CURRICULUM & SYLLABUS

OF

CIVIL ENGINEERING

DEPARTMENT

Sikkim Institute of Science and Technology

(Affiliated to Sikkim University)

Curriculum

for

Undergraduate Degree Courses in Civil Engineering

(Bachelor of Technology)

Syllabus

[Session 2020 Onwards]

A Central University established by an Act of Parliament of India,2007

Curriculum for Undergraduate Degree Courses in Technology

(B. Tech in Civil Engineering)

Chapter -1

General, Course structure & Theme & Semester-wise credit distribution

A. Definition of Credit:

1 Hr. Lecture (L) per week	**1 credit**
1 Hr. Tutorial (T) per week	**1 credit**
1Hr. Practical (P) per week	**0.5 credits**
2Hours Practical (Lab) per week	**1 credit**

B. Range of credits -A range of credits from 150 to 175 for a student to be eligible to get Under Graduate degree in Engineering. A student will be eligible to get Under Graduate degree with Honours or additional Minor Engineering, if he/she completes an additional 20 credits. These could be acquired through MOOCs.

Criteria to pass a Semester

A student in order to pass a semester must **secure in each paper a minimum of 40% of the total marks in internal examinations and 40% of total marks in the end semester examination.**

With respect to the movement of student in subsequent semesters, as per section **B. h.** of the **Revised regulations on the Conduct of Examinations,** approved by the **Executive Council on 9th June 2017**, "**...a student shall not be detained in any semester even if the student attends less than 75% of the classes held in that particular semester and/or fails in the end semester examination subject to the condition that the student has to clear all papers within the stipulated number of semesters as is fixed by the university, failing which the student would be declared 'failed' and has to restart from the first semester of the course in case still willing to pursue study."**

A student has **12 (twelve) semesters** as the **maximum number** of **permissible semesters** for the Bachelor of Technology Programme, i.e. **04 (four) semesters in addition to the regular 08 (eight) semesters.**

Nomenclature

BTEG: Bachelor of Technology General (Common Across all Disciplines of Engg.)
BTCI: Bachelor of Technology in Civil Engineering
UG: Under Graduate
C: Core Subject
L: Laboratory Subject
M: Mandatory Subject
O: Open Elective
P: Programme Elective
I: Internship
D: Dissertation

SEMESTER I					
CODE	SUBJECTS	Credit	Lecture	Tutorial	Practical
BTEG-UG-C101	ENGINEERING MATHEMATICS I	4	3	1	0
BTEG-UG-C102	ELEMENTS OF MECHANICAL ENGINEERING	3	2	1	0
BTEG-UG-C103	COMMUNICATION ENGLISH	3	2	0	0
BTEG-UG-C104	ENGINEERING PHYSICS	3	2	1	0
BTEG-UG-C105	ELEMENTS OF ELECTRICAL ENGINEERING	2	2	0	0
BTEG-UG-L106	ENGINEERING PHYSICS LABORATORY	1.5	0	0	3
BTEG-UG-L107	ELECTRICAL ENGINEERINGLABORATORY	1.5	0	0	3
BTEG-UG-L108	WORKSHOP PRACTICES	1.5	0	0	3
BTEG-UG-M109	ENVIRONMENTAL STUDIES	0	3	1	0
		19.5	14	4	9

SEMESTER II					
CODE	SUBJECTS	Credit	Lecture	Tutorial	Practical
BTEG-UG-C201	ENGINEERING MATHEMATICS II	4	3	1	0
BTEG-UG-C202	ENGINEERING CHEMISTRY	2	2	0	0
BTEG-UG-C203	BASIC ELECTRONICS	2	2	0	0
BTEG-UG-C204	MECHANICS OF SOLIDS	2	2	0	0
BTEG-UG-C205	PROBLEM SOLVING USING COMPUTERS	2	2	0	0
BTEG-UG-C206	UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS	3	2	1	0
BTEG-UG-L207	ENGINEERING CHEMISTRY LABORATORY	1.5	0	0	3
BTEG-UG-L208	PROGRAMMING LABORATORY	1.5	0	0	3
BTEG-UG-L209	ENGINEERING GRAPHICS AND DESIGN	2.5	1	0	3
		20.5	14	2	9

SEMESTER III					
CODE	SUBJECTS	Credit	Lecture	Tutorial	Practical
BTCI-UG-C301	ENGINEERING MATHEMATICS III	3	2	1	0
BTCI-UG-C302	STRENGTH OF MATERIALS	4	3	1	0
BTCI-UG-C303	FLUID MECHANICS-I	3	2	1	0
BTCI-UG-C304	TRANSPORTATION ENGINEERING-I	3	2	1	0
BTCI-UG-C305	SURVEYING-I	3	2	1	0
BTCI-UG-C306	DISASTER MANAGEMENT	3	2	1	0
BTCI-UG-L307	BUILDING DRAWING USING AutoCAD	1.5	0	0	3
BTCI-UG-L308	MATERIAL TESTING LAB-I	1.5	0	0	3
BTCI-UG-L309	SURVEYING PRACTICE-I	1.5	0	0	3
BTCI-UG-M310	CONSTITUTION OF INDIA/ ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	-	2	0	-
		23.5	15	6	9

SEMESTER IV					
CODE	SUBJECTS	Credit	Lecture	Tutorial	Practical
BTCI-UG-C401	ENGINEERING MATHEMATICS IV	3	2	1	0
BTCI-UG-C402	STRUCTURAL ANALYSIS	4	3	1	0
BTCI-UG-C403	SURVEYING-II	3	2	1	0
BTCI-UG-C404	FLUID MECHANICS-II	3	2	1	0
BTCI-UG-C405	CIVIL ENGINEERING MATERIALS AND CONCRETE TECHNOLOGY	3	2	1	0
BTCI-UG-O406	OPEN ELECTIVE I	3	2	1	0
BTCI-UG-L407	FLUID MECHANICS LAB	1.5	0	0	3
BTCI-UG-L408	MATERIAL TESTING LAB-II	1.5	0	0	3
BTCI-UG-L409	SURVEYING PRACTICE-II	1.5	0	0	3
		23.5	13	6	9

SEMESTER V					
CODE	SUBJECTS	Credit	Lecture	Tutorial	Practical
BTCI-UG-C501	ENGINEERING ECONOMICS	3	2	1	0
BTCI-UG-C502	GEOTECHNICAL ENGINEERING-I	3	2	1	0
BTCI-UG-C503	DESIGN OF RC STRUCTURE	4	3	1	0
BTCI-UG-C504	ENGINEERING HYDROLOGY	3	2	1	0
BTCI-UG-C505	ENVIRONMENTAL ENGINEERING	3	2	1	0
BTCI-UG-P506	PROGRAMME ELECTIVE-I	3	2	1	0
BTCI-UG-L507	ENVIRONMENTAL ENGINEERING LAB	1.5	0	0	3
BTCI-UG-L508	GEOTECHNICAL ENGINEERING LAB	1.5	0	0	3
		22	13	6	6

SEMESTER VI					
CODE	SUBJECTS	Credit	Lecture	Tutorial	Practical
BTCI-UG-C601	TRANSPORTATION ENGINEERING-II	3	2	1	0
BTCI-UG-C602	GEOTECHNICAL ENGINEERING-II	3	2	1	0
BTCI-UG-C603	DESIGN OF STEEL STRUCTURES	3	2	1	0
BTCI-UG-C604	ESTIMATION, COSTING AND VALUATION	3	2	1	0
BTCI-UG-P605	PROGRAMME ELECTIVE II	3	2	1	0
BTCI-UG-L606	ESTIMATION AND COSTING PRACTICE	1.5	0	0	3
BTCI-UG-L607	COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN LAB	1.5	0	0	3
BTCI-UG-I608	INDUSTRIAL TRAINING/ SEMINAR	1	-	-	-
		19	10	5	6

SEMESTER VII					
CODE	SUBJECTS	Credit	Lecture	Tutorial	Practical
BTCI-UG-C701	CONSTRUCTION PLANNING, ORGANISATION AND EQUIPMENT	3	2	1	0
BTCI-UG-P702	PROGRAMME ELECTIVE III	3	2	1	0
BTCI-UG-P703	PROGRAMME ELECTIVE IV	3	2	1	0
BTCI-UG-P704	PROGRAMME ELECTIVE V	3	2	1	0
BTCI-UG-O705	OPEN ELECTIVE II	3	2	1	0
BTCI-UG-L706	STRUCTURAL DESIGN AND DRAWING LAB	1.5	0	0	3
BTCI-UG-L707	REMOTE SENSING AND GIS LAB	1.5	0	0	3
BTCI-UG-D708	MINI PROJECT	2	0	0	3
		20	10	5	9

SEMESTER VIII					
CODE	**SUBJECTS**	**Credit**	**Lecture**	**Tutorial**	**Practical**
BTCI-UG-D801	**MAJOR PROJECT**	**12**	**-**	**-**	**-**

FORTH SEMESTER OPEN ELECTIVE-I (BTCI-UG-O406)		
CODE	**SUBJECTS**	**SUBJECTS**
BTCI-UG-O406	**E1:CONSTRUCTION MANAGEMENT**	**E4:PAVEMENT DESIGN**
	E2:ELEMENTS OF ENVORONMENTAL ENGINEERING	**E5:BASICS OF FOUNDATION ENGINEERING**
	E3: BUILDING PLANNING AND CONSTRUCTION	**E6:MAINTAINANCE AND REHABILITATION OF CONCRETE STRUCTURES**

FIFTH SEMESTER PROGRAMME ELECTIVE-I (BTCI-UG-P506)		
CODE	**SUBJECTS**	**SUBJECTS**
BTCI-UG-P506	**E1: ENGINEERING GEOLOGY**	**E4: GROUND IMPROVEMENT TECHNIQUES**
	E2: BUILDING CODES AND REQUIREMENT	**E5: TRAFFIC SYSTEMS AND ENGINEERING**
	E3: TRAFFIC FLOW MODELLING	**E6: SOLID WASTE MANAGEMENT**

SIXTH SEMESTER PROGRAMME ELECTIVE II (BTCI-UG-P605)		
CODE	**SUBJECTS**	**SUBJECTS**
BTCI-UG-P605	E1: LATEST TRENDS IN CIVIL ENGINEERING	E4: APPLICATIONS OF PROBABILITY & STATISTICS IN CIVIL ENGINEERING
	E2: DESIGN OF HYDRAULIC STRUCTURES	E5: ADVANCED FOUNDATION ENGINEERING
	E3: GROUND WATER ENGINEERING	E6: SOIL REINFORCEMENT AND GEOSYNTHETICS
	E7: IRRIGATION ENGINEERING	

SEVENTH SEMESTER PROGRAMME ELECTIVE III, IV & V (BTCI-UG-P702, BTCI-UG-P703 & BTCI-UG-P704)		
CODE	**SUBJECTS**	**SUBJECTS**
BTCI-UG-P702 BTCI-UG-P703 BTCI-UG-P704	E1: FINITE ELEMENT METHOD OF ANALYSIS	E8: SOIL DYNAMICS
	E2: STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING	E9: ADVANCED CONCRETE TECHNOLOGY
	E3: ADVANCED STRUCTURAL DESIGN	E10: DESIGN OF PRESTRESSED CONCRETE
	E4: BRIDGE ENGINEERING	E11: WATER RESOURCES ENGINEERING
	E5: ADVANCED STRUCTURAL ANALYSIS	E12: URBAN TRANSPORT PLANNING
	E6: OPTIMIZATION TECHNIQUE	E13: ADVANCED STEEL DESIGN
	E7: REMOTE SENSING AND GIS	E14: ADVANCED GEOTECHNICAL ENGINEERING

SEVENTH SEMESTER OPEN ELECTIVE-II(BTCI-UG-O705)		
CODE	**SUBJECTS**	**SUBJECTS**
BTCI-UG-O705	**E1: HUMAN RESOURCE DEVELOPMENT AND ORGANISATIONAL BEHAVIOUR**	**E3: ENGINEERING RESEARCH METHODOLOGY**
	E2: INDIAN SOCIETY	

Semester I

Course Code	Name of the Course	Credits	Internal Assessment					End Semester Examination		Total Marks
			Continuous mode	Sessional Exam		Duration	Total	Marks	Duration	
				S1	S2					
BTEG-UG-C101	ENGINEERING MATHEMATICS I	4	-	25	25	1 hrs	50	50	2 hrs	100
BTEG-UG-C102	ELEMENTS OF MECHANICAL ENGINEERING	3	-	25	25	1 hrs	50	50	2 hrs	100
BTEG-UG-C103	COMMUNICATION ENGLISH	3	-	25	25	1 hrs	50	50	2 hrs	100
BTEG-UG-C104	ENGINEERING PHYSICS	3	-	25	25	1 hrs	50	50	2 hrs	100
BTEG-UG-C105	ELEMENTS OF ELECTRICAL ENGINEERING	2	-	25	25	1 hrs	50	50	2 hrs	100
BTEG-UG-L106	ENGINEERING PHYSICS LABORATORY	1.5	50	-	-	-	50	50	2 hrs	100
BTEG-UG-L107	ELECTRICAL ENGINEERINGLABORATORY	1.5	50	-	-	-	50	50	2 hrs	100
BTEG-UG-L108	WORKSHOP PRACTICES	1.5	50	-	-	-	50	50	2 hrs	100
BTEG-UG-M109	ENVIRONMENTAL STUDIES	-	-	25	25	1 hrs	50	50	2 hrs	100

Semester II

Course Code	Name of the Course	Credits	Internal Assessment					End Semester Examination		Total Marks
			Continuous mode	Sessional Exam		Duration	Total	Marks	Duration	
				S1	S2					
BTEG-UG-C201	ENGINEERING MATHEMATICS II	4	-	25	25	1 hrs	50	50	2 hrs	100
BTEG-UG-C202	ENGINEERING CHEMISTRY	2	-	25	25	1 hrs	50	50	2 hrs	100
BTEG-UG-C203	BASIC ELECTRONICS	2	-	25	25	1 hrs	50	50	2 hrs	100
BTEG-UG-C204	MECHANICS OF SOLIDS	2	-	25	25	1 hrs	50	50	2 hrs	100
BTEG-UG-C205	PROBLEM SOLVING USING COMPUTERS	2	-	25	25	1 hrs	50	50	2 hrs	100
BTEG-UG-C206	UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS	3	-	25	25	1 hrs	50	50	2 hrs	100
BTEG-UG-L207	ENGINEERING CHEMISTRY LABORATORY	1.5	50	-	-	-	50	50	2 hrs	100
BTEG-UG-L208	PROGRAMMING LABORATORY	1.5	50	-	-	-	50	50	2 hrs	100
BTEG-UG-L209	ENGINEERING GRAPHICS AND DESIGN	2.5	35	-	15	1 hrs	50	50	2 hrs	100

Semester III

Course Code	Name of the Course	Credits	Internal Assessment					End Semester Examination		Total Marks
			Continuous mode	Sessional Exam		Duration	Total	Marks	Duration	
				S1	S2					
BTCI-UG-C301	ENGINEERING MATHEMATICS III	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-C302	STRENGTH OF MATERIALS	4	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-C303	FLUID MECHANICS-I	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-C304	TRANSPORTATION ENGINEERING-I	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-C305	SURVEYING-I	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-C306	DISASTER MANAGEMENT	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-L307	BUILDING DRAWING USING AutoCAD	1.5	50	-	-	-	50	50	2 hrs	100
BTCI-UG-L308	MATERIAL TESTING LAB-I	1.5	50	-	-	-	50	50	2 hrs	100
BTCI-UG-L309	SURVEYING PRACTICE-I	1.5	50	-	-	-	50	50	2 hrs	100
BTCI-UG-M310	CONSTITUTION OF INDIA/ ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	-	-	25	25	1 hrs	50	50	2 hrs	100

Semester IV

Course Code	Name of the Course	Credits	Internal Assessment					End Semester Examination		Total Marks
			Continuous mode	Sessional Exam		Duration	Total	Marks	Duration	
				S1	S2					
BTCI-UG-C401	ENGINEERING MATHEMATICS IV	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-C402	STRUCTURAL ANALYSIS	4	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-C403	SURVEYING-II	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-C404	FLUID MECHANICS-II	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-C405	CIVIL ENGINEERING MATERIALS AND CONCRETE TECHNOLOGY	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-O406	OPEN ELECTIVE I	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-L407	FLUID MECHANICS LAB	1.5	50	-	-	-	50	50	2 hrs	100
BTCI-UG-L408	MATERIAL TESTING LAB-II	1.5	50	-	-	-	50	50	2 hrs	100
BTCI-UG-L409	SURVEYING PRACTISE-II	1.5	50	-	-	-	50	50	2 hrs	100

Semester V

Course Code	Name of the Course	Credits	Internal Assessment					End Semester Examination		Total Marks
			Continuous mode	Sessional Exam		Duration	Total	Marks	Duration	
				S1	S2					
BTCI-UG-C501	ENGINEERING ECONOMICS	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-C502	GEOTECHNICAL ENGINEERING-I	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-C503	DESIGN OF RC STRUCTURE	4	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-C504	ENGINEERING HYDROLOGY	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-C505	ENVIRONMENTAL ENGINEERING	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-P506	PROGRAMME ELECTIVE-I	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-L507	ENVIRONMENTAL ENGINEERING LAB	1.5	50	-	-	-	50	50	2 hrs	100
BTCI-UG-L508	GEOTECHNICAL ENGINEERING LAB	1.5	50	-	-	-	50	50	2 hrs	100

Semester VI

Course Code	Name of the Course	Credits	Internal Assessment					End Semester Examination		Total Marks
			Continuous mode	Sessional Exam		Duration	Total	Marks	Duration	
				S1	S2					
BTCI-UG-C601	TRANSPORTATION ENGINEERING-II	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-C602	GEOTECHNICAL ENGINEERING-II	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-C603	DESIGN OF STEEL STRUCTURES	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-C604	ESTIMATION, COSTING AND VALUATION	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-P605	PROGRAMME ELECTIVE II	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-L606	ESTIMATION AND COSTING PRACTICE	1.5	50	-	-	-	50	50	2 hrs	100
BTCI-UG-L607	COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN LAB	1.5	50	-	-	-	50	50	2 hrs	100
BTCI-UG-I608	INDUSTRIAL TRAINING/ SEMINAR	1	50	-	-	-	50	50	2 hrs	100

Semester VII

Course Code	Name of the Course	Credits	Internal Assessment					End Semester Examination		Total Marks
			Continuous mode	Sessional Exam		Duration	Total	Marks	Duration	
				S1	S2					
BTCI-UG-C701	CONSTRUCTION PLANNING, ORGANISATION AND EQUIPMENT	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-P702	PROGRAMME ELECTIVE III	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-P703	PROGRAMME ELECTIVE IV	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-P704	PROGRAMME ELECTIVE V	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-O705	OPEN ELECTIVE II	3	-	25	25	1 hrs	50	50	2 hrs	100
BTCI-UG-L706	STRUCTURAL DESIGN AND DRAWING LAB	1.5	50	-	-	-	50	50	2 hrs	100
BTCI-UG-L707	REMOTE SENSING AND GIS LAB	1.5	50	-	-	-	50	50	2 hrs	100
BTCI-UG-D708	MINI PROJECT	2	50	-	-	-	50	50	-	100

Semester VIII

Course Code	Name of the Course	Credits	Internal Assessment					End Semester Examination		Total Marks
			Continuous mode	Sessional Exam		Duration	Total	Marks	Duration	
				S1	S2					
BTCI-UG-D701	MAJOR PROJECT	12	-	-	-	-	50	-	-	50

LIST OF HONOURS OR ADDITIONAL MINOR ENGINEERING

Minor Specialization

A student will be eligible to get Under Graduate degree with Honours or additional Minor Engineering, if he/she completes an additional 20 credits. These could be acquired through MOOCs. The institute may decide to offer subjects (from the ones Listed Below), Credited Seminar and Projects for the attainment of the proposed credit across different semesters of the course.
Minor specializations will be offered under following domain:

1. **Structural Engineering**
2. **Transportation Engineering**
3. **Geotechnical Engineering**
4. **Environmental Engineering**
5. **Water Resource Engineering**

PROBABLE LIST OF SUBJECTS FOR MINOR SPECIALIZATION

STRUCTURAL ENGINEERING	TRANSPORTATION ENGINEERING	GEOTECHNICAL ENGINEERING	ENVIRONMENTAL ENGINEERING	WATER RESOURCE ENGINEERING
MAINTAINANCE AND REHABILITATION OF CONCRETE STRUCTURES	TRAFFIC FLOW MODELLING	BASICS OF FOUNDATION ENGINEERING	ELEMENTS OF ENVIRONMENTAL ENGINEERING	GROUND IMPROVEMENTS TECHNIQUES
BUILDING CODES AND REQUIREMENTS	TRAFFIC SYSTEMS AND ENGINEERING	DESIGN OF FOUNDATIONS AND EARTH RETAINING STRUCTURES	SOLID WASTE MANAGEMENT	DESIGN OF HYDRAULIC STRUCTURES
FINITE ELEMENT METHOD OF ANALYSIS	BRIDGE ENGINEERING.	SOIL REINFORCEMENT AND GEOSYNTHETICS		GROUND WATER ENGINEERING
STRUCTURAL DYNAMICS	PAVEMENT DESIGN	SOIL DYNAMICS		WATER RESOURCE ENGINEERING
ADVANCED STRUCTURAL DESIGN	URBAN TRANSPORT PLANNING	ADVANCED GEOTECHNICAL ENGINEERING		
BRIDGE ENGINEERING.		REINFORCED EARTH AND GEOTEXTILES		
ADVANCED STRUCTURAL ANALYSIS				
ELEMENTS OF EARTHQUAKE ENGINEERING				
DESIGN OF PRE STRESSED CONCRETE				
ADVANCED STEEL DESIGN				

BTEG-UG-C101: ENGINEERING MATHEMATICS I (3L 1T 0P)

(Calculus)

Course Objective: This paper contains Differential calculus, Integral Calculus, Analytical Solid geometry and Infinite Series. The objective of teaching this paper is to give idea on these topics which will help the students in studying and understanding the mathematical as well as engineering subjects.

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

1. Understand the basics of Differential calculus, Integral Calculus,
2. Understand the basics of Analytical Solid geometry and Infinite Series.

UNIT I **10 hrs**	**Differential Calculus:** Successive differentiation, Leibnitz's theorem, Polar curves, Angle of intersection of two curves, Derivatives of arcs (Cartesian and polar), Asymptotes, Curvature, Radius of curvature, Multiple points, Points of inflection, Concavity, Convexity.
UNIT-II **10 hrs**	Rolle's theorem, Mean value theorems, Expansion of functions in Taylor's and Maclaurin's series, Indeterminate forms. Partial differentiation, Euler's theorem, Total differential, Errors and approximation, Differentiation of composite and implicit functions. Tracing of standard curves.
UNIT- III **20 hrs**	**Integral calculus:** Reduction formulae for standard integrals. Length, Area and Volume of revolution involving simple curves. **Infinite series:** Convergence, Divergence, Comparison test, Ratio test, Cauchy's root test, Cauchy's integral test, Alternating series, Leibnitz's test, absolute and conditional convergence.
UNIT-IV **20 hrs**	**Analytical solid geometry:** Direction Cosines, Planes, Straight lines, Spheres, Right circular cone and Right circular cylinder.

Text books :

1. Shanti Narayan: Differential Calculus, S Chand & Company
2. Shanti Narayan: Integral Calculus, S Chand & Company
3. Erwin Kreyszig: Advanced Engineering Mathematics , Wiley
4. R.K. Jain & S R K Iyengar, Advanced Engineering Mathematics V Ed, Narosa

Reference Books:

1.G.B. Thomas, Jr. and R. L. Finney: Calculus and Analytical Geometry
2. B S Grewal, Engineering Mathematics, Khanna Publisher
3. R G Bertle and D R Sherbert, Introduction to Real Analysis, Willey
4. Das and Mukherjee: Differential Calculus, U N Dhur & Company
5. Das and Mukherjee: Integral Calculus, U N Dhur & Company

BTEG-UG-C102: ELEMENTS OF MECHANICAL ENGINEERING (2L 1T 0P)

Course Objective: The objective of this course is to inculcate the basic concepts and principles of mechanical engineering subjects such as thermodynamics, fluid mechanics, I.C Engines, power transmission, welding and machine tools.

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

1. Understand the basic concept of Thermodynamics and its application in the field of energy technology.
2. Have idea of different IC engines, working of 2 stroke & 4 stroke petrol and diesel engines.
3. Able to understand application and working of Belt drives, chain drives. Gear drives and Gear trains (Simple & Compound Gear trains).
4. Understand the behavior of Fluid Flow.
5. Know about the various machine tools and machining process.

UNIT-I **5 hrs**	**Thermodynamics:** Introduction, systems and surroundings, property, state and process; reversible and irreversible process, cyclic process; heat, work and energy. First law of thermodynamics: energy equations for non-flow and steady flow processes, limitations of first law. Second law of thermodynamics: statements, equivalence of second law. **Properties of gases:** Introduction, characteristic equation for gases, specific heats of gases and their relation with gas constant.
UNIT- II **10 hrs**	**Thermodynamic processes:** Relationship between P, V, T, expressions for work done, heat transferred and change in internal energy and enthalpy for - constant volume process, constant pressure process, constant temperature process, isentropic process, and polytropic process – simple calculations. **Internal Combustion Engines:** Introduction, classification, Otto and Diesel cycles (no derivation), expression of efficiency, spark ignition and compression Ignition engines, working principles of 4-stroke and 2-stroke cycle engines.
UNIT- III **15 hrs**	**Fluid Mechanics:** Introduction- definition of fluid, fluid properties (Density, Sp. weight, Sp. volume, Sp. gravity), Viscosity- dynamic and kinematic, Newton's law of viscosity, different types of fluid. Definitions of compressible and incompressible fluid. Fluid statics- Statement of Pascal's law, Hydrostatic law (no derivations)**.** **Fluid Kinematics:** Continuity equation in a pipe of varying cross-section from the conservation of mass. **Fluid Dynamics**: Introduction-equation of motion, Statement and explanation of Bernoulli's equation for compressible flow (no derivation). **Transmission of Motion and Power:** Introduction, modes of transmission; belt drive – types of belts used, open and crossed belt drive, velocity ratio – slip in belt drive, simple calculations; Gear drive – types of gears, spur gear nomenclature, simple and compound gear trains – simple calculations.

UNIT- IV **15 hrs**	**Welding:** Introduction, classification, welding rods and fluxes, principles of gas, resistance and electric arc welding processes (no other specific welding process). **Metal Cutting and Machine Tools:** Introduction, definition of machine tools, cutting sped, feed and depth of cut. **Lathe:** Classification, description and function of lathe parts (details of function not necessary), list of operations performed on a lathe. **Drilling Machine:** Classification, operations on drilling machine.

Text books:

1. Elements of Mechanical Engineering: Roy, Hazra Choudhury & Hazra Choudhury-; Media Promoters and Publishers Pvt. Ltd.
2. Elements of Mechanical Engineering: Mathur & Domkundwar - Dhanpat Rai & Co.

Reference books:

1. Elements of Workshop Technology vol. II: Hazra Choudhury & Hazra Choudhury: Media Promoters and Publishers Pvt. Ltd.
2. Basic Mechanical Engineering: Gupta: Dhanpat Rai & Co.
3. Mechanical Engineering Science: Gopalakrishna: Subhash Publications.
4. A Text Book of Fluid Mechanics and Hydraulic Machine: R. K. Bansal: Laxmi Publications.
5. Thermodynamics: P.K.Nag: Tata McGraw-Hill.

BTEG-UG-C103: COMMUNICATION ENGLISH (2L 1T 0P)

Course Objective: To make them aware about the need of communication skills in the contemporary world by honing their speaking reading and writing skills. To make them industry ready by honing their personality and body language.

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

i. To help the students to hone their oral as well as written communication skills so as to make them job and industry ready.

UNIT-I **5 hrs**	Tense and Concord Basic Transformations: Positive and Negative Sentences Simple, Complex and Compound Sentences Change of Voice
UNIT- II **15 hrs**	Change of Narration Question Tag and Short Responses Preposition and Determiners Some Common Errors in English
UNIT- III **15 hrs**	Reading Comprehension and Writing Skill Reading Comprehension (Practice of Unseen Passages) Essay on Literal, Cultural and Legal Topics Formal and Informal Correspondence
UNIT- IV **10 hrs**	Précis Writing Report Writing: Status and Policy Reports Writing Proposals

Text books:

1. Bolton, David and Noel Goodey (2005) English Grammar in Steps. Orient Blackswan; New Delhi.
2. Eastwood, John. (1999) Oxford Practice Grammar.Oxford University Press; New Delhi.
3. Hewings, Martin. (2007) Advanced Grammar in Use. Cambridge University Press; New Delhi.
4. Murphy, Raymond. (2000) Essential Grammar in Use. Cambridge University Press; New Delhi.
5. Quirk, Randolph and Greenbaum, (1985) A University Grammar of English. Essex; ELBS. Longman.

