and privatization issues with digital marketing Understanding trends in digital marketing – Indian and global context, online communities and co-creation. **[8]**

Text books:

1. Moutsy Maiti: Internet Mareting, Oxford University Press India
2. Vandana, Ahuja; Digital Marketing, Oxford University Press India (November, 2015).
3. Eric Greenberg, and Kates, Alexander; Strategic Digital Marketing: Top Digital Experts Share the Formula for Tangible Returns on Your Marketing Investment; McGraw-Hill Professional (October, 2013).
4. Ryan, Damian; Understanding Digital Marketing: marketing strategies for engaging the digital generation; Kogan Page (3rd Edition, 2014).
5. Tracy L. Tuten & Michael R. Solomon: Social Media Marketing (Sage Publication)

Idea to Business Model
(BTCEOE704B)

Course Objectives:

1. This course can motivate students to have an overall idea how to start and sustain a business enterprise.
2. The students will learn basics of choosing an idea of a business model.
3. The core areas of choosing a business model are encompassed with Entrepreneurship development, PPC & communication system. The students will thus develop basic competencies how to run a business enterprise.

Course Outcome:

1. Examine the challenges associated with defining the concepts of entrepreneur and entrepreneurship
2. Discuss how the evolution of entrepreneurship thought has influenced how we view the concept of entrepreneurship today
3. Discuss how the list of basic questions in entrepreneurship research can be expanded to include research inquiries that are important in today's world
4. Discuss how the concepts of entrepreneurial uniqueness, entrepreneurial personality traits, and entrepreneurial cognitions can help society improve its support for entrepreneurship
5. Apply the general venturing script to the study of entrepreneurship

Unit-I Introduction

Search for a business idea- How to choose an idea- Product idea- selection of product- The adoption process- Product innovation- Production , planning and development strategy- New product idea. **[8]**

Unit-II Introduction to Entrepreneurship - Meaning and concept of entrepreneurship- Difference between Entrepreneurship & wage employment - Functions of an Entrepreneur.- Entrepreneur vs Managerrole of entrepreneurship in economic development – Barriers to entrepreneurship. **[8]**

Unit-III The Entrepreneur - types of entrepreneurs- Competencies required to become an entrepreneur - Creative and Design Thinking, the entrepreneurial decision process- The process of Entrepreneurial development prog (EDP)- Evaluation of EDP - Entrepreneur development training. **[8]**

Unit-IV Production system- Design of production system- Types of production system- Production, planning & control (PPC) - Steps of PPC. **[8]**

Unit-V Communication- Importance of communication system - barriers to communication - listening to people- the power of talk - personal selling - risk taking & resilience - negotiation. **[8]**

Text Books:

1. Entrepreneurship Development- Sangeeta Sharma, Kindle edition
2. Production & operations Management- Kanishka Bedi,

3. Marketing Management- Philip Kotler.
4. The Business Model Book: Design, build and adapt business ideas that drive business growth: Adam Bock , Gerard George

Machine Learning
(BTCEOE704C)

Course Objectives:

1. To introduce students to the basic concepts and techniques of Machine Learning.
2. To become familiar with regression methods, classification methods, clustering methods.
3. To become familiar with Dimensionality reduction Techniques.

Course Outcomes:

1. Gain knowledge about basic concepts of Machine Learning
2. Identify machine learning techniques suitable for a given problem
3. Solve the problems using various machine learning techniques
4. Apply Dimensionality reduction techniques.
5. Design application using machine learning techniques.

UNIT-I

INTRODUCTION – Well defined learning problems, Designing a Learning System, Issues in Machine Learning;

THE CONCEPT LEARNING TASK - General-to-specific ordering of hypotheses, Find-S, List then eliminate algorithm, Candidate elimination algorithm, Inductive bias. **[8]**

UNIT-II

DECISION TREE LEARNING - Decision tree learning algorithm-Inductive bias- Issues in Decision tree learning;

ARTIFICIAL NEURAL NETWORKS – Perceptrons, Gradient descent and the Delta rule, Adaline, Multilayer networks, Derivation of back propagation rule Back propagation Algorithm Convergence, Generalization. **[8]**

UNIT-III

Evaluating Hypotheses: Estimating Hypotheses Accuracy, Basics of sampling Theory, Comparing Learning Algorithms; Bayesian Learning: Bayes theorem, Concept learning, Bayes Optimal Classifier, Naive Bayes classifier, Bayesian belief networks, EM algorithm. **[8]**

UNIT-IV

Computational Learning Theory: Sample Complexity for Finite Hypothesis spaces, Sample Complexity for Infinite Hypothesis spaces, The Mistake Bound Model of Learning; INSTANCE-**BASED LEARNING** – k-Nearest Neighbor Learning, Locally Weighted Regression, Radial basis function networks, Case based learning. **[8]**

UNIT-V

Genetic Algorithms: an illustrative example, Hypothesis space search, Genetic Programming, Models of Evolution and Learning; Learning first order rules sequential covering algorithms-General to specific beam search-FOIL;

REINFORCEMENT LEARNING - The Learning Task, Q Learning. **[8]**

Text books:

1. Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
2. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
3. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
4. Bishop, C., Pattern Recognition and Machine Learning. Berlin: Springer- Verlag.

Renewable Energy Resources
(BTCEOE704D)

Course Objectives:

1. Understand the various forms of conventional energy resources.
2. Learn the present energy scenario and the need for energy conservation
3. Explain the concept of various forms of renewable energy
4. Outline division aspects and utilization of renewable energy sources for both domestics and industrial application
5. Analyse the environmental aspects of renewable energy resources.

Course Outcomes:

1. Describe the environmental aspects of non-conventional energy resources. In Comparison with various conventional energy systems, their prospects and limitations.
2. Know the need of renewable energy resources, historical and latest developments.
3. Describe the use of solar energy and the various components used in the energy production with respect to applications like - heating, cooling, desalination, power generation, drying, cooking etc.
4. Appreciate the need of Wind Energy and the various components used in energy generation and know the classifications.
5. Understand the concept of Biomass energy resources and their classification, types of biogas Plants- applications
6. Compare Solar, Wind and bio energy systems, their prospects, Advantages and limitations.
7. Acquire the knowledge of fuel cells, wave power, tidal power and geothermal principles and applications.

