Pimpri Chinchwad Education Trust's

PIMPRI CHINCHWAD COLLEGE OF ENGINEERING

SECTOR NO. 26, PRADHIKARAN, NIGDI, PUNE 411044

An Autonomous Institute Approved by AICTE and Affiliated to SPPU, Pune

DEPARTMENT OF CIVIL ENGINEERING

Curriculum Structure and Syllabus
of
S.Y. B.Tech Civil Engineering
(Course 2020)

Effective from Academic Year 2023-24

(Updated with minor changes)

Institute Vision

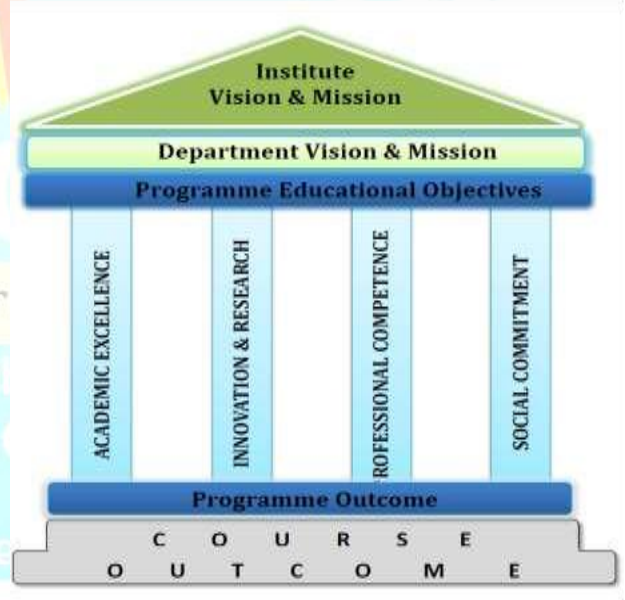
To be one of the top 100 Engineering Institutes of India in coming five years by offering exemplarily Ethical, Sustainable and Value Added Quality Education through a matching ecosystem for building successful careers.

Institute Mission

1. Serving the needs of the society at large through establishment of a state-of-art Engineering Institute.
2. Imparting right Attitude, Skills, Knowledge for self-sustenance through Quality Education
3. Creating globally competent and Sensible engineers, researchers and entrepreneurs with ability to think and act independently in demanding situations

Quality Policy

We at PCCOE are committed to impart Value Added Quality Education to satisfy the applicable requirements, needs and expectations of the Students and Stakeholders. We shall strive for academic excellence, professional competence and social commitment in fine blend with innovation and research. We shall achieve this by establishing and strengthening state-of- the-art Engineering and Management Institute through continual improvement in effective implementation of Quality Management System.



INDEX

LIST OF ABBREVIATIONS IN CURRICULUM STRUCTURE

SR. NO.	ABBREVIATION	TYPE OF COURSES
1.	BSC	Basic Science Course
2	ECC	Engineering Core Course
3	HSMC	Humanities, Social Sciences and Management Course
4	PCC	Professional Core Course
5	PEC	Professional Elective Course
6	OEC	Open Elective Course
7	PROJ	Project
8	INTR	Internship
9	Audit	Audit Course
10	MC	Mandatory Course
11	LS	Life Skill
12	PFC	Proficiency Course
13	MOOC	Massive Open Online Course
14	L	Lecture
15	P	Practical
16	T	Tutorial
17	H	Hours
18	CR	Credits
19	IE	Internal Evaluation
20	MTE	Mid Term Evaluation
21	ETE	End Term Evaluation
22	TW	Term Work
23	OR	Oral
24	PR	Practical

CURRICULUM FRAMEWORK

(2020-2021; 2021-2022; 2022-2023; 2023-2024)

Course and Credit Distribution

SR NO.	TYPE OF COURSE	NO. OF COURSES	TOTAL CREDITS	
			NO.	%
1.	Basic Science Course (BSC)	8	23	14
2.	Engineering Core Course (ECC)	14	22	14
3.	Humanities, Social Science and Management Course (HSMC)	6	13	8
4.	Professional Core Course(PCC)	24	48	30
5.	Professional Elective Course(PEC)	6	18	11
6.	Open Elective Course(OEC)	6	18	11
7.	Project(PROJ)	2	16	10
8.	Internship(INTR)	1	3	2
9.	Audit Course (AUDIT)	3	0	-
10.	Mandatory course (MC)	2	0	-
11.	Life Skill (LS)	4	0	-
12.	Proficiency course (PFC)	3	0	-
13.	Massive Open Online Courses (MOOC)	1	0	-
TOTAL		**80**	**161**	**100**

Semester wise Course Distribution

Sr. No.	TYPE OF COURSE	NO. OF COURSES/ SEMESTER								TOTAL
		1	2	3	4	5	6	7	8	
1.	Basic Science Course (BSC)	3	3	2	-	-	-	-	-	8
2.	Engineering Core Course (ECC)	6	5	2	1	-	-	-	-	14
3.	Humanities, Social Science and Management Course (HSMC)	1	1	1	1	1	1	-	-	6
4.	Professional Core Course(PCC)	-	-	6	6	4	4	4	-	24
5.	Professional Elective Course(PEC)	-	-	-	-	2	2	2	-	6
6.	Open Elective Course(OEC)	-	-	-	1	1	2	2	-	6
7.	Project(PROJ)	-	1	-	-	-	-	-	1	2
8.	Internship(INTR)	-	-	-	-	-	-	-	1	1
9.	Audit Course (AUDIT)	-	-	-	1	1	1	-	-	3
10.	Mandatory course (MC)	-	-	-	-	1	1	-	-	2
11.	Life Skill (LS)	1	1	1	1	-	-	-	-	4
12.	Proficiency course (PFC)	-	-	-	1	1	1	-	-	3
13.	Massive Open Online Courses (MOOC)	-	-	-	-	-	-	1	-	1
	TOTAL	**11**	**11**	**12**	**12**	**12**	**13**	**10**	**2**	**80**

Semester wise Credit Distribution

1 Lecture hour = 1 Credit 2 Lab Hours = 1 Credit 1 Tutorial Hour = 1 Credit

Sr. No.	TYPE OF COURSE	NO. OF COURSES/ SEMESTER								TOTAL
		1	2	3	4	5	6	7	8	
1.	Basic Science Course (BSC)	9	9	5	-	-	-	-	-	23
2.	Engineering Core Course (ECC)	9	7	3	3	-	-	-	-	22
3.	Humanities, Social Science and Management Course (HSMC)	2	2	3	2	2	2	-	-	13
4.	Professional Core Course(PCC)	-	-	12	12	8	8	8	-	48
5.	Professional Elective Course(PEC)	-	-	-	-	6	6	6	-	18
6.	Open Elective Course(OEC)	-	-	-	3	3	6	6	-	18
7.	Project(PROJ)	-	2	-	-	-	-	-	14	16
8.	Internship(INTR)	-	-	-	-	-	-	-	3	3
9.	Audit Course (AUDIT)	-	-	-	-	-	-	-	-	0
10.	Mandatory course (MC)	-	-	-	-	-	-	-	-	0
11.	Life Skill (LS)	-	-	-	-	-	-	-	-	0
12.	Proficiency course (PFC)	-	-	-	-	-	-	-	-	0
13.	Massive Open Online Courses (MOOC)	-	-	-	-	-	-	-	-	0
	Total	**20**	**20**	**23**	**20**	**19**	**22**	**20**	**17**	**161**

Curriculum structure

SY B Tech

Semester III

Civil Engineering

CURRICULUM STRUCTURE

For Second Year B. Tech. (Civil Engineering) Semester-III

Course Code	Course Type	Course Name	Teaching Scheme					Evaluation Scheme						
			L	P	T	H	CR	IE	MTE	ETE	TW	PR	OR	Total
BAS3204	BSC	Applied Mathematics	3	-	-	3	3	20	30	50		-	-	100
BCI3202	BSC	Statistical Methods in Civil Engineering	1	-	1	2	2	-	-	-	50	-	-	50
BCI3301	ECC	Engineering Geology	2	-	-	2	2	20	30	50		-	-	100
BCI3401	PCC	Strength of Materials	3	-	-	3	3	20	30	50	-	-	-	100
BCI3402	PCC	Building Planning, Construction and Material	3	-	-	3	3	20	30	50	-	-	-	100
BCI3403	PCC	Fluid Mechanics	3	-	-	3	3	20	30	50	-	-	-	100
BCI3302	ECC	Engineering Geology Lab	-	2	-	2	1	-	-	-	25	-	-	25
BCI3404	PCC	Testing of Materials Lab	-	2	-	2	1	-	-	-	-	-	25	25
BCI3405	PCC	Building Planning, Construction and Material Lab	-	2	-	2	1	-	-	-	25	-	25	50
BCI3406	PCC	Fluid Mechanics Lab	-	2	-	2	1	-	-	-	25	-	25	50
BHM3101	HSMC	Universal Human Values	3	-	-	3	3	30	-	20	-	-	-	50
BHM3939	LS	Life skill -3	-	2	-	2	-	-	-	-	-	-	-	GR
Total			18	10	1	29	23							750

L- Lecture, T- Tutorial, P- Practical, H-Hours, CR- Credit, CIE-Continuous Internal Evaluation, IE – Internal Evaluation, MTE – Mid Term Examination, ETE – End Term Examination, TW – Term Work, PR- Practical Exam, OR – Oral Exam

Semester – III

List of courses – Life Skill-3

Course Code	Course Name	
BHM3939	1. Practicing Meditation 2. Sports	Choose any one
	Performing Arts: Music, Singing, Poetry, Indian Conventional Dancing, Photography, Short Movie Making, Painting/ Sketching/ Drawing, Theatre Arts, Anchoring, Calligraphy etc.	Choose any one performing arts

CURRICULUM STRUCTURE

For Second Year B. Tech. (Civil Engineering) Semester-IV

Course Code	Course Type	Course Name	Teaching Scheme					Evaluation Scheme						
			L	P	T	H	CR	IE	MTE	ETE	TW	PR	OR	Total
BCI4407	**PCC**	**Geotechnical Engineering**	3	-	-	3	3	20	30	50	-	-	-	100
BCI4408	**PCC**	**Surveying & Geomatics**	3	-	-	3	3	20	30	50	-	-	-	100
BCI4409	**PCC**	**Concrete Technology**	3	-	-	3	3	20	30	50	-	-	-	100
BAS4601/ 2/3/4/5/6	**OEC**	**Open Elective-1**	3	-	-	3	3	20	30	50	-	-	-	100
BCI4303	**ECC**	**Mechanics of Structure**	3	-	-	3	3	20	30	50	-	-	-	100
BCI4410	**PCC**	**Geotechnical Engineering Lab**	-	2	-	2	1	-	-	-	25	-	25	50
BCI4411	**PCC**	**Surveying & Geomatics Lab**	-	2	-	2	1	-	-	-	25	50	-	75
BCI4412	**PCC**	**Concrete Technology Lab**	-	2	-	2	1	-	-	-	50	-	25	75
BHM4101	**HSMC**	**Professional skills for Engineers**	1	2	-	3	2	30	-	20	-	-	-	50
BHM4940	**LS**	**Life Skill - 4**	-	2	-	2	-	-	-	-	-	-	-	GR
BCI4911 A/B/C/D/ E	**PFC**	**Proficiency Course-1**	-	2	-	2	-	-	-	-	-	-	-	GR
BHM9961 /62/63/64/ 65	**AUDIT**	**Audit Course-1**	1	-	-	1	-	-	-	-	-	-	-	GR
		Total	**17**	**12**	**-**	**29**	**20**	-	-	-	-	-	-	**750**

L- Lecture, T- Tutorial, P- Practical, H-Hours, CR- Credit, CIE-Continuous Internal Evaluation, IE – Internal Evaluation, MTE – Mid Term Examination, ETE – End Term Examination, TW – Term Work, PR- Practical Exam, OR – Oral Exam

Semester – IV

List of courses – Open Elective Course – I

Course Code	Department	Course Name	
BAS4601	AS&H	Numerical Methods	Choose any one
BAS4602	AS&H	Mathematical Optimization	
BAS4603	AS&H	Calculus of Variation	
BAS4604	AS&H	Mathematical Modelling and Simulation	
BAS4605	AS&H	Financial Mathematics	
BAS4606	AS&H	Neural Network and fuzzy logic Control	

List of courses – Life Skill-4

Course Code	Course Name	
BHM4940	1. Social welfare and Cultural Awareness 2. Transactional Analysis	Choose any one
	Caring and service Hospital Caring, Personal Safety, First Aid, Disaster Management Gardening, Organic farming, Cooking etc.	Choose any one caring & service

List of courses – Proficiency Course –1

Course Code	Course Name	
BCI4911A	Analysis and design of water supply network using WaterGEMS	Choose any one
BCI4911B	(Slope Stability Analysis Software)	
BCI4911C	Analysis of Structures by STAAD-PRO Software	
BCI4911D	MATLAB	
BCI4911E	Building planning, design and modeling using Revit	

List of courses – Audit Course – 1

Course Code	Course Name	
BHM9961	Environmental Science	Choose any one
BHM9962	Constitution of India	
BHM9963	Emotional Intelligence	
BHM9964	Entrepreneurship development	
BHM9965	Research article writing	

Course Syllabus

SY B Tech

Semester-III

Program:	B. Tech. (Civil Engineering)			Semester:	III		
Course:	Applied Mathematics			Code:	BAS3204		
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
3	-	3	3	20	30	50	100

Prior knowledge of

1. Univariate Calculus
2. Multivariate Calculus is essential

Course Objectives:

This course aims at enabling students,

1. To get acquainted with mathematical modeling of physical systems and their solutions through higher order Linear Differential Equations.
2. To develop the problem solving skill using Statistical analysis and Probability theory.
3. To achieve a solid understanding of higher level mathematics and their applications in Civil Engineering.