Reference books:

1. Swan, Michael and Walter, Catherine. (2006) The Good English Grammar Book.Oxford University Press; New Delhi.
2. Swan, Michael. (1997) Basic English Usage.Oxford University Press; Kolkata.
3. Ashley, A. (1995) The Oxford Handbook of Commercial Correspondence. Oxford University Press;
4. New Delhi.
5. Folens, (1991) Core Skills in English: Grammar Comprehension, Creative Writing. Folens Limited.
6. Seely, John. (1998) The Oxford Guide to Writing and Speaking.Oxford University Press; New
7. Delhi.

BTEG-UG-C104: ENGINEERING PHYSICS (2L 1T 0P)

Course Objective:

1. The course focuses at developing the basic background in physics that will be required by an engineering student to pursue his B.Tech. course. The fundamental concepts and applications of the laws of physics through real life applications are embodied in the course.
2. The course start with a brief discussion on oscillation and then gives thorough idea about damped and forced oscillation, mechanical waves and wave optics required in different branches of engineering.
3. An introduction to the quantum mechanics is given so that the students can understand its application in their advanced courses in higher semesters.
4. The physics of band theory of solid is introduced which forms the backbone of electronics.
5. Overall the course aims for use of an integrated system where mathematical and scientific skills such as measuring, predicting, formulating explanations, drawing conclusions, and solving problems that are used in technology and its development. Scientific information will be made with real life examples and laboratory experiments where possible.

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

1. Understand the oscillation and waves in perspective of engineering application.
2. Learn the phenomenon of interference and diffraction of light waves and signal propagation through optical fibers.
3. Learn the fundamentals and importance of Quantum Mechanics.
4. Concept of free electron theory, band theory of solid and semiconductor.

UNIT-I **5 hrs**	**Oscillations:** Overview of vibrations with emphasis on damped and forced oscillators, resonance. **Wave:** Overview on waves, wave equation, plane waves, phase velocity, superposition, group velocity.
UNIT- II **15 hrs**	**Optics:** Interference of light waves, Young's experiment, Thin film interference and its applications, Diffraction of light – Fresnel and Fraunhofer class, Fraunhofer diffraction for single slit (derivation). Diffraction at multiple slits (qualitative discussion). **Fiber optics:** Principle and propagation of light in optical fibers, Numerical aperture and Acceptance angle, Qualitative discussions of attenuation in optical fiber.
UNIT- III **15 hrs**	**Development of Quantum Mechanics:** Inadequacy of classical mechanics, Black body radiation, Planck's radiation law, Planck's quantum hypothesis, Photoelectric effect, Wave particle duality, de Broglie waves, Matter waves, Davisson-Germer experiment, Group velocity and phase velocity. **Applications of Quantum Mechanics:** Wave packets and Heisenberg's uncertainty principle, wave function and its physical significance, Schrodinger's equation, Schrodinger's 1-D time independent equations, Potential well.

UNIT- IV **10 hrs**	**Band Theory of Solids:** Concept of free electron theory, quantum theory of free electrons, Fermi energy, Effect of temperature in Fermi-Dirac distribution, Concept of energy levels and bands, Distinction between Insulator, Semi-conductors and Conductors in terms of energy band, p-n junction.

Text books:

1. Physics by Resnick, Halliday and Krane, Vol 1&2; 5th Edn, John Wiley and Sons Inc.
2. Optics by N. Subrahmanyam, and Brij Lal., S. Chand and Company, New Delhi.
3. Physics for Scientists and Engineers with Modern Physics, by Serway and Jewatt, Volume 2; 6th Edn., Thomson
4. Concept of Modern Physics by Arthur Beiser, 6th Edn., Tata Mc Graw Hill.

Reference books:

1. Berkley Physics Course by Kittel, Knight, Ruderman, Helmholz and Moyer , Vol. 1 ; Tata Mc Graw Hill.
2. Berkley Physics Course by Crawford, Vol 3; Tata Mc Graw Hill.
3. Berkley Physics Course by Wichmann, Vol 4; Tata Mc Graw Hill.
4. Engineering Physics, by H. K. Malik and A. K. Singh, 1st Edn., Tata Mc Graw Hill.
5. Engineering Physics, by Dattu R Joshi, 1st Edn., Tata McGraw Hill.

BTEG-UG-C105: ELEMENTS OF ELECTRICAL ENGINEERING (2L 0T 0P)

Course Objective: This course focuses on DC Circuits, Magnetic Circuits, Single-Phase and Three-Phase AC Circuits, Transformer and Three-phase Induction Motors. To impart basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand its impact on the technologies associated with it. The course also introduces fundamental concepts and analysis techniques in electrical engineering to students across all disciplines. Basic and most frequently used electrical machines and its applications are also introduced.

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

1. Demonstrate an understanding to the magnetic circuits, electrical DC and AC circuits and terminologies associated with it.
2. Demonstrate an ability to solve and analyze magnetic circuits, electrical DC and AC circuits.
3. Apply the basic concepts in electrical engineering for multi-disciplinary tasks.
4. Identify the construction parts of transformer, three-phase induction motors.

UNIT-I **5 hrs**	**DC CIRCUITS:** Review of fundamental terminologies related to dc circuits, mesh current and node voltage analysis of DC circuits, star-delta and delta-star transformation. **MAGNETIC CIRCUITS**: Review of fundamental terminologies related to magnetic circuits, analogy with electric circuits, analysis of magnetic circuits, self and mutual inductances.
UNIT- II **10 hrs**	**SINGLE PHASE AC CIRCUITS**: Review of fundamental terminologies related to single-phase AC circuits. representation of sinusoidal voltages and currents, rms value and average value, j-operator, phasors, voltages and currents relationship and instantaneous and average power in a pure resistor, pure inductor and pure capacitor, impedance, admittance, analysis of circuits, power, power factor.
UNIT- III **15 hrs**	**THREE PHASE AC CIRCUITS:** Review of fundamental terminologies related to three-phase AC circuits, Symmetrical sinusoidal supply systems, voltage, current and power relationship in 3-phase balanced star and delta connected loads, Analysis of three phase balanced star and delta connected loads.
UNIT- IV **15 hrs**	**TRANSFORMERS:** Construction, principle of operation, emf equation, transformer on no-load and on-load, phasor diagrams on no-load and on-load. **THREE PHASE INDUCTION MOTOR:** Construction, principle of operation, revolving field, slip, rotor induced emf, rotor frequency, rotor reactance, expression of torque developed from rotor input and torque-slip characteristic.

Text books:

1. Fundamentals of Electric Circuits by Charles K Alexander and Matthew N. O. Sadiku, TMH Publication, 5th Edition, 2013.
2. Basic Electrical Engineering by Abhijit Chakrabarti, Sudipta Nath, and Chandan Chanda, TMH Publication, 2013.
3. Electrical Machinery by P.S. Bimbhra, Khanna Publishers, 7th Edition.

Reference books:

1. Electrical Engineering Fundamentals by Vincent Del Toro, PHI Publication, Second Edition.

2. Electrical Technology by H Cotton, CBS Publishers and Distributors,7th Edition, 2005.

BTEG-UG-L106: ENGINEERING PHYSICS LABORATORY (0L 0T 3P)

Course Objective:

1. Verify the laws of physics as discussed in theory.
2. Develop idea for modeling and construction of experimental setups.
3. Interpret the observations by graphical and analytical means.
4. Draw logical conclusions from the observations and calculations and present it.
5. Understand the sources of error in conduction of experiments and minimization of errors.

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

1. Experimental verification of resonance, inertia, damping effect and find the spring constant in oscillatory bodies.
2. Experimental verification wave optics phenomena of interference and diffraction.
3. Experimental verification of Quantum nature of light using photoelectric effect.
4. Experimental verification of the basic properties of semiconductor and its application.

LIST OF EXPERIMENTS: (Minimum of any 12 experiments)

1. To draw (A) Normal distribution error curve, and (B) to compute arithmetic mean; standard deviation and probable error of the measured lengths of the side of a rectangular metallic block.
2. To determine the force constant of a spring and to investigate resonance in forced oscillations.
3. To determine the damping constant of an under damped oscillatory motion and plot the graph between amplitude versus frequency to get the resonance frequency.
4. Determine the moment of inertia of a body by means of a torsion pendulum.
5. To find the velocity of sound in the given liquid using Ultrasonic Interferometer
6. To determine the Planck's constant and to verify the inverse square law of radiation.
7. To determine the radius of curvature of the given Plano-convex lens by Newton's Ring method.
8. To determine (a) the grating element, number of lines per unit length (1cm/1inch) in the given grating by normal incidence method and (b) the wavelength of the lines in the mercury spectrum.
9. To determine the diameter of the given thin wire using an air wedge.
10. To determine (a) the slit width of a single slit and the wavelength of an unknown light source using diffraction of light.
11. To draw the I-V characteristic curve of a semiconductor diode (Ge and Si) and determine its knee voltage, and forward dynamic resistance.
12. To draw the I-V characteristic curve of a zener diode and determine its break down voltage, forward knee voltage, and zener resistance.
13. To determine Hall-coefficient of the given semiconductor and its charge carrier density.
14. To determine the ripple factor of a half-wave and a full-wave rectifier with and without filter.
15. To determine the forbidden energy gap of a semiconductor.

Text Books:

1. A Textbook of Practical Physics by Indu Prakash, Ram Krishna, A. K. Jha, Kitab Mahal, (2012).
2. Engineering Physics Practical by S K Gupta Krishna Prakashan Media P. Ltd.-Meerut (2015).

Reference Books:

1. Advanced Practical Physics for Students by B.L. Worsnop (Author), H.T. Flint Littlehampton Book Services Ltd; 9th Revised edition Edition.

BTEG-UG-L107: ELECTRICAL ENGINEERING LABORATORY (0L 0T 3P)

Course Objective: This course on Electrical Engineering Laboratory mainly focuses on providing the students with the hands-on experiences with working on and verifying the concepts and laws associated with DC Circuits and AC Circuits. Students are also exposed to the measurement of electrical parameters like resistance inductance, power etc. Exposure to the construction, working, analysis and tests on electrical machines like transformers and three-phase induction motors.

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

1. Demonstrate practical understanding to the laws, responses and theorem associated with electrical DC and AC circuits.
2. Demonstrate an ability to make measurements with various electrical parameters like, resistances, inductances, power etc.
3. Ability to put electrical machines to drive the loads, perform tests on it to determine its parameters, load performances etc.

List of Experiments

1. Verification of Kirchhoff's Current and Voltage Laws.
2. Resonance in series R-L-C circuit.
3. Transient Response of RLC Series circuit using DC excitation.
4. Measurement of resistance and inductance of a coil.
5. Verification of network theorems -Thevenin's theorems with resistive elements DC supply.
6. Verification of network theorems - Norton's theorems with resistive elements DC supply.
7. Verification of network theorems - Superposition theorems with resistive elements DC supply.
8. Measurement of three-phase power using two wattmeter method.
9. Open and short circuit test on single-phase transformer to determine its equivalent circuit parameters, efficiency and voltage regulation.
10. Load test on squirrel cage rotor three-phase induction motors.

BTEG-UG-C108: WORKSHOP PRACTICES (0L 0T 3P)

Course Objective: To familiarize with the basic manufacturing processes and to study the various tools and equipment used, hands-on training is given in different sections. Essentially student should

1. Prepare basic joints used in carpentry
2. Prepare edges for better joint for fitting
3. Prepare basic joints in plumbing
4. Prepare various shapes and objects by using sheet metals and soldering process.

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

1. The student will be able to use different tools (Carpentry, Fitting, sheet metal working, Plumbing, Soldering) processes required to manufacture a product from the raw materials.
2. They will be able to use different measuring, marking, cutting tools used in workshop.
3. They will be aware of the safety precautions while working in workshop.

List of Experiments

- **Carpentry:** Use of carpentry tools, preparation of joints involving the following operations: plaining, chipping, tenoning and mortising. Minimum two models to be prepared; Demonstration of wood working machines
- **Plumbing:** Use of plumber's tools, various pipe fittings, exercises in thread cutting on pipes.
- **Fitting:** Use of fitter's tools; Exercises involving the following operations: measuring and marking, chipping, filing, drilling, tapping, and external threading. Minimum two models to be prepared.
- **Soldering:** Use of soldering tools, exercises involving sheet metal joints and electrical circuits/ cable joints.

Text books:

1. Elements of Workshop Technology vol. I & II: Hazra Choudhury & Hazra Choudhury: Media Promoters and Publishers Pvt. Ltd.

BTEG-UG-M109: ENVIRONMENTAL STUDIES	**(3L 1T 0P)**
Course Objective: The course exposes students to various types of environmental problems, their mitigation and prevention. It aims to generate awareness and active participation in environment related issues in workplace and society.	
Course Outcome: On successful completion of course, the students will be able to: 1. The students will be able to relate the various features of environment and their impact on the life. 2. The students will understand the gravity of pollution problem and should be able to devise methods to mitigate the problem 3. Students will able to solve numerical problem related with BOD, COD and other aspects of environment.	
UNIT-I **15 hrs**	**Environment and Ecosystem:** Introduction, Importanceand Scope of Environmental Studies Components of Environment; Atmosphere, Hydrosphere, Lithosphere and Biosphere Ecosystems: Concept, Structure and Function of an Ecosystem; Energy Flow, Food Chains, Food Webs Ecological Pyramids, Ecological Niche and Keystone Species.
UNIT-II **15 hrs**	**Resources and Conservation** Introduction and Classification of Resources Problems Associated with Resources and Conservation; Forest resources, Water Resources, Energy Resources, Land Resources Biodiversity: Introduction, Issues and Conservation
UNIT-III **15 hrs**	**Environmental Pollution and Issues** Introduction to Environmental Pollution Causes, Effects and Control Measures of: Air Pollution, Water Pollution, Soil Pollution, Noise Pollution, Nuclear Pollution Environmental Issues; Climate Change, Global Warming, Acid Rain, Ozone Layer Depletion etc. Firecracker and Associated Issues
UNIT-IV **15 hrs**	**Human and Environment** Human-Environment Relationship, Sustainable Development: Concept and Issues Role of Information Technology in Environmental Management Solid Waste Management Environmental Refugees Environmental Ethics: Issues and possible solutions
Text books:	

1. Fundamentals of Ecology - Eugene P. Odum & Garry W. Barrett
2. Environmental Chemistry - A.K. De
3. Environmental Science & Engineering – J. Glynn. Henry & Gary W. Heinke

Reference Books:

1. Renewable Energy – Power for a sustainable future – Godfrey Boyle

BTEG-UG-C201: ENGINEERING MATHEMATICS II (3L 1T 0P)

Course Objective: This paper covers Ordinary differential equation, Laplace transform, linear algebra and calculus. Differential Equation is a tool which is used for modelling of real life problems mathematically. Laplace transforms help in solving complex problem with a very simple approach. Ordinary differential equation, Laplace transform has tremendous applications in electrical engineering; Linear algebra has applications in computer sciences. Linear algebra has applications is different subjects such as Graph theory, Cryptography, Genetics, Economics, Networks etc. Calculus II is prerequisite for many mathematical and engineering subjects.

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

1. Understand the basics of Differential calculus, Integral Calculus,
2. Understand the basics of Analytical Solid geometry and Infinite Series.

UNIT I **20 hrs**	**Ordinary Differential Equations (ODE):** Formation of ODE, order, degree and solutions of ODE. Homogeneous and non-homogeneous equations, exact equations, Linear equations, Bernoulli's equations. Linear equations with constant coefficients, Non homogeneous equations, Method of variation of parameters, Cauchy's homogeneous linear equations, simultaneous equations. Applications Engineering problems.
UNIT-II **12 hrs**	**Laplace Transforms**: Transforms of elementary functions, Transforms of derivatives, Inverse transforms, Unit step function, Shifting theorems, Applications to engineering problems.
UNIT- III **16 hrs**	**Linear Algebra:** Vector spaces and subspaces, Simple examples. Linear dependence and independence; Basis, Dimension, Matrices, Elementary transformations, Inverse, Rank, Consistency of system of linear equations, Consistency, Solution by Gauss elimination method.
UNIT-IV **12 hrs**	**Multivariate Calculus:** Taylor's theorem, Extreme values, Lagrange's method of undetermined multipliers. Multiple integrals: Change of order of integration, Change of variables. Jacobians. Area and volume. Beta and Gamma functions.

Text books :

1. Shanti Narayan: Differential Calculus, S Chand & Company
2. Shanti Narayan: Integral Calculus, S Chand & Company
3. Erwin Kreyszig: Advanced Engineering Mathematics, Wiley
4. R.K. Jain & S R K Iyengar, Advanced Engineering Mathematics V Ed, Narosa

Reference Books:

1. E.D. Rainville and P. E. Bedient: A short course in differential equation.
2. B S Grewal, Engineering Mathematics, Khanna Publisher
3. R G Bertle and D R Sherbert, Introduction to Real Analysis, Willey
4. Das and Mukherjee: Differential Calculus, U N Dhur & Company
5. Das and Mukherjee: Integral Calculus, U N Dhur & Company

BTEG-UG-C202: ENGINEERING CHEMISTRY (2L 0T 0P)

Course Objective: The course will introduce students to concepts of chemistry and its application in various types of industries.

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

1. Understand concepts of electrochemistry and its application in electrochemical devices.
2. Understand the fundamentals of corrosion and how to mitigate the problem.
3. Understand the basics of fuel chemistry and provide solutions for various associated problems.
4. Understand the importance of liquid crystal chemistry in designing display panels.

UNIT-I **6 hrs**	Electrochemical changes - half reactions, origin of electrode potential, measurement of electrode potential, Nernst equation and its applications, electrochemical series & its applications, electrochemical cell and its classifications (galvanic cell, electrolytic cell), electromotive force, standard cell. Overview on Primary and secondary cell: The lead-acid storage cell, lithium-ion battery. Fuel Cell: H_2–O_2 fuel cell
UNIT- II **8 hrs**	Corrosion and its control: Corrosion – cause of corrosion, types and mechanism of corrosion - dry corrosion, Pilling Bedworth rule, electrochemical or wet corrosion (mechanism via Hydrogen evolution & Oxygen absorption), types of electrochemical corrosion (galvanic corrosion, concentration cell corrosion, water line corrosion, stress corrosion - caustic embrittlement, passivity, galvanic series, factors influencing corrosion, corrosion control-corrosion inhibitors, cathodic protection - sacrificial anodic and impressed current cathodic protection.
UNIT- III **8 hr**	Fuels: Introduction – Classification, Calorific value, Numerical problems,Liquid fuels, Petroleum- Refining, Cracking, Synthetic petrol,Petrol knocking, Diesel knocking, Octane and Cetane ratings, Anti-knock agents, Power alcohol, Bio-diesel, Gaseous fuels, Natural gas, LPG and CNG,Combustion, Calculation of air for the combustion of a fuel, Flue gas analysis, Orsat apparatus, Numerical problems on combustion. Explosives:- Rocket fuels.
UNIT- IV **8 hrs**	Chemistry of Materials Liquid crystals: Introduction, classification of liquid crystals-thermotropic & lyotropic liquid crystal, different phases of thermotropic & lyotropic liquid crystal, chemical constitution and liquid crystalline behaviour, liquid crystalline behavior in homologous series, molecular ordering in different meso phases, applications of liquid Crystals in displays (LCD), OLED.

Text books:

1. A Text book of Engineering Chemistry - Shashi Chawla

2. A Text book of Engineering Chemistry - P.C. Jain & Monika Jain

3. Engineering Chemistry - O G Palanna

Reference books:

1. Chemistry of Engineering Materials - C.V. Aggrawal

2. An Introduction to Electrochemistry - Samuel. Glasston

BTEG-UG-C203: BASIC ELECTRONICS (2L 0T 0P)

Course Objective: This course focuses on

1. To introduce analog and digital electronics and their applications.
2. To introduce the communication systems and its applications.

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

1. Explain the working of diode and transistor and their applications.
2. Understand the basic digital circuits.
3. Understand the basic communication systems and its applications in modern era.

UNIT I **8 hrs**	**Analog Electronics-I:**. Working of PN Junction diode, V-I characteristics- Forward bias and reverse bias, Diode circuits-Half wave and Full wave rectifiers, Zener diode as voltage regulator, Special purpose diodes- LED, Photo detector. **Applications**- LED bulb, OLED Display, AMOLED Display.
UNIT-II **8 hrs**	**Analog Electronics-II:** Working of PNP and NPN transistors (BJT), CE, CB, CC mode configurations and Input/output characteristic curves, Types of transistor biasing, Introduction to FET. **Applications:** single stage RC coupled amplifier, transistor as a switch.
UNIT- III **8 hrs**	**Digital Electronics:** Number systems, Basic logic gates, Universal Logic gates, Boolean algebra, Implementation of Boolean functions using logic gates, MUX-DeMUX, encoder-decoder, **Applications:** RAM, ROM, Flash memory.
UNIT-IV **6 hrs**	**Communication Engineering:** Block diagram of basic communication system, Introduction to wireless communication- 1G, 2G, 3G, 4G, 5G. **Applications:** Internet of Things (IoT).

Text books :

I. Robert L. Boylestad and Louis Nashelsky: Electronic Devices and Circuit Theory, *Pearson*.2013

2. Albert Malvino and David Bates: Electronic Principles, McGraw Hill. 2016

3. Simon Haykin : Communication Systems, Willey.

Reference Books:

1. RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan.: Internet of Things, Willey

2. M. Morris Mano and M.D. Ciletti: Digital Design, *Pearson*

BTEG-UG-C204: MECHANICS OF SOLIDS (2L 0T 0P)

Course Objective: This course focuses on

Course Objectives:

1. The main aim of the course is to teach basic mechanics of solid bodies and their responses.
2. To teach the student problem solving problems related to different force parameters, inertia and energy.
3. To introduce the student about the shape and geometry of the body and concept of moment of inertia and its applications.

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

1. Solve moderately difficult problem on Force systems.
2. Have clear ideas of stress strains.
3. Can find out the CG and MI of any simple or composite body.
4. Have a firm idea on the inertia of a body and can solve energy related problems.

UNIT I **8 hrs**	**Coplanar Concurrent and non-concurrent Force System:** Importance of Mechanics in engineering; Types of forces, Resultant of a force system, graphical principles- parallelogram law, triangle law, polygon rule, analytical method, conditions of equilibrium, Concept of free body diagrams, Lami's theorem. Moment of a force, Varignon's theorem, couple, properties of couples, resultant of non-concurrent force system, conditions of equilibrium
UNIT-II **8 hrs**	**Centroids and Moment of Inertia:** Centroid: Concept of centre of gravity, centroid of area, centroid of line, concept of line of symmetry, location of centroid by direct integration of rectangular, triangular, semi-circular and quarter circular areas, centroid of composite areas, problems. (b) Moment of Inertia: MI of plane figure with respect to an axis in its plane, MI of plane figure with respect to an axis perpendicular to the plane of the figure; Parallel axis theorem; Mass moment of inertia of symmetrical bodies, e.g. cylinder, sphere, cone.
UNIT- III **8 hrs**	**Simple Stresses and Strains:** Mechanical properties of materials, concept of stresses and strains, stress-strain diagrams, yield stress, ultimate stress, limit of proportionality, elastic limit, working stress, factor of safety, Hooke's law, Young's modulus (Modulus of elasticity), rigidity modulus, bulk modulus, Poisson's ratio, relationship among the elastic constants, bars of varying cross sections, elongation due to self-weight.
UNIT-IV **6 hrs**	**Kinetics of Particles:** Newton's second law; Equation of motion; D.Alembert's principle and free body diagram; motion of connected bodies, Concept of Friction; Laws of Coulomb friction; Angle of Repose; Coefficient of friction. Principle of work and energy; Principle of conservation of energy; Power and efficiency. Problems.

Text Books:

1. "Engineering Mechanics" by S. Timoshenko et.al. Mcgrawhill Education India Pvt. Ltd.
2. Mechanics for Engineers Ferdinand P Beer & amp; McGraw Hill(Statics & Dynamics) R.R.Johnson (Jr.)
3. Engineering Mechanics J.L.Meriam & John Wiley(Vol. I & II) L.G.Kraige

Reference Books:

1. Text Book of Applied Ramamrutham S Dhanpat Rai Mechanics.
2. Engineering Mechanics K.L.Kumar Tata McGraw Hill
3. Engineering Mechanics S.S.Bhavikatti ; Wiley Eastern.
4. Mechanics of Materials E.J.Hearn Pergamon Press
5. Strength of Materials S.S.Bhavikatti Vikas
6. Strength of Materials Ferdinand L Singer Harper & Row
7. Strength of Materials B.S.Basavarajaiah Khanna
8. Strength of Materials S.Ramamrutham Dhanpat Rai.

BTEG-UG-C205: PROBLEM SOLVING USING COMPUTERS (2L 0T 0P)

Course Objective: This course focuses on

1. To formulate simple algorithms for arithmetic and logical problems
2. To translate the algorithms to programs (in C language)
3. To test and execute the programs and correct syntax and logical errors
4. To implement conditional branching, iteration and recursion
5. To decompose a problem into functions and synthesize a complete program using divide and conquer approach
6. To use arrays, pointers and structures to formulate algorithms and programs
7. To apply programming to solve matrix addition and multiplication problems and searching and sorting problems
8. To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration

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

1. Conceptualize solutions
2. Realize solutions using suitable data structure and programming constructs

UNIT I **8 hrs**	**Introduction to Programming:** Introduction to Programming (Flow chart/pseudocode, compilation etc.), Variables (including data types) **Arithmetic expressions and precedence** **Conditional Branching and Loops:** Writing and evaluation of conditionals and consequent branching, Iteration and loops
UNIT-II **8 hrs**	**Arrays** Arrays (1-D, 2-D), Character arrays and Strings **Basic Algorithms** Searching, Basic Sorting Algorithms, Finding roots of equations, idea of time complexity
UNIT- III **8 hrs**	**Function and Recursion** **F**unctions (including using built in libraries), Recursion with example programs such as Quick sort, Ackerman function etc.
UNIT-IV **6 hrs**	**Structure and Pointers** Pointers, Structures (including self referential structures e.g., linked list, notional introduction) **File handling**

Text books :

1. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Reference Books:

2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
3. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

BTEG-UG-C206: UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS (2L 1T 0P)

Course Objective: This course is designed to inculcate relation among human being, human-nature.

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

1. Develop a critical ability to distinguish between essence and form; or between what is of value and what is superficial in life (to appreciate the importance of fundamental issues related to their happiness and real success in the life & profession).
2. Move from discrimination to commitment (to develop sensitivity and awareness leading to commitment and courage to act on the basis of their own understanding, rather than merely on the basis of assumptions)
3. Discover what they consider valuable. Accordingly, they should be able to discriminate between valuable and the superficial in real situations in their life.

UNIT I **(10 hrs)**	**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-II **(10 hrs)**	**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 Practice Exercises and Case Studies will be taken up in Practice sessions.
UNIT- III **(15 hrs)**	**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 (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family! Practice Exercises and Case Studies will be taken up in Practice Sessions
UNIT-IV **(10 hrs)**	**Understanding Harmony in the Nature and Existence - Whole existence as Co- 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 -Practice Exercises and Case Studies will be taken up in Practice Sessions.

Text books :

1. R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2
2. R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics – Teachers Manual, Excel books, New Delhi, 2010.

Reference Books:

1. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
2. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Purblishers.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
5. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III,
6. 1972, limits to Growth, Club of Rome"s Report, Universe Books.
7. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
8. A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.
9. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
10. A.N. Tripathy, 2003, Human Values, New Age International Publishers.

Relevant websites, movies and documentaries

1. Value Education websites, http://uhv.ac.in, http://www.uptu.ac.in
2. Story of Stuff, http://www.storyofstuff.com
3. Al Gore, An Inconvenient Truth, Paramount Classics, USA

4. Charlie Chaplin, Modern Times, United Artists, USA
5. IIT Delhi, Modern Technology – the Untold Story
6. Gandhi A., Right Here Right Now, Cyclewala Productions

BTEG-UG-L207: ENGINEERING CHEMISTRY LABORATORY (0L 0T 3P)

Course Objective: This course focuses on

The course aims to enable the students to understand the practical aspects of chemistry, quantitative analysis and instrumentation techniques.

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

1. The students will be able to carry out various type of titrations and quantitatively assess the analytes.
2. Understanding and use of various instruments like spectrophotometer, potentiometer, conductometer, pH meter to assess various properties of a given compound.