UNIT-I

Introduction: Various non-conventional energy resources- Introduction, availability, classification, relative merits and demerits.

Solar Cells: Theory of solar cells. Solar cell materials , solar cellarray, solarcell power plant, limitations. **[8]**

UNIT-II

Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focussing of collectors and their materials, applications and performance; solar thermal powerplants, thermal energy storage for solar heating and cooling, limitations. **[8]**

UNIT-III

Geothermal Energy: Resources of geothermal energy, thermodynamics of geothermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance and limitations. Cells: Principle of working of various types of fuel cells and their working, performance and limitations. **[8]**

UNIT-IV

Thermo-electrical and thermionic Conversions: Principle of working, performance and limitations. Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems. **[8]**

UNIT-V

Bio-mass: Availability of bio-mass and its conversion theory. Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance a nd limitations.

Wave and Tidal Wave : Principle of working, performance and limitations. Waste Recycling Plants. **[8]**

Text books:

1. Raja etal, "Introduction to Non-Conventional Energy Resources" Scitech Publications.
2. John Twideu and Tony Weir, "Renewal Energy Resources" BSP Publications, 2006.
3. M.V.R. Koteswara Rao, "Energy Resources: Conventional & Non-Conventional" BSP Publications,2006.
4. D.S. Chauhan,"Non-conventional Energy Resources" New Age International.
5. C.S. Solanki, "Renewal Energy Technologies: A Practical Guide for Beginners" PHI Learning.
6. Peter Auer, "Advances in Energy System and Technology". Vol. 1 & II Edited by Academic Press.
7. Godfrey Boyle," Renewable Energy Power For A Sustainable Future", Oxford University Press.

Operations Research

(BTCEOE704E)

Course Objectives:

The course aims at building capabilities in the students for analyzing different situations in the industrial/ business scenario involving limited resources and finding the optimal solution within constraints.

Course Outcomes:

1. Identify and develop operational research models from the verbal description of the real system.
2. Understand the mathematical tools that are needed to solve optimization problems.
3. Use mathematical software to solve the proposed models.
4. Develop a report that describes the model and the solving technique, analyze the results and propose recommendations in language understandable to the decision-making processes in Management Engineering.

UNIT-I

Introduction: Definition and scope of operations research (OR), OR model, solving the OR model, art of modelling, phases of OR study. Linear Programming: Two variable Linear Programming model and Graphical method of solution, Simplex method, Dual Simplex method, special cases of Linear Programming, duality, sensitivity analysis. **[8]**

UNIT-II

Transportation Problems: Types of transportation problems, mathematical models , transportation algorithms, Assignment: Allocation and assignment problems and models, processing of job through machines. **[8]**

UNIT-III

Network Techniques: Shortest path model, minimum spanning Tree Problem, Max-Flow problem and Min-cost problem. Project Management: Phases of project management, guidelines for network construction, CPM and PERT. **[8]**

UNIT-IV

Theory of Games : Rectangular games, Minimax theorem, graphical solution of 2x nor mx2 games, game with mixed strategies, reduction to linear programming model. Quality Systems: Elements of Queuing model, generalized poisson queing model, single server models. **[8]**

UNIT-V

Inventory Control: Models of inventory, operation of inventory system, quantity discount. Replacement: Replacement models: Equipments that deteriorate with time, equipments that fail with time. **[8]**

Text books:

1. Wayne L. Winston,"Operations Research" Thomson Learning, 2003.
2. Hamdy H. Taha, "Operations Research-An Introduction" Pearson Education, 2003.
3. R. Panneer Seevam, "Operations Research" PHI Learning, 2008.
4. V.K.Khanna, "Total Quality Management" New Age International, 2008.

Value Relationship & Ethical Human Conduct –For A Happy & Harmonious Society (BTCEOE704F)

Course Objectives:

1. To help the students to understand the importance and types of relationship with expressions.
2. To develop the competence to think about the conceptual framework of undivided society as well as universal human order.
3. To help the students to develop the exposure for transition from current state to the undivided society and universal human order.

Course Methodology:

1. The methodology of this course is exploration and thus universally adaptable. It involves a systematic and rational study of the human being vis-a-vis the rest of existence.
2. It is free from any dogma or set of do's and don'ts related to values.
3. It is a process of self-investigation and self-exploration, and not of giving sermons. Whatever is found as truth or reality is stated as a proposal and the students are facilitated and encouraged to verify it in their own right, based on their Natural Acceptance and subsequent Experiential Validation.
4. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student leading to continuous self-evolution.
5. This self-exploration also enables them to critically evaluate their preconditioning and present beliefs. Introduction to the course: Basic aspiration of a Human Being and program for its fulfilment, Need for family and relationship for a Human Being, Humanhuman relationship and role of behavior in its fulfillment, Human-rest of Nature

UNIT-I

Relationship and role of work in its fulfilment, Comprehensive Human Goal, Need for Undivided Society, Need for Universal Human Order, an appraisal of the Current State, Appraisal of Efforts in this Direction in Human History.

UNIT-II

Understanding Human-Human Relationship & its fulfilment: Recognition of Human-Human Relationship, Recognition of feelings in relationship, Established Values and Expressed Values in Relationship, interrelatedness of feelings and their fulfilment, Expression of feelings, Types of relationship and their purpose, mutual evaluation in relationship, Meaning of justice in relationship, Justice leading to culture, civilization and Human Conduct.

UNIT-III

Justice from family to world family order: Undivided Society as continuity and expanse of Justice in behaviour – family to world family order, continuity of culture and civilization, Universal Order on the basis of Undivided Society, Conceptual Framework for Universal human order, Universal Human Order as continuity and expanse of order in living: from family order to world family order, a conceptual framework for universal human order.

UNIT-IV

Program for Ensuring Undivided Society and Universal Human Order: Education –Sanskar, Health – Sanyam, Production-work, Exchange – storage, Justice-preservation.