Course Outcomes:

After learning the course, the students will be able to

1. **Calculate** the deflection for bending of a beam and whirling of shaft problems **using** the concepts of higher order linear differential equations**.**
2. **Apply** descriptive statistical techniques to find measures of variability of numerical data .
3. **Analyze** the data using probability theory and hypothesis testing.
4. **Examine** the vector fields using concepts of vector differentiation.
5. **Use** vector integration for **conversion** of line to surface integration and surface to volume integration
6. **Solve** wave, transport, one and two-dimensional heat flow equations using the separation of variables method.

Detailed Syllabus:

Unit	Description	Duration (H)
1.	**Linear Differential Equations:** Introduction of Linear and Nonlinear differential equations, Linear differential equation of n^{th} order with constant coefficients, General method, Shortcut methods, Method of Variation of Parameters, Applications to problems on bending of beam & whirling of shafts.	7
2.	**Statistics:** Measures of Variability: Standard deviation, Coefficient of variation, Moments, Skewness and Kurtosis, Curve fitting, Correlation and Regression.	8
3.	**Probability Distribution and Hypothesis Testing:** Probability, Discrete & Continuous random variable, Binomial, Poisson & Normal distributions. **Hypothesis Test**: z-Test, t-Test, p-Test, Chi-Square test, ANOVA Test.	8
4.	**Vector Differentiation Calculus:** Introduction, Vector differential operators, Gradient, Divergent, and Curl, Physical interpretation of vector differentiation, Directional derivatives, Solenoidal, Irrotational and conservative fields, Scalar potential.	7
5.	**Vector Integration Calculus:** Line, Surface, and Volume Integration of vectors, Work-done, Green's lemma, Gauss's divergence theorem, Stoke's theorem. Applications to problems in Fluid Mechanics.	8
6.	**Applications of Partial Differential Equations:** Partial differential equations, Method of separation of variables, One dimensional Wave, Heat and Transport equation, Two-dimensional Heat flow equation.	7
	Total	45

Text Books:

1. B.V. Ramana , “Higher Engineering Mathematics”, Tata McGraw-Hill, 34 edition, ISBN 13:9780070634190.
2. Erwin Kreyszig, “Advanced Engineering Mathematics” Wiley Eastern Ltd.,10 Edition, ISBN 13: 9780470458365.

Reference Books:

1. Peter V. O'Neil, “Advanced Engineering Mathematics”, Thomson Learning ,7 Edition, ISBN 13: 9781337274524.
2. M. D. Greenberg , “Advanced Engineering Mathematics”, Pearson Education, 2 Edition, ISBN 13: 9780486492797.
3. S.R.K. Iyengar, Rajendra K. Jain, “Advanced Engineering Mathematics”, Alpha Science International, Ltd,4 Edition, ISBN 13: 9781842658468.
4. B. S. Grewal , “Higher Engineering Mathematics”, Khanna Publication, 42 Edition, ISBN 13: .9788174091955.
5. N. P. Bali, Manish Goyal, “ A textbook of Engineering Mathematics”, 9th Edition, ISBN 16:978-8131808320.

e-sources:

1. NPTEL Course lectures links:
   https://nptel.ac.in/courses/111/105/111105090/ (Probability).
   https://nptel.ac.in/courses/111/105/111105038/ (P.D.E).

2. V-lab (IIT-Bombay) link: http://vlabs.iitb.ac.in/vlabs-dev/labs/numerical_lab/labs/explist.php

Program:	B. Tech. (Civil Engineering)			Semester:			III
Course:	Statistical methods in Civil Engineering			Code:			BCI3202
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	TW	OR	PR	Total
1	1	2	2	50	-	-	50

Prior Knowledge of: Linear Algebra Univariate Calculus, Linear Algebra Univariate Calculus. (Methods and basic concepts in mathematics is essential)

Course Objectives:

1. To build conceptual understanding of statistical methods.
2. To impart knowledge of the applications of statistical methods in Civil Engineering domains

Course Outcomes:

After learning the course, the students will be able to:

1. Apply regression, correlation in Civil Engineering
2. Apply probability and statistics in Civil Engineering
3. Apply concept of matrices in Civil Engineering
4. Apply linear differential equations in Civil Engineering

Detailed Syllabus:

Unit	Description	Duration (H)
	Applications of following methods in civil engineering domain:	
1	a) Regression and correlation	7
2	b) Probability and Statistics	8
3	c) Matrices	7
4	d) Linear Differential Equations	8
		30

Assignments: Six assignment based on the above topics will be covered in tutorial

Text Books:

1. Higher Engineering Mathematics by B.V. Ramana (Tata McGraw-Hill), 2018
2. Advanced Engineering Mathematics by Erwin Kreyszig (Wiley Eastern Ltd.), 10th Edition
3. Advanced Engineering Mathematics, 2e, by M. D. Greenberg (Pearson Education).

Reference Books:

1. Advanced Engineering Mathematics, 7e, by Peter V. O'Neil (Thomson Learning), 2012
2. Higher Engineering Mathematics by B. S. Grewal (Khanna Publication, Delhi).
3. Applied Mathematics (Volumes I and II) by P. N. Wartikar & J. N. Wartikar (Pune Vidyarthi Griha Prakashan, Pune).

e-sources:

NPTEL Course lectures links:

https://nptel.ac.in/courses/111/105/111105090/
https://nptel.ac.in/courses/127/106/127106019/

Program:	B. Tech. (Civil Engineering)			Semester:	III		
Course:	Engineering Geology			Code:	BCI3301		
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
2	-	2	2	20	30	50	100

Prior Knowledge: Earth Science. (Physical Geography is essential)

Course Objectives:

1. To impart the knowledge of the physical properties of minerals, various rocks types, their inherent characteristics and its applications to civil engineering.
2. To introduce plate tectonics and comprehend structural geology applied to civil engineering projects.
3. To provide knowledge of geomorphic features formed by fluvial and marine processes, preliminary geological exploration.
4. To introduce the concepts of site selection of dams, reservoir and tunnels.

Course Outcomes:

After learning the course, the students will be able to:

1. Classify various rocks and minerals with their uses in civil engineering
2. Interpret the effect of plate tectonics and identify geological structures
3. Explain the geomorphology and process of subsurface geological investigations
4. Comprehend the importance of geological nature of the site, precautions and treatments to improve the site conditions for dams, reservoirs and tunnels.

Detailed Syllabus:

Unit	Description	Duration (H)
1.	**Mineralogy, Petrology and General Geology** a) Scope and sub divisions of geology. b) Introduction to mineralogy: physical properties of minerals, classification of minerals. c) Introduction to petrology: rock cycle **Igneous Petrology**: plutonic, hypabyssal and volcanic rocks, mineral composition, structure, texture and classification of igneous rocks, commonly observed igneous rocks. **Sedimentary Petrology:** rock weathering, origin, mineral composition, genetic classification of secondary rocks, grain size classification and textures, sedimentary structures, digenesis process, commonly observed sedimentary rocks. **Metamorphic Petrology:** metamorphism, agents, types of metamorphism, texture and structures, mineral composition, commonly observed metamorphic rocks.	**08**
2.	**Plate Tectonics and Structural Geology** a) Introduction to plate tectonics theory and mountain building activity. b) Structural geology: out crop, dip and strike, conformable series, unconformity and overlap, faults and their types, folds and their types, inliers and outliers. c) Structures: structural features resulted due to igneous intrusions, concordant and discordant igneous intrusions, joints and their types.	**07**
3.	**Geomorphology and Preliminary Geological Studies** a) Geomorphology: geological action of river, coastal geology. b) Preliminary geological explorations: reconnaissance survey, desk study, surface and subsurface geological investigation: methods, significance and limitations, RQD, core recovery c) Techniques of correlation for surface and subsurface exploration for landforms, geology and groundwater studies	**07**
4.	**Role of Engineering Geology in Reservoirs, Dams and Tunneling.** a) Geology of dams & reservoir: strength, stability and water tightness of foundation rocks, influence of geological conditions on the choice and type of dams, preliminary geological work on dams and reservoir sites, precautions to be taken to counteract unsuitable conditions and their relevant treatments with case studies. b) Tunneling: Preliminary geological investigations, important geological considerations while choosing alignment, difficulties during tunneling as encountered due to various geological conditions.	**08**
	Total	**30**

Text Books:

1. Text Book of Engineering Geology by R. B. Gupte, P.V.G. Publications, Pune, 2001.
2. A Text Book of Engineering Geology by N. Chenna Kesavulu, McMillan India Ltd, 2010.
3. Principles of Engineering Geology by D. Venkat Reddy, Vikas Publishers, 2010.
4. Engineering and General Geology by Parbin Singh, S.K. Kataria & Sons, 2013.
5. Principles of Engineering Geology by K.M. Bangar, Standard Publishers, 2020.
6. Structural Geology by Marland P. Billings, Pearson Education, 3rd Edition, 2016.

Reference Books:

1. Physical Geology by P. K. Mukherjee, World Press, 2013.
2. Physical Geology by Arthur Holmes, ELBS Publication, 2016.
3. Principles of Engineering Geology and Geotechniques by D. P. Krynine & W. R. Judd. CBS Publishers, New Delhi, 2018.
4. Engineering Geology by F. G. H Blyth and De Frietus, Reed Elsevier India Ltd, 7th Edition, 1984.

Program:	B. Tech. (Civil Engineering)			Semester:	III		
Course:	Strength of Materials			Code:	BCI3401		
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
3	-	3	3	20	30	50	100

Prior Knowledge of: Engineering Mathematics, Engineering Mechanics. (Derivative, integration, mathematical calculations, equilibrium conditions, types of supports and analysis of beams is essential)

Course Objectives:

1. To impart knowledge of stresses and strains for determinate structural members.
2. To build concept of shear force and bending moment diagram for determinate beams.
3. To provide knowledge of slope and deflection for determinate structural members.

Course Outcomes:

After learning the course, the students will be able to:

1. Calculate different types of stresses, strains in determinate and indeterminate structures.
2. Develop shear force and bending moment diagram for determinate beams and calculate the torsional stresses in circular shaft.
3. Calculate shear and bending stresses and draw stress distribution diagram.
4. Determine principal stresses and strains and apply failure theories.
5. Analyze axially loaded and eccentrically loaded column.
6. Determine the slopes and deflection of determinate beams.