At least Ten Experiment to be carried out in a semester

1. To estimate the weight of Mohr's salt crystal dissolved in 250 ml using KMnO4 solution and pure oxalic acid crystals.
2. To estimate the total hardness of given sample of water using EDTA solution and CaCO3.
3. To estimate the weight of FeCl3 using K2Cr2O7 and Mohr's salt.
4. To estimate the percentage of MnO2 in a given sample of pyrolusite using Oxalic Acid and KMnO4 solution.
5. To prepare a titration curve for phosphoric acid and sodium hydroxide by using pH meter.
6. Determination of strength of given HCl solution by titrating against NaOH conductometrically.
7. Determination of concentration of KMnO4 solution by spectrophotometer.
8. To determine the amount of sodium and potassium in a given water sample by flame photometer.
9. To determine the amount of Fe in the given solution by Potentionmetric titration.
10. To determination Ferrous ions in given sample of water spectrophotometrically.
11. To determine the number of components, present in organic mixture by thin layer chromatography and Rf value.
12. Synthesis and characterization of organic compounds (e.g. Iodoform).
13. Synthesis and characterization of inorganic compounds.

Text books :

1. Experimental Chemistry Note Book for Engineers- Dr.Lalit Kumar Sharma, Rajesh Kumar
2. Laboratory Manual on Engineering Chemistry- Anupama Rajput
3. Essentials of Experimental Engineering Chemistry- Shashi Chawla

Reference Books:

1. Vogel's Quantitative Chemical Analysis – J Mendhan, RC Denncy, JD Barnes, MJK Thomas
2. Instrumental methods of analysis – Willard, Merit & Dean

BTEG-UG-L208: PROGRAMMING LABORATORY (0L 0T 3P)

Course Objective: This course focuses on

The course aims to enable the students to understand the use of various programming constructs and data structures.

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

1. To formulate the algorithms for simple problems
2. To translate given algorithms to a working and correct program
3. To be able to correct syntax errors as reported by the compilers
4. To be able to identify and correct logical errors encountered at run time
5. To be able to write iterative as well as recursive programs
6. To be able to represent data in arrays, strings and structures and manipulate them through a program
7. To be able to declare pointers of different types and use them in defining self referential structures.
8. To be able to create, read and write to and from simple text files.

1. Familiarization with programming environment
2. Simple computational problems using arithmetic expressions
3. Problems involving if-then-else structures
4. Iterative problems e.g., sum of series
5. 1D Array manipulation
6. Matrix problems, String operations
7. Simple functions
8. Numerical methods (Root finding, numerical differentiation, numerical integration):
9. Programming for solving Numerical methods problems
10. Recursive functions
11. Pointers and structures
12. File operations

BTEG-UG-L209: ENGINEERING GRAPHICS AND DESIGN (0L 0T 4P)

Course Objective: The course is aimed at developing basic graphic skills, skills in preparation of basic drawings and skills in reading and interpretation of engineering drawings.

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

1. Use the drawing instruments effectively and able to dimension the given figures
2. Understand the standards and common cases as well as dimensioning in technical drawings development.
3. Understand the concept of projection and acquire visualization skills, projection of points and able to draw the basic views related to projections of Lines, Planes, Solids
4. Able to develop multi-aspect sketches, sectional views and geometries of the development of design projects.
5. Visualize objects in all dimensions and learn displaying techniques for graphical communication in design process.

UNIT-I	**Lettering, conventions and dimensioning. Scales:** Representative fraction, construction of plain and diagonal scales. Principles of orthographic projections following 1st angle projection.
UNIT- II	**Projection of points and Straight Lines:** Projection of points in all quadrants, Projections of lines in different positions with respect to the reference planes, true length, angle of inclination of lines with reference planes. **Projection of planes:** Projection of plane lamina of different geometrical shapes in different positions with respect to the reference plane
UNIT- III	**Projection of solids**: Projection of solids of different geometrical shapes by change of position method. **Section of Solids:** Section of solids of different geometrical shapes by change of position method.
UNIT- IV	**Orthographic Projection:** Conversion of pictorial views into orthographic projections of simple machine parts. **Isometric Projection:** Isometric axes, lines, planes and Isometric scale, Isometric Projections of prisms, pyramids, cylinders, cones and simple machine parts. **Computer Aided Drawing:** Introduction to AutoCAD, Basic commands for 2D drawing like: Line, Circle, Polyline, Rectangle, Hatch, Fillet, Chamfer, Trim, Extend, Offset, Dim style, etc.

Text books:

1. Engineering Drawing Vol. I & II, by Gopalakrishna
2. Engineering drawing by N.D.Bhatt

Reference books:

1. Machine drawing by N.D.Bhatt

BTCI-UG-C301: MATHEMATICS-III	**(3L 1T 0P)**
UNIT-I **(10 hrs)**	**Fourier Analysis:** Periodic functions, Trigonometric Series, Fourier series of odd and even functions, functions with arbitrary period, half range expansion, Fourier integrals, Fourier transforms, Fourier sine and cosine transforms, Convolution theorem (statement only).
UNIT-II **(12 hrs)**	**Partial Differential Equations** Definition, degree, order of PDE, Formulation of PDE, Linear and non-linear PDE. Solution of first order linear PDE, Lagrange's method. Solution of first order Nonlinear PDE. Charpit's method. Solution of higher order PDE by direct integration. Solution of higher order linear PDE with constant coefficients, homogeneous and nonhomogeneous, Derivations of one dimensional wave equation (vibrating string) and its solution by using method of separation of variables, simple problems. Solution of 2D Laplace's equation.
UNIT- III **(10 hrs)**	**Vector Calculus** Gradient, divergence and curl and their physical meaning and identities. Line surface and volume integrals. Simple problems.
UNIT-IV **(10 hrs)**	**Probability Theory** Introduction to probability, finite sample space, conditional probability and independency. Baye's theorem, one dimensional random variable, mean variance and expectation, Chebyschev's inequality, Two and higher dimensional random variables, covariance, correlation coefficients, least squares principle of curve fitting. Distributions: Binomial, Poisson, Uniform, Normal, Gamma, Chi square and exponential, simple problems.

Text Books:

1. C.E. Weatherburn: Vector Analysis

2. Erwin Kreyszig: Advanced Engineering Mathematics

Reference Books:

1. Meyer: Introductory Probability and Statistical Application – Addison-Wesley publishing company

2. I Sneddon: Elements of Partial Differential Equations.

BTCI-UG-C302: STRENGTH OF MATERIAL (3L 1T 0P)

Prerequisite: BTCI-UG-C204 Mechanics of Solids

Course Objectives:

1. To learn the fundamentals of deformable body mechanics in general and strength of material in particular.
2. To study the internal effects produced and deformations of bodies caused in structural elements by externally applied forces.
3. To gain insight into the strain energy concepts and statically indeterminate problems.
4. To introduce the concepts of elastic stability and buckling of bars
5. To expose the students to the basics of thin and thick cylinders subjected to pressure.
6. Finally, to understand the strength characteristics of different materials and structural members subjected to shear, torsion and bending.

Course outcomes: On successful completion of course, the learner will be able to:

1. Provide quick solutions to elementary problems of strength of materials.
2. Develop elementary skills of working stress design
3. Acquire all necessary fundamentals needed for pursuing courses on structural analyses and design

UNIT-I (9 hrs)	**Introduction:** Tension, compression & shear: types of external loads – self weight – internal stresses – normal and shear stresses – strain – Hooke's law – Poisson's ratio – relationship between elastic constants – stress strain diagrams working stress – elongation of bars of constant and varying sections – statically indeterminate problems in tension and compression – assembly and thermal stresses – strain energy in tension, compression and shear.
UNIT-II (12 hrs)	**Analysis of stress and strain**: stress on inclined planes for axial and biaxial stress fields - principal stresses - Mohr's circle of stress - principal strains - strain rosette – principal stress/strain problem as an eigenvalue problem. **Bending moment and shear force**: different types of beams - shear force and bending moment diagrams for simply supported overhanging and cantilever beams - relationship connecting intensity of loading, shearing force and bending moment - shear force and bending moment diagrams for statically determinate plane frames.
UNIT- III (10 hrs)	**Stresses in Homogeneous Beams:** Simple bending theory, derivation of pure bending equation, section modulus, moment of resistance, modulus of rupture, derivation of shear stress in beams, shear stress distribution across rectangular, triangular and circular sections, problems. **Torsion of circular Shaft** Pure torsion, derivation of pure equation, transmission of power, polar modulus of section, strength and stiffness of solid and hollow shafts, Equivalent moment and equivalent torque
UNIT-IV (11 hrs)	**Slope and Deflection – Double Integration Method:** Derivation of Double Integration Method, slope and deflection of statically determinate beams loaded with various type of loading.

	Deflection of beams: Slope and deflection by (a) Moment area method (b) Conjugate beam method. **Axially loaded compression members** Classification, definition of effective length, slenderness ratio, critical load, derivation of Euler's equation for a column hinged at both ends, Rankine-Gordon formula.

Text Books:

1. Reddy C S, **Basic Structural Analysis**
2. SS Bhavikatti, **Structural Analysis –I**

Reference Books:

1. C K Wang, **Structural Analysis**
2. R C Hibbeler, **Structural Analysis**
3. Rao Prakash, **Structural Analysis A unified approach**
4. Norris and Wilber, **Elementary Structural Analysis**
5. Junnarkar, **Mechanics of Structures** Vol. I and Vol. II
6. Timoshenko, **Theory of Structures**

BTCI-UG-C303: FLUID MECHANICS I (2L 1T 0P)

Prerequisite: Nil

Course Objectives: The objectives of this course are to:

Familiarize the students with fluid properties and their relationships with kinematic and dynamic characteristics of fluids and design pipe system.

Course Outcomes: On successful completion of course, the students will

1. Estimate hydrostatic forces on structures.
2. Estimate forces due to fluid-structure interaction.
3. Design and analyze piping systems and pipe –networks.
4. Plan experimental studies in fluid mechanics using the principles of dimensional analysis and similitude.

UNIT-I (8 hrs)	**Introduction:** Scope and importance of the subject, Definition of fluid, Distinction between a solid and a fluid, Distinction between a liquid and a gas, continuum. **Fluid Properties and Classifications:** Specific weight, mass density, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity, and their units, dimensions and significance. Classification of fluids – ideal and real fluids, Newtonian and non-Newtonian fluids, compressible and incompressible fluids.
UNIT-II (6 hrs)	**Fluid Pressure and Measurements:** Pressure at a point in a static fluid, Pascal law. Atmospheric, absolute, gauge and vacuum pressures. Pressure measurement- simple manometers and differential manometer.
UNIT- III (10 hrs)	**Kinematics of Fluid Motion** Introduction, methods of describing fluid motion- Lagrangian and Eulerian approach. Classification of flow – steady flow, unsteady flow, uniform flow and non-uniform flow, laminar and turbulent flow, compressible and incompressible flow, three two and one dimensional flow, continuity equation in differential form in Cartesian co-ordinates, continuity equation in one dimensional flow. **Dynamics of Fluid Flow** Euler's equation of motion in one dimension, Bernoulli's equation, limitation and modification of Bernoulli's equation. Application of Bernoulli's equation, venturimeter, orifice meter and pitot tube.
UNIT-IV (12 hrs)	**Laminar Flow & Turbulent Flow Through Pipes** Reynold's experiment, Head loss due to friction (Darcy-Weisbach equation), minor losses in pipe lines. Concept of equivalent pipe and equivalent length. **Flow Measurements** Flow through orifices and mouth pieces. Classification of orifice and mouth pieces. Hydraulic coefficients and their determination, Flow through notches and weirs, Rectangular, triangular, trapezoidal notches, broad crested weir.

Text Books:

1. Streeter V L and Wiley E B, **Fluid Mechanics**, McGraw Hill Book Co, New York
2. Jain A K and Seth S.M**, Hydraulics and Fluid Mechanics**, Standard Book House, N Delhi
3. Modi P N and Seth S M, **Hydraulics and Fluid Mechanics**, Eurasia Publishing House, New Delhi

Reference Books:

1. Kumar K L, **Engineering Fluid Mechanics**, Tata McGraw Hill, New Delhi
2. Subramanya K, **Theory and Applications of Fluid Mechanics**, Tata McGraw Hill New Delhi
3. Raghunath H M, **Fluid Mechanics and Machinery**, CBS Publishers and Distributors, New Delhi

4. Shames, **Mechanics of Fluids**, McGraw Hill Book Co.
5. SOM, **Fluid Mechanics and Machines**, Tata McGraw Hill New Delhi.

BTCI-UG-C304: TRANSPORTATION ENGINEERING-I (2L 1T 0P)

Prerequisite: Nil

Course Objectives:

1. To understand the importance of transportation and characteristics of road transport
2. To know about the history of highway development, surveys and classification of roads
3. To study about the geometric design of highways
4. To study about traffic characteristics and design of intersections
5. To know about the pavement materials and design

Course Outcomes:

1. Carry out surveys involved in planning and highway alignment.
2. Design cross section elements, sight distance, horizontal and vertical alignment.
3. Implement traffic studies, traffic regulations and control, and intersection design.
4. Determine the characteristics of pavement materials.
5. Design flexible and rigid pavements as per IRC.

UNIT-I (13 hrs)	**Introduction:** Highway planning survey, location, soil surveys, highway economics and highway financing. **Introduction to Transportation System Planning:** Definition of trip generation, factors governing trip generation, purpose of trip distribution, different methods of trip distribution, uniform growth factor method, purpose of trip assignment, purpose of model split, factors affecting model split.
UNIT-II (10 hrs)	**Highway Geometric Design:** Width, camber, gradient, sight distances, requirements of horizontal alignment – including radius of curvature, super elevation, curve resistance, grade compensation, transition curves and vertical curves.
UNIT- III (7 hrs)	**Traffic Engineering:** Vehicular and road user characteristics, traffic studies – speed, speed delay, origin and destination, volume, traffic density, traffic capacity, relationship between speed, travel time, volume, density and capacity, passenger car units, traffic signs, traffic signals.
UNIT-IV (8 hrs)	**Pavement Materials and Mix Design:** Subgrade soil properties, CBR test, aggregates, desirable properties, tests, bituminous materials, bitumen and tar, tests. Bituminous mixes, requirements, design, Marshall Method. Types of pavement structures, functions of pavement components, design factors.

Text Books:

1. Khanna and Justo, **Highway Engineering**.
2. Hewes, **Highway Engineering**.
3. Sehgal and Bhanot, **A Text Book of Highway Engineering**.

Reference Books:

1. Vazirani and Chandola, **Transportation Engineering Part I**
2. Kadiyali L R, **Traffic and Transportation Planning**.
3. Dr. Krishnamurthy, **Introduction to Bridges**.
4. Nayak B S, **A Book on Maintenance Engineering for Civil Engineers**.

BTCI-UG-C305: SURVEYING-I (2L 1T 0P)

Prerequisite: Nil

Course Objectives:

To impart knowledge about the surveying theories and practices like chain surveying, compass surveying, leveling, theodolite survey and tachometric surveying.

Course Outcomes:

The students would be able to know about

1. chain surveying
2. compass surveying
3. method of traversing to conduct survey
4. different levelling techniques
5. plane table survey procedures
6. survey technics using theodolite
7. tachometric surveying

UNIT-I (10 hrs)	**Introduction**: Importance of surveying, types of surveying, principle of surveying, provision of control, conventional signs, scales (plain and diagonal), plan and map. Chain survey, instruments, principles of chain survey, chaining and ranging, survey stations and lines, errors in chaining, chaining on uneven ground, chaining on sloping ground, basic problems in chaining, obstacle in chaining, field book entry, standard conventional symbols for different objects.
UNIT-II (12 hrs)	**Compass Survey:** Principles, use and adjustment of prismatic compass and surveyors compass, bearings and included angles, declination, local attraction, plotting of open and closed traverses, graphical adjustment of compass traverse, errors. **Plane Table Survey:** Methods, orientation, solving two and three points problems with Bessel,s method, traversing with plane table.
UNIT- III (8 hrs)	**Leveling:** Terms and definitions, differential leveling, checking of levels, reducing errors and mistakes in leveling, Methods of levelling.collimation correction, curvature and refraction, sensitiveness of bubble tube, profile leveling, cross sections, reciprocal leveling, two peg test, contouring - applications and uses, calculation of areas and volume, use of planimeter.
UNIT-IV (8 hrs)	**Theodolite Survey:** Theodolite description, measurement of horizontal and vertical angles, height and distance formulae, theodolite traverse, electronic theodolite.

Text Books:

1. Surveying and Levelling by N.N.Basak, TMH Publication
2. Surveying by B.C. Punamia, A.K. Jain and A.K. Jain, Vol. 1, Laxmi Publications (P) Ltd., New Delhi

Reference Books:

1. Surveying and levelling by T.P.Kanetkar and S. Kulkarni, Vol-I
2. Surveying by K.R. Arora, Standard Book House, Delhi
3. S.K.Duggal, Surveying, Vol-I, TMH Publications, New Delhi

BTCI-UG-C306: DISASTER MANAGEMENT (2L 1T 0P)

Prerequisite: NIL

Course Objectives:

1. To provide basic conceptual understanding of disasters.
2. To understand approaches of Disaster Management
3. To build skills to respond to disaster

UNIT-I (10 hrs)	**Definition and types of disaster** Hazards and Disasters, Risk and Vulnerability in Disasters, Natural and Man-made disasters, earthquakes, floods drought, landside, land subsidence, cyclones, volcanoes, tsunami, avalanches, global climate extremes. Man-made disasters: Terrorism, gas and radiations leaks, toxic waste disposal, oil spills, forest fires.
UNIT-II (8 hrs)	**Study of Important disasters** Earthquakes and its types, magnitude and intensity, seismic zones of India, major fault systems of India plate, flood types and its management, drought types and its management, landside and its managements case studies of disasters in Sikkim (e.g) Earthquakes, Landside). Social Economics and Environmental impact of disasters
UNIT- III (9 hrs)	**Mitigation and Management techniques of Disaster** Basic principles of disasters management, Disaster Management cycle, Disaster management policy, National and State Bodies for Disaster Management, Early Warming Systems, Building design and construction in highly seismic zones, retrofitting of buildings.
UNIT-IV (8 hrs)	**Training, awareness program and project on disaster management** Training and drills for disaster preparedness, Awareness generation program, Usages of GIS and Remote sensing techniques in disaster management, Mini project on disaster risk assessment and preparedness for disasters with reference to disasters in Sikkim and its surrounding areas.

Text Books:

1. Disaster Management Guidelines, GOI-UND Disaster Risk Program (2009-2012)
2. Damon, P. Copola, (2006) Introduction to International Disaster Management, Butterworth Heineman.
3. Gupta A.K., Niar S.S and Chatterjee S. (2013) Disaster management and Risk Reduction, Role of Environmental Knowledge, Narosa Publishing House, Delhi.
4. Murthy D.B.N. (2012) Disaster Management, Deep and Deep Publication PVT. Ltd. New Delhi.
5. Modh S. (2010) Managing Natural Disasters, Mac Millan publishers India LTD.

BTCI-UG-L307: BUILDING DRAWING USING AutoCAD (1L 0T 4P)

Prerequisite: BTG-UG-L209 Engineering Graphics and Design

Course Objective

1. To understand the principles of planning and bylaws
2. To draw plan, elevation and section of load bearing and framed structures
3. To draw plan, elevation and section of public and industrial structures
4. To prepare detailed working drawing for doors, windows, etc.

Course Outcomes (COs):

1. Apply the principles of planning and bylaws used for building planning.
2. Draw plan, elevation and section for various structures.

Course Contents

Classification of buildings - Principles of planning - Dimensions of buildings - Building bye-laws for floor area ratio, open spaces - Orientation of buildings - Lighting and Ventilation - Planning and preparing sketches and working drawings of Residential buildings (Flat and sloping roof), Schools, Hostels, Hospitals, Single-storey factory buildings with trusses. Detailed working drawings of the component parts - Doors and Windows - Roof Trusses - Staircases-Toilets.

References:

1. Shah M.G. Kale. M. &Patki SY Building Drawing, Tata Mcgraw Hill, New Delhi, 2000

BTCI-UG-L308: MATERIAL TESTING LAB-I (0L 0T 3P)

Prerequisite: BTCI-UG-C302: STRENGTH OF MATERIAL

Course Objectives:

1. To conduct tension test on steel, aluminium, copper and brass
2. To conduct compression tests on spring, wood and concrete
3. To conduct flexural and torsion test to determine elastic constants
4. To determine hardness of metals

Course Outcomes:

1. Conduct tension test on steel, aluminium, copper and brass
2. Conduct compression tests on spring, wood and concrete
3. Conduct flexural and torsion test to determine elastic constants
4. Determine hardness of metals

Course Contents:

1. Tension test on mild steel.
2. Compression test on cast iron.
3. Compression test on wood.
4. Shear test on mild steel specimen.
5. Torsion test on mild steel specimen.
6. Rockwell hardness test.
7. Brinell,s hardness test.
8. Impact test: (a) Izod (b) Charpy.
9. Fatigue test (Demonstration)

(b) Test on Bricks:

Compressive strength, Absorption, Efflorescence.

(c) Test on Bitumen:

Specific gravity, viscosity, softening point, flash and fire point, ductility, penetration value.

Reference Books:

1. H.E.Davis, G E Torxell and C T Wiskocil, **The Testing and Inspection of Engineering Materials**. , McGraw Hill Book Company.
2. A.J.Fanner, **Mechanical Testing of Materials**, Geergenewnes Ltd. London.
3. A V K Suryanarayana, **Testing of Metallic Materials**, Prentice Hall of India.
4. S K Khanna and C E G Justo, **Highway Materials Testing**.
5. Relevant IS Codes.

BTCI-UG-L309: SURVEYING PRACTICE-I (0L 0T 3P)

Prerequisite: BTCI-UG-C305: SURVEYING-I

1. Introduction to chain survey. To conduct direct and indirect ranging.
2. Construction of geometric figures using chain and tape- triangle, pentagon, trapezium, hexagon.
3. To erect perpendicular from a given point to a given line and from a given line to any given point using: (i) Chain and tape only. (ii) Cross staff.
4. Study of compass and construction of regular pentagon and hexagon.
5. Construction of a quadrilateral
6. Distance between two inaccessible points.
7. Plane table surveying – radiation and intersection method.
8. Solving three point problem by Bessel,s method.
9. Plane table traversing.
10. Levelling – study of instrument.
11. Simple leveling – to find out elevation of different points shown on the ground with respect to given arbitrary B.M.
12. To find difference in level between two points by height of instrument method.
13. To find difference in level between two points by rise and fall method including inverted staff reading.
14. To find difference in level between two points by reciprocal leveling.
15. Theodolite – study of the instrument.
16. Measurement of horizontal angle by method of repetition.
17. Measurement of horizontal angle by method of reiteration.
18. Measurement of vertical angles.
19. To find RL when the base of object is inaccessible.
20. Single plane method.
21. Double plane method.
22. Distance between inaccessible points.
23. Theodolite traversing.
24. Repetition.
25. Test.

Reference Books:

1. Kanetkar T P, and Kulkarni S V, **Surveying and Levelling Part I & II**
2. Punmia B C, **Surveying Vol I**, Lakshmi Publications.

BTCI-UG-M310: CONSTITUTION OF INDIA (2L 0T 0P)

Prerequisite: Nil

Course Objectives: Following are the objectives of this course

- To know about Indian constitution.
- To know about central and state government functionalities in India.
- To know about Indian society.

Course Outcomes: Upon completion of the course, students will be able to:

1. Understand the functions of the Indian government
2. Understand and abide the rules of the Indian constitution.
3. Understand and appreciate different culture among the people.

UNIT-I (6 hrs)	**Introduction:** Historical Background, Constituent Assembly of India, Philosophical foundations of the Indian Constitution , Preamble, Fundamental Rights, Directive Principles of State Policy, Fundamental Duties, Citizenship, Constitutional Remedies for citizens.
UNIT-II (8 hrs)	**Parliamentary form of government:Executive**: President; Prime Minister and Council of Ministers - Election, Powers and Functions; **Legislature**:Lok Sabha and Rajya Sabha– Composition, Powers and Functions. **Judiciary**– Supreme Court, Composition, Powers, Functions and Judicial Review- Judicial Activism.
UNIT- III (8 hrs)	**Amendment of the constitution:** Powers and procedure; State Government – Governor, Chief Minister and Council of Ministers – Powers and Functions. **Party System:** National and regional Parties; Trends in Party System Election Commission – Electoral Reforms and voting Behavior.
UNIT-IV (8 hrs)	**Election Commission: Election Commission:** Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women. **Rural Local Government:** Evolution Structure and Function**;** Gram Sabha; Gram Panchayat; Panchayat Samiti; Zila Panchayat. **Urban Local government:** Evolution structure and function; Municipal corporation**;** Nagar panchayat.

Text Books:

1. Durga Das Basu, “Introduction to the Constitution of India “, Prentice Hall of India, New Delhi.
2. R.C.Agarwal, (1997) “Indian Political System”, S.Chand and Company, New Delhi.
3. Maciver and Page, “ Society: An Introduction Analysis “, Mac Milan India Ltd., New Delhi.
4. K.L.Sharma, (1997) “Social Stratification in India: Issues and Themes”, Jawaharlal Nehru University, New Delhi.
5. Our Constitution: An Introduction to India’s Constitution and Constitutional law by KashyapSubhash
6. Introduction to the Constitution of India by D. D. Basu

Reference Books:

1. Sharma, Brij Kishore, “Introduction to the Constitution of India: Prentice Hall of India, New Delhi.
2. U.R.Gahai, “Indian Political System “, New Academic Publishing House, Jalaendhar.
3. R.N. Sharma, “Indian Social Problems “, Media Promoters and Publishers Pvt. Ltd.

BTCI-UG-M309: ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE (2L 0T 0P)

Prerequisite: Nil

Course Objectives:

1. The course aims at imparting basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.
2. Holistic life styles of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
3. The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system

Course Outcome:

Ability to understand, connect up and explain basics of Indian Traditional knowledge, modern scientific perspective.

UNIT-I (8 hrs)	**Basic structure of Indian knowledge system.** Basic features and importance of Vedic knowledge; AstadashVidhya- 4 Vedas, (Rig-Veda, Sama-Veda, Yajur-Veda, and Atharva) 4 Upa Vedas (Dhanurveda, Gandharvaveda, Ayurveda and Arthasastra), 6 Vedangs (Siksha, Chhanda, Vyakarana, Nirukta, Jyotisha and Kalpa) And 4 Upangas (Dharma Sastra, Memangsa, Purana and Tarka Sastra). **Modern Science and Indian Knowledge:** Basic features, significance and relevance in modern society. The Idea of Zero, the Decimal System, Numeral Notations, Fibonacci Numbers, Binary Numbers, a Theory of Atom, Plastic Surgery and Ayurveda.
UNIT-II (6 hrs)	**Yoga and holistic health care:** Origin of Yoga & its brief development, Meaning of Yoga & its importance, Yoga as a Science of Art (Yoga Philosophy), Meaning of meditation and its types and principles. **Principles of Yogic Practices:** Meaning of Asana, its types and principles, meaning of Pranayama, its types and principles, Meaning of Kriya its types and principles.
UNIT- III (6 hrs)	**Philosophical Traditions:** Serve DarsanaSangraha: meaning features and significance (CharvakaSystem,Bauddha System, Arhata or ,Jaina System, Ramanuja System, Purna-prajna System, Nakulis-PasupataSystem,Saiva System, Pratyabhijna or Rcognitive System, Rasesvara or Mercurial System, Vaiseshika or Aulukya System, Akshapada or Nyaya System, Jaiminlya System, Papiniya System, Sankhya System)
UNIT-IV (8 hrs)	**Indian Linguistic Tradition**: **Theoretical**: Phonetics: Sounds of a language–Phonology: Sound patterns–Morphology: Word formation and structure–Syntax: Sentence structure–Semantics: Study of meaning. **Applied**–Understanding and teaching other languages, translation, speech therapy. **Indian Artistic Tradition:** Basic features, significance and importance and region associated: Chitra Kala , Murti Kala, Bastu Kala, and Sangit, (The Famous Traditional Art Forms in India: Warli Art, Gond Art, Madhubani, Miniature Paintings ,Tanjore Paintings, Kalamkari , Kalighat Pats PhadPai)

Text books:

1. V Shivakrishnan (Ed) : Cultural Heritage Of India Course Material VidhyaBhawan Mumbai 5th Edition , 2014
2. The Sarva-Darsana-Samgraha, Or Review Of The Different Systems Of Hindu Philosophy By Madhava Acharya Publication Date 1882 ,Topics Hinduism ,Publisher London,Contributor Robarts - University Of Toronto.