UNIT-V

Human Tradition: Scope and Steps of Universal Human Order, Human Tradition (Ex. Family order to world family order), Steps for transition from the current state, Possibilities of participation of students in this direction, Present efforts in this direction, Sum up.

Text books:

1. A Foundation Course in Human Values and Profession Ethics (Text Book and Teachers' Manual),
2. R. R. Gaur, R. Asthana, G. P. Bagaria (2010), Excel Books, New Delhi.
3. Avartansheel Arthshastra, A. Nagraj, Divya Path Sansthan, Amarkantak, India.
4. An Appeal by the Dalai Lama to the World: Ethics Are More Important Than Religion, Dalai Lama XIV, 2015.
5. Economy of Permanence – (a quest for social order based on non-violence), J. C. Kumarappa (2010), Sarva-Seva-Sangh-Prakashan, Varansi, India.
6. Energy and Equity, Ivan Illich (1974), The Trinity Press, Worcester & Harper Collins, USA.
7. Human Society, Kingsley Davis, 1949.
8. Hind Swaraj or, Indian home rule Mohandas K. Gandhi, 1909.
9. Integral Humanism, Deendayal Upadhyaya, 1965.
10. Lohiya Ke Vichar, Lok Bharti , Rammanohar Lohiya, 2008.
11. Manav Vyavahar Darshan, A. Nagraj, Divya Path Sansthan, Amarkantak, India.
12. Manaviya Sanvidhan, A. Nagraj, Divya Path Sansthan, Amarkantak, India
13. Samadhanatmak Bhautikvad, A. Nagraj, Divya Path Sansthan, Amarkantak, India
14. Small Is Beautiful: A Study of Economics as if People Mattered, E. F. Schumacher,1973, Blond & Briggs, UK.
15. Slow is Beautiful, Cecile Andrews (http://www.newsociety.com/Books/S/Slow-is- Beautiful)
16. Sociology Themes and Perspectives, Harper Collins; EIGHT edition (2014), Martin Holborn and Peter Langley, 1980.
17. Samagra kranti: Jaya Prakash Narayan's philosophy of social change, Siddharth Publications Renu Sinha, 1996.
18. Science & Humanism – towards a unified worldview, P. L. Dhar & R. R. Gaur (1990), Commonwealth Publishers, New Delhi
19. Vyavaharvadi Samajshastra, A. Nagraj, Divya Path Sansthan, Amarkantak, India.
20. Vyavahatmak Janvad, A. Nagraj, Divya Path Sansthan, Amarkantak, India.
21. The Communist Manifesto, Karl Marx, 1848.
22. Toward a True Kinship of Faiths: How the World's Religions Can Come Together Dalai Lama XIV, 2011

Reference Videos.

1. Kin school (30 minutes)
2. Technology (Solar City etc.).
3. Natural Farming.
4. Economics of Happiness (1h 8m).

Minor Project
(BTCE706P)

Students will be asked to work upon minimum one topic during the semester.

They will submit the report of each topic containing following information (as per need of topic) like: introduction, general information, usage/application (if any) detailed description of work/process, relevant diagrams, drawings & tabulation (if any), observation and results (as applicable) or any other relevant information as per topic.

Internship Assessment
(BTCE707P)

Project Management & Entrepreneurship
(BTCE801)

Course Objectives:

1. To outline the need for Project Management.
2. To highlight different techniques of activity planning.
3. Project Planning & Management

Course Outcomes:

1. Evaluate and select the most desirable projects.
2. Apply appropriate approaches to plan a new project and develop project schedule.
3. Identify the important risks facing in a new project.

Unit	Topics	Lectures
I	**Entrepreneurship:** Entrepreneurship: need, scope , Entrepreneurial competencies & traits, Factors affecting entrepreneurial development, Entrepreneurial motivation (Mc Clellend's Achievement motivation theory), conceptual model of entrepreneurship , entrepreneur vs. intrapreneur; Classification of entrepreneurs; Entrepreneurial Development Programmes	8
II	**Entrepreneurial Idea and Innovation:** Introduction to Innovation, Entrepreneurial Idea Generation and Identifying Business Opportunities, Management skills for Entrepreneurs and managing for Value Creation, Creating and Sustaining Enterprising Model & Organizational Effectiveness	8
III	**Project Management:** Project management: meaning, scope & importance, role of project manager; project life-cycle Project appraisal: Preparation of a real time project feasibility report containing Technical appraisal,; Environmental appraisal, Market appraisal (including market survey for forecasting future demand and sales) and Managerial appraisal.	8
IV	**Project Financing:** Project cost estimation & working capital requirements, sources of funds, capital budgeting, Risk & uncertainty in project evaluation , preparation of projected financial statements viz. Projected balance sheet, projected income statement, projected funds & cash flow statements, Preparation of detailed project report, Project finance.	8
V	**Social Entrepreneurship:** Social Sector Perspectives and Social Entrepreneurship, Social Entrepreneurship Opportunities and Successful Models, Social Innovations and Sustainability, Marketing Management for Social Ventures, Risk Management in Social Enterprises, Legal Framework for Social Ventures.	8

Text Book:

1. Innovation and Entrepreneurship by Drucker, P.F.; Harper and Row

2. Business, Entrepreneurship and Management: Rao, V.S.P. ;Vikas
3. Entrepreneurship: Roy Rajeev; OUP.
4. Text Book of Project Management: Gopalkrishnan, P. and Ramamoorthy, V.E.; McMillan
5. Project Management for Engineering, Business and Technology: Nicholas, J.M., and Steyn, H.; PHI
6. Project Management: The Managerial Process: Gray, C.F., Larson, E.W. and Desai, G.V.; MGH

Subject Code: BTCE802A	Probability Methods in Civil Engineering	3L:0T:0P	3Credits

Course Objectives:

1. Identify the data types
2. Analyze, test, verify and critique the probabilistic models associated with data types
3. Model and analyze the uncertainties in engineering systems
4. Estimate consequences of certain events
5. Apply concepts and develop computational models for development of reliability-based design codes.

Course Outcomes:

1. Apply probabilistic techniques for the analysis of complex Civil Engineering structures using advanced techniques.
2. Demonstrate mathematical and statistical knowledge and skills to be applied in various civil engineering structures.
3. Apply the laws of logic to mathematical statements.
4. Develop mathematical thinking in the conduct of different experiments and presentation of results precisely.