Detailed Syllabus:

Unit	Description	Duration (H)
1.	**Simple stresses and strains**: a) Stress and strain -linear, lateral, shear and volumetric, generalized Hooke's law. Elastic constants and their relationship for isotropic materials. b) Axial force diagram, stresses, strains and deformation in determinate and indeterminate homogeneous and composite bars under concentrated loads, self-weight and temperature changes.	8
2.	**Shear force, bending moment diagram and torsion of circular shafts:** a) Concept and definition of shear force and bending moment. Beams under various types of loading, shear force and loading diagram from given bending moment diagram. b) Stresses, strains and deformation in determinate and indeterminate shafts of hollow and solid sections of homogenous and composite materials subjected to torsion.	7
3.	**Stresses in beams due to shear and bending:** a) Shear stress distribution diagram for standard sections, maximum and average shear stress. b) Theory of pure bending, flexure formula, bending stress distribution diagram, moment of resistance and section modulus.	7
4.	**Principal Stresses and Strains:** a) Concept of principal planes and principal stresses, normal and shear stresses on an oblique plane, magnitude and orientation of principal stresses and maximum shear stress. b) Combined effect of axial stress, bending moment, shear and torsion. Theories of failure for maximum: normal stress, shear stress and strain theory.	8
5.	**Axially and eccentrically loaded columns:** a) Critical load and buckling, Euler's formulae for column with hinged ends, equivalent length for various end conditions. Rankine's formula. b) Direct and Bending Stresses: Eccentrically loaded short columns including biaxial cases.	8
6.	**Slope and deflection of determinate beams:** a) Double integration method (Macauley's method). b) Moment Area method, Conjugate beam method.	7
	Total	**45**

Text Books:

1. Mechanics of Structures Vol. I by S. B. Junnarkar and Dr. H. J. Shah, Charotar Publishing House Pvt Ltd., 23rd Edition, 2013.
2. Strength of Materials by R. Subramanian, Oxford University Press, 4th Edition, 2012
3. Strength of Materials by S. S. Ratan, Tata McGraw Hill.2nd Edition, 2011

Reference Books:

1. Elements of Strength of Materials by Timoshenko and Young, East-West Press Ltd. 5th Edition, 2013.
2. Strength of Materials by F.L. Singer and Andrew Pytel, Harper and Row Publication.
3. Mechanics of Materials by Beer and Johnston, McGraw Hill Publication. 7th Edition, 2017
4. Introduction to Mechanics of Solids by E.P. Popov, Prantice Hall Publication. 2nd Edition, 2011
5. Mechanics of Materials by Gere & Timoshenko, CBC publisher. 8th Edition, 2013
6. Elementary Structural Analysis by Norris, Wilbur and Utku, Tata McGraw Hill Publisher.
7. Intermediate Structural Analysis by R. C. Hibbler, Pearson Education Publishers.

E Resources:

https://nptel.ac.in/courses/105/105/105105108/
https://nptel.ac.in/courses/112/107/112107146/

Program:	B. Tech. (Civil Engineering)			Semester:	III		
Course:	Building Planning, Construction and Material			Code:	BCI3402		
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
3	-	3	3	20	30	50	100

Prior Knowledge of:
Basic Civil Engineering (knowledge of Building Components)
Engineering Graphics (Basic concept of isometric & orthographic projection,scale, line types, lettering, dimensioning etc.)

Course Objectives:

1. To impart knowledge of submission drawing by understanding Building bye laws.
2. To make aware about various building components and their construction methods.
3. To provide knowledge of construction materials and their properties.

Course Outcomes:

After learning the course, the students will be able to:

1. Explain concepts of building planning, control regulations and building bye-laws.
2. Apply knowledge of building planning for preparing submission drawings, building municipal bye laws.
3. Suggest appropriate type of building component and material suitable for given condition.
4. Enumerate methods of construction of various building components.
5. Explain important properties of building materials used in civil engineering construction.
6. Suggest suitable construction materials, satisfying the performance criteria.

Detailed Syllabus

Unit	Description	Duration (H)
1.	**Building design & drawing:** Principles of Building & Architectural Planning, Importance of building drawing, Types of building drawings, concept of line plan, presentation drawings, developed plan, sanction plan- elevation, section, selection of scales for various drawings, abbreviations and symbols as per IS 962. Building bye-laws- set back distance, open spaces, floor area ratio (F.A.R.), concept of volume to plot area ratio (VPR), building line, control line, height regulations, standard room sizes, minimum ventilation, parking space requirement.	7
2.	**Architectural planning of buildings:** Functional requirements and dimensions of various units. Development of plan, elevation, sectional elevation, and schedule of opening from the given line plan of residential buildings. Prepare water supply, sanitary and electrical layout for residential buildings. Planning of public buildings like primary health centre, school building, college canteen, office building.	8
3.	**Masonry construction & Form work:** Building components and their basic requirements i.e substructure and superstructure requirements. Foundation-relevance with geotechnical investigation. Masonry- its type, construction procedure and supervision. Scaffolding requirement and types**.** Recent trends in lightweight masonry, Form work and casting procedure for reinforced concrete columns, R.C.C. beams, R.C.C. slabs.	8
4.	**Building components:** Various components of building, their functions, types and method of construction of - foundation, plinth, plinth filling, column, beam, slab/roof, flooring, lintel, arches, weather shed, waterproofing treatments, parapet wall, windows, doors, stairs, elevators, escalators etc. Design of dog legged stairs and quarter turn stairs.	7
5.	**Building Material:** Physical, chemical and engineering properties of building materials as per BIS specifications, laboratory tests to be performed. Types, strength, durability and application of building materials like clay products, timber, stones, bricks, sand, lime, aggregates cement, mortar and concrete (PCC, RCC & PS). Safety aspects with respect to storage of materials.	8
6.	**Miscellaneous materials:** Miscellaneous construction materials for various items in building construction like industrial form of timber, plastic, PVC, FRP, ceramic products, Ferro-cement, glass, steel, aluminum, gypsum, bituminous materials, paints (its constituents & types), decorative panels, thermal & sound insulating materials, and waterproofing compounds. Performance criteria, sustainability and life-cycle cost for above mentioned materials, Eco-friendly building materials.	7
	Total	**45**

Text Books:

1. Building Materials by S.S.Bhavikatti, Vikas Publication House Private Ltd. First Edition (2014)
2. Building Materials by S.V. Deodhar, Khanna Publication
3. Building Construction by B.C. Punmia, Laxmi Publications.11th Edition (2016)
4. Building Materials by B.C. Punmia, Laxmi Publications.11th Edition (2016)
5. Building Materials by S. K. Duggal, New Age International Publishers. 5th Edition (2019)
6. Building Construction by S.C. Rangwala, Charotar Publications.33rd Edition (2016).
7. Building Construction by Bindra and Arora, DhanpatRai Publications.11th Edition (2010)
8. Building Drawings with an integrated Approach to Built-Environment by M. G. Shah, C. M. Kale and S. Y. Patki, New Delhi, Tata McGraw Hill.5th Edition (2017)

Reference Books:

1. The construction of buildings; seventh edition, Vol.1 & Vol.2 by R. Barry, Oxford: Blackwell Science.5th Edition (1999) ISBN-13
2. Building Materials Technology by Ruth T. Brantley & L. Reed Brantley, Tata McGraw Hill. (1995).
3. National Building Code (R 2016).
4. Building Design and construction by Frederick Merrit, Tata McGraw Hill.5th Edition (1994) Hand Book.
5. I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings, Revision-2 (R 2017

E-Resources:

1. https://www.bis.gov.in/standards/technical-department/national-building-code/
2. https://theconstructor.org/construction/project/basics-building-construction/25260/

IS Code:

1. IS 650 – 1991, IS 14032 – 1988,
2. IS 2386 (Part I To VIII) 1963
3. IS 3495 (Parts I TO iv) 1976
4. IS: 2720 (Part. XIII) 1986, IS:2720 (Part.30) 1980

Program:	B. Tech. (Civil Engineering)			Semester:	III		
Course:	Fluid Mechanics			Code:	BC13403		
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
3	-	3	3	20	30	50	100

Prior Knowledge of: Physics, Engineering Mechanics. **(**Engineering Mathematics is essential)

Course Objectives:

1. To impart knowledge of fluid properties, dimensional analysis using Buckingham π theorem, fluid statics, buoyancy and floatation
2. To build the concept of fluid kinematics and fluid dynamics with reference to fluid flow
3. To make aware of boundary layer theory and flow around submerged bodies
4. To get acquainted of open channel flow and hydraulic machinery.

Course Outcomes:

After learning the course, the students will be able to:

1. Understand fluid properties and carry out dimensional analysis
2. Solve problems involving fluid statics, buoyancy and floatation
3. Understand the concept of fluid kinematics, fluid dynamics and pipe flow
4. Explain boundary layer theory and solve problems on flow around submerged bodies
5. Apply basic governing equations to solve problems on open channel flow
6. Understand classification of hydraulic machinery (pumps and turbines)

Detailed Syllabus:

Unit	Description	Duration (H)
1.	**Properties of Fluids:** Definition of fluid and fluid mechanics: examples and practical applications, classification of fluids: real and ideal, physical properties of fluids, Newton's law of viscosity dynamic and kinematic viscosity, compressibility, cohesion, adhesion, surface tension, capillarity, vapour pressure. **Dimensional Analysis and Model Studies:** Dimensional homogeneity, dimensional analysis using Buckingham's π theorem method, geometric, kinematic and dynamic similarity, important dimensionless numbers (Reynold, Froude, Euler, Mach and Weber) and their significance.	**7**
2.	**Fluid Statics:** Basic equation of hydrostatics, concept of pressure, pressure head, Pascal's law, measurement of pressure (absolute, gauge), principle of manometers for balancing liquid column, dead weight, pressure transducers and their types, total pressure and centre of pressure on plane horizontal, vertical, inclined and curved surfaces: practical applications. **Buoyancy and Floatation** Principle of floatation and buoyancy, stability of floating and submerged bodies.	**7**
3.	**Fluid kinematics and fluid dynamics:** Classification of flows, continuity equation, forces acting on fluid mass in motion, Euler's equation of motion along a stream line, Bernoulli's equation and modified Bernoulli's equation, concept of hydraulic gradient line and total energy line, application of Bernoulli's equation to measure discharge and velocity of flow: venturi-meter, orifice meter, rotameter and pitot tube. **Laminar and turbulent flow through pipe** Characteristics of laminar flow, laminar flow through a circular pipe: Hagen Poiseuille equation, turbulent flow. Head loss, major and minor losses, variation of friction factor for laminar flow and for turbulent flow, resistance to flow in smooth and rough pipes. Flow through simple and compound pipe, pipes in series and parallel, Dupit's equation, Introduction to Hardy Cross method.	**8**
4.	**Boundary layer theory** Concept, development of boundary layer on flat plate and factors affecting growth, boundary layer thickness, displacement thickness, boundary layer separation and methods to control separation **Fluid flow around submerged objects:** Practical problems involving fluid flow around submerged objects, definitions and expressions	**8**

	for drag and lift, drag coefficient, lift coefficient, types of drag. Introduction to drag on sphere, cylinder, flat plate and Aerofoil. Karman's vortex street, development of lift, introduction to Magnus effect, lift on cylinder and Aerofoil, polar diagram.	
5.	**Flow through open channel** Classification of flow, concept of uniform flow, prismatic and non-prismatic channel, hydraulically efficient channel cross sections (rectangular, trapezoidal, circular),concept of specific energy, subsequent depths, sub critical and supercritical flow in rectangular channels. **Flow over notches and weirs** Introduction, theoretical background of notches and weirs for measurement of flow, classification and engineering applications of notches and weirs.	**8**
6.	**Introduction to hydraulic machinery** Pumps: Types of pumps and engineering application of pumps, centrifugal pump: efficiency, characteristics, head calculations **Turbines:** Elements of hydropower plant, types of turbines classification of turbines, impulse turbine and reaction turbine along with its engineering applications	**7**
	Total	**45**

Text Books:

1. Hydraulics and Fluid Mechanics including Hydraulic Machine by Dr P. N. Modi & S. M. Seth 21st Edition, Standard book house publication, 2017.
2. Flow in Open Channels by K Subramanya, 5th Edition, Pub: Tata McGraw Hill, 2019.

Reference Books:

1. Fluid Mechanics by R.J.Garde and A.J. Mirajgaonkar Pub : SCITECH Publications(India)Pvt.Ltd, Chennai,2010
2. Fluid Mechanics by Streeter Wylie and Bedford – Pub : McGraw Hill International ,New Delhi,2017
3. Open Channel Hydraulics by Ven Tee Chow,Pub : McGraw Hill Book Company , Koga,2009
4. A Text Book of Fluid Mechanics and Hydraulic Machines,by Dr. R.K.Rajput,Pub S Chand and Co.Ltd,2015
5. Fluid Mechanics,Fundamentals and applications by Yunus A. Cengel and John M.Cimbala,Mc Graw Hill International ,2019
6. Fluid Mechanics and its Applications,Vijay Gupta,Santosh K Gupta,New Age International pvt.Ltd,2012

Hand books:

1. http://www.engmatl.com/home/viewdownload/10-engineering-handbooks-pocketbooks/123- fluid-mechanics-handbook
2. http://www.springer.com/materials/mechanics/book/978-3-540-25141-5.

Program:	B. Tech. (Civil Engineering)			Semester:	III		
Course:	Engineering Geology Lab			Code:	BCI3302		
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	Hours	TW	OR	PR	Total
02	-	01	02	25	-	-	25

Course Objectives:

1. To impart the knowledge of different types of rocks & minerals and their application in civil engineering.
2. To make aware the basic aspects occur due to structural features like folds, unconformities and faults.

Course Outcomes:

After learning the course, the students will be able to:

1. Classify the different types of rock, their characteristics and their application in civil Engineering
2. Explain the physical properties, classification of minerals.
3. Construct graphical representation of bore log using drilling data.