3. K.S Subrahmanialyer, Vakyapadiya Of Bhartrihari(Brahman Kanda) Deccan College Pine 1965. Panini Shiksha, MotilalBanarasidas

Reference Books:

1. V.N Jha , Language, Thoughts And Reality.
2. Pramod Chandra, Indian Arts , Abhinav Publications 1897
3. Light on Yoga by B.K.S. Iyengar
4. The Heart of Yoga: Developing a Personal Practice by T.K.V. Desikachar
5. The Seven Spiritual Laws of Yoga by Deepak Chopra
6. The Secret Power of Yoga: A Woman's Guide to the Heart and Spirit of the Yoga Sutras by Nischala Joy Devi
7. Yoga: The Iyengar Way by Silva, Mira, and Shyam Mehta

BTCI-UG-C401: MATHEMATICS IV (2L 1T 0P)

Prerequisite: BTCI-UG-C301: Engineering Mathematics III

Course Objective: Ability to implement the basic principles of numerical techniques in day to day application of Civil Engineering.

Course Outcome: Identify the application potential of numerical methods.

1. Solve Civil engineering problems using numerical methods.
2. Demonstrate application of numerical methods to civil engineering problems.
3. Apply differential equations and integration to solve civil engineering problems.
4. Outline and Propose the finite difference techniques Apply the concept of partial differential equations and Solve practical problems

UNIT-I (10 hrs.)	**Introduction:** Approximate and Significant number, rounding off numbers, errors and their computation. **Linear Algebraic Equations** (a) Gauss Elimination method (b) Gauss Jordan Elimination Method (c) Choloskey Decomposition method (d) Gauss Siedal and Jacobi Iterative methods**:** **Matrix Inversions:** (a) Gauss Elimination method. (b) Gauss Jordan Elimination Method.
UNIT-II (12 hrs)	**Eigen Value Problems** (a) Forward and Inverse Iteration Method. (b) Jacobi Method **Application of Finite Difference Techniques** (a) Statically determinate and indeterminate beams. (b) Buckling of columns. Finite Differences and Interpolation
UNIT- III (8 hrs)	**Numerical Integration by:** (a) Trapezoidal rule (b) Simpsons rule (c) Gaussian Quadrature **Solution of Non-linear Equations by:**(a) Bisection method (b) Newton - Raphson method
UNIT-IV (6 hrs.)	**Solution of Differential Equations by:** (a) Runge – Kutta method(b) Adams – Bashforth method. **Curve Fitting**

Text Books:

1. Salvadori M G and Baron M L, **Numerical Methods in Engineering**, Prentice Hall of India, New Delhi.
2. Krishnaraju N and Muthu K U, **Numerical Methods for Engineering Problems**, Macmilan India, New Delhi.

Reference Books:

1. Sastry S S, **Introductory Methods of numerical Analysis**, Prentice Hall of India
2. Rajasekaran S, **Numerical Methods for Science and Engineering**, Wheeler and Co.Pvt Ltd.
3. Ralph G Stanton, **Numerical Methods in Science and Engineering**, Prentice Hall of India, New Delhi.

BTCI-UG-C402: STRUCTURAL ANALYSIS (2L 1T 0P)

Prerequisite: BTCI-UG-C302: Strength of Material

Course Objective:

1. To impart the principles of elastic structural analysis and behavior of indeterminate structures.
2. To impart knowledge about various methods involved in the analysis of indeterminate structures.
3. To apply these methods for analyzing the indeterminate structures to evaluate the response of structures
4. To enable the student get a feeling of how real-life structures behave
5. To make the student familiar with latest computational techniques and software used for structural analysis.

Course Outcome:

The student after undergoing this course will be able to:

1. To understand analysis of indeterminate structures and adopt an appropriate structural analysis technique.
2. Determine response of structures by classical, iterative and matrix methods.

UNIT-I (11 hrs)	**Strain Energy:** Strain energy, strain energy due to axial force and bending moment, virtual work on rigid and elastic bodies, principle of virtual work, Bettistheorm, Maxwell's law of reciprocal deflections. **Deflection of beams and trusses:** Deflection of trusses by unit load method, deflection of beams using unit load method and castigliano's theorem.
UNIT-II (8 hrs)	**Three hinged arches:** Analysis of three hinged parabolic and semi-circular arches. Determination of horizontal reaction, normal thrust, radial shear and bending moment. **Cables and Suspension bridges** Analytical solution of cable structure, length of a cable, three hinged suspension bridges with stiffening girder.
UNIT- III (12 hrs)	**Analysis of simple statically indeterminate beams by:** (a) Consistent deformation method (b) Three-moment method. **Analysis of Indeterminate beams and frames by:** (a) Slope deflection method, derivation of slope - deflection equation, slope-deflection equation for beams and frames, problems. (b)Moment distribution method: Steps of moment distribution method, distribution factor at a pinned end and at a fixed end, problems.
UNIT-IV (10 hrs)	**Analysis of Indeterminate beams and frames by:** (a) Slope deflection method, derivation of slope - deflection equation, slope-deflection equation for beams and frames, problems. (b)Moment distribution method: Steps of moment distribution method, distribution factor at a pinned end and at a fixed end, problems.

	Kani's Method of Analysis Analysis for continuous beams without support sinking. Analysis of symmetrical frames with hinged and fixed boundary conditions.

Text Books:

1. Reddy C S, **Basic Structural Analysis**.
2. Rao Prakash, **Structural Analysis – A unified approach**.
3. Norris and Wilber, **Elementary Structural Analysis**.

Reference Books:

1. Junnarkar, **Mechanics of Structures Vol. I & II**
2. Timoshenko ,**Theory of Structures.**

BTCI-UG-C403: SURVEYING-II (2L 1T 0P)

Prerequisite: BTCI-UG-C305: SURVEYING-I

Course Objective: To impart knowledge about different advance surveying technics like triangulation, setting out of curves, hydrographic survey, astronomical survey, photogrammetry etc.

Course objectives: On successful completion of course, the learners will be able to

1. Different types of curves and different methods for setting out of simple and transition curves
2. Different adjustment methods of survey measurements
3. Astronomical survey procedures
4. Triangulation system for conducting survey
5. Hydrographic survey methods
6. Use of terrestrial and aerial photogrammetry to conduct survey

UNIT-I (8 hrs)	**Tacheometry:** Principles, methods – analytic tacheometer , distance and elevation formulae for horizontal and inclined site with staff vertical and normal, Beaman,s stadia arc – range finder.
UNIT-II (12 hrs)	**Curves:** Introduction, simple curve, basic definition, compound curve, reverse curve, transition curve, lemniscate curve, vertical curve, design of vertical curve. **Construction Survey** Introduction, instruments for setting out – pipe-line, building and structures, staking out a highway.
UNIT- III (9 hrs)	**Photogrammetric Survey** **(a)** Terrestrial: principles, photo-theodolite, horizontal and vertical distances of points from photographic measurements. **(b**: Aerial camera, scale of vertical photograph, drag and lift computation of flight plane. **Underground Survey** Introduction, application of underground surveys, auxiliary theodolite, aligning the theodolite, problems in tunnel survey.
UNIT-IV (7 hrs	**Hydrographic Survey:** Shore line survey, methods of sounding, locating, reduction of sounding and plotting, three-point problem, nautical sextant and station pointer. **Geodetic Survey** Introduction, Geodesy, Definition of Geodetic Survey, concept, application, advantages and disadvantages

Text Books:

1. Kanetkar T P and Kulkarni S V, **Surveying and Levelling Part I & II** , Pune Vidyarthi Griha Prakashana, Pune.
2. Devid Clark, **Plane and Geodetic Surveying for Engineers, Vol I & II,** CBS Publication
3. Norman Thomas, **Surveying,** Edward Arnold Publishers (ELBS) London.

Reference Books:

4. Arora K R, **Surveying Vol. I & II**, Standard Book House New Delhi
5. Punmia B.C, **Surveying Vol. I & II,** Lakshmi Publications, New Delhi

BTCI-UG-C404: FLUID MECHANICS-II (2L 1T 0P)

Prerequisite: BTCI-UG-C303: FLUID MECHANICS I

Course Objective: The course is intended to give students good understanding of internal architectural details and functioning of 8085 and 8086 microprocessors. The students will have thorough and in-depth knowledge of microprocessors, its architecture, working principles including timing diagrams and assembly language programming using hand assembly as well as assembler.

Course outcomes: On successful completion of this course, learners should be able to

1. Identify the basic element and functions of the 8085/8086 microprocessor.
2. Describe the architecture of the 8085/8086 microprocessor and its peripheral devices.
3. Demonstrate the operation between the microprocessor and its interfacing devices.
4. Write programs for microprocessor applications using the assembly language.
5. Complete the experiments in laboratory and present the technical report.

UNIT-I (12 hrs)	**Flow in Open Channels** Introduction to free surface flow (Uniform and Non-uniform Flows), Chezy's and Manning's formulae, hydraulically efficient channel cross section, rectangular, trapezoidal and circular section, specific energy, specific energy curve, critical depth, alternate depth
UNIT-II (9 hrs)	**Flow in Open Channels** critical flow in a rectangular channel, Froude's number and its significance, hydraulic jump in a horizontal rectangular channel, loss of energy in a hydraulic jump, gradually varied flow, characteristics and classification of flow profiles **Model Studies** Similitudes, dimensionless parameters, Reynold's law and Froude's law, Reynolds and Froude model laws, undistorted and distorted models.
UNIT- III (8 hrs)	**Application of Impulse Momentum Principle** Momentum equation, impact of free jets, force exerted by a jet on stationery and moving flat plates, forces exerted by a jet on stationery and moving curved vanes, series of vanes.
UNIT-IV (10 hrs)	**Hydraulic Machines & Centrifugal Pump** General layout of hydro power plants, classification of turbines, (Pelton Wheel and Francis Turbine) impulse turbine, reaction turbine, principle, work done and efficiencies of impulse and reaction turbines. Classification, description, and general principle of operation of centrifugal pump, work done and efficiencies.

Text Books:

1. Jain A K, **Fluid Mechanics**, Khanna Publishers, New Delhi.
2. Modi P N and Seth S M, **Hydraulic and Fluid Mechanics**, Standard Book House, New Delhi.

3. Chow, Vente, **Open Channel Hydraulic**, Tata McGraw Hill Publishing, N.Delhi

4. Jagadish Lal, **Hydraulic Machines**, Metropolition Book Co. Pvt. Ltd. N.Delhi.

Reference Books:

1. Raghunath H.M, **Fluid Mechanics and Machinery**, CBS CBS Publishers, New Delhi

2. Subramanya K, **Theory and Applications of Fluid Mechanics**, Tata McGraw Hill

3. Streeter V L and Wiley E B, **Fluid Mechanics**, McGraw Hill Co.

4. Garde R L, **Fluid Mechanics through Problems**, New Age International.

BTCI-UG-C405: CIVIL ENGINEERING MATERIALS AND CONCRETE TECHNOLOGY (2L 1T 0P)

Prerequisite: NIL

Course Objectives:

4. To understand the properties of ingredients of concrete
5. To study the behaviour of concrete at its fresh and hardened state
6. To study about the concrete design mix
7. To know about the procedures in concreting
8. 5. To understand special concrete and their use

Course outcomes:

1. Test all the concrete materials as per IS code.
2. Design the concrete mix using ACI and IS code methods.
3. Determine the properties of fresh and hardened of concrete.
4. Design special concretes and their specific applications.
1. 5. Ensure quality control while testing/ sampling and acceptance criteria.

UNIT-I (8 hrs.)	**Construction Materials:** Tiles: For flooring, roofing and decorative – properties and uses. Lime: Properties and uses. Timber: Varieties, properties, uses, defects, seasoning and preservation. **Foundations** Introduction to different types of foundations – masonry footing, isolated, combined and strap, RCC footings, raft foundation, friction piles and bearing piles, caissons and coffer dams **Brick Masonries** Bricks: Types, refractive and modular bricks and their application. Bonds in bricks, reinforced brick work, hollow block construction and rat trap masonry.
UNIT-II (10 hrs.)	**Walls:** Load bearing and partition walls, damp proof construction for walls and floors. **Doors and Windows:** Different types of doors and windows with necessary sketches. **Flooring** Granolithic, concrete, marble, and terrazzo flooring including methods of laying. **Roofing:** Sloped roofs – lean to, coupled and collared roofs, king post and queen post trusses **Stairs** Types of R.C. stairs with sketches **Plastering and Painting:** Colour washing, White washing and distempering of walls. **Reinforced Concrete Construction:** Lintels, beams, slab, and chejjas – functions, methods of construction and detailed sketches, form work details for R.C.C. columns, beams and slabs.
UNIT- III (12 hrs.)	**Concrete Technology** **Fresh Concrete**: Definition, Cement: Types, composition, properties and uses. Coarse aggregate and fine aggregate, properties and uses. Physical tests on ingredient of fresh concrete as per I.S. Quality of water and water-cement ratio, segregation, and bleeding. Mix design, proportion, batching, workability, mixing, placing, compacting, various methods of curing, Test on fresh concrete as per IS.
UNIT-IV (6 hrs)	**Admixtures:** A brief description on commonly used admixtures and their effects on concrete. **Hardened Concrete**: Maturity, creep, shrinkage, Destructive and non-destructive tests as per IS: 13311 **Mixed Design**: as per IS: 10262.

Text Books:

1. Shetty M S, **Concrete Technology**, S. Chand and Co, New Delhi

2. **I.S Hand Book on Mix design**, BIS New Delhi

Reference Books:

1. Punmia B C, **Building Construction**, Lakshmi Publications, New Delhi.
2. Sushil Kumar, **Building Construction**, Standard Publication and Distributions, New Delhi.
3. S.P.Arora and S.P. Bindra, **Building Construction**, Dhanpat Rai Publications.
4. **National Building Code**, BIS, New Delhi.

BTCI-UG-0406: OPEN ELECTIVE I	**(2L 1T 0P)**
To be chosen from pool of electives.	

BTCI-UG-L407: FLUID MECHANICS LAB (0L 0T 3P)

Prerequisite: BTCI-UG-C303: Fluid Mechanics I & BTCVL-UG-C404: Fluid Mechanics-II

1. Calibration of V-notch
2. Calibration of rectangular notch
3. Calibration of Cippoletti notch
4. Calibration of Orifices
5. Calibration of mouthpieces
6. Calibration of venture meter
7. Calibration of Orifice meter
8. Determination of friction factor of pipes
9. Experiment on Venturi flume
10. Experiment on standing wave flume
11. Calibration of broad crested weir
12. Calibration of curved weir
13. Impact of jet on vanes
14. Test on Centrifugal pump
15. Test on Pelton Turbine
16. Test on Francis Turbine
17. Demonstration of Kaplan Turbine
18. Revision of experiments

Reference Books:

1. Modi P N and Seth S M, **Hydraulics and Fluid Mechanics**, Standard Book House.
2. Jain A K, **Fluid Mechanics**, Khanna Publishers.
3. Subramanian K, **Theory and Applications of Fluid Mechanics**, Tata McGraw Hill Publishing Co. Ltd, New Delhi.

BTCI-UG-L408: MATERIAL TESTING LAB -II (0L 0T 3P)

prerequisite: BTCI-UG-C306: Building Materials and Concrete Technology

Course Objectives: To test the basic properties ingredients of concrete, fresh and hardened concrete properties.

(a) Test on cement

1. Determination of Specific Gravity of cement.
2. Determination of fineness of cement.
3. Determination of standard consistency of cement.
4. Determination of setting times of cement.
5. Determination of soundness of cement.
6. Determination of strength of cement.

(b) Test on Fine and Coarse aggregates for concrete

1. Determination of specific gravity of fine aggregate.
2. Determination of specific gravity of coarse aggregate.
3. Determination of fineness modulus of fine aggregate.
4. Determination of fineness modulus of coarse aggregate.
5. Determination of bulking of sand.
6. Determination of clay (or silt) content in sand.

(c) Test on concrete

1. Determination of workability of concrete by slump test.
2. Determination of workability of concrete by compaction factor test.
3. Determination of workability of concrete by Vee-Bee consistometer test.
4. Determination of compressive strength of concrete.
5. Determination of tensile strength of concrete.

(d) Test on Aggregates

1. Determination of aggregate impact value.
2. Determination of aggregate abrasion value. (Los Angeles test)
3. Flakiness and Elongation indices of aggregates – demonstration
4. Rebound hammer test – demonstration.

(e) Revision of experiments

Reference Books:

1. Shetty M S, **Concrete Technology**, S Chand and Co.
2. Neville A M, **Properties of concrete**, ELBS London.

3. Gurucharan Singh, **Materials of Construction**.
4. V V Shastry and M L Gamber, **Laboratory Manual of Concrete Testing Part I & II**

BTCI-UG-L409: SURVEYING PRACTICE – II (0L 0T 3P)

Prerequisite: BTCI-UG-C403: SURVEYING-II

Tacheometric Surveying:

a) Measurement of distances and elevations:

(i) For line of sight horizontal

(ii) For line of sight inclined.

b) To find the gradient of line joining two points at different elevations.

1. Determination of Tacheometric constants.
2. Tacheometric traverse.
3. Contouring using Tacheometer.
4. Use of direct reading Tacheometer.

Curve Surveying:

i) Setting out simple curve by chain and tape.

ii) Offsets from long chord

iii) Offsets from tangent

iv) Successive bisection of areas

v) Offsets from chord produced

vi) Simple curve using Theodolite

vii) Setting out compound curves

viii) Setting out reverse curves

ix) Parallel straight

x) Unparallel straight

xi) Transition curves

xii) Combined curves

xiii) Bernoulli,s Lemniscate.

Theodolite Surveying: Permanent adjustments of theodolite

Study of Instruments:

a) Hand level

b) Clinometers, Abney Delosey,s Ceylon Ghat Tracer, Indian pattern clinometers.

c) Sextants: (i) Box sextant (ii) Nautical sextant.

d) Use of Planimeter

e) Study of total station.

Reference Books:

a. Kanetkar T P and Kulkarni S V, Surveying and Levelling Part I & II

b. Punmia B C, Surveying Vol I & II, Lakshmi Publications, New Delhi

BTCI-UG-C501: ENGINEERING ECONOMICS (3L 1T 0P)

Prerequisite: Nil

Course Objective:

1. The aim of the course is to provide basic understanding of economics for engineer.
2. The course will improve student's abilities on economic activities which happen in the daily life.
3. Students can able to develop their own perceptive of economy based on logical reasoning and
4. To sensitize the students on issue and problems on Indian economy.

UNIT-I (8 hrs)	**Introduction to basic economics and Engineering economy**- How people make decisions, interact and how the economy works, Relationship among Science, Engineering, Technology and Economic Development, Utility Analysis, Laws of Demand and Supply, Market Equilibrium; Elasticity of demand its measurements and application.
UNIT-II (8 hrs)	**Engineering Production function**- Output Elasticity, Homogeneous production function, technological progress, Production Function in the short and long run, difference between firm and industry, Economies of scale, Concepts of Cost and revenue Analysis, Break-Even analysis.
UNIT- III (8 hrs)	**Meaning of Market, Structure of markets**: Pricing and Output Determination in Perfect competition, Monopoly, Monopolistic and Oligopoly; Macroeconomic concepts-National Income, Business Cycles, Inflation, Deflation, Stagflation; Monetary and Fiscal Policy.
UNIT-IV (7 hrs)	**Performance of Indian economy since 1951**-Primary Secondary and Tertiary sectors; Economic reforms and liberalization-Indian's growth post liberalization, India's five year plans, Niti Aayog; International Trade- Foreign Exchange Rate, Balance of Payment.

Text Books:

1. Gregory. N. Mankiw, "Principles of Microeconomics", Cengage Learning, 7th Edition, 2013.
2. Rudiger Dornbusch and Stanley Fischer, "Macroeconomics", McGraw-Hill Europe. 11th Edition, 2011.
3. Gregory. N. Mankiw, "Principles of Macroeconomics", Cengage Learning, 6th Edition, 2012.
4. JagdishHanda, "Monetary Economics", Routledge, 2nd Edition, http://dl4a.org/uploads/pdf/Monetary%20Economics.pdf.

Reference Books:

1. Engineering Production Functions: A Survey; Author(s): Sören Wibe; Source: Economica, New Series, Vol. 51, No. 204 (Nov., 1984), pp. 401-411; Stable URL: https://www.jstor.org/stable/2554225
2. Lipsey and Chrystal, "Economics", Oxford University Press, 13th Edition, 2015.

BTCI-UG-C502: GEOTECHNICAL ENGINEERING-I (2L 1T 0P)

Preriquisite: Nil

Course Objectives:

To impart knowledge about the basic soil properties and classification of soil and basic soil mechanics like effective stress theory and permeability of soil.

Course Outcome:

At the end of this course students will know about

1.The basic soil properties like grain size distribution, specific gravity, density etc.

2. Different classification systems of soil.

3. Effective stress imposed due to the overburden of soil considering different types soil condition.

4. Permeability of soil medium and its effect on the soil properties and construction.

UNIT-I (8 hrs)	**Index Properties** Soil as a three phase material, physical properties of soil – specific gravity, void ratio, porosity, degree of saturation, bulk density, dry density, saturated density, relative density, moisture content, inter-relationships between them, Atterberg's limits, sieve analysis, hydrometer analysis, field identification of soils. **Soil Classification IS** classification of soils.
UNIT-II (8 hrs)	**Flow through Soils** Concept of permeability, Darcy's law, factors affecting permeability, laboratory determination of permeability of soils, permeability of stratified deposits, principles of effective, neutral and total stresses, quick sand condition and capillarity in soils. **Seepage through Soils** Laplace equation (no derivation), flow nets, their properties and applications, phreatic line, piping, graded filters.
UNIT- III (7 hrs)	**Compaction of Soils** Optimum moisture content, maximum dry density and zero air voids line, factors affecting compaction, IS light and heavy compaction tests. **Stress Distribution in Soils** Assumptions, limitations and comparison of Boussinesq's and Westergaard's theory for stresses in soils, use of Boussinesq's and Westergaard's equations for determination of stress distribution (no derivation) for point load, and uniformly loaded circular and rectangular areas.
UNIT-IV (9 hrs)	**Compressibility of Soils** Concept of consolidation of soils, definition of - compressibility index, coefficient of compressibility, coefficient of volume compressibility, normally consolidated, pre-consolidated, over consolidated and under consolidated soils, one dimensional consolidation – Terzaghi's theory (no derivation), consolidation test, Casagrande's method for determination of pre-consolidation pressure. **Shear Strength of Soils** Concept of shear strength of soils, Mohr-Coulomb theory and failure criteria, laboratory determination of shear strength parameters – direct shear, tri-axial, unconfined compression and vane shear tests, limitations of test results.

Text Books:

1. Punmia P C, **Soil Mechanics and Foundations**, Laxmi Publications Pvt. Ltd.

2. Murthy V N S, **A Text Book of Soil Mechanics and FoundationEngineering**, Sai Kripa Technical Consultant, Bangalore.

3. Gopal Ranjan and Rao A S R, **Basic and Applied Soil Mechanics**, New Age International

Reference Books:

1. Terzagi K and Peck R B, **Soil Mechanics in Engineering Practice,** A Wiley International

2. Taylor D W, **Fundamentals of Soil Mechanics**, Asia Publishing House, Bombay

3. Ramiah B K and Chickanagappa L S, **Hand Book of Soil Mechanics andFoundation Engineering**, Oxford and IBH

BTCI-UG-C503: DESIGN OF RC STRUCTURE (2L 1T 0P)

Prerequisite: BTCI-UG-C402: Structural Analysis-I

Course Objectives:

To provide a comprehensive knowledge on the behaviour of R.C.C structures.

2. To understand the significance of working stress and limit state design methods.

3. To study comprehensively, the design and reinforcement detailing of beams, columns, slabs, staircases, footings.

Course Outcome:

At the end of this course students will:

Understand the behaviour of R.C.C structures. Assess and apply the appropriate design methodology and reinforcement detailing of different types of RCC structural elements i.e. Beams, columns, slabs, staircases and foundations.

UNIT-I **(7 hrs)**	**Design by Working Stress Method** Role of reinforcement, behavior of RCC sections, Principles of design of reinforced concrete members – Straight line theory, assumptions, determination of neutral axis, determination of stress and strain due to bending moment Basic concepts of design for bending moment and shear forces - under reinforced, over-reinforced and balanced beam. Design of singly/ Doubly reinforced sections.
UNIT-II **(14 hrs)**	**Limit State Method** Principle of limit state method of design, characteristic loads, characteristic strength, partial safety factors, stress strain characteristics of concrete and steel. Introduction to stress block parameters for collapse, limit state of serviceability. **Limit State Design of Beams** Design of rectangular beams (singly and doubly reinforced), design for shear and torsion.
UNIT- III **(9 hrs)**	**Design of One Way and Two Way Slabs** Limit state design of one way and two way slabs for various boundary conditions **Limit State Collapse in Compression** Limit state collapse in compression: design of axially loaded short RC columns of square/ rectangular cross-sections under axial loading.
UNIT-IV **(10 hrs)**	**Column footing** Types of footing, design of isolated footing. **Stair cases** Types of stairs, design of dog legged stair case.

Text Books:

1 Shah H J, **Reinforced Concrete Vol.I,** Charotar .

2 Sinha N.C and Roy S.K, **Fundamentals of Reinforced Concrete**, S Chand .

3 Shah N L and Karve S R, **Illustrated Reinforced Concrete Design**,

4 Karve S R and Shah Limit **state Theory and Design of Reinforced Concrete**.

5 Jain A K **Reinforced Concrete – Limit State Design**.

Reference Books:

1. Mallick & Gupta **Reinforced concrete Design**

2. P.C. Varghese **Limit State Design of Reinforced Concrete**
3. Pillai and Menon **Reinforced Concrete Design**, Tata McGraw Hill
4. **IS 456 – 2000** Code of Practice for plain and reinforced concrete.
5. **SP-16 -1980** Design Aids for Reinforced Concrete IS 456 – 1978

BTCI-UG-C504: ENGINEERING HYDROLOGY (2L 1T 0P)

PREREQUISITE: BTCI-UG-C404: Fluid Mechanics-II

Course Objectives:

To build on the students' background in hydrology and understanding of water resources systems.

Course Outcome:

On completion of the course, the students will be able to:

1. Understand the essential components of the hydrologic cycle, water balance, surface storage, groundwater flow and storage.
2. Perform hydrologic and hydraulic routing for river flood flows using hydrological data.
3. Know measurement techniques for calculating yield from well.
4. Understand different aspects pertaining to reservoir planning and perform calculations for reservoir capacity and estimation of reservoir life.

UNIT-I (11 hrs)	**Introduction** Definition and scope of the subject, world water resources, water resources of India, hydrologic cycle, hydrological data, hydrological equation. **Precipitation** Types of precipitation, rainfall intensity, duration and measurement, annual precipitation- depth, area, duration analysis, mean rainfall on a basin, isohytal, Theission polygon, supplementing missing precipitation records, double mass curve analysis, moving average curve.
UNIT-II (11 hrs)	**Infiltration** Definition and factors affecting infiltration, infiltrometers, infiltration indices, infiltration equations, infiltration curves, determination of loss rates. **Water Losses** Evaporation and transpiration, factors affecting evaporation, measurement and estimation of evaporation, evaporation formulae, measure to reduce evaporation, transpiration process and factors affecting transpiration, evapo-transpiration.
UNIT- III (6 hrs)	**Runoff** Surface runoff process, types of catchments, catchments characteristics, factors affecting runoff, estimation of runoff, rainfall runoff correlations, use of multi-linear regression equation, stream gauging, mass flow curves and their uses.
UNIT-IV (8 hrs)	**Hydrographs** Hydrographs and their characteristics, base flow separation, unit hydrographs, derivation of unit hydrograph, instantaneous unit hydrograph, S – hydrograph and its use, Snyder's synthetic unit hydrograph, uses of unit hydrograph.

Text Books:

1. Ven te Chow, **Applied Hydrology**, McGraw Hill
2. Mutreja, **Applied Hydrology**, McGraw Hill

Reference Books:

1. Subramanya K, **Engineering Hydrology**, Tata McGraw Hill
2. Raghunath H M, **Hydrology**, Wiley New Delhi, Kanna Publishers

BTCI-UG-C505: ENVIRONMENTAL ENGINEERING (2L 1T 0P)

PREREQUISITE: NIL

Course Objectives:

The objectives of the study are

1. To discuss the various systems of water supply and factors affecting the water supply.

2. To discuss the water treatment processes of water supply.

3. To introduce the various types and disposal methods of municipal solid waste.

Course Outcome:

After finishing of this course, the students will able to

1. Assess water supply schemes depending on population forecasting demand.
2. Understand various unit operations under water treatment plant.
3. Prepare a proper distribution network for water supply to individual households.
4. Know about various disposal method for proper Solid Waste Management and rules and regulation for sustainable waste management.