Unit	*Topics*	Lectures
I	Introduction: Role of Probability in Civil Engineering Problems, Random Events: Definition of basic random events; Application of set theory in definition of composite event operations; Probability of events and definition of probability axioms; Solution of real life examples from Civil Engineering.	8
II	Random Variables: Definition of random variables – discrete and continuous; Probability definitions – PMF, PDF, CDF; Moments and expectations. Functions of Random Variables: Definition of probability distributions of functions of single random variables – exact methods and approximate methods; Moments and expectations of functions – direct and indirect methods.	8
III	Multiple Random Variables: Definition of joint, marginal, and conditional probability distributions; Definitions of moments and expectations, including the definition of correlation coefficient; Functions of multiple random variables.	8
IV	Common Probability Models: Discrete random variables – binomial distribution, Poisson's distribution; Continuous random variables – exponential distribution, gamma distribution; Central limit theorem; Normal and lognormal distributions.	8
V	Statistics and sampling: Goodness of fit tests; regression and correlation analyses; estimation of distribution parameters from statistics; hypothesis testing and significance; Bayesian updating of distributions.	8

References

1. Papoulis, A, and S. U. Pillai (2002), Probability, Random Variables and Stochastic Processes,McGraw- Hill, New York.

2. Richard A. Jonson and C. B. Gupta (2005), Miller and Freund's Probability and Statistics forEngineers, Pearson Education, Inc., United States.
3. West M. and J. Harrison (1997), Bayesian Forecasting and Dynamic Models, Springer-Verlag,New York.
4. Ang, A. H-S., and Tang, W., H. “Probability concepts in engineering: Emphasis on applications incivil and environmental engineering.” Wiley.
5. Kottegoda, N. T., and Rosso, R. “Applied Statistics for Civil and Environmental Engineers.”Wiley.
6. Ross, S. “A first course on probability.” Prentice Hall.

Subject Code: BTCE802B	Solid Waste Management	3L:0T:0P	3Credits

Course Objectives:

To make the students conversant with different aspects of the types, sources, generation, storage, collection, transport, processing and disposal of municipal solid waste.

Course Outcomes:

1. Understand the concept of solid waste management.
2. Explain handling and processing of solid waste.
3. Apply the concept of landfilling for disposal of solid waste.
4. Design composting and other solid waste conversion units.
5. Understand the various hazardous waste, risk assessment and legislation

Unit	*Topics*	Lectures
I	Solid waste: Public health and ecological impacts, Sources and types of solid wastes, material flow and waste generation, Functional elements: Waste generation, storage, collection, Transfer and transport, processing and recovery, disposal. Physical and chemical composition of municipal solid waste, integrated solid waste management, hierarchy of waste management options, different methods for generation rates. Storage: movable bins, fixed bins. Collection: home to home collection, community bin system. Theory and design of hauled container system, stationary container system.	8
II	Transportation: handcart, tri-cycle, animal cart, tripper truck, dumper placer, bulk refuse carrier, railroad transport, water transport, conveyors, layout of routes. Engineering system for on-site handling and processing of solid waste: separators, size reduction equipments, screening equipments, densification, baling, cubing, pelleting equipments.	8
III	Land filling: Site selection criteria, landfill layout, landfill sections, Occurrence of gases and leachate in landfills: composition and characteristics, generation factors, initial adjustment phase, transition phase, acid formation phase, methane formation phase, maturation phase of gases and leachate, Introduction to engineered landfills.	8
IV	Composting, types of composting, process description, design and operational consideration of aerobic composting, process description, design and operational consideration of anaerobic composting. Thermal conversion technologies: incineration and pyrolysis system, energy recovery, system. Overview of solid waste management practices in India.	8
V	Introduction to Hazardous wastes, Definition of Hazardous waste, The magnitude of the problem; Hazardous waste: Risk assessment, Environmental legislation, Characterization and site assessment, Waste minimization and resource recovery, Transportation of hazardous waste, Disposal of hazardous waste. Introduction to Electronic waste and Biomedical waste and their disposal.	8

References

1. Tchobanoglous, G., Theisen, H., & Vigil, S.A; Integrated Solid Waste Management: McGraw Hill,New York
2. Solid Waste Engineering, Principle & Management issues by Ven Te Chow

3. Bhide, A.D., B.B. Sundaresan, Solid Waste Management in developing countries.
4. Manual on Municipal solid Waste Management, CPHEEO, Govt. of India.
5. Guidelines for Management and Handling of Hazardous wastes MOEF (1991), Govt. of India.
6. Datta, M; Waste Disposal in Engineered Land fills, Narosa Publishers, Delhi.
7. Waste Management "Asian and Pacific Center for Transfer of Technology (N.D.) India", September1993.
8. Solid and Hazardous Waste Management: Science and Engineering by M.N. Rao, Razia Sultana &Sri Harsha Kota
9. E-Waste Management: From Waste to Resource by RamzyKahhat, Klaus Hieronymi, EricWilliams.
10. Biomedical Waste Management by R. Radhakrishan
11. Electronic Waste Management (Issues in Environmental Science and Technology) by R. E.Hester , R. M. Harrison & Martin T. Goosey

Subject Code: BTCE802C	Geo-synthetics and Reinforced Soil Structures	3L:0T:0P	3Credits

Course Objectives:

1. To understand the history and mechanism of reinforced soil.
2. To know the various types of geosynthetics, their functions and applications.
3. To enable the design of reinforced soil retaining structures

Course Outcomes:

1. Identify the type of Geosynthetic and their relevance.
2. Analyze &compute different properties of Geosynthetics.
3. Understand the emerging trends of Geosynthetic in geotechnical applications.
4. Design the Reinforced Earth Walls using Geosynthetic material.
5. Design the Reinforced Foundation using Geosynthetic materials.