List of experiments:

Term work shall consist of the following:

1. Megascopic identification of following mineral specimens (around 24).

Silica group: Rock Crystal, Rosy Quartz, Transparent Quartz, Milky Quartz, Smoky Quartz, Amethyst, Chalcedony,

Feldspar group: Orthoclase, Microcline, Plagioclase, **Mica group**: Muscovite, Biotite, **Olivine group:** Olivine, **Pyroxene group:** Augite, Diopside, **Amphibole group**: Hornblende, Asbestos, **Ore group:** Calcite, Gypsum Tourmaline, Chromite, Limonite, Kyanite, Graphite, Hematite.

2. Megascopic identification of following different rock specimens (around 24).

a) Igneous Petrology: Plutonic, Hypabyssal, Volcanic Rock, Muscovite Granite, Hornblende Granite, Syenite, Diorite, Gabbro, Dolerite, Rhyolite, Pumice, Compact Basalt, Amygdaloidal Basalt, Volcanic Breccia.

b) Sedimentary Petrology: Rudaceous, Areanceous, Argillaceous, Chemical and Organic Deposits: Laterite, Bauxite, Conglomerate, Secondary Breccia, Sandstone (Red), Sandstone with Ripple marks, Red Limestone, Black Limestone, Chert Breccia, Secondary Quartzite, Mudstone, Grit, Shale (White), Shale (Black).

c) Metamorphic Petrology: Contact Metamorphic rocks, Dynamo-thermal Metamorphic rocks: Kyanite Quartzite Marble, Phyllite, Slate, Augen Gneisse, Hornblende Gneisse, Mica Schist, Biotite Schist with Garnet, Muscovite Schist, Talc Schist, Quartz Sericite, Schist, Graphite Schist, Amphibolite.

3. Interpretation and construction of geological sections from contoured geological maps (8 maps).

4. Site selection for alignment of dams / tunnels / roads / canals / bridges based on geological maps.

5. Logging of drill core and interpretation of drilling data with graphical representation of bore log.

6. Site visit to study various geological features.

Reference Books:

1. Physical Geology by P. K. Mukherjee, World Press, 2013.
2. Physical Geology by Arthur Holmes, ELBS Publication, 2016.
3. Principles of Engineering Geology and Geotechniques by D. P. Krynine & W. R. Judd. CBS Publishers, New Delhi, 2018.
4. Engineering Geology by F. G. H Blyth and De Frietus, Reed Elsevier India Ltd, 7th Edition, 1984.
5. Engineering and General Geology by Parbin Singh, S.K. Kataria & Sons, 2013.
6. Principles of Engineering Geology by K.M. Bangar, Standard Publishers, 2020.
7. Structural Geology by Marland P. Billings, Pearson Education, 3rd Edition, 2016.

Program:	B. Tech. (Civil Engineering)			Semester:		III	
Course:	Testing of Materials Lab			Code:		BCI3404	
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	Hours	TW	OR	PR	Total
2	-	1	2	-	25	-	25

Course Objective:

1. To provide the knowledge of characteristics and behavior of civil engineering materials used in buildings and infrastructure.

Course Outcomes:

After learning the course, the students will be able to:

1. Evaluate material strength through tension test, shear test, torsion test, impact test, bending test, compression test, and abrasion test.
2. Experimentally verify the test results with Indian Standard specification.
3. Analyze determinate beams using software tool.

Detailed Syllabus:

All the following tests are mandatory:

Group A [Metals]

1. Tension test on mild and TMT steel. Bending test on TMT.
2. Shear (Single & Double) test on mild steel.
3. Torsion test on mild steel.
4. Impact (Izod & Charpy) test on mild steel, aluminum, brass.

Group B [Timber & Ply Wood]

1. Compression test on timber (Parallel & Perpendicular)
2. Bending test on timber and plywood.

Group C [Bricks & Tiles]

1. Water absorption and Efflorescence on bricks.
2. Compressive strength test on bricks
3. Flexural strength of flooring tiles.
4. Abrasion test of flooring tiles.

Group D [Software Tool]

1. Analysis of determinate beams by using software tool.

Reference Books:

1. S. Timoshenko and Young, Engineering Mechanics, Tata McGraw Hill, 4th Edition, 2013.
2. W. A. Nash Strength of Material, Schaum's Outline Series, McGraw Hill, 4th edition, 1998.
3. S. Timoshenko and Gere, Mechanics of Materials, PWS Publication Co. Ltd., 3rd edition, 1997.
4. J. M. Gere, Mechanics of Materials, Brooks/Cole. Publishing Co.6th edition, 2008.
5. G.H. Ryder, Strength of Materials, Prentice Hall Publications, 3rd edition, 2002.

IS Codes:

1. I.S. 1608:1995 Method for tensile testing of steel products.
2. 5242:1979 Methods of test for determining shear strength of metals
3. 1717 Method of simple torsion test.
4. 1598 For Izod impact test
5. 1727 For Charpy impact test.
6. 1708 (part 8) – 1986 Compression test on timber (Parallel to grain)
7. 1708 (part 9)- 1986 Compression test on timber (Perpendicular to grain)
8. 1708 and 883 Bending strength and modulus of elasticity of timber
9. 3495 (part III)- 1976 Water absorption capacity of bricks, Efflorescence test on bricks
10. 3495 (part-I) Compressive strength of bricks
11. 1237:1959 Specification for cement flooring tiles

Program:	B. Tech. (Civil Engineering)			Semester:		III	
Course:	Building Planning, Construction and Material Lab			Code:		BCI3405	
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	Hours	TW	OR	PR	Total
2	-	1	2	25	25	-	50

Course Objective:

1. To build their ability for preparing submission drawings and understanding sanction procedure.
2. To impart knowledge of building materials with respect to their specifications and cost.

Course Outcomes:

After learning the course, the students will be able to:

1. Prepare submission drawings for residential buildings as per Building bye laws.
2. Suggest suitable building materials available in the market as per the requirement of the project and its cost.
3. Explain procedure of sanctioning of building plan by concerned authority.

Detailed Syllabus:

Lab Experiments / Assignments:

1. Assignment: Drafting following sketches using AutoCAD
   a) Types of Foundation
   b) Entrance Steps- Plan & Elevation
   c) Types of Arches
2. Draw the line plans of any one residential building and any two public buildings (Using AutoCAD)
3. Floor Plan/ Typical floor plan, elevation and section, area statement with construction notes, schedule of openings, site plan indicating water supply and drainage line of any type of building (with, make group of max. four students) (Using AutoCAD)
4. Introduction to working drawings and selection of scale.
5. Site Visit: Any on-going Construction Site (visit report should contain: details of the project, stage of construction, sketches of components with cross section & dimensions, materials used and site plan, etc.)
6. Report file:
   a) It shall consist of data used for the project, Planning considerations and line plans & Design calculations.
   b) Collection of documents required for sanctioning of plan.
   c) Dimension standards of Residential building.
   d) Site Visit Report
7. Conduct market survey for different civil engineering materials with respect to application, cost and quality, and prepare report on the same. Also collect brochures of building materials.

Reference Books:

1. Building Drawings with an integrated Approach to Built-Environment by M. G. Shah, C. M. Kale and S. Y. Patki, New Delhi, Tata McGraw Hill.5th Edition (5 th July 2017)
2. Auto CAD 2019 Fundamentals Part 1- Autodesk Authorized Publisher.
3. Engineering Graphics Essentials with AutoCAD 2019 Instruction – Kirstie Plantenberg.
4. Beginning Auto CAD 2020 Exercise Workbook – Cherly R. Shrock, Steve Heather.
5. Auto CAD 2018, 3D Modeling – Munir Hamad.

Program:	B. Tech. (Civil Engineering)			Semester:		III	
Course:	Fluid Mechanics Lab			Code:		BCI3406	
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	Hours	TW	OR	PR	Total
2	-	1	2	25	25	-	50

Course Objectives:

1. To impart knowledge of properties of fluid, pressure measurement and buoyancy
2. To provide Knowledge of fluid kinematics, fluid dynamics and fluid flow around submerged bodies
3. To impart knowledge of open channel flow.

Course Outcomes:

After learning the course, the students will be able to:

1. Demonstrate viscosity, pressure, discharge measurement and seepage below weir.
2. Apply basic principle of stability of floating bodies, Bernoulli's theorem, Darcy-Weisbach friction factor
3. Analyze flow around circular cylinder or Aerofoil, velocity distribution and uniform flow in open channel

A) List of Laboratory Experiments: (Any ***eight*** out of the following)

1. Measurement of viscosity of fluid by Redwood viscometer
2. Measurement of pressure using different pressure measuring devices (including Transducers /state of arts digital instruments also).
3. Determination of stability of floating bodies using ship model
4. Experimental verification of Bernoulli's theorem with reference to loss of energy
5. Calibration of venturimeter / orifice meter.
6. Determination of Darcy- Weisbach friction factor (f) for a given pipe and study of variation with Reynolds number (Re)
7. Flow around a circular cylinder/Aerofoil
8. Study of uniform flow formulae for open channel
9. Velocity distribution in open Channel Flow.
10. Drawing flow net by Electrical Analogy for flow below Weir (with and without sheet pile)

B) Assignments: (Any ***two*** out of the following)

1. Pipe network flow analysis using WaterGEMS/EPANET and validation by Hardy Cross method
2. Study of Specific Energy Diagram and plotting it for given problem statement
3. Developing a demo model related to any fluid flow phenomenon (physical model/soft model)

C) Site visit: Report on Site visit to hydropower plant or any one of the Research Institute (CWPRS, WALMI, NWA etc.)

Reference Books:

1. Fluid Mechanics by R.J.Garde and A.J. Mirajgaonkar Pub : SCITECH Publications(India)Pvt.Ltd, Chennai,2010
2. Fluid Mechanics by Streeter Wylie and Bedford – Pub : McGraw Hill International ,New Delhi,2017
3. Open Channel Hydraulics by Ven Tee Chow,Pub : McGraw Hill Book Company , Koga,2009
4. A Text Book of Fluid Mechanics and Hydraulic Machines, by Dr. R.K.Rajput,Pub S Chand and Co.Ltd,2015
5. Fluid Mechanics, Fundamentals and applications by Yunus A. Cengel and John M.Cimbala, Mc Graw Hill International , 2019
6. Fluid Mechanics and its Applications,Vijay Gupta,Santosh K Gupta,New Age International pvt.Ltd,2012

Hand books:

1. http://www.engmatl.com/home/viewdownload/10-engineering-handbooks-pocketbooks/123- fluid-mechanics-handbook
2. http://www.springer.com/materials/mechanics/book/978-3-540-25141-5

Program:	B. Tech. (All branches)			Semester:		III	
Course:	Universal Human Values(HSMC-3)			Code:		BHM3101	
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
3	-	3	3	30	-	20	50

Prior Knowledge: Nil

Course Objectives:

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Course Outcomes:

After learning the course, the students will be able to:

1. Understand the relevance of Universal Human Values.
2. Interpret the concept of 'Self' & 'Body'.
3. Develop harmony in the family based on nine Universal Human Values.
4. Apply the sense of Harmony in society.
5. Take part in maintaining coexistence with Nature.
6. Integrate Universal HumanValues in personal and professional life.

Detailed Syllabus:

Unit	Description	Duration (H)
1.	**Introduction to Value Education:** Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity – Current Scenario, Method to fulfil the Basic Human Aspirations	**06**
	Practice Session: Sharing about Oneself, Exploring Human Consciousness, Exploring Natural Acceptance	**03**
2.	**Harmony in the Human Being:** Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health	**06**
	Practice Session: Exploring the difference of Needs of Self and Body, Exploring Sources of Imagination in the Self, Exploring Harmony of Self with the Body	**03**
3.	**Harmony in the Family:** Harmony in the Family – the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, Nine universal values in relationships viz. Trust, Respect, Affection, Care, Guidance, Reverence, Glory, Gratitude, Love	**04**
	Practice Session: Exploring the Feeling of Trust, Exploring the Feeling of Respect	**03**
4.	**Harmony in Society:** Understanding Harmony in the Society, Vision for the Universal Human Order**,** Human Order Five Dimensions	**03**
	Practice Session: Exploring Systems to fulfil Human Goal	**02**
5.	**Harmony in the Nature/Existence:** Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence	**03**
	Practice Session: Exploring the Four Orders of Nature, Exploring Co-existence in Existence	**02**

6.	**Implications of the Holistic Understanding – a Look at Professional Ethics:** Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession	**04**
	Practice Session: Exploring Ethical Human Conduct, Exploring Humanistic Models in Education, Exploring Steps of Transition towards Universal Human Order	**06**
	Total	**45**

Text Books:

1. A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
2. Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books:

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
4. On Education - J Krishnamurthy
5. Rediscovering India - by Dharampal
6. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi

E Resources

http://madhyasth-darshan.info/postulations/knowledge/knowledge-of-humane-conduct/
https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
https://youtu.be/OgdNx0X923I

Program:	B. Tech. (All branches)			Semester:	III		
Course :	Life Skills-3			Code :	BHM3939		
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	Hours	TW	OR	PR	Total
2	-	-	2	-	-	-	GR

Prior knowledge: Nil

Objectives:

1. To attain mental, emotional balance and spiritually to achieve self-realization and enlightenment to help better understanding of the inner personality & its establishment of harmony with the external demands.
2. To learn to build team spirit and adapt to the various skills required in various sports activities.
3. To provide a platform to express their mind, body, and emotions through performing arts.