UNIT-I (10 hrs)	**Water supply engineering**- water demands, types of demands, per capita demand, factors affecting demand, design period. Forecasting population- different methods and their suitability. Sources of water- surface water sources, intakes, groundwater sources.
UNIT-II (12 hrs)	**Quality of water**– water quality parameters, drinking water standards, physical, chemical and bacteriological analysis of water, pollution and contamination of water, sources, classification and prevention of water pollution, water borne diseases, impurities in water. Treatment of water (process details and design considerations)- aeration, plain sedimentation, sedimentation with coagulation, optimum dosage of coagulant, filters and their different types, disinfection, water softening, miscellaneous advanced treatment methods, removal of iron and manganese, arsenic and fluoride removal technologies, fluoridation and defluoridation, desalination, membrane filtration.
UNIT- III (12 hrs)	**Water supply schemes** – gravitational, pumping and combined schemes, pumps and pumping stations. **Transmission of water** – materials of water supply pipes, distribution systems, different layouts of pipe networks, hardy-cross method of analysis, house connection from mains, valves, meters and hydrants, storage and balancing reservoirs, pressure in distribution system, storage and distribution reservoirs, capacity of reservoirs, type of reservoirs, detection and prevention of leaks in distribution systems and maintenance. Water supply under emergencies.
UNIT-IV (8 hrs)	**Introduction to Municipal Solid Waste and Biomedical Waste Management**. Characteristics of Municipal solid waste. Collection, segregation and conveyance of Municipal Solid Wastes. Disposal methods of Municipal and Biomedical Solid Wastes. Energy generation and recovery. Waste management and handling rules and regulations. Waste to energy approach for municipal solid wastes. Introduction to biomedical waste rules.

Text Books:

1. CPHEEO Manual on water supply and treatment, Ministry of Urban Development.

2. Birdie, G. S., and Birdie, J. S., Water Supply and Sanitary Engineering, Dhanpat Rai and Sons, New Delhi, 2007.

3. Sawyer and McCarty, Chemistry for Environmental Engineering, Tata McGraw-Hill, New Delhi, 2003.

Reference Books:

1. Modi, P. N., Water Supply Engineering, Standard Book House, New Delhi, 2010.

2. D. Srinivasan. Environmental Engineering. PHI publication.

BTCI-UG-P506: PROGRAMME ELECTIVE I (2L 1T 0P)

To be chosen from pool of electives.

BTCI-UG-L507: ENVIRONMENTAL ENGINEERING LABORATORY (0L 0T 3P)

1. Determination of solids: Total solids, suspended solids, dissolved solids, volatile solids, fixed solids, settable solids.

2. Determination of Alkalinity, Acidity and pH.

3. Determination of Calcium, Magnesium and total Hardness.

4. Determination of Chlorides.

5. Determination of Dissolved Oxygen.

6. Determination of Residual Chlorine and chlorine demand.

7. Determination of percentage available chlorine in Bleaching powder.

8. Determination of B.O.D.

9. Total count test and MPN determination.

10. Filter sand analysis – Effective size and uniformity coefficient.

Reference Books

1. **Standard methods for the examination of Water and Waste water**, ALPHA – AWWA - WPCF
2. Sawyer and McCarty, **Chemistry for Environmental Engineering**.
3. **IS: 3025 -1964, Methods of sampling and test** (physical and chemical) for water used in Industry.
4. S K Hussain, **A Text Book of Water Supply and Sanitary Engineering**.
5. **Methods for Chemical Analysis of Water and wastes** – 1974 U.S. EPA t echnology transfer 625/6-75003 p.p 266 – 267.
6. G S Birdie, **Environmental Engineering.**
7. **Drinking Water Standards**, IS: 10500 – 1983.

BTCI-UG-L508: GEOTECHNICAL LAB (0L 0T 3P)

Prerequisite: BTCI-UG-C502: GEOTECHNICAL ENGINEERING-I

Course objectives: To understand the laboratory tests used for determination of physical, index and Engineering properties of soil.

List of Experiments

1. Determination of natural moisture content.
2. Determination of specific gravity
3. Determination of Atterberg's limits.
4. Determination of in-situ unit weight by

(a) sand replacement method

(b) core cutter method.

5. Determination of coefficient of permeability by

(a) Constant head permeameter

(b) Variable head permeameter.

6. Compaction test – Standard and modified compaction tests, use of Proctor needle.
7. Determination of shear strength characteristics by

(a) Direct shear test

(b) Unconfined compression test

(c) Triaxial test (no pore pressure and volume change measurement)

(d) Vane shear apparatus

8. Field Tests – Demonstration of the following tests:

(a) Cone penetration tests

(b) CBR tests

References:

1. IS: 2720 Part II, 1973, Soil test, determination of Water Content
2. IS: 2720 Part III sec: I, 1980, Soil test, determination of Specific Gravity.
3. IS: 2720 Part XXIX, 1975, Soil test, determination of dry density of soils in place by the core cutter.
4. IS: 2720 part IV, 1965, method of test for soil, grain size analysis.
5. IS: 2720 part V, 1965, determination of liquid and plastic limits
6. IS: 2720 part VI, 1964, determination of shrinkage factors
7. IS: 2720, part XXVIII, 1966, determination of dry density of soil in place by sand replacement method.
8. IS: 2720, part VII, 1965, determination of dry density by using light compaction
9. IS: 2720 part XVII, 1966, soil test, laboratory determination of permeability
10. IS: 2720 part XI, 1971, soil test, determination of shear strength

11. IS: 2720 part XIII, 1972, soil test, direct shear test
12. IS: 2720, part XXXIX, sec. I, 1977, soil test, direct shear test.
13. IS: 2720 part X, 1973, soil test, determination of unconfined compression
14. IS: 2720 part XVI 1965, Laboratory determination of CBR
15. Bowles J E, Engineering Properties of Soil and their Measurement, McGraw Hill
16. Lambe T W, Soil Testing for Engineers, John Wiley and Sons
17. Cheng Liu and Jack B Evett, Soil Properties, Testing, Measurements and Evaluation, Prentice Hall New Jersey.

BTCI-UG-C601: TRANSPORTATION ENGINEERING-II (2L 1T 0P)

Prerequisite: Transportation Engineering-I

Course Objectives: The main objective of the course is to:

I. Introduce different transportation systems and their importance and their role in development

II. Understand standards and norms of National and International organizations which are framed for efficient functioning of existing transport systems

III. Impart Knowledge regarding the functioning of various components like rails, sleepers, Tracks, Geometric curves, Runways, Taxiways Aprons Wear houses, Jetties etc

IV. Design elements like horizontal curves, vertical curves, super elevation etc

V. Analyze how signal systems ,visual aids and Markings etc help in safe working of transportation systems

Course outcomes: After completing this course the student must demonstrate the knowledge and ability to:

1. Gain knowledge regarding various specifications and standards set by organizations and official bodies.
2. Differentiate the working of various transport systems and their working in different scenarios
3. Understanding the functions of various components in Rail, Air, Water transport systems and their importance.
4. Capable of carrying out surveys needed to be done while constructing Railways Airports and seaports
5. Have an in depth knowledge on curve sections super elevations and many other design elements
6. Explain the working of various design elements used in different Transport systems
7. Calculate entities like maximum permissible loads on rails ,degree of curves, permissible speeds on various gauges etc

UNIT-I (10 hrs)	**Introduction** Railway terminology, reasons for laying a new railway line, factors influencing the proposed route, railway surveys – reconnaissance survey, preliminary survey, location survey. **Tractive Resistance:** Resistance due to friction and wind action, resistance due to curves, resistance due to gradients, resistance due to speed of the train, hauling capacity and tractive effort. **Alignment Details** Grades and curves, effects of normal and ruling gradients, use of vertical profile, humps, sags, pusher and balanced grades, super elevation, equilibrium cant, cant deficiency and grade compensation.
UNIT-II (10 hrs)	**Permanent Way** Component parts, ballast, sleepers, rails, fastenings, railway creep, anti-creep devices, guard rails, maintenance and improvement of permanent way, drainage. **Points and Crossing** Necessity of turn-outs, switches, types of track junctions, design of a turn-out. **Stations and Yards:** Types of railway stations, classification of stations and yards.
UNIT- III (10 hrs)	**Signaling and Interlocking** Objectives and principles of signaling, classification of signals, types of signals in stations and yards, different methods of interlocking. **Tunnels:** Advantages of tunneling, shape, and size of tunnels, tunnel alignment, shafts and pilot tunnels. **Tunneling through soft rock and soils**: Different methods adopted, tunneling using shield, methods of tunneling, lining of tunnels.

UNIT-IV **(8 hrs)**	**Tunneling through hard rock**: Different methods of tunneling through hard rock, grouting and lining of tunnels. **Miscellaneous topics**: Tunnel ventilation, dust removal. **AIRPORTS** Factors to be considered in airport planning, ICAO classification of airports, site selection, airport surveys. **Airport Geometric Standards**: Runway length, width, sight distance, grades and change of grades, taxiways, aprons, orientation of runway, effect of wind direction and cross wind component including wind rose diagram. **Visual Aids** – night aids, instrumental landing systems and their functioning.

Text Books

1. Anita, **Railway Engineering**.
2. Agarwal and Soudhi**, Introduction to Railway Engineering.**
3. Arora and Saxena, **A Text Book of Railway Engineering**

Reference Books:

1. Rangwala, **Railway Engineering**
2. Vazirani and Chandola, **Transportation Engineering**
3. Srinivasan, **Dock, Harbours and Tunnels**.
4. Morgan,**Harbours.**
5. Khanna, Arora and Jain, **Airport Planning and Design**.
6. Sehgal and Bhanot, **A Text Book on Highway Engineering and Airport**

BTCI-UG-C602: GEOTECHNICAL ENGINEERING-II (2L 1T 0P)

Prerequisite: Geotechnical Engineering-I

Course Objective: To impart knowledge about the analysis and design of different types of foundations.

Course Outcomes: The students would be able

1. To know about the stress distribution on soil due to foundation loading.
2. To know about the design criteria of different types of foundations.
3. To analyze and design different types of shallow foundations like isolated and raft footing.
4. To analyze and design pile foundations.
5. To calculate the settlement of soil due to foundation loading.

UNIT-I (13 hrs)	**Soil Exploration:** Objective, methods of boring, requirements of good sampler, types of samples, sampler tubes, significant depth, depth and spacing of bore holes, penetration tests, exploration log, planning of exploration programme, Content of Geotechnical investigation report. **Earth Pressure**: Rankine and Coulomb,s theories for active and passive condition, Bell,s equation for C-F soil, earth pressure at rest - factors influencing earth pressure like surcharge, water table and wall friction.
UNIT-II (14 hrs)	**Stability of Slopes** Finite and infinite slopes,types of failure of finite slopes, method of slice and friction circle, effect of sudden draw down and submergence. **Bearing Capacity of Shallow Footings** Tezaghi,s theory (no derivation), modes of shear failure, factors affecting bearing capacity, allowable bearing pressure IS recommendations – permissible, total and differential settlement, estimation of bearing capacity from plate load and penetration tests.
UNIT- III (8 hrs)	**Pile Foundation:** Pile driving, bearing capacity of a single pile in clay and sand – Engineering News and Hiley,s formulae, IS pile load test, group action and negative skin friction.
UNIT-IV (7 hrs)	**Well Foundation:** Components of well foundation, depth of well as per IRC, sinking of wells, tilts and shifts. **Soil Improvement Techniques:** Introduction, methods of stabilization – mechanical, cement, lime and grouting, pre-loading, de-watering and vibroflotation techniques.

Text Books:

1. Arora K R, **Soil Mechanics and Foundation Engineering**, Standard Publishers an
2. Gopal Ranjan and Rao A S R, **Basic and Applied Soil Mechanics**, New Age International
3. Punmia B C, **Soil Mechanics and Foundations**, Laxmi Publications
4. Murthy V N S, **A Text Book of Soil Mechanics and Foundation Engineering**, Sai Kripa Technical Consultant, Bangalore

Reference Books:

1. Bowels J E, **Foundation Analysis and Design**, McGraw Hills Book Company

2. Srinivaslu and Vaidyanathan, **Hand Book of Soil Mechanics and FoundationEngineering**, Tata McGraw Hill Book Company.

3. Ramiah B K and Chickanagappa L S, **Hand Book of Soli Mechanics and FoundationEngineering**, Oxford and IBH.

4. Hsai – Yang Fang, **Foundation Engineering Hand Book**, CBS Publishers

BTCI-UG-C603: DESIGN OF STEEL STRUCTURES (2L 1T 0P)

Prerequisite: BTCI-UG-C402 Structural Analysis

Course Objective: To introduce the students to limit state design of structural steel members subjected to compressive, tensile and bending loads, including connections. Design of structural systems such as roof trusses, gantry girders as per provisions of current code (IS 800 - 2007) of practice for working stress and Limit state Method.

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

1. Understand the concepts of various design philosophies
2. Design common bolted and welded connections for steel structures
3. Design tension members, understand the effect of shear lag, and understand the design concept of axially loaded columns and column base connections.
4. Understand specific problems related to the design of laterally restrained and unrestrained steel beams.

UNIT-I (10 hrs)	**Introduction:** Introduction to Pre-engineering building. Structural steel types – Mechanical Properties of structural steel- Indian structural steel products. Steps involved in the Design Process -Steel Structural systems and their Elements -Type of Loads on Structures and Load combinations- Code of practices, Loading standards and Specifications - Concept of Allowable Stress Method, and Limit State Design Methods for Steel Structures-Relative advantages and Limitations-Strengths and Serviceability Limit states. Allowable stresses as per IS 800.
UNIT-II (8 hrs)	**Connections:** Type of Fasteners- Bolts Pins and welds- Types of simple bolted and welded connections Relative advantages and Limitations-Modes of failure-the concept of Shear lag-efficiency of joints- Axially loaded bolted connections for Plates and Angle Members using bearing type bolts –Prying forces and Hanger connection– Design of Slip critical connections with High strength Friction Grip bolts.- Design of joints for combined shear and Tension- Eccentrically Loaded Bolted Bracket Connections- Welds-symbols and specifications- Effective area of welds-Fillet and but Welded connections-Axially Loaded connections for Plate and angle truss members and Eccentrically Loaded bracket connections.
UNIT- III (14 hrs)	**Tension Members:** Types of Tension members and sections –Behavior of Tension Members modes of failure-Slenderness ratio- Net area – Net effective sections for Plates, Angles and Tee in tension – Concepts of Shear Lag- Design of plate and angle tension members-design of built up tension Members- Connections in tension members – Use of lug angles – Design of tension splice. **Compression Members** Types of compression members and sections–Behavior and types of failures-Short and slender columns- Current code provisions for compression members- Effective Length, Slenderness ratio –Column formula and column curves- Design of single section and compound Angles-Axially Loaded solid section Columns subjected to biaxial bending - Design of Built up Laced and Battened type columns – Design of column bases – Plate and Gusseted bases for Axially loaded columns- Splices for columns.
UNIT-IV (10 hrs)	**Flexural Members** Types of steel Beam sections- Behavior of Beams in flexure- Codal Provisions – Classification of cross sections- Flexural Strength and Lateral stability of Beams –Shear Strength-Web Buckling, Crippling and defection of Beams- Design of laterally supported Beams- Design of solid rolled section Beams- Design

	of Plated beams with cover plates - Design Strength of Laterally unsupported Beams – Design of laterally unsupported rolled section Beams- Purlin in Roof Trusses-Design of Channel and I section Purlins. Concepts of Allowable stress design for bending and Shear –Check for Elastic deflection-Calculation of moment carrying capacity –Design of Laterally supported Solid Hot Rolled section beams-Allowable stress deign of Angle Tension and Compression Members and estimation of axial load carrying capacity.

Text Books:

1. Subramanian.N, "Design of Steel Structures", Oxford University Press, New Delhi, 2013.
2. Gambhir. M.L., "Fundamentals of Structural Steel Design", McGraw Hill Education India Pvt.
5. Ltd., 2013
6. Duggal. S.K, "Limit State Design of Steel Structures", Tata McGraw Hill Publishing Company,
7. 2005

Reference Books:

1. Narayanan.R.et.al. "Teaching Resource on Structural Steel Design", INSDAG, Ministry of
2. Steel Publications, 2002
4. Sai Ram. K.S. “Design of Steel Structures “Dorling Kindersley (India) Pvt. Ltd., New Delhi,
3. 2nd Edition, 2015, www.pearsoned.co.in/kssairam
5. Shiyekar. M.R., "Limit State Design in Structural Steel", Prentice Hall of India Pvt. Ltd,
4. Learning Pvt. Ltd., 2nd Edition, 2013
6. Bhavikatti.S.S, "Design of Steel Structures" By Limit State Method as per IS:800– 2007, IK
5. International Publishing House Pvt. Ltd., 2009
7. Shah.V.L. andVeena Gore, "Limit State Design of Steel Structures", IS 800–2007, Structures Publications, 2009.
8. IS 800 :2007, General Construction in Steel - Code of Practice, (Third Revision), Bureau of Indian Standards, New Delhi, 2007.
9. SP 6(1) Hand book on structural Steel Sections

BTCI-UG-C604: ESTIMATION COSTING AND VALUATION (2L 1T 0P)

Prerequisite: Nil

Course Objective:

- Determination of quantities of items and labour requirement of civil engineering works.
- Preparation of estimate of the civil engineering works.
- Preparation of specification of construction items.
- To introduce the students in depth knowledge of professional practice as well the quantity analysis of construction works like, multi-storied structures, Water works & sanitary works, Irrigation works, Road estimates, culverts, etc.

Course Outcome:

- The students will get a diverse knowledge of estimating, costing and professional practice, which will be use full in tackling real life problems.
- The students will be able to understand the procedure to carry out the estimation and steps to prepare reports of construction works.
- The students will learn the purpose and importance of valuation

UNIT-I (8 hrs)	**Earth Work Calculation:** Measurement of earth work by cross sections, spot levels, contours, mass diagram and its characteristics. **Specifications:** Definition, types, principles, detailed specification for different components of buildings.
UNIT-II (13 hrs)	**Specifications:** Definition, types, principles, detailed specification for different components of buildings. **Rate Analysis** Purpose, factors affecting, over-head charges, turn-out of work, rate analysis for different items of building.
UNIT- III (8 hrs)	**Departmental Procedure** Functioning and organization of PWD, tender and its notification, EMD and security deposit, qualification of contractor, responsibilities of engineer, owner, contractor, different methods of execution of work, measurement book, nominal muster roll, running bill, agreement, schedule rate, contract: - types of contract, termination of contract, work slip, arbitration. olumn bases – Plate and Gusseted bases for Axially loaded columns- Splices for columns.
UNIT-IV (13 hrs)	**Valuation** Purpose of valuation, different methods of valuation (open land and land with buildings), valuation of properties, types of rent, rent fixation, depreciation – different methods, book value, market value, scrap and salvage value, time value of money, interest factors, amortization, deferred payments. **Estimation** Definition, types of estimate, units of measurement, method of estimation, project contingencies, work charged establishment, plinth area, carpet area, estimation for buildings, R.C.C. works, roads.

Text Books:

1. Dutta B N, **Estimating and Costing in Civil Engineering**.
2. Chakraborti M, **Estimating and Costing in Civil Engineering**.
3. Birdie , **Estimating and Costing in Civil Engineering**.

Reference Books:

1. CPWD Manual for Standard Specification and Rate Analysis.

2. PWD Sikkim Schedule of Rates.
3. Roshan H Nanavati, **Professional Practice**.

BTCI-UG-P605: PROGRAMME ELECTIVE II (2L 1T 0P)

To be chosen from pool of electives.

BTCI-UG-L606: ESTIMATION AND COSTING-PRACTISE (0L 0T 3P)

Prerequisite: BTCI-UG-C604: Estimation Costing and Valuation

Taking out quantities and preparing abstract of estimated cost for:

1. Residential load bearing structure (use both centre-line and long-wall short-wall method)
2. Office building – framed structure.
3. Slab, culvert, water tank.
4. Waste weir
5. Earth work calculation for roads, reservoirs.

BTCI-UG-L607: COMPUTER AIDED STRUCTURAL ANALYSIS AND DESIGN LAB (0L 0T 3P)

Prerequisite: BTCI-UG-C503: Design of RC Structure & BTCI-UG-C603: Design of Steel Structures

Course Outcomes (COs): Students will be able to create and analyze framed structures elements in a design software.

List of Experiments

1. Introduction to Design Software's Graphical User Interface.
2. Creating nodes and members, model generation of simple structural components.
3. Usage of model editing tools to modify a single member and multiple members.
4. Creating models, assigning support, member and material specification.
5. Creating models with load on members.
6. Creating models with different load cases/combinations.
7. Creating model, performing analysis and design a G+2 framed structure.

Software needed:

1. STAAD Pro V8i
2. ETABS
3. SAP 2000

Reference:

1. STAAD.Pro V8i Technical Reference Manual – Bentley Communities.
2. Web reference: https://www.csiamerica.com/products/etabs/watch-and-learn
3. Web reference: https://www.csiamerica.com/products/sap2000/watch-and-learn

BTCI-UG-I608: INDUSTRIAL TRAINING/ SEMINAR

Each student has to undergo industrial training for a minimum period of TWO weeks. This may be taken in a phased manner during the vacation starting from the end of fifth semester or to attend winter training course on courses beyond the scope of normal curriculum organized by the department by calling experts from outside. Student has to submit to the department a training report in the prescribed format and also make a presentation of the same. The report should include the certificates issued by the industry or by department.

BTCI-UG-C701: CONSTRUCTION PLANNING, ORGANIZATION & EQUIPMENTS (2L 1T 0P)

Course Objectives:

- To train the students with the latest and the best in the rapidly changing fields of Construction Engineering, Technology and Management.
- To prepare the students to be industry leaders who implement the best engineering and management practices and technologies in the construction industry.
- To continually work with industry to enhance the program's effectiveness and the opportunities for innovation in the construction industry.
- To conduct research to develop advanced technologies and management approaches.

Course Outcome: On successful completion of the programme, the students will

- Be able to apply theoretical and practical aspects of project management techniques to achieve project goals.
- Possess organizational and leadership capabilities for effective management of construction projects.
- Be able to apply knowledge and skills of modern construction practices and techniques.
- Have necessary knowledge and skills in accounting, financing, risk analysis and contracting.
- Be capable of using relevant software packages for planning, scheduling, executing and controlling of construction projects.

UNIT-I (6 hrs)	**Introduction** Management - Characteristics, Purpose, Different level Management, Roles and Skills. Project, Project management, Project life cycle, Introduction to Construction management- Classification of construction works, Requirement of Construction Industry, Characteristics, Importance, Necessity, Objective, Function Various Construction Stages, Construction Team.
UNIT-II (6 hrs)	**Function of Construction Management** **Construction Planning**: Principles of planning, Objectives, Stages of planning by different agencies. **Construction Organization:** Principles of Organization, type of organization for construction team. **Project Updating** Data required for updating, updating flow chart, Target delivery date, Process and progress report on project updating.
UNIT- III (10 hrs)	**Network Analysis** Introduction, Definition, Terminology, Classification of network, Fulkerson's rule for numbering the events. Network logic, Difference between AOA and AON diagram, Common error in drawing network, Scheduling- Gantt or Bar charts, milestone charts, Network analysis- Objective, Procedure and advantage of network technique, CPM and PERT, Work break down structure.
UNIT-IV (14 hrs)	**Project scheduling and Resource levelling:** Introduction, Resource levelling and allocation, importance of project schedule and other project schedule details. Network crashing and cost-time trade off **Management of Construction Equipment's** Classification of construction equipment: Earthwork equipment and Concreting equipment, factor affecting selection of construction equipment's, Plant and equipment acquisition.

Text Books

1. Kumar Neeraj Jha, **Construction Project Management,** Theory and Practice, PEARSON.

2. K K CHITKARA, **Construction Project Management**, Planning Scheduling and Controlling, McGraw Hill Education (INDIA).

Reference Books:

1. Seetharam S, **Construction Engineering and Management**, Umesh Publication, Delhi

2. Sengupta B, Guhatata H, **Construction Management and Planning**, McGraw Hill Companies.

3. Punmia B C, and Khandelwal K K, **Project Planning and Control with PERT and CPM,** Laxmi Publication.

BTCI-UG-P702: PROGRAMME ELECTIVE III (2L 1T 0P)

To be chosen from pool of electives.

BTCI-UG-P703: PROGRAMME ELECTIVE IV (2L 1T 0P)

To be chosen from pool of electives.

BTCI-UG-P704: PROGRAMME ELECTIVE V **(2L 1T 0P)**

To be chosen from pool of electives.

BTCI-UG-O705: OPEN ELECTIVE II **(2L 1T 0P)**

To be chosen from pool of electives.

BTCI-UG-L706: STRUCTURAL DESIGN AND DRAWING LAB (0L 0T 3P)

Prerequisite: BTCI-UG-C503: Design of RC Structure & BTCI-UG-C603: Design of Steel Structures

Rectangular Combined Footing: Types of footing, pressure distribution under footing, purpose of combined footing.

[1 sheet]

Stair Case: Types of stairs, live load on stairs, general notes on design of stairs, design of dog-legged and open-newel types.

[1 sheet]

Retaining Walls: Types of retaining wall, general design requirement, design of cantilever retaining wall and counter fort type retaining wall.

[1 sheet]

Water Tanks: Introduction, requirement of materials, design of water tank as per IS code 3370, rectangular and circular tanks resting on ground.

[1 sheet]

Columns and beams: Built-up columns, column splices, column bases subjected to axial loads, gusseted bases subjected to only axial loads.

[2 sheets]

Roof Trusses: Design of roof truss, purlin and bearing plate.

[2 sheets]

Welded plate girders: Design of plate girders

[1 sheet]

Reference Books

1. Duggal S K, **Design of Steel Structures**
2. Arya A S and Ajmani J R, **Design of Steel Structures.**
3. **IS: 800** – 1974
4. **SP 6 (1) ISI 64**, Structural Steel Section
5. **Teaching Resource for Structural Steel Design**, prepared by INSDAG.
6. **SP-16** Design Aids for IS: 456 – 1978
7. **SP – 34**, Hand Book on Concrete Reinforcement and Detailing.
8. **IS: 3370 Part II & IV**, Code of Practice for Concrete Structures for the Storage of Liquids
9. Krishnaraju N, Advanced **Reinforced Concrete Design**.
10. Shah H J, **Reinforced Concrete Vol. I**, Charotak Publishing House
11. Dr. Shah N L and Dr. Karve S R, **Illustrated Reinforced Concrete Design**. Structure Publisher.
12. **IS: 456 – 2000**, Code of Practice for Plain and Reinforced Concrete.
13. Jain A K, **Reinforced Concrete – Limit State Design**.
14. Karve S R and Shah V L, **Limit State Theory and design of Reinforced Concrete**.

BTCI-UG-L707: Remote Sensing & GIS Lab (0L 0T 3P)

1. Digital Image Processing.

2. Digital image enhancement.

3. Extraction of features.

4. Image Interpretation

5. Image Classification

6. GIS Operations: digitization of features; query buildings; arithmetic operations; Boolean operations; buffering.

7. Database Management in GIS

8. GIS data manipulation: interpolations and extrapolations.

9. GIS Analysis: measurements; proximity analysis; terrain analysis.

Reference Books:

1. John R Jenson, Introductory Digital Image Processing, Prentice Hall.

2. Burrough P A, Principles of Geographical Information System for Land Resource Assessment, Oxford University Press.

3. Bonham-Carter G F, Geographic information systems for geoscientists modelling with GIS (1995) Pergamon.

4. ESRI

BTCI-UG-D708: MINI PROJECT (0L 0T 4P)

Students are required to undertake innovative and research oriented project under the direct supervision of a faculty member of the department. The mini project should not only to reflect their knowledge gained in the previous semesters but also to acquire additional knowledge and skill of their own effort.

BTCI-UG-D801: MAJOR PROJECT

- The project work may be carried out in the institution/industry/ research laboratory or any other competent institutions.
- The duration of the project work shall be a minimum of 16 weeks which may be extended up to 24 weeks.
- A mid-semester evaluation of the project work shall be done.
- An interim project report on the progress of the work shall be submitted to the department during the mid-semester evaluation.
- The final evaluation and viva-voice will be conducted after submission of the final project report in the prescribed form.
- Student has to make a presentation on the work carried out, before the department committee as part of project evaluation.

BTCI-UG-O406: OPEN ELECTIVE I (2L 1T 0P)

E1: CONSTRUCTION MANAGEMENT

Course Objectives: The objectives of this course are to:

1. To make them understand the concepts of Project Management for planning to execution of projects.
2. To make them understand the feasibility analysis in Project Management and network analysis tools for cost and time estimation.
3. To enable them to comprehend the fundamentals of Contract Administration, Costing and Budgeting.
4. Make them capable to analyze, apply and appreciate contemporary project management tools and methodologies in Indian context.