Unit	*Topics*	Lectures
I	Introduction to Geosynthetics, types of geosynthetics, artificial and natural geosythetics and their applications, manufacture of geosynthetics, strength of reinforced soils, testing of Geosynthetics	8
II	Drainage application of geosynthetics, filtration applications of geosynthetics, erosion control using geosynthetics. Geosynthetics in flexible payment, introduction to geosyenthitcs in landfills, geosynthetics for construction of landfills.	8
III	Sustainable infrastructure development, different types of soil retaining structures, design codes for reinforced soil retaining walls, construction aspects of geosythetics reinforced soil retaining wall, testing requirements for reinforced soil retaining walls, geosynthetic reinforced soil embankments.	8
IV	Design of reinforced soil retaining walls – simple geometry, design of reinforced soil retaining walls – sloped backfill soil, soil embankments supported on geocell mattresses, geosynthetic reinforced pile systems for high embankments	8
V	Reinforced soil for supporting shallow foundations, response of footings resting on reinforced foundation soils, bearing capacity analysis of footings resting on reinforced foundation soils, carbon footprint analysis	8

References

1. Koerner, R.M. "Designing with Geosynthetics", Prentice Hall, New Jersey, USA, 4thedition, 1999.
2. Jewell, R.A., "Soil Reinforcement with Geotextiles", Special Publication No. 123,CIRIA, Thomas Telford. London, UK, 1996.
3. Geosynthetics - New Horizons, Eds. G.V. Rao, PK Banerjee, J.T. Shahu, G.V. Ramana,Asian Books Private Ltd., New Delhi, 2004.
4. Hoe I. Ling, Guido Gottardi , Daniele Cazzuffi , Jie Han , Fumio Tatsuoka “Design andPractice of Geosynthetic-Reinforced Soil Structures”
5. Sanjay Kumar Shukla, Erol Guler “Advances in Reinforced Soil Structures”

Subject Code: BTCE802D	Disaster Preparedness and Management	3L:0T:0P	3Credits

Course Objectives:

1. To introduce disaster, its nature and types.
2. To understand disaster zoning and hazard assessment.
3. To know about the disaster mitigation and preparedness.
4. To understand management during disaster and construction technology for its mitigation.
5. To identify relief measures.

Course Outcomes:

1. Understand the basic concepts of disasters and hazards
2. Classify the natural disasters.
3. Analyze the impacts of disaster on various societal components
4. Understand the components of disaster management cycle and roles of various agencies its risk reduction
5. Understand the process of recovery, reconstruction and development methods

Unit	*Topics*	Lectures
I	Introduction-Concepts and definitions: disaster, hazard, vulnerability, risks-severity, frequency and details, capacity, impact, prevention, mitigation.	8
II	Disasters-Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.	8
III	Disaster Impacts-Disaster impacts (environmental, physical, social, ecological,economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.	8
IV	Disaster Risk Reduction (DRR)-Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.	8

V	Disasters, Environment and Development-Factors affecting vulnerability such asimpact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.	8

Text/Reference Books:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority)
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).
3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall.
4. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication.
5. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation
6. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003
7. Inter Agency Standing Committee (IASC) (Feb. 2007). IASC Guidelines on Mental Health and Psychosocial Support in Emergency Settings. Geneva: IASC

Subject Code: BTCE802E	Sustainable Construction Methods	3L:0T:0P	3Credits

Course Objectives:

To equip practising civil engineers and architects with the knowledge and skills to manage projects effectively, using minimum resources and energy requirements, and with a minimum carbon footprint.

Course Outcomes:

1. Classify the sustainable construction materials.
2. Apply cutting-edge construction technologies.
3. Evaluate different sustainable construction methods.
4. Apply different rating systems of construction/buildings as a professional.
5. Apply life cycle approach to optimize the performance of green construction materials

Unit	*Topics*	Lectures
I	Types of foundations and construction methods. Basics of Formwork and Staging. Common building construction methods (conventional walls and slabs; conventional framed structure with block work walls). Modular construction methods for repetitive works.	8
II	Precast concrete construction methods. Basics of Slip forming for tall structures. Basic construction methods for steel structures. Basics of construction methods for Bridges.	8
III	Identification of cutting-edge sustainable construction materials, technologies, and project management strategies for use in the construction industry and evaluation of their potential to reduce the negative environmental impacts of construction activity.	8
IV	Study and evaluation of current LEED and GRIHA rating for construction system. Detailed case study and analysis of highly successful recent "green construction projects". Guidance to students for the LEED Green Associate professional licensing examination.	8
V	Environmental impact of materials; life-cycle assessment; material selection to optimize performance; design, evaluation, and production of green construction materials.	8

References

1. Rebecca L. Henn; Andrew J. Hoffman (2013), Constructing Green the Social Structures of Sustainability (Urban and Industrial Environments), MIT Press.
2. Steve Goodhew Sustainable Construction Processes: A Resource Text ISBN: 978-1-405- 18759-6 May 2016 Wiley-Blackwell.
3. Kim S. Elliott, Precast Concrete Structures – 12 June 2019, CRC Press Taylor and Francis.
4. S.B.Marinković, Life cycle assessment (LCA) aspects of concrete, Wood head Publishing Series in Civil and Structural Engineering 2013, Pages 45-80

Subject Code: BTCEOE803A	FILTER DESIGN	3L:0T:0P	3 Credits

Course Objective:

1. Understand about the characteristics of different filters.
2. Understand the concept of Approximation Theory.
3. Learn about the switched capacitor filter.

Course Outcome:

1. Choose an appropriate transform for the given signal.
2. Choose appropriate decimation and interpolation factors for high performance filters.
3. Model and design an AR system.
4. Implement filter algorithms on a given DSP processor platform.