Outcomes:

After completing the course, the students should be able to:

1. Achieve a balanced state of mind and enjoy improved mental, physical, emotional, and spiritual wellbeing.
2. Apply sportsmanship skills in the context of leadership, sports management etc.
3. Demonstrate the ability to think critically about a variety of visual and performing arts.

Detailed Syllabus:

Unit	Description	Duration (H)
1.	**Practicing Meditation** Pranayama and Breathing exercises, Meditation Technique, Thoughtless Awareness : Through Patanjali /Sahajayoga/Vipassana /Madhyastha Darshan/ Art of Living etc., or **Sports:** Indoor Games / Outdoor Games	**12**
2.	**Performing arts** Music, Singing, Poetry, Indian Conventional Dancing, Photography, Short Movie Making, Painting/ Sketching/ Drawing, Theatre Arts, Anchoring, Calligraphy etc	**12**
	Total	**24**

Reference Books:

1. Vishnu Devananda, “Meditation and Mantras” ,1978.
2. Swami Vivekananda, “Patanjali’s Yoga Sutras”, 1 Jan 2012.
3. Shri Mataji Nirmala Devi, “Sahajayoga an Introduction”
4. William Hart , S. N. Goenka, “The Art of Living”, 4 August 2009.
5. Dennis Hill, “Meditation Deep Peace”, Trafford Publishing, 7 August 2014.
6. Boria Majumdar, Sachin Tendulakar, “Sachin Tendulkar – Playing It My Way”, Hodder & Stoughton, Hachette Livre publishing, 6 November 2014.
7. Milkha Singh, “The Race of My Life”, 2013.
8. Sfurti Sahare, “Think and Win like Dhoni”, 3 July 2016.
9. Dina Serto and Mary Kom, “Unbreakable”, 19 November 2013.
10. Ronojoy Sen, “Nation at Play: A History of Sport in India”, 2015.
11. Andre Agassi, “Open”, 2009.
12. Dr. Monica Hiten Shah, “Sangeet Aradhana”, Aradhana Sangeet Academy Ahmedabad, Edition 2018.
13. Kishori Amonkar , “Recreating A Dream”, Standard Edition .
14. Veejay Sai & foreward by Girish Karnad, “Drama Queens – Women who created history on Stage”, Roli Books publication.
15. Jiwan Pani, “Back to the roots – Essays on Performing Arts of India”, 1 January 2004.

Course Syllabus

SY B Tech

Semester-IV

Program:	B. Tech. (Civil Engineering)			Semester:	IV		
Course:	Geotechnical Engineering			Code:	BCI4407		
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
03	-	03	03	20	30	50	100

Prior Knowledge of: Engineering Mathematics (Differentiation, Integration), Engineering Mechanics (Laws of mechanics). (Engineering Geology is essential)

Course Objectives:

1. To make aware of soil classification and provide the knowledge of methods for determination of index and engineering properties of soil.
2. To impart the knowledge of the soil-water interaction and the effects of static vs flowing water on soil strength.
3. To provide the knowledge of soil behavior under stress regime.

Course Outcomes:

After learning the course, the students will be able to:

1. Determine index properties of soil and classify in to different types of soil.
2. Describe the concepts of permeability and apply it in seepage analysis.
3. Explain the concepts of compaction and its application.
4. Calculate shear strength parameters using strength tests.
5. Determine the vertical stress, effective stress and its influence on soil behavior.
6. Compute the lateral thrust due to backfill on the retaining wall and classify the soil slopes.

Detailed Syllabus:

Unit	Description	Duration (H)
1.	**Introduction and Index properties of soil.** a) Introduction to geotechnical engineering and its applications to civil engineering, types of soil structure, introduction to soil exploration: objective and purpose. b) Three phase soil system, weight volume relationships, index properties of soil: methods of determination and their significance, IS and Unified soil classification systems.	08
2.	**Permeability and Seepage.** a) Permeability definition and necessity of its study, Darcy's law, factors affecting permeability, laboratory measurement of permeability: constant head method and falling head method as per IS 2720, field test for determination of permeability- pumping in test and pumping out test as per IS 5529 Part-I, permeability of stratified soil deposits. b) Seepage and seepage pressure, quick sand phenomenon, critical hydraulic gradient, general flow equation for 2-D flow (Laplace equation), flow net, properties and application, construction of flow net for earthen dam.	07
3.	**Compaction** a) Introduction, comparison between compaction and consolidation, compaction tests- standard proctor test, modified proctor test, zero air void line, factors affecting compaction, effect of compaction on soil properties. b) Field compaction methods and compaction equipment for different types of soil, placement water content, field compaction control- use of compaction test result, proctor needle in field compaction control.	07
4.	**Shear Strength of Soil.** a) Introduction: shear strength an engineering property, Mohr's stress circle, Mohr-Coulomb failure theory, effective stress principle- total stress, effective stress and neutral stress / pore water pressure, peak and residual shear strength, factors affecting shear strength. b) Measurement of shear strength: direct shear test, triaxial compression test, unconfined compression test, vane shear test, their suitability for different types of soils, different drainage conditions for shear tests, sensitivity and thixotropy of cohesive soils.	08
5.	**Stress Distribution in Soils** a) Boussinesq's theory with assumptions for point load and circular load (with numerical), pressure distribution diagram on a horizontal and vertical plane, pressure bulb and its significance. b) Westergaard's theory, equivalent point load method, approximate stress distribution method.	07

6	**Earth Pressure and Stability of Slopes** a) Earth Pressure: introduction, Rankine's state of plastic equilibrium in soils- active and passive states due to wall movement, earth Pressure at rest, Rankine's theory: earth pressure on retaining wall due to submerged backfill, backfill with uniform surcharge, backfill with sloping surface, Coulomb's wedge theory. b) Stability of slopes: classification of slopes and their modes of failure, Taylor's stability number, infinite slopes in cohesive and cohesion less soil.	**08**
	Total	**45**

Text Books:

1. Soil Mechanics and Foundation Engineering by B. C. Punmia, Laxmi Publications, 16th Edition, 2017.
2. Geotechnical Engineering by Shashi K. Gulhati & Manoj Datta, Tata McGraw Hill, 2017.
3. Principles of Soil Mechanics and Foundation Engineering by V.N.S. Murthy, UBS Publishers, 2018.
4. Soil Mechanics and Foundation Engineering by K. R. Arora, Standard Publisher, 7th Edition, 2019.

Reference Books:

1. Geotechnical Engineering by C. Venkatramaiah, New Age International Publishers, 5th Edition, 2017.
2. Principles of Geotechnical Engineering by Braja M. Das, Cengage Learning, 8th Edition, 2020.
3. Geotechnical Engineering by P Purushothma Raj, Tata McGraw Hill, 2017.
4. Geotechnical Engineering by Principles & Practices by Donald. P. Coduto, Pearson Education, 2nd Edition, 2017.
5. Basic and Applied Soil Mechanics by Gopal Ranjan and A. S. R. Rao, Newage International, 3rd Edition, 2016.
6. Physical and Geotechnical Properties of Soils by Joseph E. Bowles, International Students Edition.

e-Resources:

1. http://ascelibrary.org/page/books/s-gsp.
2. http://accessengineeringlibrary.com/browse/geotechnical-engineersportable-handbook-second edition.
3. http://nptel.ac.in/courses/105101084/
4. http://nptel.ac.in/courses/105106142/

Program:	B. Tech. (Civil Engineering)			Semester:		IV	
Course:	Surveying and Geomatics			Code:		BCI4408	
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
3	--	3	3	20	30	50	100

Prior Knowledge of: Basic Civil Engineering. (Principles of survey, applications of survey, scale, use of tape, dumpy level etc, is essential)

Course Objectives:

1. To develop an ability in students to apply knowledge of mathematics, science, and engineering to understand the measurement techniques in surveying.
2. To make student competent to use techniques, methods and equipment/tools necessary for linear and angular measurement in horizontal and vertical plane.
3. To prepare students for the fundamentals of Space Based Positioning System & Geographic Information System.

Course Outcomes:

After learning the course, the students will be able to:

1. Draw the traverse using compass or plane table and apply corrections if any.
2. Prepare contour plan for an area and also estimate earthwork in road work by leveling.
3. Measure horizontal and vertical angles after performing temporary adjustments on theodolite.
4. Analyze the distances by angle measurement through tacheometry.
5. Prepare data for curve setting through various methods.
6. Explain the fundamentals of space-based positioning system & geographic information system.

Detailed Syllabus:

Unit	Description	Duration (H)
1.	**Compass and Plane Table Surveying** a) Concept of ranging, chaining, offsetting and traversing. b) Concept of bearing, meridian and their types, construction and use of prismatic compass, local attraction and correction, dip, declination and calculation of true bearings, area calculation of traverse. c) Plane table surveying: Principle, accessories and their uses, advantages and disadvantages, methods-Radiation, intersection, traversing, resection.	8
2.	**Levelling and Contouring** a) Levelling: Introduction, types, benchmarks, use of auto level, digital level and laser level in the construction industry, principal axes of dumpy level, testing and permanent adjustments, reciprocal levelling, curvature and refraction corrections, distance to the visible horizon. b) Contouring – direct and indirect methods of contouring, uses of contour maps, study and use of topo-sheets, c) Profile leveling and cross-sectioning and their applications.	7
3.	**Theodolite Surveying.** a) Study of vernier transit 20" theodolite, uses of theodolite for angle measurement: horizontal angle, vertical angles, deflection angles. Magnetic bearing, prolonging a line, lining in and setting out an angle with a theodolite. Fundamental axes of theodolite: testing and permanent adjustments of a transit theodolite. b) Theodolite traversing – computation of consecutive and independent coordinates, adjustment of closed traverse by transit rule and Bowditch's rule, Gale's traverse table. Checks, omitted measurements, area calculation by independent coordinates.	8
4.	**Tacheometry& Electronic Measurement Techniques.** a) Tacheometry – Principle of stadia tacheometry, fixed hair method with vertical staff to determine horizontal distances and elevations of points, finding tacheometric constants. Tacheometric contouring. b) Surveying using total station – Study and use of Electronic Total Station (ETS) and its types, functions: missing lines, remote elevation measurements, remote distance measurements, area measurement.	7

5.	**Curves**. a) **Introduction** to horizontal and vertical curves (no numerical and derivations to be asked on vertical curves and reverse curves), different types and their applications, simple and compound circular curves, elements and setting out by linear methods such as radial and perpendicular offsets, offsets from long chord, successive bisection of chord and offsets from chords produced. b) **Angular methods:** Rankine's method of deflection angles (one and two theodolite methods). (Numerical on simple circular curves to be asked), Transition curves: necessity and types.	**8**
6.	**a) Introduction to SBPS, SBPS systems** - GPS, GLONASS, Galileo, GAGAN, BeiDou and their features, Segments of SBPS (Space, Control and User), applications of SBPS in surveying. SBPS Co-ordinates & heights, Factors governing accuracy and types of errors in SBPS positioning. Earth ellipsoid, Geodetic datum and Co-ordinate systems. Applications of DGPS (Differential Global Positioning System) in surveying. **b) Geographical Information System** -Introduction, Definition, Objectives, Components (people, procedure, hardware, software & data) & functions (input, manipulation, management, querry, analysis and visualization) of GIS. Coordinate systems and projections, Georeferencing, GIS data – spatial (Raster & vector) & aspatial data. Introduction to vector and raster data analysis such as network analysis, overlay analysis, Management of aspatial data.	**7**
	Total	**45**

Text Books:

1. Surveying and Levelling Vol. I and Vol. II by T. P. Kanetkar and S.V.Kulkarni , PVG Prakashan.
2. Surveying and Levelling by Subramanian, Oxford University Press.
3. Surveying, Vol. I & II by Dr. B. C. Punmia, Ashok K. Jain, ArunK.Jain,Laxmi Publications.
4. Surveying, Vol. I & II by S. K. Duggal, TataMc-Graw Hill.