UNIT-I (8 hrs)	**Basics of Management:** Modern scientific management (Contribution by Fayol , F.W. Taylor , Mayo), Management Functions, Management Styles, SWOT Analysis in construction **Project Management:** Basic forms of organization with emphasis on Project and matrix structures; project life cycle, planning for achieving time, cost, quality, project feasibility reports based on socio-techno-economic environmental impact analysis, project clearance procedures and necessary documentation for major works like dams, multistoried structures, ports, tunnels, Qualities, role and responsibilities of project manager, Role of Project Management Consultants, Enterprise Resource Planning (ERP)
UNIT-II (8 hrs)	**Project Scheduling:** Construction Scheduling, Work break down structure, activity cost and time estimation in CPM, PERT, RPM (Repetitive Project Modeling) techniques. LOB technique, Mass haul diagrams. Precedence Network Analysis, software in Construction scheduling (MSP, primavera, Construction manager).
UNIT- III (8 hrs)	**Project Controlling:** Monitoring and Control, Crashing, Resource Leveling, Updating. **Construction site management**: Site mobilization – demobilization aspects, various Resources management based on funds availability, 10 coordinating, communicating & reporting Techniques, Application of MIS to construction, Training for Construction Managers ,Engineers , Supervisors
UNIT-IV (8 hrs)	**Safety Engineering:** A Causes of Accidents on various sites, safety measures and safety policies to be adopted, determination of safety parameters, personal protective equipment. Workmen Compensation Act, Minimum wages act Type of Industrial Hazards-Nature, Causes and Control Measures, Hazard Identifications and Control Techniques - HAZOP, FMEA, FMECA. -Cost of Construction Injuries-Legal Implications c) Safety Organization –Safety Policy, Safety Record Keeping, Safety Culture, Safety and First Line Supervisors, Middle Managers, Top Management Practices, Sub contractual obligation, Project Coordination and Safety Procedure

Text books

1. Construction Planning & management By P S Gahlot & B M Dhir , New Age International Limited Publishers 11
2. Construction Project planning & Scheduling By Charles Patrick, Pearson, 2012
3. Construction Project Management Theory & practice --- Kumar Neeraj Jha, Pearson,2012

4. Construction management Fundamantals by Knutson, Schexnayder, Fiori, Mayo, Tata McGraw Hill, 2nd Edition, 201

Reference Books:

1. Modern construction management--.Harris, Wiley India.
2. Construction Management and Planning by Sengupta and Guha-Tata McGraw Hill publication.
3. Project Management – K Nagrajan – New age International Ltd.
4. Work study – Currie.

E2: ELEMENTS OF ENVIRONMENTAL ENGINEERING

Course Objectives: The objective of this course is to:

1. Impart knowledge of environment and different types of pollution
2. Impart knowledge about causes and preventive measures against water, air, solid waste and noise pollution
3. Impart knowledge about environmental impact assessment

Course Outcomes: Course Outcomes:

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

1. Understand importance of environment and different types of pollution.
2. Explain causes and preventive measures against water, air, solid waste and noise pollution
3. Formulate various mitigation measures to reduce the pollution.

UNIT-I (8 hrs)	**Water Sources**- Origin of waste water – Types of water pollutants and their effects, Sources of water pollution and their effects
UNIT-II (8 hrs)	**Air Pollution** - Causes of air pollution – Types & sources of air pollutants- Climatic & Meteorological effect on air pollution concentration- Formation of smog and fumigation, Different air pollution episodes in India and Abroad.
UNIT- III (8 hrs)	**Sources and Types of Municipal Solid Wastes** - Sources and types of solid wastes – factors affecting generation of solid wastes; characteristics - effects of improper disposal of solid wastes – public health effects- principle of solid waste management – social & economic aspects- public awareness- role of NGOs- legislation
UNIT-IV (8 hrs)	**Environmental Impact Assessment**- Assessment of Impact on land, water and air, noise, social, cultural flora and fauna - Environmental Impact Assessment (EIA) - Environmental Impact Statement (EIS) – EIA capability and limitations –Legal provisions on EIA.

Text Books:

1. Garg, S.K, (2015) “Environmental Engineering (Vol.II): Sewage disposal and Air
2. Pollution Engineering” Khanna Publishers (33th Edition, 2008)
3. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G, (1985), “Environmental
4. Engineering” McGraw-Hill international edition (7th Edition)

Reference Books:

5. Dr. B.S.N. Raju, (1995), “Water supply and Waste Water Engineering” McGraw-Hill Education
6. Dr. P.N. Modi,(2010), “Sewage treatment disposal and waste water engineering”
7. Standard Book House-Delhi (4th Edition)
8. Urban and Jain (1993) “Environmental Impact Assessment”, McGraw-Hill Education
9. Relevant I.S. Codes

E3: BUILDING PLANNING AND CONSTRUCTION

Course Objectives:

1. Learn about building byelaws laid by planning authorities.
2. Learn about the principles and methods to be followed in constructing various components of a building.
3. Understand about masonry types in brick and stone construction

Course Outcomes: Course Outcomes:

At the end of the course the student will be able to

1. Know the various building Bye-Laws laid by town planning authorities and local regulatory bodies for planning various buildings
2. Learn about masonry types in brick and stone construction
3. Understand about various building components.
4. Know about damp prevention and fire protection methods.
5. Understand about various types of roofs.

UNIT-I (12 hrs)	**Residential Buildings:** Different types of Residential Buildings Selection of Site for Residential Building, Components of building, bye-laws and regulations, Orientation of Buildings
UNIT-II (8 hrs)	**Masonry:** Definitions of terms used in masonry, Materials used, Stone masonry, Brick masonry, Different bonds used for brick masonry,
UNIT- III (8 hrs)	**Floors and Roofs:** Components of a floor, materials used for floor construction, Different types of flooring, Ground floor and upper floors, Types of roofs
UNIT-IV (8 hrs)	**Damp proofing:** Causes and effect of dampness on buildings, Materials and methods used for damp proofing, Fire hazards.

Text Books:

1. N. KumaraSwamy & A. Kameswara Rao, (1998)," Building planning and Drawing,
2. Charotar Publishers, (6th Edition).
3. S.K. Duggal, (2010), "Building Materials" New Age International Publishers, (4th
4. Edition).

Reference Books:

1. Dr. B.C. Punmia, Ashok Kr. Jain, Arun Kr. Jain, (2008), "Building Construction", Laxmi Publications, (10th Edition)
2. D.N. Ghose , (1989), "Materials of construction", Tata-McGraw-Hill Publishing Company Limited.
3. Sushil Kumar Sushil Kumar, (2003), "Engineering Materials", Metropolitan Book Co., Private Ltd., New Delhi.

E4: PAVEMENT DESIGN

Prerequisite: BTCI-UG-C304 Transportation Engineering-I & BTCI-UG-C601 Transportation Engineering-II

Course Objectives: Course Objective:

Engineering analysis of stresses and strains in typical highway pavement structures due to loading from traffic and climate; characterization of paving materials; structural pavement design

Course Outcomes: Course Outcomes:

At the end of the course the student will be able to

- Analyze the stresses and strains in a flexible pavement using multi-layered elastic theory.
- Analyze stresses and strains in a rigid pavement using Westergaard's theory.
- Design a flexible pavement using IRC, Asphalt Institute, and AASHTO methods.
- Design a rigid pavement using IRC, and AASHTO methods.
- Design of joints, Dowel & tie bars.

UNIT-I (8 hrs)	**Factors Affecting Pavement Design**: Variables Considered in Pavement Design, Types of Pavements, Functions of Individual Layers, Classification of Axle Types of Rigid Chassis and Articulated Commercial Vehicles, Legal Axle and Gross Weights on Single and Multiple Units, Tire Pressure, Contact Pressure, EAL and ESWL Concepts, Traffic Analysis: ADT, AADT, Truck Factor, Growth Factor, Lane Distributions & Vehicle Damage Factors, Effect of Transient & Moving Loads.
UNIT-II (8 hrs)	**Stresses In flexible Pavement**: Vehicle-Pavement Interaction: Transient, Random & Damping Vibrations, Steady State of Vibration, Experiments on Vibration, Stress Inducing Factors in Flexible and Rigid pavements; Stress In Flexible Pavements: Visco-Elastic Theory and Assumptions, Layered Systems Concepts, Stress Solutions for One, Two and Three Layered Systems, Fundamental Design Concepts;
UNIT- III (8 hrs)	**Stresses in Rigid Pavements**: Westergaard's Theory and Assumptions, Stresses due to Curling, Stresses and Deflections due to Loading, Frictional Stresses, and Stresses in Dowel Bars & Tie Bars
UNIT-IV (12 hrs)	**Design of Flexible Pavements:** Factors effecting Design. Deflection studies in Flexible Pavements. Present Serviceability Index.IRC guidelines for Flexible Pavements**.** **Design of Rigid Pavements**: Factors effecting Design – Wheel load & its repetition, subgrade strength & proportion, strength of concrete- modulus of elasticity. Reinforcement in slab.

1. **Text Books:**
2. Design of Functional Pavements, Nai C. Yang, McGraw Hill Publications
3. Concrete Pavements, AF Stock, Elsevier, Applied Science Publishers
4. Principles of Pavement Design, Yoder.J. &Witzorac Mathew, W. John Wiley & Sons Inc

Reference Books:

1. Pavement Analysis & Design, Yang H. Huang, Prentice Hall Inc.
2. Pavement and Surfacing for Highway & Airports, Micheal Sargious, Applied Science Publishers Limited.
3. IRC: 37 & 58 Codes for Flexible and Rigid Pavements Design

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E5: BASICS OF FOUNDATION ENGINEERING

Prerequisite: BTCI-UG-C602 Geotechnical Engineering-II

Course Objectives:

The course content enables students to

- Learn Soil and its formation.
- Learn the various methods of Sub-soil exploration.
- Impart knowledge on types of shallow foundations, theories required for the
- determination of their bearing capacity and imbibe the concepts of pile foundations.

Course Outcomes:

At the end of the course the student will be able to:

- Explain Soil and its formation.
- Identify the method of Soil Exploration.
- Classify the types of shallow foundations and theories required for the
- determination of their bearing capacity.
- 4. Explain the necessity of pile Foundation.

UNIT-I (8 hrs)	**Introduction:** Definition of soil - Definition of soil Engineering and Geotechnical Engineering - Origin of Soils-Formation of Soils-Transportation of Soils-Major soil deposits of India.
UNIT-II (8 hrs)	**Subsoil Investigation for Foundations:** Borings for Exploration-Auger boring, Wash Boring, Rotary Drilling, Percussion Drilling-Split Spoon Samplers-Standard Penetration Test- Cone Penetration Test- In-situ Vane Shear Test.
UNIT- III (8 hrs)	**Bearing capacity**: Bearing capacity theories of shallow foundation- Terzaghi Bearing capacity theory, IS Code Method - Settlement of Foundation-Loads for Settlement Analysis-Allowable Settlement.
UNIT-IV (12 hrs)	**Shallow Foundation:** Types of Foundations: Strip, Isolated, Strap, Combined Footings, Raft foundation - Loads on foundations – Proportioning of footings. **Deep Foundations**: Necessity of pile foundation – classification of piles – Factors governing: choice of type of pile – Load transfer mechanism – piling equipments and methods.

Text Books:

1. Arora K.R. (2014), Soil Mechanics and Foundation Engineering, Standard Publishers; 7th Edition.

2. Punmia B.C., Ashok Kumar Jain, Arun Kumar Jain (2005), Building Construction, Laxmi Publications, 5th Edition.

Reference Books:

1. Gopal Rajan & Rao A.S.R. (2006), Basic and Applied Soil Mechanics, New Age; 2nd Edition.

2. Murthy V.N.S. (2009), Soil Mechanics &Foundation Engineering, CBS; 1st Edition

E6: MAINTAINANCE AND REHABILITATION OF CONCRETE STRUCTURES

Prerequisite: BTCI-UG-C302 Strength of Material & BTCVL-UG-C306 Building Material and Concrete Technology

Course Objectives: To make the students to gain the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.

Course Outcomes: Students must have gained knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.

UNIT-I (12 hrs)	NDT and semi destructive testing. Appraisal of damage and deterioration of structures by non-destructive and other techniques.
UNIT-II (7 hrs)	Causes of deterioration of concrete, environmental aspects and earthquake effects.
UNIT- III (10 hrs)	**Repair and strengthening of superstructure** Structural components, load bearing wall, panel walls, strengthening of foundation, grouting, grout material, guniting, shotcreting, under pinning.
UNIT-IV (7 hrs)	**Repair of steel structures** Repair of bridges, buildings, towers etc., monuments and historical structures. **Prevention of water leakage in structures** Under-water repair, durability of repairing material, case histories.

Text Books:

1. Testing of Concrete in Structure by Bungey, Surrey University Press
2. Non Destructive Testing by Malhotra & Carino (CRC Press)
3. Corrosion of Steel in Concrete by Broomfield John P

BTCI-UG-P506: PROGRAMME ELECTIVE-I (2L 1T 0P)

E1: ENGINEERING GEOLOGY	
Prerequisite: Nil **Course Objectives:** To prepare civil engineering students for a career in geotechnical engineering	
Course Outcomes: After Completion of the course students will: 1. understand the role of geology in the design and construction process of underground openings in rock. 2. be able to apply geologic concepts and approaches on rock engineering projects. 3. be able to identify and classify rock using basic geologic classification systems. 4. be able to use the geologic literature to establish the geotechnical framework needed to properly design and construct heavy civil works rock projects.	
UNIT-I **(7 hrs)**	**Introduction:** Geology and Civil Engineering, earth as a planet, its structure and composition. **Physical Geology:** Origin and development of river system, erosion, transportation and deposition by rivers, Weathering (deterioration) of rocks, kinds of weathering, agencies, causes and products of weathering, Soil formation, soil profile, classification of soils, erosion and conservation.
UNIT-II **(10 hrs)**	**Structural Geology:** Outcrop, dip and strike, clinometer, compass. Definition, different parts of folds, faults, joints and unconformity and their recognition in the field and their importance in Civil Engineering projects. **Petrology**: Sources of rocks, minerals, definition, physical proportion of important rock forming and ore minerals, Rock cycle, classification of rocks in to igneous, sedimentary and metamorphic, texture and structure in rocks.
UNIT- III **(9 hrs)**	**Engineering Geology:** Geological consideration in selection of sites for dams and reservoirs, tunnels, bridges and highways, landslides – their causes and prevention. Earthquake waves, seismic zones of India and world, earthquakes in India, causes and effects, micro-seismic zoning, engineering consideration against earth quakes. **Rock Mechanics:** Introduction to rock mechanics and rock engineering, simple failure criteria, Rock masses: strength, deformability, failure criteria, Rock mass classification schemes: Q and RMR, Foundations and slope stability: foundations on discontinuous rock, slope instability basic mechanisms and static equilibrium solutions, Q and RMR.
UNIT-IV **(10 hrs)**	**Geophysical Techniques:** Different types of geophysical techniques, theories, applications, instruments, advantages and disadvantages **Hydrogeology:** Occurrence of ground water, types of aquifers, geo-hydrological zones in India, groundwater development in India, Selection for well sites, application of geological and geophysical methods, electrical resistivity, seismic refraction, gravity and magnetic methods.

Text Books:

1. Mukherjee P K, **A Text Book of Geology.**

2. Breth F G H and De Freitas, **Geology for Engineering**.

3. Krayrine and Judd, Principles **of Engineering Geology and Getechniques**.

4. Sathyanarayana Swamy B S, **Engineering Geology Lab. Manual**, LCSE, N Delhi.

Reference Books:

1. Gurappa K M, **Structural Geology Maps and Problems.**

2. Gokhale W, **Manual of Geological Maps** (1987) CBS Publishers, New Delhi.

3. Fetter C W, **Applied Hydrogeology** (2000), Prentice Hall; 4 edition

4. Singhal BBS and Gupta RP, **Applied Hydrogeology of Fractured Rocks** (1999), Springer

5. Goodman R E, **Introduction to Rock Mechanics** (1989), Wiley, 2nd edition.

E2: BUILDING CODES AND REQUIREMENT

Prerequisite: BTCI-UG-C306 Building Material and Concrete Technology

Course Objectives:

To prepare civil engineering students for a career in geotechnical engineering

Course Outcomes: After Completion of the course students will:

1. understand the role of geology in the design and construction process of underground openings in rock.
2. be able to apply geologic concepts and approaches on rock engineering projects.
3. be able to identify and classify rock using basic geologic classification systems.
4. be able to use the geologic literature to establish the geotechnical framework needed to properly design and construct heavy civil works rock projects.

UNIT-I (8 hrs)	**Introduction to National Building Code**-: Scope and Terminologies, Administration-: Building Permit and Inspection.
UNIT-II (8 hrs)	**General building requirements-:** Land Use classification, Classification of Buildings, Area and Height Limitations, Requirements of various parts of Building.
UNIT- III (8 hrs)	**Fire and Safety**: fire prevention, life safety, Design and Construction-: construction practices and safety, Earth quake resistant of masonry wall, Wind load design.
UNIT-IV (8 hrs)	**Building Services**-: Plumbing, Lighting and ventilation, Acoustics, Sound Insulation and Heat Insulation in buildings.

References:

National Building Code of India 2005

SP 64 (2001), SP 7 (2005), Bureau of Indian Standards

E3: TRAFFIC FLOW MODELLING

Prerequisite: BTCI-UG-C304 Transportation Engineering-I & BTCI-UG-C601 Transportation Engineering-II

Course Objectives:

To know the traffic flow characteristics, to study various traffic surveys, to understand the Traffic Signal timing design and Traffic Flow theories.

Course Outcomes: Use the Traffic survey analysis for management of traffic and for designing new road infrastructure, Ability to design various types of intersections, Implementation of Traffic Control devices and traffic regulations, Applications of Traffic flow theories in solving congestion problems and use of simulation techniques

UNIT-I (10 hrs)	**Introduction to Traffic Engineering**: Properties of Traffic Engineering Elements, Road Vehicle performance. **Traffic Studies**: Volume studies, Speed studies, Origin and destination studies and parking studies
UNIT-II (8 hrs)	**Traffic Control devices** Various Traffic Control devices, Principles of Intersection Design, Design of signalized and unsignalized intersections, Signal Coordination
UNIT- III (9 hrs)	**Traffic Regulations and Statistical methods** **Traffic Safety and Level-of-service**: Accidents, Lighting, Capacity and Level-of-service analysis
UNIT-IV (10 hrs)	**Uninterrupted traffic Flow:** Theory Fundamentals of Traffic flow theory, Uninterrupted Traffic flow including Macroscopic and Microscopic Traffic flow models **Interrupted traffic Flow**: Theory Fundamentals of Interrupted Traffic Flow, Shockwave Analysis, Car following theory, Queuing Theory, Vehicle arrival

Text Books:

1. Kadiyali, L. R., Traffic Engineering and Transport Planning, Khanna Publishers
2. O'Flaherty C A, "Transport Planning and Traffic Engineering", Butterworth Heinemann, Elsevier, Burlington, MA

Reference Books:

3. Mannering Fred L., Kilarski Walter P. and Washburn Scott S., Principles of Traffic Engineering and Traffic Analysis, Third Edition, Wiley
4. Roess, R. P., Prassas, E. S., and McShane, W. R., Traffic Engineering, 4th Edition, Prentice Hall
5. Chakroborty Partha and Animesh Das, Principles of Transportation Engineering, Prentice hall

E4: GROUND IMPROVEMENT TECHNIQUES

Prerequisite: BTCI-UG-C602 Geotechnical Engineering-II

Course Objectives:

Course objectives: This course will enable students to

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.

Course Outcomes: Course Outcomes: After studying this course, students will be able to:

1. Give solutions to solve various problems associated with soil formations having less strength.
2. Use effectively the various methods of ground improvement techniques depending upon the requirements.
3. utilize properly the locally available materials and techniques for ground improvement so that economy in the design of foundations of various civil engineering structures

UNIT-I (7 hrs)	**Introduction** Necessity of ground improvement, scope, texture and structure in rocks, engineering properties of rocks, testing of engineering properties of rocks.
UNIT-II (12 hrs)	**Principles of Soil Stabilization:** Methods, chemical – cement – lime stabilization, ash and slag stabilization, grouting principles, examples of application of grouting, stabilization of soils with lime columns, stone columns, deep compaction, consolidation, Other techniques, principles and construction techniques, blasting- design principles and applications, soil reinforcement. **Preloading:** Type of soil and applicability, types of preloading, design philosophy, prefabricated vertical drain, design of prefabricated vertical drain (with and without considering smear zone) and case study
UNIT- III (7 hrs)	**Stone Column:** Introduction, Type of soil and suitability, design principle, use of standard design code and new developments, design example and case study
UNIT-IV (10 hrs)	**Reinforced Earth** Introduction, principles and advantages of reinforced earth, behaviour of reinforced earth, design methods, material specifications, soil nailing – construction procedure, design and specifications, civil engineering application of geo-synthetics.

Text Books:

1. Fang H Y, **Foundation Engineering Hand Book**, CBS Publishers New Delhi
2. Alam Singh and Chowdhary G R, **Soil Engineering in Theory and Practice Part – 3**, CBS Publishers.

Reference Books:

1. Alam Singh, **International Overviews Current Practice in Geotechnical Engineering**, IBT Publishers.
2. **Geotechnical Engineering – Indian Experiences**, A Compilation of IGS Annual Lectures: 1978 – 1992 by Kuberan R, Nakul Dev and Govindan K K, Indian Geotechnical Society.

E5: TRAFFIC SYSTEMS AND ENGINEERING

Prerequisite: BTCI-UG-C304 Transportation Engineering-I & BTCI-UG-C601 Transportation Engineering-II

Course Objectives:

- Provide an insight on traffic and its components, factors affecting road traffic and the design of intersection.
- Explain sampling of data, analysis and interpretation of data in conducting various surveys.
- Explain traffic movements, types of intersections, islands, crossings and their design.
- Illustrate the design of signals and explain the redesigning of existing signals.

Course Outcomes: After the completion of the course students should be

- Able to acquire and apply knowledge of traffic, its components, factors affecting road traffic in intersection design.
- Able to apply the knowledge of sampling data in conducting various surveys and analysis
- Capable of understanding traffic movements and designing islands, intersections and road lightings.
- Capable of designing signals, redesigning the existing signals

UNIT-I (8 hrs)	**Introduction:** Components of road traffic - the vehicle, driver and road. Objectives and scope of traffic engineering.
UNIT-II (8 hrs)	**Traffic Engineering:** Road user characteristics; human and vehicle characteristics, factors affecting road traffic; methods of measurement. Concepts of passenger car units for mixed traffic flow.
UNIT- III (9 hrs)	**Traffic Engineering Studies and Analysis:** Sampling in traffic studies; adequacy of sample size; application of sampling methods for traffic studies, objectives, methods of traffic study, equipment, data collection, analysis and interpretation (including case studies) of (i) Spot speed (ii) Speed and delay (iii) Volume (iv) Origin - destination (v) Parking. Traffic manoeuvres and Stream Characteristics; application in intersection design.
UNIT-IV (10 hrs)	**Traffic Regulations and Control:** flow; Other regulations and control. traffic and method of control. General regulations; Regulations on Vehicles, drivers and Traffic management; noise and air pollution due to road

Text Books:

1. Kadiyali, L.R. `Traffic Engineering and Transport Planning', Khanna Publishers.
2. Drew, D.R. `Traffic Flow Theory and Control', McGraw Hill Book Co.
3. IRC and IS Publications.

Reference Books:

1. Institute of Transportation Engineers, `Manual of Transportation Engineering Studies', Prentice Hall
2. Khanna and Justo, ‘Text book of Highway Engineering’, Nemchand Brothers, Roorkee, 2000.

E6: SOLID WASTE MANAGEMENT

Prerequisite: BTCI-UG-C505 Environmental Engineering

Course Objectives:

1. Understanding of problems of municipal waste, biomedical waste, hazardous waste, industrial waste etc.\
2. Knowledge of legal, institutional and financial aspects of management of solid wastes.
3. Become aware of Environment and health impacts solid waste mismanagement 4. Understand engineering, financial and technical options for waste management

Course Outcomes: After completion of the course students should be able to-do sampling and characterization of solid waste; analysis of hazardous waste constituents including QA/QC issues; understand health and environmental issues related to solid waste management; apply steps in solid waste management-waste reduction at source, collection techniques, materials and resource recovery/recycling, transport, optimization of solid waste transport, treatment and disposal techniques; economics of the onsite vs. offsite waste management options

UNIT-I (10 hrs)	**Solid Waste:** Definition, sources, classification and characteristics, need for integrated solid waste management transport, collection equipment, systems of collection, garbage chutes, transfer stations, route optimization, municipal solid waste characteristics and quantities **Disposal Methods:** Open dumping, selection of site, ocean disposal, feeding to hogs.
UNIT-II (8 hrs)	**Sanitary Land Filling:** Definition, land-fills planning, landfill processes, landfill design, landfill operations, post-closure care and use of old landfills, methodology, trench, area, ramp and pit method, site selection, prevention of site pollution, lechate treatment, gas collection and recirculation.
UNIT- III (10 hrs)	**Composting:** Aerobic and anaerobic composting, factors affecting, microbiology, different methods, mechanical process. **Incineration**: Process 3T, s to control high temperature, design approach, prevention of air pollution, pyrolysis.
UNIT-IV (8 hrs)	**Recycle and Reuse:** Material and energy, recovery operations, reuse in other industries, plastic wastes, and environmental significance.

Text Books:

1. Tchbanogious G, Theisen and Lilsaissen, **Solid Waste Engineering Principles and Management Issues**, McGraw Hill.
2. Bhide and Sundreshan, **Solid Waste Management in Dry Countries**.
3. Joseph D. Hagerty, Joseph Pavoli L, John E Heer Jr Van Nostrand Reinhold Co. 1975, **Solid Waste Management**.

BTCI-UG-P605: PROGRAMME ELECTIVE-II (2L 1T 0P)

E1: LATEST TRENDS IN CIVIL ENGINEERING

Prerequisite: Nil

Course Objectives: The main aim of this course is to provide the knowledge about latest development and ongoing in construction industry.

Course Outcomes: After completion of the course, students will have knowledge on:

- Emerging trends in ground improvement and recent improvements in concrete
- Building information modelling in construction
- Current trends in Water Resources and Modern Construction Practices
- Recent trends in environmental engineering.

UNIT-I (10 hrs)	**Emerging trends in ground improvement** Need for Ground Improvement, Classification of ground modification techniques, Emerging trends in ground improvement. **Recent improvements in concrete**: Fiber reinforced concrete, High strength concrete, Self-compacting concrete, testing self-compacting concrete, concreting in cold weather, Concreting in hot weather.
UNIT-II (8 hrs)	**Building information modeling (BIM)** Introduction, BIM in Construction Management, Interpretation of BIM, Benefits of BIM, Virtual Prototyping of Models, Collaboration and Information Management, Potential of BIM enabled Models.
UNIT- III (10 hrs)	**Current Trends in Water Resources:** Extreme hydrology, Flood and drought, Rain water harvesting, Artificial groundwater recharge, Flood reduction modelling**.** **Modern construction practices:** Modern construction equipment, Prefabricated structure, Ready mix concrete**,** modern methods of construction, composite construction.
UNIT-IV (8 hrs)	**Recent trends in environmental engineering** Environmental impact assessment, Environmental management, Air pollution, Solid and hazardous waste management.

E2: DESIGN OF HYDRAULIC STRUCTURES

Prerequisite: BTCI-UG-C405 Irrigation Engineering

Course Objectives: This course will enable students to; Analyze and design gravity dams. Find the cross-section of earth dam and estimate the seepage loss. Design spillways and aprons for diversion works. Design CD works and chose appropriate canal regulation works.

Course Outcomes: After studying this course, students will be able to: Check the stability of gravity dams and design the dam. Estimate the quantity of seepage through earth dams. Design spillways and aprons for various diversion works. Select particular type of canal regulation work for canal network

UNIT-I (7 hrs)	**Gravity dams:** Non-overflow section, forces acting on gravity dams, design of gravity dams by step method, introduction to other methods like trail load, finite element, slab analogy etc., stresses in dams, stress concentration in openings of dams, design of sluices, air vents and galleries
UNIT-II (10 hrs)	**Spillways:** Types of spillways, design of spillways, energy dissipators, gates, types of hoist. **Earth dams:** Investigations, design of cross section of dams, slope stability analysis, settlement analysis.
UNIT- III (11 hrs)	**Design of weirs and barrages on permeable foundations:** Introduction, causes of failure of weirs, creep theory, Khosla's theory. **Design of canal sections:** Design of unlined canals- introduction, design formulae. Kennedy's theory and Lacey's theory, drawbacks and comparison. Design of lined canals, design parameters, design procedures, types of lining
UNIT-IV (8 hrs)	**Design of masonry structures:** Canal falls, definition, types, design of trapezoidal notch fall. **Canal regulators:** Design of cross regulator and distributary head regulator.