Unit	Topics	Lectures
I	Introduction: Fundamentals, Types of filters and descriptive terminology, why we use Analog Filters, Circuit elements and scaling, Circuit simulationand modelling. Operational amplifiers: Op-amp models, Op-amp slew rate, Operational amplifiers with resistive feedback: Noninverting and Inverting, Analysing Op-amp circuits, Block diagrams and feedback, The Voltage follower, Addition and subtraction, Application of Op-amp resistor circuits.	8
II	First order filter: Bilinear transfer functions and frequency response – Bilinear transfer function and its parts, realization of passive elements, Bode plots, Active realization, The effect of A(s), cascade design.	8
III	Second order low pass and band pass filters: Design parameters, Second order circuit, frequency response of low pass and band pass circuits, Integrators and others biquads.	8
IV	Second order filters with arbitrary transmission zeros: By using summing, By voltage feed forward, cascade design revisited. Low pass filters with maximally flat magnitude: the ideal low pass filter, Butterworth response, Butterworth pole locations, low pass filter specifications, arbitrary transmission zeros.	8
V	Low pass filter with equal ripple (Chebyshev) magnitude response: The chebyshev polynomial ,The chebyshev magnitude response, Location of chebyshev poles, Comparison of maximally flat & equal–ripple responses, Chebyshev filter design Inverse chebyshev and cauer filters: Inverse chebyshev response, From specifications to pole and zero locations, Cauer magnitude response, Chebyshev rational functions, Cauer filter design.	8

Text Book:

1. Rolf. Schaumann, Haiqiao Xiao, Mac. E. Van Valkenburg, “Analog Filter Design”, 2ndIndianEdition, Oxford University Press.

Reference Books:

1. J. Michael Jacob, “Applications and Design with Analog Integrated Circuits”, Second edition,Pearson.

2. T. Deliyannis, Yichuang Sun, J.K. Fidler, “Continuous-Time Active Filter Design”,CRC Press.

Subject Code: BTCEOE803B	BIOECONOMICS	3L:0T:0P	3 Credits

Course Objective:

This course is designed with an objective to provide an understanding of the basic knowledge of bioecomics to students so that they can explore entrepreneurship opportunities in the bio based industry. This course also serves interdisciplinary innovation in terms of sustainable bioeconomy

Course Outcome:

1. Students will be able to understand basic concept of Bioeconomics, challenges, opportunities& regulations
2. Students will be able to understand development and innovation in terms of bioeconomy towards sustainable development
3. Students will be able to understand Inter- and transdisciplinarity in bioeconomy &research approaches
4. Students will be able to explain biobased resources, value chain, innovative use of biomass and biological knowledge to provide food, feed, industrial products

Unit	Topics	Lectures
I	Introduction: Fundamentals, Types of filters and descriptive terminology, why we use Analog Filters, Circuit elements and scaling, Circuit simulationand modelling. Operational amplifiers: Op-amp models, Op-amp slew rate, Operational amplifiers with resistive feedback: Noninverting and Inverting, Analysing Op-amp circuits, Block diagrams and feedback, The Voltage follower, Addition and subtraction, Application of Op-amp resistor circuits.	08
II	Economic Growth, Development, and Innovation in terms of bioeconomy, Environmental Economics and the Role of Government, Modelling and Tools Supporting the Transition to a Bioeconomy, Role of biobased Economy in sustainable development.	08
III	Inter- and transdisciplinarity in Bioeconomy & research approaches, primary production, processing of bio based resources, Markets, Sustainability Management and Entrepreneurship in biobased products.	08
IV	Biobased Resources and Value Chains, Processing of Biobased Resources, Markets, Sustainability Management and Entrepreneurship opportunity in biobased product. Food Security and Healthy Nutrition in the Context of the Bioeconomy, Use of Biomass for the Production of Fuel and Chemicals, The importance of Biotechnology for the Bioeconomy.	08
V	sustainable and innovative use of biomass and biological knowledge to provide food, feed, industrial products, bioenergy and ecological services, importance of bioeconomy- related concepts in public, scientific, and political discourse, Dynamic Management of Fossil Fuel, Biofuel.	08

Text Book:

1. Principles of Bioeconomics by I. Sundar, Vedams eBooks (P) Ltd New Delhi, India
2. Bioeconomy:Shaping the Transition to a Sustainable, Biobased Economy by Iris Lewandowski, Springer.
3. Sociobiology and Bioeconomics by Koslowski, Peter
4. Modeling, Dynamics, Optimization and Bioeconomics I, by Pinto, Alberto Adrego, Zilberman, David, Springer.

Subject Code: BTCEOE803C	Design Thinking	3L:0T:0P	3Credits

Course Objective:

The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real- time problems.

Course Outcomes:

1. Have an awareness of how design thinking can be applied in a wide range of contexts, from the personal to the global
2. Investigate and think creatively about design problems and opportunities
3. Initiate an attitude of playfulness to aid design thinking
4. Develop visual literacy and articulacy to explain design decisions
5. Use computing tools and online environments to aid design thinking.

Unit	*Topics*	Lectures
I	Introduction to design thinking, traditional problem solving versus design thinking, history of design thinking, wicked problems. Innovation and creativity, the role of innovation and creativity in organizations, creativity in teams and their environments, design mindset. Introduction to elements and principles of design, 13 Musical Notes for Design Mindset, Examples of Great Design, Design Approaches across the world	8
II	Understanding humans as a combination of I (self) and body, basic physical needs up to actualization, prosperity, the gap between desires and actualization. Understanding culture in family society, institution, startup, socialization process. Ethical behavior: effects on self, society, understanding core values and feelings, negative sentiments and how to overcome them, definite human conduct: universal human goal, developing human consciousness in values, policy, and character. Understand stakeholders, techniques to empathize, identify key user problems. Empathy tools- Interviews, empathy maps, emotional mapping, immersion and observations, customer journey maps, and brainstorming, Classifying insights after Observations, Classifying Stakeholders, Do's & Don'ts for Brainstorming, Individual activity- 'Moccasin walk'	8
III	Defining the problem statement, creating personas, Point of View (POV) statements. Research- identifying drivers, information gathering, target groups, samples, and feedbacks. Idea Generation-basic design directions, Themes of Thinking, inspirations and references, brainstorming, inclusion, sketching and presenting ideas, idea evaluation, double diamond approach, analyze – four W's, 5 why's, "How Might We", Defining the problem using Ice-Cream Sticks, Metaphor & Random Association Technique, Mind-Map, ideation activity games - six thinking hats, million-dollar idea, introduction to visual collaboration and brainstorming tools - Mural, JamBoard	8