Reference Books:

1. Plane Surveying by A. M. Chandra, New Age International Publishers.
2. Surveying and Levelling by N. N. Basak , Tata McGraw Hill. (2013)
3. Surveying Vol. I & II by Dr. K. R. Arora , Standard Book House. (2013, 2014)
4. Surveying: Theory and Practice by James M. Anderson, Edward M. Mikhail, Tata McGraw Hill. (2013)
5. Plane and Geodetic Surveying for Engineers. Vol. I by David Clark, Constable. (2013)

e-Resource
nptel: https://archive.nptel.ac.in/courses/105/104/105104101/

Program:	B. Tech. (Civil Engineering)			Semester:	IV		
Course:	Concrete Technology			Code:	BCI4409		
Teaching Scheme/week				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
3	-	3	3	20	30	50	100

Prior Knowledge of: Basic Civil Engineering**. (**Building construction materials specifically cement concrete is essential)

Course Objectives:

1. To make aware of fundamental properties of various ingredients of concrete
2. To provide the knowledge of behavior and properties of concrete at its fresh and hardened state
3. To build their ability to design concrete mix.
4. To impart knowledge of special concrete and repairs of concrete.

Course Outcomes:

After learning the course, the students will be able to:

1. Understand the classification and properties of various concrete ingredients.
2. Apply the knowledge of different tests on fresh concrete to identify its properties.
3. Apply the knowledge of different tests on harden concrete to identify its properties.
4. Decide a concrete mix proportion using IS guidelines and field requirements.
5. Describe concreting techniques, equipment's and need of special concrete
6. Explain the durability of concrete to select suitable repair techniques

Detailed Syllabus:

Unit	Description	Duration(H)
1.	**Concrete Ingredients:** a) Cement- Manufacturing, classification and types, tests on cement, chemical composition and hydration of cement Aggregate- mechanical and physical classification, properties and tests, alkali-aggregate reaction, Grading of aggregates, artificial and recycled aggregate b)Water and admixtures: Quality of water for concrete, Function and classification of admixture, Types-i) Chemical admixtures: Plasticizers, super plasticizers, accelerators, retarders, air entraining ii) Mineral admixtures-fly ash, silica fume, ground granulated blast furnace slag.	8
2.	**Properties and Tests on Fresh Concrete:** a) Properties: Production of concrete and curing methods, workability, cohesion and segregation, effect of temperature, concept of maturity b) Tests: measurement of workability using slump cone, compaction factor, Vee-Bee consistometer and flow table apparatus, Marsh cone test	7
3.	**Properties and Tests on Hardened Concrete:** a) Properties: Factors affecting strength, micro-cracking and stress-strain relationship, relation between tensile and compression strength, impact strength, abrasion resistance, creep and shrinkage. b) Tests: Destructive tests: compression strength, flexural strength and tensile strength, pullout test, core test. Nondestructive tests: rebound hammer, ultrasonic pulse velocity, and impact echo test.	8
4.	**Mix Design of Concrete:** a)Concrete Mix Design– Characteristic strength concept and objectives of mix design, factors to be considered, statistical quality control, acceptance criteria for concrete as per IS specifications. Quality control guidelines. b) Methods of Mix Design: IS code method and DOE method (with and without mineral admixture)	7
5.	**Concreting Equipment, Techniques and Special concretes:** a) Concreting Equipment: concrete mixers, pumps, vibrators and compaction equipment's. Special concreting techniques- Pumped concrete, Ready mix concrete, under water concreting, roller compacted concrete, cold and hot weather concreting. b) Special concretes: Light weight concrete and its types, self-compacting concrete, high strength concrete, High performance concrete, fiber reinforced concrete, geo-polymer concrete, vacuum concrete , Ferrocement.	8

6.	**Deterioration and Repairs in Concrete:** a) Deterioration –Durability and factors affecting durability, Permeability, sulphate attack, acid attack, chloride attack, effect of sea water, carbonation of concrete, corrosion of reinforcement. b) Repairs – Evaluation of cracks and diagnosis of concrete, repair of defects using various types and techniques, shotcrete and grouting. Introduction to retrofitting of concrete, Corrosion monitoring.	**7**
	Total	**45**

Text Books:

1. Concrete Technology by M. L. Gambhir, 5th Edition, Tata McGraw-Hill Publication,2013.
2. Concrete Technology: Theory and practice by M. S. Shetty and A. K. Jain, 8th Edition, S Chand Publication,2018.
3. Properties of Concrete by A. M. Neville – 5th Edition, Pearson Publication,2012.

Reference Books:

1. Concrete Technology by A.R. Santhakumar, 2nd Edition, Oxford University Press,2018.
2. Concrete : Microstructure, Properties and Materials by P. Kumar Mehta, Paulo J. M. Monteiro, 4th Edition, McGraw-Hill Education,2014.
3. Concrete Mix Design by A. P. Remideos, Himalaya Publishing House.
4. Concrete Structures, Repair, Rehabilitation and Retrofitting by J. Bhattacharjee, 1st Edition, CBS Publishers & Distributors Pvt. Ltd,2017.

IS Codes:

IS 383:2016- Coarse and Fine Aggregate for Concrete Specification
IS 456:2000 with Reaffirmed 2016-Plain and Reinforced concrete- code of practice
IS 516 : 1959 with Reaffirmed 2018- Methods of tests for strength of concrete
IS 1489 (Part 1) : 2015(4 Revision)- Portland pozzolana cement - Specification: Part 1 fly Ash Based
IS 2386 (Part 1 to 5):1963 with Reaffirmed 2021 -Methods of Test for Aggregates for Concrete
IS 4031 (Part 1,10 to 13):1996 with Reaffirmed 2021 -Methods of physical tests for hydraulic cement
IS 9103 : 1999 (1 Revision) with Reaffirmed 2018- Specification for Concrete Admixtures
IS 1199 : Part 1 to 5: 2018 - Fresh Concrete Methods of Sampling, Testing and Analysis
IS 10262 : 2019 (2 Revision)- Concrete Mix Proportioning Guidelines
IS 13311 : Part 2 : 1992 with Reaffirmed 2018- Method of Non-destructive Testing of Concrete-methods of Test : Part 1Ultrasonic Pulse Velocity
IS 13311 : Part 2 : 1992 with Reaffirmed 2018- Method of Non-destructive Testing of Concrete-methods of Test : Part 2 Rebound Hammer

e-resources:

https://onlinecourses.nptel.ac.in/
https://www.ultratechcement.com/videos/supervising-work.1ujfe5RRhF0

Program:	B. Tech. (Civil Engineering)			Semester:	IV		
Course:	Open Elective 1- Numerical Methods			Code:	BAS4601		
Teaching Scheme/week				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
3	-	3	3	20	30	50	100

Prior Knowledge of:

1. Univariate Calculus
2. Multivariate Calculus is essential

Course Objectives:

This course aims at enabling students to get acquainted with,

1. Concepts and techniques of Numerical Methods to solve systems of linear equations.
2. Numerical techniques to solve integration, ordinary and partial differential equations, and their applications.
3. Open-source software to perform numerical techniques.

Course Outcomes:

After learning the course, the students will be able to:

1. **Understand** and perform the numerical methods to **solve** the systems of linear equations
2. **Evaluate** differentiation and integration using different Numerical methods.
3. **Understand** basic operators, packages, syntax of open-source software and **develop a program** for systems of linear equations, differentiation and Integration using.
4. **Solve** ordinary differential equations of first order using single & multistep numerical methods..
5. **Apply** explicit and implicit methods to solve the partial differential equations viz One-dimensional Heat equation, Wave equation and Laplace equations.
6. **Analyze** the solution of ODE & PDE using open-source software.

Detailed Syllabus:

Unit	Description	Duration(H)
1.	**System of linear equations:** Gauss elimination method by pivoting, Gauss-Jordan method, LU decomposition, Cholesky method, Relaxation method, Jacobi and Gauss-Seidel iterative methods.	7
2.	**Numerical Integration**: Difference formulae for numerical differentiation, Boole's rule, Romberg integration and Gauss quadrature for multiple integration.	8
3.	**Problem Solving-I:** Solutions of systems of linear equations, Differentiation and Integration using open-source software.	8
4.	**Ordinary differential equations:** Euler's method, Modified Euler's method, Runge-Kutta 4^{th} order methods, predictor corrector method.	7
5.	**Partial Differential Equations:** Difference formulae for numerical partial differentiation. Explicit and Implicit method, Stability of finite difference method, Applications of finite difference analysis in boundary value problems: Laplace equation, one dimensional diffusion equation, Wave equation.	7
6.	**Problem Solving-II:** Solutions of ordinary and partial differential equations using open-source software.	8
	Total	45

Text Books:

1. S.S. Sastry, "Introductory Methods of Numerical Analysis", PHI learning Pvt Ltd, 5^{th} Edition, ISBN 10: 9788120345928
4. B. S. Grewal, "Numerical Methods in Engineering & Science", Khanna Publishers, 43rd Edition, ISBN 13: 9788174092489

Reference Books:

1. S.R.K. Iyengar, Rajendra K. Jain, "Advanced Engineering Mathematics", Alpha Science International, Ltd,4 Edition, ISBN 13: 9781842658468
2. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw-Hill, 34 edition, ISBN 13:9780070634190.
3. Abhishek K Gupta," Numerical Methods using MATLAB", Springer, First Edition, ISBN 13: 9781484201541
4. Victor A. Bloomfield, "Using R for Numerical Analysis in Science and Engineering", CRC Press, First Edition, ISBN: 9781315360492

e-sources:

1. **NPTEL Course lectures links:**
   https://nptel.ac.in/courses/127/106/127106019/ (Methods of root finding)
   https://nptel.ac.in/courses/115/103/115103114/ (NM & Simulation)
   https://nptel.ac.in/courses/122/106/122106033/ (N.M. with programming)

2. **V-lab (IIT-Bombay) link**: http://vlabs.iitb.ac.in/vlabs-dev/labs/numerical_lab/labs/explist.php

Program:	B. Tech. (Civil Engineering)			Semester:		IV	
Course:	Open Elective 1- Mathematical Optimization			Code:		BAS4602	
Teaching Scheme/week				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
3	-	3	3	20	30	50	100

Prior Knowledge: Linear Algebra & Univariate Calculus, Multivariate Calculus, Applied Mathematics.

Course Objectives: This course aims at enabling students to

1. Develop a practical approach to mathematical problem solving.
2. Get familiar with many commonly used tools and techniques in optimization work.
1. Understand the different mathematical approaches for optimization.

Course Outcomes:

After learning the course, the students will be able to:

1. Formulate and solve linear programming models using basic theoretical principles.
2. Apply variants of Simplex methods and duality to find optimal solutions for constrained and unconstrained problems.
3. Understand basic operators, packages, syntax of software to develop programs to optimize Linear Programming Problems.
4. Solve transportation and assignment problems using optimization techniques.
5. Analyze the project network and nonlinear problems using different methods to optimize models.
6. Develop programs for transportation and assignment problems and Nonlinear Programming problems

Detailed Syllabus:

Unit	Description	Duration(H)
1.	**Linear Programming (LP)-I:** Introduction, formulation of Linear Programming problems, Graphical solution method, alternative or multiple optimal solutions, Unbounded solutions, Infeasible solutions, Maximization – Simplex Method,	7
2.	**Linear Programming (LP)-II:** Minimization – Simplex method, Simplex Algorithm using Big-M method, Two phase method, Unrestricted variables, Degeneracy, Types of linear programming solutions.	8
3.	**Duality:** Duality in linear programming, Formulation of Dual Linear programming problems. **Problem Solving-I:** Solutions of LPP using software.	8
4.	**Transportation Problems:** Introduction, Mathematical model of transportation problem, transportation algorithm, Methods of finding initial solutions: North-west Corner rule, Least cost method, VOGEL's approximation method, Optimality of initial solution using MODI Method. **Assignment Problems:** Introduction, Mathematical model of Assignment problem, solutions to Assignment problems using Hungarian method, variations in Assignment problems.	7
5.	**Network Analysis:** Network diagram, Project management: PERT and CPM, Critical path analysis, Project scheduling with uncertain activity time, Project time-cost, trade-off.	8
6.	**Nonlinear programming:** Introduction, General nonlinear programming problem, Graphical solution method, Quadratic programming: Kuhn-Tucker conditions.**Problem Solving-II:** Solutions of Assignments and Transportation problems and nonlinear optimization problems using software.	7
	Total	**45**

Text Books:

1. Rao S S, Engineering Optimization theory and Practice, Willy Easter Ltd. 4th Edition, ISBN: 978-0-470-18352-6
2. Taha Hamdy, Operation Research: An Introduction, Pearson Education, 9th Edition, ISBN: 0134444019