Text Books:

1. W.P.Justin and Creacer (1954), " **Engineering for dams**", Vol I, II & III Wiley Publishers.

2. Leliausky S (1958), " **Irrigation and Hydraulic Design**", Vol III, John Wiley Publishers, New York.

3. Sharaar et.al, " **Earth and Rockfill Da**ms"

Refrerence Books:

1. R.S.Varshney (1978), " **Concrete Dams**", IBH Publishers, New Delhi.

2. Garg S.K, (1976), **" Irrigation and Hydraulic Structures**", Khanna Publications,

E3: GROUND WATER ENGINEERING

Prerequisite: BTCI-UG-C405 Irrigation Engineering

Course Objectives:

- To study occurrence movement and distribution of water that is a prime resource for development of a civilization.
- To know diverse methods of collecting the hydrological information, which is essential, to understand surface and ground water hydrology.
- To know the basic principles and movement of ground water and properties of ground water flow.

Course Outcomes:

- Provide a background in the theory of hydrological processes and their measurement
- Apply science and engineering fundamentals to solve current problems and to anticipate, mitigate and prevent future problems in the area of water resources management
- An ability to manipulate hydrological data and undertake widely-used data analysis. • a systematic understanding of the nature of hydrological stores and fluxes and a critical awareness of the methods used to measure, analyze and forecast their variability; and the appropriate contexts for their application.

UNIT-I (10 hrs)	**Introduction:** Definition of ground water, hydrological classification of geological formations, aquifers and their types, subsurface zones and water-table, springs: occurrence, flow and storage of groundwater in igneous, sedimentary and metamorphic rocks, geological zones in India. **Fundamentals of Ground Water Flow:** Darcy,s law and range of its validity, oil anisotropy, circulation of groundwater in isotropic and anisotropic media, groundwater flow in fractured rocks, parallel plate model, double porosity model, equivalent porous medium model, discrete fracture network model, and equivalent parallel plate model, groundwater flow in confined and unconfined aquifers, Dupuit's assumptions, principles and mechanics of solute transport, advection, dispersion, molecular diffusion, retardation.
UNIT-II (8 hrs)	**Mechanics of Well Flow** Water table contour map and flow net analysis, groundwater flow problems, steady uniform flow, steady radial flow to a well, a well in a uniform flow, aquifer parameters, introduction to unsteady flow in aquifers, pump tests, radial flow to a well in an extensive confined aquifer, barrier and recharge boundaries, image well, introduction to unsteady radial flow.
UNIT- III (8 hrs)	**Exploration of Groundwater** Surface and subsurface methods for well-site selection, field investigation, remote sensing and GIS applications, geophysical methods, tracer tests.
UNIT-IV (10 hrs)	**Well Development and Management:** Well-design criteria, size and spacing of wells, diameter of wells, well characteristics, well efficiency, construction and maintenance, screens and casings., dug well versus tube well construction. **Groundwater Recharge:** Water level fluctuation and rainfall infiltration factor method, traditional methods of groundwater conservation, artificial recharge of groundwater, planning and site selection, various methods and structures such as rainwater harvesting, stream augmentation, bank filtration,

	recharge wells, ditch and furrow, well injection, aquifer storage and recovery, groundwater basin management and conjunctive use.

Text Books:

1. Todd D K, **Groundwater Engineering**.
2. Walton W C, **Groundwater Resources**, McGraw Hill
3. Sharma and Chawla, **Manual of Groundwater and Tube**, C.B.I.P wells.

Reference Books:

1. De Weist R J M, **Geo-hydrology**, John Wiley.
2. Bouwer H, **Groundwater Hydrology**, McGraw Hill
3. Raghunath H M, **Groundwater,** Wiley Eastern Ltd.

E4: APPLICATIONS OF PROBABILITY & STATISTICS IN CIVIL ENGINEERING

Prerequisite: Nil

Course Objectives: This course is designed to equip the students with a working knowledge of probability, statistics, and modeling in the presence of uncertainties. The major objective of the course is to help the students to develop an intuition and an interest for random phenomena, and to introduce both theoretical issues and applications that may be useful in real life.

Course Outcomes: This course is intended to contribute to the following program outcomes:

- An ability to apply knowledge of mathematics, science and engineering
- An ability to design and conduct experiments, as well as to analyze and interpret data
- An ability to identify, formulate and solve engineering problems
- An ability to use the techniques, skills and modern engineering tools necessary for engineering practice

UNIT-I (10 hrs)	**Introduction** Role of probability and statistics in Civil Engineering. **Random Events**: Definition of basic random events; Application of set theory in composite event operations. Probability of events. **Random Variables:** Definition; discrete and continuous variables; Probability definitions - PMF, PDF, CDF; Moments and expectations; Functions of random Variables; Moments and expectations of functions – direct and indirect methods.
UNIT-II (10 hrs)	**Probability Distributions** Discrete distributions - binomial distribution, Poisson's distribution; Continuous distributions – exponential distribution, gamma distribution; Central limit theorem; Normal and lognormal distributions; Extreme value distributions. **Sampling Distributions:** Chi-square distribution, t - distribution, F distribution. **Parameter Estimation:** Point estimation, confidence interval estimation.
UNIT- III (6 hrs)	**Correlation and Regression Analysis** Simple regression; multiple regression; logistic regression. **Analysis of Variance** Hypothesis Testing; Tests of hypotheses on the mean and variance.
UNIT-IV (10 hrs)	**Advanced Statistical Analyses**: Principal Component analysis; Factor analysis; Cluster analysis; Monte Carlo simulations. **Applications in Civil Engineering**: Construction Planning and Management; Engineering Geology; Environmental Engineering; Geotechnical Engineering; Hydrology and Water Resources Engineering; Structural Engineering; Transportation Engineering.

Text Books:

1. Ang, A. H-S., and Tang, W., H. "Probability concepts in engineering : Emphasis on applications in civil and environmental engineering." Wiley.

2. Kottegoda, N. T., and Rosso, R. “Applied Statistics for Civil and Environmental Engineers.” Wiley.

Reference Books :

1. Ross, S. “A first course on probability.” Prentice Hall.

2. Johnson, R. A., and Gupta, C. B. “Miller and Freund’s Probability and Statistics for Engineers.” Pearson Education.

E5: ADVANCED FOUNDATION ENGINEERING

Prerequisite: BTCI-UG-C602 Geotechnical Engineering-II

Course Objectives:

To Impart the knowledge of the sub surface investigation and bore log report interpretation

- To developed the knowledge and skills for evaluating the bearing capacity of the soil
- To Analyze and evaluate the load carrying capacity of the various types of foundation

Course Outcomes:

After the successful completion of the course it is expected that student would be able to….

- Conduct the site investigation for a proposed structure and prepare the report
- Apply the knowledge of the bearing capacity theories and test to evaluate the Safe bearing capacity of the soil for a given site
- Analyze the foundation for its load carrying capacity and estimate the settlement
- Select appropriate foundation for given structure/machine and soil conditions

UNIT-I (8 hrs)	Bearing Capacity Brinch Hansen's, Meyerhoff's and Skempton's bearing capacity equations. Plate load test and penetration tests. Design principles of shallow foundations, Isolated, combined and raft foundations.
UNIT-II (9 hrs)	Design of Piles and Pile caps: Brom's theory. Principles of design of sheet and anchor bulk head. Well foundation: Bearing capacity, lateral stability. Terzaghi's method and IRC method. Foundation on Expansive Soils: Problems of foundations on expansive soils. Remedial measures.
UNIT- III (13 hrs)	Coffer dams: Types, design and analysis for stability. Machine foundations: Degree of freedom – general criteria, mass-spring-dash-pot model. Block foundation subjected to vertical, horizontal and rocking vibrations. Elastic half space approach. Vibration isolation.
UNIT-IV (6 hrs)	Ground Improvement Techniques: Necessity, traditional methods, reinforced earth structures. Materials, application and design principles. Principles and construction of granular piles, sand drains, geodrains, lime columns.

Text Books

1. Bowles J E, (1997), "**Foundation Analysis and Design**", McGraw Hill, New York.

2. Winterkorn H F and Fange H Y, (1991), " **Foundation Engineering Hand book**", Van Nostand Reinhold Company, New York.

Reference Books:

3. Teng W C, (1981), " **Foundation Design**", Prentice Hall of India", New Delhi.

4. Srinivaslu P and Vaidyanathan C V, (1987), " **Hand Book of Machine Foundations**", Tata McGraw Hill.

5. Poulos H G and Davis E H, (1980), " **Pile Foundation Analysis and Design**", John Wiley and Sons, New York.

E6: SOIL RIENFORCEMENT AND GEOSYNTHETICS

Prerequisite: BTCI-UG-C602 Geotechnical Engineering-II

Course Objectives:

To determine the properties, functions and applications of various geosynthetic materials and to design reinforced soil structures

Course Outcomes:

Able to apply the appropriate geosynthetic material for improving ground for various Civil Engineering projects, and design of various reinforced soil structures.

UNIT-I (8 hrs)	**An Overview of Geosynthetics**: Classification of Geosynthetics, Functions and applications, Properties of geotextiles, Geogrids and Geomembrane
UNIT-II (9 hrs)	**Soil Reinforcement:** Mechanism, improvement of Bearing capacity, Embankments on soft ground, Soil Nailing.
UNIT- III (13 hrs)	Reinforced Embankmentsand Reinforced soil walls –Internal and External Stability.
UNIT-IV (6 hrs)	**Geosynthetics for Highways**: Roadway Reinforcement, applications for Separation, Filtration, Drainage, Reinforcement, Moisture Barrier, Membrane encapsulation. Landfills: Geosynthetic applications for landfill liners, covers and other components.

Text Books

- Koerner, R. M. – Designing with Geosynthetics, Prentice Hall; 2nd edition (1991)
- Rao, G. V., & Raju G. V. S. S. – Engineering with Geosynthetics, Tata-McGraw Hill. Publication, New Delhi. (2004.)

Reference Books:

- Hausmann, M. R. – Engineering Principles of Ground Modifications, McGraw Hill Pub Co, 1989
- Xianthakos, Abreimson and Bruce – Ground Control and Improvement, John Wiley & Sons, 1994.
- M. P. Moseley and K. Krisch (2006) – Ground Improvement, II Edition, Taylor and Francis
- Jones C. J. F. P. (1985) – Earth Reinforcement and soil structures – Butterworths, London.
- Siva Kumar Babu .GL 2013-Introduction to Soil Reinforcement & Geosynthetics, University Press

E7: IRRIGATION ENGINEERING

Prerequisite: Nil

Course Objectives:

The objective of the course is to introduce students to the basic concepts of irrigation and drainage system design and construction of various hydraulic structures with their planning and management.

Course outcomes:

1. At the end of the course, the students will be able

1. Understand the concept of irrigation and estimate the irrigation water requirements.
2. To plan and execute a canal network in the field.
3. To plan and design irrigation projects.
4. Design channels and other irrigation structures required for irrigation, drainage, flood control and other management projects.

UNIT-I **(9 hrs)**	**Introduction** Definition, necessity, benefits and ill-effects of irrigation, classification of irrigation projects, types of irrigation systems, their merits and demerits, methods of distribution of water, comparative study of these methods, need for planned utilization of water resources. **Water Requirements of Crops:** Introduction, functions, factors affecting, quality of irrigation water, main crops and their seasons, consumptive use of crops and irrigation requirements, irrigation efficiencies, duty, delta, base period, relationship among them, related terms, estimation of design discharges, storage capacities, factors affecting duty and measures to improve duty, soil moisture contents, depth and frequency of irrigation, assessment of irrigation water charges.
UNIT-II **(8 hrs)**	**Water Requirements of Crops** estimation of design discharges, storage capacities, factors affecting duty and measures to improve duty, soil moisture contents, depth and frequency of irrigation, assessment of irrigation water charges. **Sediment Transport and Design of Irrigation Channels** Importance of sediment transport, sediment load, bed formation, mechanics of sediment transport, shield's diagram, regime channel.
UNIT- III **(8 hrs)**	**Water Logging and Salinity** Definition of salinity and water logging, causes of water logging, water logging control, leaching, open drainage, tile drainage and reclamation of saline lands.
UNIT-IV **(8 hrs)**	**Rivers, Their Behavior, Control and Training** Importance of rivers and necessity of controlling them, types of rivers and their characteristics, classifications of rivers, behavior of rivers, control and training of rivers, methods of river training.

Text Books:

1. Punmia B C, and Pande B B, **Irrigation and Water Power Engineering**, Standard Publishers, New Delhi.
2. Sharma R K, **Irrigation Engineering and Hydraulic Structures**, Oxford and IBH
3. Garg S K, **Irrigation Engineering and Hydraulic Structures**, Khanna Publishers

Reference Books:

1. Modi P N, **Irrigation, Water Resources and Water Power Engineering**.

2. Priyani V B, **Fundamental Principles of Irrigation and Water Power**, Chartor Book Stall, TulasiSadan, Station Road, Anand

BTCI-UG-P702, BTCI-UG-P703 & BTCI-UG-P704 PROGRAMME ELECTIVE-III,IV& V (2L 1T 0P)

E1: FINITE ELEMENT METHOD OF ANALYSIS

Prerequisite: BTCI-UG-C402 Structural Analysis-I

Course Objectives: To introduce the concepts of Mathematical Modeling of Engineering Problems. To appreciate the use of FEM to a range of Engineering Problems

Course Outcomes: Upon completion of this course, the students can able to

- understand different mathematical techniques used in FEM analysis
- Understand the concepts of Nodes and elements
- Understand use of FEA in Structural and thermal problem
- Understand the application of FEA in heat transfer problem
- Learn how to do analysis learn the various concepts and types of analysis
- Learn finite element modeling techniques.

UNIT-I (12 hrs)	**Introduction:** Brief general description of the method, theory of elasticity, constitutive relationships, plane stress and plane strain. **Concept of an Element:** Types of elements, displacement models, compatibility and convergence requirements, displacement models by generalized co-ordinates, Lagrangian polynomials and Hermitian polynomials, natural coordinates, formulation of shape functions for different types of elements.
UNIT-II (7 hrs)	**Variational Method of Formulation:** Minimization of potential energy approach, formulation of element stiffness and consistent load vector for different types of elements, static condensation.
UNIT- III (7 hrs)	**Isoparametric Elements:** Concept, numerical integration.
UNIT-IV (10 hrs)	**Applications** (a) Application of finite element method to pin-jointed and rigid jointed framed structures. (b) Application to plane stress, plane strain and axi-symmetric problems.

Text Books:

1. Desai C S and Abel J E, **Introduction to the Finite Element Approach**, CBS Publications, New Delhi
2. Krishnamoorthy C S, **Finite Element Anaysis**, Tata McGraw Hill
3. Cook R D, Malkas D S and Plesha M E, **Concepts and Applications of Finite Element Analysis**, John Wiley and Sons, New York

Reference Books:

1. Bathe K J, **Finite Element Procedures in Engineering Analysis**, Prentice Hall N J
2. Rajasekaran S, **Finite Element Analysis in Engineering Design**, Wheeler Publishing Allahabad.
3. Zinkiewiez O C, **The Finite Element Method**, Tata McGraw Hill Book Co.

E2: STRUCTURAL DYNAMICS AND EARTHQUAKE ENGINEERING

Prerequisite: BTCI-UG-C402 Structural Analysis-I

Course Objectives: The main objective of the course is to introduce dynamic loading and the dynamic performance of the structures to the students. Different types of dynamic loading also to be discussed.

The detailed study on the performance of structures under earthquake loading is also one of the focus of the course.

Course Outcomes: At the end of the course, student will have the knowledge to analyse structures subjected to dynamic loading and to design the structures for seismic loading as per code provisions.

UNIT-I (8 hrs)	**Engineering Seismology**: Terminology, causes and effects of earthquakes, magnitude and intensity, accelerograms, faults, folds, selection of sites for structures, ground motion in an earthquake, types of seismic waves, seismic zones, modified Mercalli scale. **Introduction to Dynamics:** Objectives, dynamic loading, difference between static and dynamic force, types of motions, formulation of equations of motion: (a) D,Alembert's principle (b) Principle of virtual work.
UNIT-II (10 hrs)	**Single Degree of Freedom Systems** (a) Components of the system, types of vibration, undamped and damped free vibrations, logarithmic decrement. (b) Forced vibrations due to harmonic excitation, steady state and transient response, transmissibility, vibration isolation, evaluation of damping, half power bandwidth method.
UNIT- III (10 hrs)	**Multi-Degree of Freedom Systems:** Equations of motion, undamped and damped free vibration, Eigen values and Eigen vectors, orthogonality conditions, power method, characteristic equation method.
UNIT-IV (8 hrs)	**Methods of seismic analysis** Seismic design philosophy, equivalent static lateral force method with examples, ductility considerations in earthquake resistant design in RC buildings (IS: 13920)

Text Books:

1. Rao S D, **Mechanical Vibrations**, Addison Wesely New York
2. Chopra A K, **Dynamics of Structures – Theory and Applications to Earthquake Engineering**, Prentice Hall of India
3. Seto, **Mechanical Vibrations**, Schuam,s Outline Series, McGraw Hill Book Co.
4. Jai Krishna, Chandrasekaran A R and Brijesh Chandra, **Elements of Earthquake Engineering**, South Asian Bulishers, New Delhi

Reference Books:

1. Thaniby W T, **Theory of Vibrations with Applications**, CBS Pblishers
2. Paz M, **Structural Dynamics**, CBS Publishers, New Delhi
3. Mukhopadhay, **Vibrations- Structures and Structural Systems**, Oxford and IBH, New Delhi
4. Biggs J M, **Introduction to Strucural Dynamics**, McGraw Hill Publications
5. Claugh and Penzien, **Dynamics of Structures**, McGraw Hill Publications

E3: ADVANCED STRUCTURAL DESIGN

Prerequisite: BTCI-UG-C402 Structural Analysis

Course Objectives:

- To provide a comprehensive knowledge on the behaviour of R.C.C structures.
- To understand the significance of working stress and limit state design methods.
- 3. To study comprehensively, the design and reinforcement detailing of Bunkers, silos, Water tanks, Grid floors, Portal frames and curved beams.

Course Outcomes: At the end of this course students will:

Understand the behaviour of R.C.C structures. Assess and apply the appropriate design methodology and reinforcement detailing of different types of RCC structural elements i.e. Bunkers, silos, Water tanks, Grid floors, Portal frames and curved beams.

UNIT-I (8 hrs)	**Design of Bunkers and Silos** Classification of bunkers, lateral pressure on silos, Airy's theory, detailed design of bunkers and silos.
UNIT-II (12 hrs)	**Design of Water Tanks:** Underground Water Tanks (circular and rectangular), Underground Water Tanks (circular and rectangular). **Design of Box Culvert:** Type of box culverts, design principles, example
UNIT- III (8 hrs)	**Design of Grid Floors and Portal Frames** Design of grid floors by approximate methods and IS code method, design of portal frames- single storey and single bay.
UNIT-IV (8 hrs)	**Design of Beams Curved in Plan** Design beams curved in plan.

Text Books

1. Hughese B P, **Limit State Theory for Reinforced Concrete Design**.
2. Mallick and Gupta, R**einforced Concrete**.
3. Park R and Paualy, **Reinforced Concrete Structures**.

Reference Books:

1. Ramachandra, **Limit State Design**.
2. Jain O P and Jaikrishna, **Design of Reinforced Concrete Structures Vol. 2**.
3. Krishnaraju N, **Advanced R.C.C. Design**.

E4: BRIDGE ENGINEERING

Prerequisite: BTCI-UG-C402 Structural Analysis

Course Objectives: The objective is to equip the students with a thorough understanding of the behaviour and design of bridges. Various applied loads, such as truck load, impact, horizontal braking/centrifugal forces, wind and seismic loads are discussed thoroughly. Background to design equations for different types of bridges and relevant modern research will also be discussed to provide the students with solid understanding of the topics covered.

Course Outcomes: The students are expected to be able to understand the load-carrying capacity of various types of bridges, upon learning the structural responses to different kinds of loads. They should be able to design short and medium span bridges, with confidence using existing codes of practice, taking into account of the structural strength, service life and durability. It is also expected that the student would know the limitations of the design methods used.

UNIT-I (7 hrs)	**Introduction:** Definitions, components of a bridge, classification, importance and standard specifications. **Investigation for bridge:** Site selection, data drawing, design discharge, linear water way, economical span, location of piers and abutments, vertical clearance above HFL, scour depth, traffic projection, investigation report, choice of bridge type.
UNIT-II (12 hrs)	**Standard specifications for road bridges** IRC bridge code, determination of dead loads and live loads, wind loads, longitudinal forces, centrifugal forces, horizontal forces due to water current, buoyancy effect, earth pressure, temperature effect, deformation stresses, secondary stresses, erection stresses, seismic forces. **Culverts:** RCC slab culvert, pipe culvert and box culvert.
UNIT- III (10 hrs)	**Concrete bridges:** Analysis and design of small bridges and culverts, structural details of minor bridges and culverts, T-beam reinforces concrete bridges and pre-stressed concrete bridges, continuous bridges, cantilever bridges. **Sub structures**: Different types of bridge bearings, piers and masonry abutments, different types of foundation and their choices, wing walls, abutment and pier design for minor bridges, depth of bridge foundation, length of clear span and number of spans and the effect of contraction on the normal scour depth, return wall, wing wall.
UNIT-IV (7 hrs)	**Super structures:** Construction of superstructures for temporary bridges, semi-permanent bridges, submergible bridges, low-cost bridges, steel-arch bridges, RCC bridges and cable stayed bridges, wearing course, expansion joint, approach road, approach slab, protection works for shallow foundation for minor bridges, special precautions during construction, failure and restoration of bridge super structure, sub-structure and its maintenance.

Text Books:

1. Ponnuswamy S, " **Bridge Engineering**", Tata McGraw Hill Publishing Co., New Delhi, 2003.

2. Whitney C.S, " **Bridges**", Greenwich House 1983.

3. N.K.Raju, " **Design of bridges**", Oxford & IBH Publishing Co. pvt.ltd

Reference Books:

1. D.J.Victor, " **Essentials of bridge engineering**", Oxford & IBH Publishing Co. pvt. Ltd.

2. Indian Road Congress Codes"

E5: ADVANCED STRUCTURAL ANALYSIS

Prerequisite: BTCI-UG-C402 Structural Analysis

Course Objectives:

- To impart the principles of elastic structural analysis and behaviour of indeterminate structures.
- To impart knowledge about various methods involved in the analysis of indeterminate structures.
- To apply these methods for analyzing the indeterminate structures to evaluate the response of structures
- To enable the student, get a feeling of how real-life structures behaves

Course Outcomes: The student after undergoing this course will be able to:

- To understand analysis of indeterminate structures and adopt an appropriate structural analysis technique
- Determine response of structures by classical, iterative and matrix methods

UNIT-I (9 hrs)	**Introduction:** Classification of structures, equation of static equilibrium, internal forces, free-body diagram, degree of static indeterminacy, degree of kinematic indeterminacy, stability. **Column Analogy method:** Introduction, sign convention, stresses in a column, application to beams, application to symmetric frames.
UNIT-II (9 hrs)	**Plastic Analysis:** Ductility behavior in the plastic range, concept of plastic hinge, plastic moments, shape factor for different shapes of cross section, redistribution of moment, collapse mechanism. Upper and lower bound theorems. Determination of collapse loads using static and kinematics methods for simple structures.
UNIT- III (12 hrs)	**Analysis by Displacement Method:** Matrix formulation of displacement method, generation of 1-dimensional frame element stiffness matrix, flexural, axial and shear deformations, concept of local effects, generation of load vector, effects of finite joints, application to plane frames. **Analysis by force method:** Matrix formulation of force methods, Solution of simultaneous equations generation of 1-dimensional frame element stiffness matrix, flexibility and displacement approaches, concept of local effects, generation of local vector, application to plane frames.
UNIT-IV (6 hrs)	**Influence Lines** Concept of influence lines using equilibrium methods and by using Muller Breslau principle for both statically determinate and indeterminate structures.

Text Book:

1. Reddy C S (2004),"**Basic Structural Analysis**", Tata McGraw Hill, New Delhi.

2. Rao Prakash D.S (1996), "**Structural Analysis**" Universities Press, India.

Reference Books:

1. Gupta S P, Pandit G S, and Gupta R (2003), " **Theory of Structures**",volume 2, McGraw Hill, New Delhi.

2. Vaidyanathan R, and Perumal R, (2004), " **Comprehensive Structural Analysis**", Vol I & II, Laxmi Publications, New Delhi.

E6: OPTIMIZATION TECHNIQUE

Prerequisite: Nil

Course Objectives: Introduction to optimization techniques using both linear and non-linear programming. The focus of the course is on convex optimization though some techniques will be covered for non-convex function optimization too. After an adequate introduction to linear algebra and probability theory, students will learn to frame engineering minima maxima problems in the framework of optimization problems.

Course Outcomes: By the end of the course, students should be able to:

- Cast engineering minima/maxima problems into optimization framework.
- Learn efficient computational procedures to solve optimization problems
- Use Matlab to implement important optimization methods.

UNIT-I (11 hrs)	**Introduction:** Historical Development; Engineering applications of Optimization; Art of Modeling, Objective function; Constraints and Constraint surface; Formulation of design problems as mathematical design problem, Classification of optimization problem. **Optimization using Calculus:** Stationary points; Functions of single and two variables; Global Optimum, Convexity and concavity of functions of one and two variables, Optimization of function of one variable and multiple variables; Gradient vectors; Examples, Optimization of function of multiple variables subject to equality constraints; Lagrangian function, Kuhn-Tucker Conditions;
UNIT-II (7 hrs)	**Linear Programming** Standard form of linear programming (LP) problem; Canonical form of LP problem; Assumptions in LP Models; Elementary operations, Graphical method for two variable optimization problem; Examples, Motivation of simplex method, Simplex algorithm and construction of simplex tableau; Simplex criterion; Minimization versus maximization problems.
UNIT-III (7 hrs)	**Dynamic Programming** Sequential optimization; Representation of multistage decision process; Types of multistage decision problems; Concept of sub optimization and the principle of optimality, Recursive equations – Forward and backward recursions; Computational procedure in dynamic programming (DP), Discrete versus continuous dynamic programming; Multiple state variables; curse of dimensionality in DP
UNIT-IV (11 hrs)	**Dynamic Programming Applications:** Problem formulation and application in Design of continuous beam and optimal geometric layout of a truss, Water allocation as a sequential process, Capacity expansion and Reservoir operation. **Stochastic Optimization:** Introduction to probability distribution, Chance constrained linear programming, stochastic dynamic programming

Text Books:

1. Vedula,S. and Mujumdar,P.P., Water Resources Systems : Modeling Techniques and Analysis, Tata-McGraw Hill, 2005.
2. S.S. Rao,"Engineering Optimization: Theory and Practice", New Age International P. Ltd., New Delhi, 2000.
3. G. Hadley,"Linear programming", Narosa Publishing House, New Delhi, 1990.

Reference Books:

4. H.A. Taha,"Operations Research:An Introduction", 5th Edition, Macmillan, New York, 1992.
5. K. Deb,"Optimization for Engineering DesignAlgorithms and Examples",Prentice-Hall of India Pvt. Ltd., New Delhi, 1995.

E7: REMOTE SENSING AND GIS

Prerequisite: BTCI-UG-C403: Surveying-II

Course Objectives:

- Apply principles of Remote sensing and GIS to collect, map and retrieve spatial information.
- Plan, assess and evaluate natural and manmade systems using geospatial models and methods
- Use geospatial tools and techniques for hazard mitigation and resource planning.
- Pursue research and develop capabilities to handle multi-disciplinary field projects
- Work in teams and demonstrate leadership skills with professional ethics.