IV	Fundamental concepts of critical thinking, the difference between critical and ordinary thinking, characteristics of critical thinkers, critical thinking skills-linking ideas, structuring arguments, recognizing incongruences, five pillars of critical thinking, argumentation versus rhetoric, cognitive bias, tribalism, and politics. Case study on applying critical thinking on different scenarios.	8
V	The argument, claim, and statement, identifying premises and conclusion, truth and logic conditions, valid/invalid arguments, strong/weak arguments, deductive argument, argument diagrams, logical reasoning, scientific reasoning, logical fallacies, propositional logic, probability, and judgment, obstacles to critical thinking. Group activity/role plays on evaluating arguments.	8

Text Book:

1. Vijay Kumar, 101 Design Methods: A Structured Approach for Driving Innovation in Your Organization, 2013, John Wiley and Sons Inc, New Jersey
2. BP Banerjee, Foundations of Ethics and Management, 2005, Excel Books
3. Gavin Ambrose and Paul Harris, Basics Design 08: Design Thinking, 2010, AVA Publishing SA
4. Roger L. Martin, Design of Business: Why Design Thinking is the Next Competitive Advantage, 2009, Harvard Business Press, Boston MA

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

1. Develop a strong understanding of the design process and apply it in a variety of business settings
2. Analyze self, culture, teamwork to work in a multidisciplinary environment and exhibit empathetic behavior
3. Formulate specific problem statements of real time issues and generate innovative ideas using design tools
4. Apply critical thinking skills in order to arrive at the root cause from a set of likely causes
5. Demonstrate an enhanced ability to apply design thinking skills for evaluation of claims and arguments.

Subject Code: BTCEOE803D	Introduction to Women's and Gender Studies	3L:0T:0P	3Credits

Course Objectives:

1. Understand and engage with central debates in the field of Women's and Gender Studies.
2. Define and apply basic terms and concepts central to this field.
3. Apply a variety of methods of analyzing gender in society, drawing upon both primary and secondary sources.
4. Apply concepts and theories of Women's and Gender Studies to life experiences and historical events and processes.
5. Communicate effectively about gender issues in both writing and speech, drawing upon Women's and Gender Studies scholarship and addressing a public audience.

Course Outcomes:

1. To define and evaluate gender as a social construct.
2. To identify the ways gender, power, privilege, and oppression play out across a range of cultures and human experiences.
3. To demonstrate an understanding of gender as it intersects with sexuality, race, ethnicity, religion, class and other critical variables.
4. To analyse human interactions and social/political systems using a "gender lens".

To	*Topic*	Lectures
I	**Women and Society:** Understanding Sex- Gender, Gender shaping Institutions, Theories of Gender construction Understanding Sexism and Androcentrism, Understanding Patriarchy and Theories of Patriarchy, Private and Public dichotomy, Sexual Division of Work, Patriarchy practices in different institutions and Text Books.	8
II	**Feminist Theory:** Rise of Feminism, Introduction to various stands of Feminism- Liberal Feminism, Radical Feminism, Marxist Feminism, Socialist Feminism, Cultural Feminism, Eco-Feminism, Post Colonial Feminism, Post Modern Feminism. Waves of Feminism.	8
III	**Women's Movement:** The socio-economic conditions of women during the age of Industrial revolution the Call for Women's Rights 1848, Women's rights movement 1848-1920,Historical Developments of Social Reform Movements in India , Women's groups and organizations, Women's Movement Movements for Uniform Civil code and ShahBano case, Dalit women and the question of double marginality.	8
IV	**Gender Roles and Psychology of Sex:** Difference Conceptualization of gender roles and gender role attitudes, Gender: Aggression, Achievement, Communication, Friendship and Romantic, Relationships Sex Differences in Mental Health Trauma relating to Rape , Taboo , Childhood Sexual Abuse , Domestic Violence , Sexual Harassment at Work Place, Educational Institutions, Eve Teasing etc.	8

V	**Gender and Representation:** Gender and Mass Media- Print Media, Gender and Mass Media-Electronic Media, Gender and Films, Advertisements, Mega Serials, Stereotyping and breaking the norms of women's roles Women's Representation in Literary Texts.	8

Suggested reading:

1. Basab iChakrabarti, Women's Studies: Various Aspects. UrbiPrakashani2014
2. Arvind Narrain. Queer: Despised Sexuality Law and Social Change. Book for Change. 2005
3. Chandra Talpade Mohanty, Feminism without Borders: Decolonizing Theory, Practicing Solidarity. Duke University Press.
4. Flavia Agnes. Law and Gender Inequality: The Politics of Women's Rights in India. Oxford University Press, 2001
5. Sonia Bathla, Women, Democracy and the Media: Cultural and Political Representations in the Indian Press, Sage, New Delhi, 1998.

6.

Subject Code: BTCEOE803E	Quality Management	3L:0T:0P	3Credits

Course Objective:

1 Introduce the importance of quality in improving competitiveness.
2 Understand the Implication of Quality on Business.
3 Implement Quality Implementation Programs.
4 Have exposure to challenges in Quality Improvement Programs.

Course outcome:

1. Realize the importance of significance of quality.
2. Manage quality improvement teams.
3. Identify requirements of quality improvement programs.
4. Identify improvement areas based on cost of poor quality.
5. Organize for quality and development of quality culture through small group activities.

Unit	Topic	Lectures
1	Quality Concepts: Evolution of Quality Control, concept change, TQM Modern concept, Quality concept in design, Review of design, Evolution of proto type. Control on Purchased Product: Procurement of various products, evaluation of supplies, capacity verification, Development of sources, procurement procedure. Manufacturing Quality: Methods and techniques for manufacture, inspection and control of product, quality in sales	8
2	Quality Management: Organization structure and design, quality function, decentralization, designing and fitting, organization for different type products and company, economics of quality value and contribution, quality cost, optimizing quality cost, seduction program. Human Factor in quality Attitude of top management, cooperation of groups, operators attitude, responsibility, causes of apparatus error and corrective methods.	8
3	Control Charts, Theory of control charts, measurement range, construction and analysis of R charts, process capability study, use of control charts. Attributes of Control Chart, Defects, construction and analysis of charts, improvement by control chart, variable sample	8
4	Defects diagnosis and prevention defect study, identification and analysis of defects, correcting measure, factors affecting reliability, MTTF, calculation of reliability, building reliability in the product, evaluation of reliability, interpretation of test results,	8
5	ISO-9000 and its concept of Quality Management, ISO 9000 series, Taguchi method, JIT in some details.	8

Text and Reference Books:

1. Lt. Gen. H. Lal, "Total Quality Management", Eastern Limited, 1990.
2. Greg Bounds, "Beyond Total Quality Management", McGraw Hill, 1994.