Reference Books:

1. Sharma S. D. Operation Research, Kadar Nath Ram Nath & Co. Edition, ISBN: 9380803389
2. Matteo Fischetti, "Introduction to mathematical optimization", First Edition, ISBN: 9781692792022
3. Judith L. Gersting, "Mathematical Structures for Computer Science", Freeman Co, 4 Edition, ISBN: 9780716783060
4. Peter V. O'Neil, "Advanced Engineering Mathematics", Thomson Learning ,7 Edition, ISBN 13: 9781337274524
5. Hira and Gupta, "Operation research", S. Chand publication, ISBN (13): 9788121909686.
6. Sharma J. K. "Operations Research- Theory and Applications", Trinity Press, 6 Edition, ISBN: 9789385935145

E-sources:

1. **NPTEL Course lectures links:**
   https://nptel.ac.in/courses/111/102/111102012/ (LPP)
   https://nptel.ac.in/courses/110/106/110106059/ (Transportation & Assignments Problems)

Program:	B. Tech. (Civil Engineering)			Semester:	IV		
Course:	Open Elective 1- Calculus of Variation			Code:	BAS4603		
Teaching Scheme/week				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
3	-	3	3	20	30	50	100

Prior Knowledge of:

1. Linear Algebra & Univariate Calculus
2. Multivariate Calculus

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of mathematical principles related to:

1. Formulation of variational problems and analysis of key properties of system behavior.
2. Construction of variational problem for multivariate functional and it's solution
3. Application of mathematical methods of calculus of variation to construct finite element structure for several engineering problems

Course Outcomes:

After learning the course, the students will be able to:

1. Solve variational problems to optimize constrained and unconstrained functional.
2. Apply Euler-Lagrange's equation to determine stationary paths of a multivariable functional.
3. Understand basic operators, packages, syntax of software to develop programs to optimize functional.
4. Apply theory & techniques of calculus of variation for boundary value problems.
5. Discuss finite element models for ordinary differential equations.
6. Analyze the solution and FEM models of ordinary differential equations using open-source software.

Detailed Syllabus:

Unit	Description	Duration(H)
1.	**The foundations of calculus of variations** Introduction, The Euler-Lagrange differential equation, Minimal path problems, open boundary variational problems. **Constrained variational problems.** Algebraic boundary conditions, Lagrange's solution, Isoperimetric problems, Closed-loop integrals,	7
2.	**Multivariate functional** Variational problems in parametric form, Functional with two independent variables, Minimal surfaces, Functionals with three independent variables (only conversion). **Higher order derivatives** The Euler-Poisson equation, The Euler-Poisson system of equations, Algebraic constraints on the derivative.	8
3.	**Problem Solving-I:** Solutions of constrained and unconstrained variational problems using open source software.	8
4.	**Approximate methods** Euler's method, Rayleigh-Ritz method, Galerkin's method	7
5.	**Finite Element Methods** Boundary integral method, Finite element method, Case Studies.	8
6.	**Problem Solving-II:** Solutions of Approximate and FEM models using open source software.	7
	Total	45

Text Books:

1. Mark Kot, "A First Course in the Calculus of Variations", AMS, ISBN: **978-1-4704-1495-5**
2. A.S. Gupta , "Calculus of Variation with applications" , PHI Learning PVT LTD, ISBN: 978-8120311206

Reference Books:

1. L.Elsgolts, "Differential equations and calculus of variations", MIR Publications, ISBN 13: 978-1410210678
2. B. S. Grewal , "Higher Engineering Mathematics", Khanna Publication, 42 Edition, ISBN 13: .9788174091955
3. Krishnamoorthy C. S., "Finite element analysis: theory and programming", Mcgraw hill education (india) pvt. Ltd., 2 Edition, ISBN 13: 9780074622100
4. Moaveni, Saeed, "Finite element analysis : theory and application with ansys" Pearson education pvt.. ltd, 2 Edition, ISBN: 0137850980

E-sources:

1. **NPTEL Course lectures links:**
   https://nptel.ac.in/courses/111/104/111104025/ **(Functional)**
   https://nptel.ac.in/courses/112/104/112104193/ **(FEM)**

Program:	B. Tech. (Civil Engineering)			Semester:	IV		
Course:	Open Elective 1- Mathematical Modeling and Simulation			Code:	BAS4604		
Teaching Scheme/week				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
3	-	3	3	20	30	50	100

Prior Knowledge of:

1. Linear Algebra & Univariate Calculus
2. Multivariate Calculus
3. Higher order of differential equations.

Course Objectives:

After completion of the course, students will have adequate background, conceptual clarity and knowledge of mathematical principles related to:

1. Mathematical Modeling and its uses in different engineering disciplines.
2. Mathematical techniques that can be used to build a proper mathematical model for a given engineering problem.
3. Simulation of mathematical models using open source software.

Course Outcomes:

After learning the course, the students will be able to:

1. **Identify** the types of mathematical modeling according to the real life problem.
2. **Build** a simple mathematical model.
3. **Understand** basic operators, packages, syntax of software to develop programs for analytical solutions of ordinary and partial differential equations.
4. **Apply** Explicit and Implicit methods to partial differential equations for **analyzing** heat, wave and Laplace equations.
5. **Predict** the performance of the mathematical model.
6. **Develop** programs for Numerical Solutions of ordinary and partial differential equations using open-source software

Detailed Syllabus:

Unit	Description	Duration(H)
1.	**Basics of Mathematical Modeling:**: Introduction, open and closed systems, advantages and limitations, properties, needs and techniques used, discussion on non-uniqueness of models. Classification of mathematical models: Classical and Continuous models, Deterministic, Probabilistic and Stochastic models, Areas of applications.	7
2.	**Procedure and Techniques of Mathematical Modeling:** Procedure: Introduction, Identification of parameters, significant parameters, reduction of an open problem to a closed form, Techniques: Analytical Methods, Numerical Methods, Computer simulation, physical interpretation, case studies.	8
3.	**Problem Solving-I:** Analytical Solutions of ordinary and partial differential equations using open source software.	8
4.	**Numerical Methods:** Explicit and Implicit finite difference scheme, Stability of finite difference method, Applications of finite difference analysis in boundary value problems: one dimensional diffusion equation, Wave equation, Laplace equation.	7
5.	**Prediction of Performance:** Steps involved in a computer model, predict performance of an experimental system, Numerical Simulation and its Validation, Multiscale modeling, Sensitivity analysis.	7
6.	**Problem Solving-II:** Numerical Solutions of ordinary and partial differential equations using open source software.	8
	Total	45

Text Books:

1. Frank Severance,System Modeling and Simulation: An Introduction", John Wiley & Sons limited,2001, ISBN:978-8126519606
2. S.S. Sastry, "Introductory Methods of Numerical Analysis", PHI learning Pvt Ltd, 5th Edition, ISBN 10: 9788120345928
3. Erwin Kreyszig, "Advanced Engineering Mathematics" Wiley Eastern Ltd.,10 Edition, ISBN 13: 9780470458365

Reference Books:

1. Averill Law, "Simulation modeling and analysis" , Mc-graw Hill Publication, 5 Edition, ISBN: 9780073294414
2. Abhishek K "Gupta, Numerical Methods using MATLAB", Springer, First Edition, ISBN 13: 9781484201541
3. John A Sokolowski and Catherine M Banks ,"Principles of Modeling and Simulation", John Wiley, First Edition, ISBN:9780470289433

E-sources:

1. **NPTEL Course lectures links:**
   https://nptel.ac.in/courses/111/107/111107113/ (Mathematical Modelling)
   https://nptel.ac.in/courses/115/103/115103114/ (NM & Simulation)
   https://nptel.ac.in/courses/122/106/122106033/ (N.M. with programming)

2. **V-lab (IIT-Bombay) link**: http://vlabs.iitb.ac.in/vlabs-dev/labs/numerical_lab/labs/explist.php

Program:	B. Tech. (Civil Engineering)			Semester:		IV	
Course:	Open Elective 1- Financial Mathematics			Code:		BAS4605	
Teaching Scheme/week				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
3	-	3	3	20	30	50	100

Prior Knowledge of:

1. Basic Mathematics
2. Probability

Course Objectives:

The course aims at:

1. Address issues related to globalization of financial markets,
2. Development and Feasibility of financial transactions,
3. Provide the students with knowledge of a range of mathematical and computational techniques that are required for a wide range of quantitative positions in the financial sector
4. Forecasting market developments.

Course Outcomes:

After learning the course, the students will be able to:

1. Demonstrate knowledge of the fundamental concepts of financial mathematics
2. Identify various types of cash flow patterns, Compute the future value and the present value of different cash flow streams.
3. Understand types of Options and apply it to hedge against risks in existing investments.
4. Understand the characteristics of different financial assets such as money market instruments, bonds, and stocks, and how to buy and sell these assets in financial markets.
5. Describe and to analyze the investment environment, different types of investment vehicles;
6. Analyze the degree of risk for its effective management

Detailed Syllabus:

Unit	Description	Duration(H)
1.	**Fundamentals of Financial Mathematics I:** Introduction of Financial Mathematics and its application in real life, Sources of Finance; Short term finance and Long term Funds (basics), Rate of interest, simple interest, compound interest.	7
2.	**Fundamentals of Financial Mathematics II:** The time value of money, annuities and cash flows, loans, general cash flows and portfolios, derivatives, swaps, and hedging.	8
3.	**Basics of Options :**Options; (call option and put options), payoffs call and put options, speculation (call or put) and its application (option).	8
4.	**Stocks and bonds:** Stocks and bonds, Valuation of stocks and bonds, Mutual funds, Cost of capital and ratio analysis.	7
5.	**Basics of Investment:** Investment return. Uneven cash flows Compounding frequency of interest, Economic equivalence. Portfolio diversification	7
6.	**Risk & uncertainty:** Decision under risk & uncertainty, Risk premium, Portfolio diversification, Life Insurance, Endowment	8
	Total	**45**

Text Books:

1. Marek Capinski and Tomasz Zastawniak, “Mathematics for Finance”, Springer 2nd Edition, ISBN 13:978-0857290816.
2. Ambad Nazri Wahidudin, “Financial Mathematics and its Applications”, Ventus Publishing ApS, ISBN 978-8776819286

Reference Book:

1. Giuseppe Campolieti Roma M. Makarov “Financial mathematics a Comprehensive treatment”, CRC Press Taylor and Francis Group, 1st Edition, ISBN 978-1439892428

E-sources:

1. **NPTEL Course lectures links:**
   https://nptel.ac.in/courses/112/107/112107260/

Program:	B. Tech. (Civil Engineering)			Semester:		IV	
Course:	Open Elective 1- Neural Network and Fuzzy Logic Control			Code:		BAS4606	
Teaching Scheme/week				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
3	-	3	3	20	30	50	100

Prior Knowledge of: Nil

Course Objectives: This course aims at enabling students to get acquainted with,

1. Knowledge of Neural Networks and its use for controlling real time systems.
2. Knowledge about fuzzy set theory to solve various engineering problems.
3. Open-source software to perform NN toolbox and Fuzzy Logic

Course Outcomes:

After learning the course, the students will be able to:

1. Understand the architecture of Neural networks and types of Neural Networks.
2. Apply backpropagation and optimizers algorithms to update weights of Neural Network.
3. Understand basic operators, packages, syntax of software and Train the neural networks using MATLAB toolbox.
4. Understand the various fuzzification and defuzzification methods.
5. Apply a fuzzy logic control system to handle uncertainty and solve engineering problems.
6. Implementation of fuzzy logic toolbox in fuzzy control system.