Course Outcomes: At the end of the program, the student will be able to:

- Identify specific data and methodologies for effective mapping and evaluation of natural resources
- Develop geospatial models and tools to address the social and engineering problems
- Apply geospatial technologies for hazard mitigation and management
- Design multi-criteria geospatial systems for decision making process

UNIT-I (10 hrs)	**Aerial Photography and Photogrammetry:** Basic principles, photographic systems, visual interpretation and mapping, ground truth verification, radiometer and its application. **Basic Concepts of Remote Sensing**: Idealized remote sensing system, physics of remote sensing, electromagnetic spectrum, black body concept, atmospheric windows, geometry of scanners, CCD arrays and platforms, history of space imaging characteristics of space platform like LANDSAT, SPOT, IRS etc. characteristics of sensors like MSS, TM, LISS – I and II, outputs from various sensors.
UNIT-II (6 hrs)	**Classification of Digital Data and Information:** Supervised, unsupervised, extraction procedure for different applications and terrain evaluation, thematic interpretation, transfer of interpreted thematic information to base map, ground verification.
UNIT- III (12 hrs)	**Application of Remote Sensing** **Geology and Geohazards:** geological structures, landforms, topography, rocks. Identification of minerals and ore deposits.Identification of zones prone to landslide, earthquake, tsunami, avalanche, soil creep, beach erosion, land subsidence etc. **Hydrological hazards**: flood forecasting, flood inundation mapping, risk zoning, reservoir sedimentation, fluvial geomorphology and environmental appraisal, snow melt initiation, drought, water quality and soil moisture, **Urban and regional planning:** mapping for monitoring urban growth and changes, urban land use/land cover mapping, land degradation, deforestation, desertification.
UNIT-IV (8 hrs)	**Fundamentals of Geographic Information Systems** Database concept, data types, data structures and models, coordinate systems and geo-referencing, concept of map projections, interpolation techniques, geo-spatial analysis and modeling. **Applications of Geographic Information Systems**

	Applications of GIS in flood study, water resources assessment and management, ground water potential modeling, basin erosion, sedimentation, land-use/ land-cover study, spatial water quality analysis, vulnerability assessment, hazard zoning and risk assessment, forecasting etc.

Text Books

1. Paul R Wolf, **Elements of Photogrammetry**, McGraw Hill.
2. Lillesand and Kiefer, **Remote sensing and Image Interpretation**, John Wiley and Sons.
3. Ravi R Gupta, **Remote Sensing Geology**, Springer
4. Floyd F Sabins, **Remote Sensing Principles and Interpretation**, WH Freeman and Co.
5. John R Jenson**, Introductory Digital Image Processing**, Prentice Hall.

Reference Books:

1. Burrough P A, **Principles of Geographical Information System for Land Resource Assessment,** Oxford University Press.
2. Bonham-Carter G F, **Geographic information systems for geoscientists modelling with GIS** (1995) Pergamon.
3. Alard Meijerink
4. Hall M K, Schaller C J, Walker C S, and Kendal L P, **Exploring Water Resources: GIS Investigations for the Earth Sciences** (2002), Brooks Cole

E8: SOIL DYNAMICS

Prerequisite: BTCI-UG-C602 Geotechnical Engineering-II

Course Objectives: To understand the wave propagation in soils, determine dynamic properties of soil for analyzing and designing foundations subjected to vibratory loading.

Course Outcomes: Able to understand the fundamentals of wave propagation in soil media, evaluate the dynamic properties of soil, and design foundations for centrifugal and reciprocating machines

UNIT-I (10 hrs)	**Fundamentals of Vibration**: Definitions, Simple harmonic motion, Response of SDOF systems of Free and Forced vibrations with and without viscous damping, Frequency dependent excitation, Systems under transient loads, Rayleigh's method of fundamental frequency, Logarithmic decrement, Determination of viscous damping, Transmissibility, Systems with Two and Multiple degrees of freedom, Vibration measuring instruments.
UNIT-II (6 hrs)	**Wave Propagation and Dynamic Soil Properties:** Propagation of seismic waves in soil deposits – Attenuation of stress waves, Stress-strain behaviour of soils under cyclic loads, Strength of cyclically loaded soils, Dynamic soil properties – Laboratory and field testing techniques, Elastic constants of soils, Correlations for shear modulus and damping ratio in sand, gravels, clays and lightly cemented sand. Liquefaction of soils and its evaluation using simple methods.
UNIT- III (12 hrs)	**Vibration Analyses:** Types, General Requirements, Permissible amplitude, Allowable soil pressure, Modes of vibration of a rigid foundation block, Methods of analysis, Lumped Mass models, elastic half space method, elasto-dynamics, effect of footing shape on vibratory response, dynamic response of embedded block foundation, Vibration isolation.
UNIT-IV (8 hrs)	**Design of Machine Foundations:**Analysis and design of block foundations for reciprocating engines, Dynamic analysis and design procedure for a hammer foundation, IS code of practice design procedure for foundations of reciprocating and impact type machines. Vibration isolation and absorption techniques.

Text Books:

1. Swami Saran – Soil Dynamics and Machine Foundation, Galgotia Publications Pvt. Ltd. (2010)
2. Prakash, S. – Soil Dynamics, McGraw Hill Book Company (1981)
3. Prakash, S. and Puri, V. K. – Foundation for Machines: Analysis and Design, John Wiley & Sons, 1998.

Reference Books:

1. Kameswara Rao, N. S. V. – Vibration Analysis and Foundation Dynamics, Wheeler Publication Ltd., 1998.
2. Das, B. M. & Ramana, G.V. – Principles of Soil Dynamics, 2nd Edition, CL Engineering Publishers, 2010.

E9: ADVANCED CONCRETE TECHNOLOGY

Prerequisite: BTCI-UG-C306: Building Materials and Concrete Technology

Course Objectives:

- To understand the Seepage analysis and related applications
- To learn the mechanisms contributing to shear strength of soils, factors affecting and procedures for determination of shear parameters in laboratory
- To gain knowledge in the settlement analysis, earth pressure computation.

Course Outcomes:

- Competence in understanding the Seepage / Shear Strength / Compressibility Characteristics of Soil
- Ability to compute earth pressure
- Core competence in analysis & design of Embankments and Earthen Dams

UNIT-I (10 hrs)	**Concrete materials:** Cement - Ordinary Portland, Portland Pozzolana, chemical composition, grade of cement, hydration, tests for cement, fineness, soundness, compressive strength, setting time. **Aggregates** - classification, requirements, size, shape, texture, Tests for coarse aggregates: specific gravity, grading of aggregate, Flakiness index, Elongation Index, Impact value, abrasion value, crushing value, alkali aggregate reaction. Tests for fine aggregates: specific gravity, sieve analysis, fineness modulus, bulking of sand, Water - general requirements, quality of water.
UNIT-II (8 hrs)	**Fresh Concrete:** Workability, factors affecting, measurement of workability, different tests for workability, segregation, bleeding, process of manufacture of concrete -batching, mixing, transportation, compaction, curing of concrete, curing methods, admixtures in concrete - air entraining agents, plasticizer and super plasticizer, accelerators, retarders, workability agents. Mineral admixtures: fly ash, silica flumes, Ground Glass Blast Furnace Slag, Metakoline **Hardened Concrete:** Strength of concrete, w/c ratio, gel/space ratio, gain of strength with age, maturity concept of concrete, effect of maximum size of aggregate on strength, relation between compressive and tensile strength, factors affecting modulus of elasticity, definition and factors affecting creep and shrinkage.
UNIT- III (8 hrs)	**Durability of concrete:** Strength and durability relationship, effect of w/c on durability, different exposure condition as per IS 456 minimum and maximum cement content, effect of permeability, sulphate attack, methods of controlling sulphate attack. Durability of concrete in sea water, Test on hardened concrete - flexural strength, comparison of cube test and cylinder test, Schmidt's rebound hammer, Ultrasonic pulse velocity method.
UNIT-IV (12 hrs)	**Special Concrete:** Light weight concrete, no-fines concrete, high density concrete, fiber reinforced concrete, self-compacting concrete, high strength concrete, high performance concrete, manufacturing of ready mix concrete, cold weather concreting, hot weather concreting, pavement quality concrete**.**

	Concrete Mix Design: Objectives of mix design, different methods of mix design, factors affecting mix proportions, quality control of concrete, statistical methods, acceptance criteria, Numerical on mix design by ACI 211.1-91, IS 10262- 2009andIS 456. Mix design of fly ash concrete by IS 10262 – 2009.

Text Books:

1. Shetty M S, **Concrete Technology**, S. Chand and Co, New Delhi
2. **I.S Hand Book on Mix design**, BIS New Delhi

Reference Books:

3. **National Building Code**, BIS, New Delhi.
4. Concrete TechnologyA. M. Neville Pearson Education, New Delhi

E10: DESIGN OF PRE STRESSED CONCRETE

Prerequisite: BTCI-UG-C402: Structural Analysis-I

Course Objectives: To introduce the students to the basic concepts and principles of Prestressed concrete structure.

Course Outcomes: At the end of the course the students will be able to:

- design prestressed concrete beam
- design prestressed composite beams
- design flexural members with partial prestressing

UNIT-I (9 hrs)	**Basic Concepts of Pre-stressing:** Need for high strength concrete and high tensile steel, stress strain characteristics and properties, advantages and applications of pre-stressed concrete. **Basic Principles of Pre-stressing:** Load balancing concept, pre-tensioning and post-tensioning systems, tensioning methods and end anchorages. **Losses of Pre-stress:** Various losses in pre-tensioned and post-tensioned systems, determination of jacking force.
UNIT-II (7 hrs)	**Analysis of Sections for flexure** Stresses in concrete due to pre-stress and loads, stresses in steel due to loads. **Camber and Deflections** Prediction of short term and long term deflections of un-cracked members, IS code provisions, cable layouts.
UNIT- III (13 hrs)	**Limit State of Collapse and Servicability:** Criteria for limit state, IS code recommendations, ultimate flexural and shear resistance of sections, shear reinforcement, limit state of serviceability, control of deflection and cracking, classification of PSC structures. **Transmission of Pre-stress in Post-tensioned Members:** Transmission length, bond stress, anchorage stresses in post-tensioned members, bearing stress and bearing tensile force, stress in end blocks, methods, IS code provisions for the design of end block reinforcements.
UNIT-IV (10 hrs)	**Design of Symmetrical and Unsymmetrical Members:** Permissible stresses, design of pre-stressing force and eccentricity, limiting zone of pre-stressing force and eccentricity, cable profile. **Analysis of Continuous beams:** Primary and secondary moments, Concordant cable profile, determination of C-line for different loading cases.

Text Books

1. Krishnaraju N, **Pre-stressed Concrete**
2. Dayaratnam P, **Pre-stressed Concrete Structures**.
3. Lin T Y and Ned Burns H **Design of Pre-stressed Concrete Structures**.

Reference Books:

4. Sinha N C and Roy S K, **Fundamentals of Pre-stressed Concrete**.
5. Libby, Modern **Pre-stressed Concrete**.

E11: WATER RESOURCES ENGINEERING

Prerequisite: BTCI-UG-C405: Irrigation Engineering

Course Objectives: The objective of the course is to introduce students to the basic concepts irrigation and drainage system design and construction of various hydraulic structures with their planning and management.

Course Outcomes: At the end of the course, the students will be able

1. Understand the concept of irrigation and estimate the irrigation water requirements.
2. To plan and execute a canal network in the field.
3. To plan and design irrigation projects.
4. Design channels and other irrigation structures required for irrigation, drainage, flood control and other management projects.

UNIT-I (10 hrs)	**Introduction:** Definition, functions and advantages of irrigation, Present Status of irrigation in India, Systems of irrigation, Soil moisture and Crop-Water relations, Irrigation- Water quality, Duty and consumptive use of water, frequency of irrigation, irrigation efficiency. **Water logging and drainage:** Causes and effects of water logging, Measures for it prevention, Causes of Reclamation of salt effected Lands, Reclamation Procedure, land drainage, design of drainage system, Tile drains.
UNIT-II (10 hrs)	**Canal Irrigation:** Types of canals, Parts of canal Irrigation system, Planning and alignments of irrigation canals, Estimation of design discharge of a canal, Design of Channel, Kennedy's silt theory, Lacey's theory, canal lining types of lining, Types of drainage arrangement, Selection of drainage arrangement, Design aspect of lined channel, procedure of design
UNIT- III (10 hrs)	**Design of Stable Channels:** Rigid boundary channels carrying Clearwater and sediment laden water, Alluvial Channels carrying Clearwater and sediment laden water, Procedure for design of irrigation channels, Various components of canal structures, Sediment distribution, Silting and berming of channel. **Hydraulics of Alluvial Rivers:** Critical tractive force, incipient motion of sediment, Regimens of flow, Resistance of flow in alluvial channels, Transport of sediment.
UNIT-IV (12 hrs)	**Surface and Subsurface Flow considerations for design of Canal Structures:** Design for surface and subsurface flows, Bligh's, Lane's and Khosla's methods, Design of falls distributory and cross regulators Diversion head works, Canal head regulators, Canal falls, Outlets, Cross drainage works. **Dams:** Types of dams, Factors influencing selection of the type of dam and site, investigations. Gravity dams – forces and load combinations for design, modes of failure and stability requirements, elementary and practical profiles, joints, keys, water stops, openings and galleries, temperature control and foundation treatment.

Text Books:

1. Irrigation and Water Resources G.L.Asawa New age International Engineering Publishers
2. Theory and Design of Irrigation Structure R.S. VarshneyNem Chand & Bros. Roorkee
3. Engineering Hydrology K Subramanya Tata-McGrawHill

Reference Books:

1. Applied Hydrology V.T.Chow Mc Graw Hill
2. Introduction to Hydrology W.Viesman, Kneep,Harper and Row G.L.Lewis, L.W

3. Modi, P. N., Irrigation, Water Resources, and Water Power Engineering, Standard Book House, 2008.

E12: URBAN TRANSPORT PLANNING

Prerequisite: BTCI-UG-C304 Transportation Engineering-I

Course Objectives: • To cover concepts of Transportation planning, various modes, transit systems and their suitability

• To give idea of modeling in planning, to develop the methodology of travel demand modeling for Urban Transportation Systems

• To provide knowledge of Land use planning and transportation interaction.

Course Outcomes: • The students will gain an experience in the implementation of planning transportation routes in new developing towns and cities.

• The students will get a diverse knowledge to solve the problem of congestion and inconvenience.

• The students would be able to understand and evaluate current scenarios of traffic management and improve it.

UNIT-I (6 hrs)	**Introduction** Development plans, objectives and goals; level of planning; role of transportation at national, regional and urban level**.** **Urbanization**: Definition of urban area; trends in urbanization; urban class groups; metropolitan city; transportation problems & identification.
UNIT-II (12 hrs)	**Transportation Surveys**: The transportation study area definition; division into traffic zones; network identification and coding; types of travel and characteristics of various surveys; home interview; roadside survey; goods, mass transit and intermediate public transport surveys; sampling and expansion factors; accuracy checks, screen line checks, consistency checks. **Travel Forecasting:** Growth factor methods and urban transportation planning system; growth factors; average growth factor method and Furness method
UNIT- III (10 hrs)	**UTP System**: Trip generation; zonal regression methods and category analysis; trip distribution method; gravity models and opportunity models; modal split methods; factors affecting modal split; trip end models and trip distribution models; route assignment; factors affecting route choice; diversion curve; shortest paths; all or nothing assignment.
UNIT-IV (8 hrs)	**Corridor Identification**: Prediction issues and forecasting of the travel demand and future desires; corridor identification and corridor screen line analysis. **Mass Transit Systems:** Bus and rail transit; characteristics, capacities, route planning.

Text Books:

1 Kadiyali, L.R., Traffic Engineering & Transport Planning, Khanna Publishers, New Delhi

2 Jotin Khisty, S.C. and Kent Lall, B., Transportation Engineering – An Introduction, Prentice-Hall, NJ

3 Salter, R J., Highway Traffic Analysis and Design, ELBS B.

Reference Books:

1. Hutchison, B.G., Introduction to Transportation Engineering, & Planning, McGraw Hill Book Co.
2. John W. Dickey, Metropolitan Transportation Planning, Tata McGraw Hill Pub. Co.
3. Vukan R. Vuchic, Urban Public Transportation System & Technology, Prentice Hall, Inc.
4. Papacostas, C.S., Fundamentals of Transportation System Analysis, PHI
5. Jotin Khisty, C. and Kent Lall, B., Transportation Engineering – An Introduction, Prentice-Hall, NJ

E13: ADVANCED STEEL DESIGN

Prerequisite: BTCI-UG-C603: Design of Steel Structures

Course Objectives:

- To teach the students advance level design of steel structures.
- To make the students familiar with the relevant BIS codes to be used in construction industries.
- To teach the students modern design methods such as plastic design and design of light gauge steel.

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Course Outcomes: On completion of this course, the students will be able to

- Design complicated structures like plate girder, gantry girder, Industrial structures, tanks and slabs.
- Design steel structures on plastic theory where ever possible.
- Use relevant BIS for above structural design.

UNIT-I (8 hrs)	**Plate Girder** Introduction, general consideration, distribution of stresses, web panel subjected to combined bending and shear, design of plate girder using IS:800-2007, behaviour of longitudinally stiffened plate, welding of girder components.
UNIT-II (10 hrs)	**Industrial Structures** Introduction, Roof and side coverings, Design loads, purlins, end bearings, general framing of industrial builings, bracings. **Gantry Girder**: Introduction, loading consideration, maximum load effect, selection of gantry girder, design of gantry girder.
UNIT- III (8 hrs)	**Steel Tanks and Stack** Introduction, Classification of steel tank, Wind load on tank and stack, Earthquake force on tank and stack, Design of Pressed steel tank with staging, Design consideration for steel stack,
UNIT-IV (10 hrs)	**Plastic Design** Introduction, Stress strain curve, Strength of tensile and compression members, bending of rectangular section, theory of plastic bending, calculation of plastic moment, plastic hinge and mechanism, strength of redundant structures, ultimate load analysis fundamentals; Static method and Mechanism method, Distributed loading, load factor, effect of axial forces on plastic moment, lateral buckling, design of columns, design of connections.

Text Books

1. Design of Steel Structures by Arya and Ajmani, Nem Chand & Brothers.
2. Design of Steel Structures by N. Subramanian, Oxford University Press

Reference Books:

3. BIS: 800-1984, B IS:800-200, BSI:1079-1973, BIS:801-1975.
4. Bowles, J.E. 1980, Structural Steel Design, McGraw Hill publication
5. Chen W.F. and S.E. Kim1997, Steel Design Using Advanced Analysis, CRS Press

E14: ADVANCED GEOTECHNICAL ENGINEERING

Prerequisite: BTCI-UG-C602 Geotechnical Engineering-II

Course Objectives:

- To understand the Seepage analysis and related applications
- To learn the mechanisms contributing to shear strength of soils, factors affecting and procedures for determination of shear parameters in laboratory
- To gain knowledge in the settlement analysis, earth pressure computation.

Course Outcomes:

- Competence in understanding the Seepage / Shear Strength / Compressibility Characteristics of Soil
- Ability to compute earth pressure
- Core competence in analysis & design of Embankments and Earthen Dams

UNIT-I (8 hrs)	**Soil water hydraulics**: Seepage mathematical Analysis-finite difference formulae of study state and transient flow water soils- construction of flow nets in homogenous soils by graphical methods- computation of seepage for 10 ground water- embankments earth uplift pressures critical hydraulics- safety factors.
UNIT-II (10 hrs)	**Shear strength properties of soils:** Review of conventional shear stress factors affecting shear strength of soils – pore pressure in soils- pore pressure measurements in triaxial compression test and field measurements- total and effective shear stress parameters- stress path – Hvorslave shear parameters – shear strength, thixotrophy and liquefaction of soils.
UNIT- III (8 hrs)	**Consolidation of properties:** one, two and three dimensional consolidation theories – primary, secondary, consolidation process finite difference formulations of consolidation equations – radial consolidation – sand rain and other techniques to accelerate consolidation process- estimation of settlements.
UNIT-IV (10 hrs)	**Limiting equilibrium conditions**: review of (Rankine, coulomb) Earth pressure theories computation of earth pressure using theory of plasticity for cohesive and cohesionless soils- soil tension effects- rupture zonesreliability of solutions- Earth pressure computations- soil properties to be used- graphical and computer solutions- Earth pressure theories by elasticitypressure in soils- green elevators, coal bunkers etc.

TEXT BOOKS

1. Scott, R.F., Principles of Soil Mechanics, Eastern Willey Publications.
2. Lambe, T.W. and Whitman, R.V., Soil Mechanics, John Wiley and Sons, 1969.
3. Alam Singh, Soil Engineering in Theory and Practice, Asia Publishing House,1981

BCI-UG-O705 OPEN ELECTIVE-II (2L 1T 0P)

E1: HUMAN RESOURCE DEVELOPMENT AND ORGANIZATIONAL BEHAVIOR

Prerequisite: Nil

Course Objectives: The objective of the course is to familiarise the students about the different aspects of managing people in the organisations from the stage of acquisition to development and retention. In order to be successful, today's organizations must integrate organizational behavior and HRD. Organizations are dependent upon their employees to obtain the goals of the organization. It is through the employees that organizations can overcome the challenges with which organizations are faced today. Employees have to be motivated as a way of making them increase their productivity which is accomplished through the examination of organizational behavior and implementation of human resource development initiatives.

Learning outcomes: On completion of the course it is expected to endow the students with skills of

- List and define basic organizational behavior principles, and analyze how these influence behaviors in the workplace.
- Analyze individual human behavior in the workplace as influenced by personality, values, perceptions, and motivations.
- Outline the elements of group behavior including group dynamics, communication, leadership, power & politics and conflict & negotiation.
- Understand your own management style as it relates to influencing and managing behavior in the organization systems.
- Enhance critical thinking and analysis skills through the use of management case studies, personal application papers and small group exercises.
- Strengthen research, writing and presentation skills.

UNIT-I (8 hrs)	**Human Resource Development:** Definition & Background, Economic Development, HRD and Organizational Socialization, Development of Individual through Training: Designing Training Programs: On –the Job, Off the Job, Methods, Other methods of HRD: Suggestion schemes, Counselling, career planning, 17 talent management, Competency mapping, Strategic Interventions: HRD in Service and Information Technology Sectors, HRD for Women and Workers, Mentoring, HR Audit: Audit

	Methodology, Writing the HRD Report, Designing and using HRD Audit for Business Improvement, Training need analysis, HRD in India: Cases in PSUs and Private Sector Enterprises.
UNIT-II (10 hrs)	**Fundamentals of Organizational Behaviour**: Understanding Organizational Behaviour - Fundamental Concepts, Organizational processes, Organizational structure, Organizational Change and Innovation processes. Effectiveness in organizations - Models of Organizational Behaviour, Systems theory and time dimension of effectiveness, developing competencies, Limitations of Organizational Behaviour, Continuing challenges. Social systems and organizational culture - Understanding a Social System, Social Culture, Role, Status, Organizational culture, Influencing culture change, Sustaining the culture, Characteristics of effective socialization.
UNIT- III (8 hrs)	**Understanding and Managing Individual Behaviour:** Individual differences and work behavior, Personality, Attitudes, Perceptions, Attributions and Emotions, Motivation, Job Design, Work and Motivation, Evaluation, Feedback and Rewards, Managing misbehavior, Stress and Counseling.
UNIT-IV (8 hrs)	**Group Behaviour and Interpersonal Influence:** Informal and Formal Groups, Team and Team Building, Managing Conflict and Negotiation, Power and Politics, Empowerment and Participation, Assertive Behaviour. **Organizational Processes**: Communication, Decision Making, Leadership. Organizational Structure and Design, Innovation.

Text Books:

1. Swati Sharma, Handbook of Organizational Behaviour and Human Resources 1 Edition

2. Mirza Saiyadain, Jag Sodhi, Cases in Organizational Behaviour and Human Resource Management Paperback – 18 Mar 2009

3. Organizational Behaviour-Robbins, Judge & Sanghi, Pearson Education Publication.

4. Organizational Behaviour-McShane & Glinow, McGraw Hill Publication.

Reference Books:

1. Sanjeev Kumar Singh, Human Resource Development: HRD—IR Interface Approach

2. G G Jadhav, Human Resource Management And Organizational Behaviour

E2: INDIAN SOCIETY (2L 1T 0P)

Prerequisite: Nil

Course Objective:

The basic objective of this paper is to present a comprehensive and integrated profile of Indian society. This paper aims to analyse traditional features of Indian society.

UNIT-I (8 hrs)	**Evolution of Indian Society**: Traditional bases of Indian Society; Unity and Diversity in India; India as a Pluralistic Society.
UNIT-II (8 hrs)	**Indian Social Institutions:** Kinship, Family, Marriage; Caste and its Changing Dimensions.
UNIT- III (8 hrs)	**Processes of Social Change in India:** Sanskritization, Westernization, Parochiatization and Universatization
UNIT-IV (8 hrs)	**Social Issues and Problems:** Gender Discrimination, Secularism and Religious Minorities, Problems of Dalits Women and OBC and Affirmative Actions

Text Books:

1. Ahuja, Ram (1997): Society in India: Concept, Theories and Recent Trends, Jaipur: Rawat Publication. Beteille,
2. Andre (1992): Backward Classes in Contemporary India, New Delhi: OUP.
3. Dube, S.C.(1991): Indian Society, New Delhi : National Book Trust.
4. Ghurye, G.S. (1968): Social Tension, Bombay:

Reference Books:

1. Popular Prakashan. Karve, Iravati (1961): Hindu Society: An Interpretation, Pune: Daccan College.
2. Mandelbaum, D.G. (1970): Society in India, Bombay: Popular Prakashan.
3. Sharma K.L.(ed.) (1994): Caste and Class, Jaipur, Rawat Publication.
4. Srinivas, M.N.(1980): India's : Social Structure, New Delhi : Hindustan Publication.
5. Srinivas, M.N.(1985): Social Change in Modern India, New Delhi :
6. Orient Longman. India: 2010 Govt. of India, New Delhi, Govt. of India publication division.

E3: ENGINEERING RESEARCH METHODOLOGY (2L 1T 0P)

Prerequisite: Nil

Course Objective: This course covers the various stages of research work in engineering sciences and highlights the importance, scope, functioning and procedures to be followed for successful research outcomes and its documentation and presentation. It also intends to give students the tools to conceptualize their theses in terms of research questions and design, methodology, data collection and qualitative as well as quantitative analysis.

Course outcomes: At the end of this course, the students will demonstrate their ability to

- Understand the research method as a major component leading to the learning and completion of Dissertation.
- Produce a dissertation research proposal with researchable topic related to the field of engineering and applied science, appropriate research method, and a display of literature review.
- Complete a research leading to a dissertation.

UNIT-I (10 hrs)	**Research Methodology:** Objectives and Motivation of Research, Types of Research, Research Approaches, Significance of Research, Research Methods verses Methodology, Research and Scientific Method, Important of Research Methodology, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India, Benefits to the society in general. Defining the Research Problem: Definition of Research Problem, Problem Formulation, Necessity of Defining the Problem, Technique involved in Defining a Problem.
UNIT-II (10 hrs)	**Literature Survey:** Importance of Literature Survey, Sources of Information, Assessment of Quality of Journals and Articles, Information through Internet. Literature Review: Need of Review, Guidelines for Review, Record of Research Review. **Research Design:** Meaning of Research Design, Need of Research Design, Feature of a Good Design Important Concepts Related to Research Design, Different Research Designs, Basic Principles of Experimental Design, Developing a Research Plan, Design of Experimental Set-up, Use of Standards and Codes.
UNIT- III (10 hrs)	**Data Collection:** Collection of primary data, Secondary data, Data organization, Methods of data grouping, Diagrammatic representation of data, Graphic representation of data. Sample Design, Need for sampling, some important sampling definitions, Estimation of population, Role of Statistics for Data Analysis, Parametric V/s Non Parametric methods, Descriptive Statistics, Measures of central tendency and Dispersion, Hypothesis testing, Use of Statistical software. Data Analysis: Deterministic and random data, Uncertainty analysis, Tests for significance: Chisquare, student's t-test, Regression modeling,

	Direct and Interaction effects, ANOVA, F-test, Time Series analysis, Autocorrelation and Autoregressive modeling.
UNIT-IV (12 hrs)	**Research Report Writing:** Format of the Research report, Synopsis, Dissertation, Thesis its Differentiation, References/Bibliography/Webliography, Technical paper writing/Journal report writing, making presentation, Use of visual aids. Research Proposal Preparation: Writing a Research Proposal and Research Report, Writing Research Grant Proposal.

Text Books:

1. C.R Kothari, Research Methodology, Methods & Technique; New Age International Publishers, 2004

2. R. Ganesan, Research Methodology for Engineers, MJP Publishers, 2011

3. Ratan Khananabis and Suvasis Saha, Research Methodology, Universities Press, Hyderabad, 2015.

4. Y. P. Agarwal, Statistical Methods: Concepts, Application and Computation, Sterling Publs., Pvt., Ltd., New Delhi, 2004

5. Vijay Upagade and Aravind Shende, Research Methodology, S. Chand & Company Ltd., New Delhi, 2009

Reference Books:

1. G. Nageswara Rao, Research Methodology and Quantitative methods, BS Publications, Hyderabad, 2012.

2. Naval Bajjai “Business Research Methods” Pearson 2011.

3. Prahalad Mishra “ Business Research Methods “ Oxford 2016