Menon, H.G, "TQM in New Product manufacturing", McGraw Hill 1992

Subject Code: BTCEOE803F	Modeling of Field-Effect Nano Devices	3L:0T:0P	3Credits

Course Objective:

1. Introduce novel MOSFET devices and understand the advantages of multi-gate devices.
2. Introduce the concepts of nanoscale MOS transistor and their performance characteristics.
3. Study the various nano-scaled MOS transistor circuits.

Course Outcome:

1 Study the MOS devices used below 10nm and beyond with an eye on the future.

2 Understand and study the physics behind the operation of multi-gate systems.

3 Design circuits using nano-scaled MOS transistors with the physical insight of their functional characteristics.

4 Understand and study the physics behind the Radiation effects in SOI MOSFETs.

5 Understand the impact of device performance on digital circuits.

Unit	Topic	Lectures
1	MOSFET scaling, short channel effects - channel engineering - source/drain engineering - high k dielectric - copper interconnects - strain engineering, SOI MOSFET, multigate transistors – single gate – double gate – triple gate – surround gate, quantum effects – volume inversion – mobility – threshold voltage – inter subband scattering, multigate technology – mobility – gate stack	**8**
2	MOS Electrostatics – 1D – 2D MOS Electrostatics, MOSFET Current-Voltage Characteristics – CMOS Technology – Ultimate limits, double gate MOS system – gate voltage effect - semiconductor thickness effect – asymmetry effect – oxide thickness effect – electron tunnel current – two dimensional confinement, scattering	**8**
3	Silicon nanowire MOSFETs – Evaluvation of I-V characteristics – The I-V characteristics for nondegenerate carrier statistics – The I-V characteristics for degenerate carrier statistics – Carbon nanotube – Band structure of carbon nanotube – Band structure of graphene – Physical structure of nanotube – Band structure of nanotube – Carbon nanotube FETs – Carbon nanotube MOSFETs – Schottky barrier carbon nanotube FETs – Electronic conduction in molecules – General	**8**
4	Radiation effects in SOI MOSFETs, total ionizing dose effects – single-gate SOI – multi-gate devices, single event effect, scaling effects	**8**

5	Digital circuits – impact of device performance on digital circuits – leakage performance trade off – multi VT devices and circuits – SRAM design, analog circuit design – transconductance - intrinsic gain – flicker noise – self heating –band gap voltage reference – operational amplifier – comparator designs, mixed signal –	**8**

Text and Reference Books:

1. J P Colinge, "FINFETs and other multi-gate transistors", Springer – Series on integrated circuits and systems, 2008
2. Mark Lundstrom, Jing Guo, "Nanoscale Transistors: Device Physics, Modeling and Simulation", Springer, 2006
3. M S Lundstorm, "Fundamentals of Carrier Transport", 2nd Ed., Cambridge University Press, Cambridge UK, 2000.

Subject Code: BTCEOE803G	Computerized Process Control	3L:0T:0P	3Credits

Course Objective:

1. Understand Basics of Computer-Aided Process Control.
2. Analyse Industrial communication System.
3. Design Process Modelling for computerized Process control.
4. Design Advanced Strategies For Computerised Process control.
5. Analyse Computerized Process Control.

Course Outcome: -

1 Understand the Role of computers in process control, Elements of a computer aided Process control System, Classification of a Computer.

2 Design Phase Locked Local Loop, Mixers. Time Division Multiplexed System –TDM/PAM system.

3 Realize Process model, Physical model, Control Model. Modelling Procedure.

4 Formulate of Cascade Control, Predictive control, Adaptive Control, Inferential control, Intelligent Control, Statistical control.

5 Design Electric Oven Temperature Control, Reheat Furnace Temperature control.

Unit	Topic	Lectures
1	Basics of Computer-Aided Process Control: Role of computers in process control, Elements of a computer aided Process control System, Classification of a Computer –Aided Process Control System Computer Aided Process–control Architecture: Centralized Control Systems, Distributed control Systems, Hierarchical Computer control Systems. Economics of Computer-Aided Process control. Benefits of using Computers in a Process control. Process related Interfaces: Analog Interfaces, Digital Interfaces, Pulse Interfaces, Standard Interfaces.	**8**
2	Industrial communication System: Communication Networking, Industrial communication Systems, Data Transfer Techniques, Computer Aided Process control software, Types of Computer control Process Software, Real Time Operating System	**8**
3	Process Modelling for computerized Process control: Process model, Physical model, Control Model, Process modelling. Modelling Procedure: Goals Definition, Information Preparation, Model Formulation, Solution Finding, Results Analysis, Model Validation	**8**
4	Advanced Strategies For Computerised Process control: Cascade Control, Predictive control, Adaptive Control, Inferential control, Intelligent Control, Statistical control.	**8**
5	Examples of Computerized Process Control: Electric Oven Temperature Control, Reheat Furnace Temperature control, Thickness and Flatness control System for metal Rolling, Computer-Aided control of Electric Power Generation Plant.	**8**

Text Books:

1. S. K. Singh, “Computer Aided Process control”, PHI.

Reference Books:

1. C. L. Smith, “Digital computer Process Control”, Ident Educational Publishers.
2. C. D. Johnson, “Process Control Instrumentation Technology”, PHI.
3. Krishan Kant, “Computer Based Industrial Control”
4. Pradeep B. Deshpande & Raymond H. Ash, “Element of Computer Process Control with Advance Control Applications”, Instrument Society of America, 1981.
5. C. M. Houpis & G. B. Lamond, “Digital Control System Theory”, Tata McGraw Hill.

Project

Subject Code: BTCE804P