Detailed Syllabus:

Unit	Description	Duration(H)
1.	**Architecture of Neural Network:** Introduction, Biological neuron, Artificial neuron, Neuron modeling, Activation Function, Learning Techniques, Basic learning rules, Types of Neural Network: Single layer feedforward, Multi-layer feed forward network, Recurrent Neural Network.	7
2.	**Neural Networks For Control:** Loss function, Weight initialization, Back propagation Neural Network, Optimizers algorithms, Feedback networks, Associative Memory Network and it‟ types, Discrete time hop field networks.	8
3.	**Problem Solving-I: :** Neural Network (NN) Toolbox, NN Simulink Demos, Neural Network (ANN) implementation, NN Tool Artificial Neural Network (ANN) implementation, Case studies-	7
4.	**Fundamental of Fuzzy Logic: Fundamental of Fuzzy Logic:** Classical sets, Fuzzy Sets, Membership function, Cardinality of fuzzy set, Fuzzy complement, Fuzzy Composition, properties and operation on Fuzzy sets, Fuzzy Relation, Fuzzification, Defuzzification	8
5.	**Fuzzy Logic Control:** Fuzzy Rule, Decision making Logic, Linguistic variables, Inferences, Fuzzy Inference system: Mamdani FIS, Sugeno FIS, Designing Fuzzy Controller, Fuzzy optimization, Introduction to generate a genetic algorithm, Applications of FIS.	8
6.	**Problem Solving-II:** Fuzzy Logic Toolbox, Fuzzy Logic Simulink Demos, Fuzzy Logic Controller (FLC) implementation, Simulink Fuzzy Logic Controller (FLC) implementation, Applications of FLC to Control System.	7
	Total	**45**

Text Books:

1. Kosko, B, “Neural Networks and Fuzzy Systems: A Dynamical Approach to Machine Intelligence”, PrenticeHall, NewDelhi, 2004.
2. Ross T. J. , “Fuzzy logic with engineering applications (Vol. 2)”, New York: Wiley, 2004, ISBN: 9783030375478

Reference Books:

1. Jack M. Zurada, “Introduction to Artificial Neural Systems”, PWS Publishing Co., Boston, 2002.
2. Zimmerman H.J., “Fuzzy set theory and its Applications”, Kluwer Academic Publishers Dordrecht, 2001.
3. Driankov,Hellendroonb, “Introduction to fuzzy control”, Narosa Publishers,2001.
4. G Klir, B Yuan, “Fuzzy sets and fuzzy logic : Theory and application”, PHI, ISBN:
5. LauranceFausett, Englewood cliffs, N.J., “Fundamentals of Neural Networks”, PearsonEducation, New Delhi, 2008.
6. B Yegnanarayana : Artificial Neural Networks for pattern recognition ,PHI Learning Pvt. Ltd., 14-Jan-2009

E-source: Online course “Fuzzy logic and Neural Network” by Prof. Dilip Kumar Pratihar, IIT Kharagpur.
https://nptel.ac.in/courses/127/105/127105006/

Program:	B. Tech. (Civil Engineering)			Semester:		IV	
Course:	Mechanics of Structures			Code:		BCI4303	
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	H	IE	MTE	ETE	Total
3	-	3	3	20	30	50	100

Prior Knowledge of: Engineering Mechanics, Strength of Materials. **(**Equilibrium conditions, types of supports and analysis of beams, basics of slope and deflection of beams is essential)

Course Objectives:

1. To impart the knowledge about the basic concepts required for analysis of structures.
2. To develop ability of analyzing structures.

Course Outcomes:

After learning the course, the students will be able to:

1. Explain the concepts of static and kinematic indeterminacy and analyze determinate beams using influence line diagram (ILD).
2. Analyze multi-storey multi-bay frames by approximate methods.
3. Analyze beams and frames by slope deflection method.
4. Analyze beams and frames by moment distribution method.
5. Analyze beams and frames by stiffness matrix method.
6. Apply the concepts of plastic analysis in the steel structures.

Detailed Syllabus:

Unit	Description	Duration (H)
1.	**Fundamentals of structure and Influence Line Diagram:** a) Types and classification of structures based on structural forms, concept of indeterminacy, static and kinematics degree of indeterminacy. b) Basic concept of influence line diagram, Muller: Braslau's principle, influence line diagram for reaction, shear and moment to simply supported and overhanging beams, application of influence line diagram to determine reaction, shear and moment in beams.	8
2.	**Analysis of multi-storied multi-bay 2-D rigid jointed frames:** a) Approximate methods of analysis of multi-storied multi-bay 2-D rigid jointed frames by Portal method and Cantilever Method. b) Approximate methods of analysis of multi-storied multi-bay 2-D rigid jointed frames by substitute frame method.	8
3.	**Slope-Deflection Method:** a) Slope-deflection equations, equilibrium equation of Slope-deflection method, application of Slope deflection method to beams without joint translation and rotation, yielding of support, application to non-sway rigid jointed rectangular portal frames, bending moment diagram. b) Sway analysis of rigid joint rectangular single bay single storey portal frames using Slope deflection method. (Involving not more than three unknowns)	7
4.	**Moment Distribution Method:** a) Stiffness factor, carry over factor, distribution factor, application of Moment distribution method of analysis to beams without joint translation and yielding of support, application to non-sway rigid jointed rectangular portal frames, bending moment diagram. b) Sway analysis of rigid jointed rectangular single bay single storey portal frames using Moment distribution method (Involving not more than three unknowns).	7
5.	**Stiffness Matrix Method:** a) Fundamental concepts of flexibility and stiffness, relation between them. Stiffness method of analysis- Structure approach only. Application to beams (Involving not more than three unknowns). b) Application of Stiffness structure approach to rigid jointed rectangular portal frames (Involving not more than three unknowns).	7

6.	**Plastic Analysis of structure:** a) True and idealized stress-strain curve for mild steel in tension, stress distribution in elastic, elasto-plastic and plastic stage, concept of plastic hinge and collapse mechanism, Plastic modulus of section, Plastic moment, shape factor. Statistical and kinematical method of analysis, upper, lower bound and uniqueness theorem. b) Plastic analysis of determinate and indeterminate beams, single bay single storied portal frame	**8**
	Total	**45**

Text Books:

1. Theory of Structures by S. Ramamrutham and R. Narayan, Dhanpat Rai Publishing Company (P) Ltd.
2. Structural Analysis-I & II by S. S. Bhavikatti, Vikas Publishing House Pvt. Ltd, 4th Edition, 2014
3. Structural Analysis: A Matrix Approach by G.S.Pandit and S. P. Gupta, Tata McGraw Hill Education Pvt. Limited, 2nd Edition, 2016

Reference Books:

1. Intermediate Structural Analysis by C. K. Wang, Tata McGraw Hill Education Pvt. Ltd. 7th Edition, 2013
2. Mechanics of Structures Vol. II (Theory and Analysis of Structures) by Dr. H. J. Shah and S. B. Junnarkar, Charotar Publishing House Pvt. Ltd, 23rd Edition, 2013
3. Basic Structural Analysis by C. S. Reddy, Tata McGraw Hill Education Pvt. Ltd.
4. Structural Analysis by R. C. Hibbler, Pearson Education. 3rd Edition, 2013
5. The Plastic Methods of Structural Analysis by B. G. Neal, Champman & Hall.
6. Structural Analysis by AslamKassimali, Cengage Learning India Private Limited
7. Matrix Analysis of Framed Structures by William Weaver Jr. and James M. Gere, Springer US.

e-Resources:

https://nptel.ac.in/courses/105/101/105101086/
https://nptel.ac.in/courses/105/106/105106050/

Program:	B. Tech. (Civil Engineering)			Semester:	IV		
Course:	Geotechnical Engineering Lab			Code:	BCI4410		
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	Hours	TW	OR	PR	Total
02	-	01	02	25	25	-	50

Course Objectives:

To make aware of soil classification and provide the knowledge of methods for determination of index and engineering properties of soil.

Course Outcomes:

After learning the course, the students will be able to:

1. Determine index properties of soil & apply the knowledge on field
2. Determine engineering properties of soil & apply the knowledge on field
3. Interpret existing soil investigation report

Lab Experiments

The term work shall consist of a journal giving details of 10 out of 12 of the following experiments. Sr. No 13 is compulsory.

1. Water content determination by two methods a) oven drying method, b) calcium carbide method
2. Specific gravity determination by pycnometer /density bottle.
3. Sieve analysis, particle size determination and IS classification as per I.S. Codes.
4. Determination of consistency limits and their use in soil classification as per I.S. Codes.
5. Field density test by a) core cutter b) sand replacement
6. Determination of coefficient of permeability by a) constant head and b) variable head method.
7. Direct shear test.
8. Unconfined compression test.
9. Vane shear test.
10. Standard proctor test / Modified proctor test.
11. Differential free swell test.
12. Triaxial test
13. Collection of sample soil investigation report for any construction project and write report about interpretation of index properties of soil.

Assignments:

1. Solution of problems on shear strength parameters using graph.
2. Rehbann's and Culmann's graphical method for determination of earth pressure.
3. Flow net construction for sheet pile or earthen dam.

Reference Books:

1. Geotechnical Engineering by C. Venkatramaiah, New Age International Publishers, 5th Edition, 2017.
2. Principles of Geotechnical Engineering by Braja M. Das, Cengage Learning, 8th Edition, 2020.
3. Geotechnical Engineering by P Purushothma Raj, Tata McGraw Hill, 2017.
4. Geotechnical Engineering by Principles & Practices by Donald. P. Coduto, Pearson Education, 2nd Edition, 2017.
5. Basic and Applied Soil Mechanics by Gopal Ranjan and A. S. R. Rao, Newage International, 3rd Edition, 2016.
6. Physical and Geotechnical Properties of Soils by Joseph E. Bowles, International Students Edition.

IS Codes: SP36 Compendium of Indian Standards on Soil Engineering, Part 1:1987 Laboratory Testing of soils for Civil Engineering Purposes.

e-Resources:

1. http://ascelibrary.org/page/books/s-gsp.
2. http://accessengineeringlibrary.com/browse/geotechnical-engineersportable-handbook-second edition.
3. http://nptel.ac.in/courses/105101084/
4. http://nptel.ac.in/courses/105106142/

Program:	B. Tech. (Civil Engineering)			Semester:	IV		
Course:	Surveying & Geomatics Lab			Code:	BCI4411		
Teaching Scheme				Evaluation Scheme-			
Practical	Tutorial	Credit	Hours	TW	OR	PR	Total
2	-	1	2	25	-	50	75

Course Objectives:

To develop the ability to carry out survey work, and carry out required analysis required for construction projects.

Course Outcomes:

After learning the course, the students will be able to:

1. Evaluate required distances, angles and reduced levels using various instruments.
2. Analyze data required for setting out buildings and roads.
3. Estimate earthwork for profile and cross-section levelling.

Note: Practical (PR) Examination is based on performance of any three practical (10 marks each) with 20 marks oral examination, based on practical performed.

List of Laboratory Assignments

Perform any eight out of ten lab assignments and all projects are mandatory:

1. Measurement of magnetic bearings of sides of a triangle /polygon, correction for local attraction and calculations of true bearings using prismatic compass.
2. Plane table survey by intersection method.
3. Simple and differential levelling (with at least three change points) using auto / digital level.
4. Measurement of horizontal angles (by repetition method) using 20" vernier transit theodolite.
5. Finding horizontal and vertical distance using tacheometer.
6. Setting out a building from a given foundation plan (minimum six coordinates).
7. Setting out a circular curve by Rankine's method of deflection angles.
8. Study and use of nautical sextant.
9. Determination of distance of any two points on the surface of earth using (any) android App and comparing it with the the actual distance on ground to know the accuracy.
10. Study and use of total station.

Project I: Road project using Auto level for a minimum length of 100 m including fixing of alignment, profile levelling, cross-sectioning, plotting of L section and Cross Section. (One full imperial sheet including plan, L-section and any three typical Cross-sections).

Project II: Tachometric contouring project with at least two instrument stations about 60 m to 100 m apart and generating **contours using any software (minimum contour interval 1 meter).**

Reference Books:

1. Plane Surveying by A. M. Chandra, New Age International Publishers.
2. Surveying and Levelling by N. N. Basak , Tata McGraw Hill. (2013)
3. Surveying Vol. I & II by Dr. K. R. Arora , Standard Book House. (2013, 2014)
4. Surveying: Theory and Practice by James M. Anderson, Edward M. Mikhail, Tata McGraw Hill. (2013)
5. Plane and Geodetic Surveying for Engineers. Vol. I by David Clark, Constable. (2013)

Program:	B. Tech. (Civil Engineering)			Semester:	IV		
Course:	Concrete Technology Lab			Code:	BCI4412		
Teaching Scheme/week				Evaluation Scheme			
Practical	Tutorial	Credit	Hours	TW	OR	PR	Total
2	-	1	2	50	25	-	75

Course Objectives:

To develop the ability to perform various tests and interpret results of ingredients of concrete and properties of fresh and hardened concrete.

Course Outcomes:

After learning the course, the students will be able to:

1. Evaluate the different properties of concrete ingredients.
2. Decide a concrete mix proportion using IS guidelines and field requirements.
3. Demonstrate the test on fresh and harden concrete.

Lab Experiments

Tern work and oral exam based on syllabus and following experiments. Students have to review code provisions for all the practicals and include conclusions and recommendations based on the observed readings/results and code specifications.

Part A- Cement and Cementitious materials:

1. Determination of Fineness of cement, fly ash and consistency of standard Cement Paste.
2. Determination of Initial and Final Setting times of Cement and soundness of cement.
3. Determination of Compressive Strength of Cement.

Part B- Fine & coarse aggregate

4. Determination of Fineness modulus of Coarse and Fine Aggregates.
5. Moisture content, silt content, density and Specific gravity of fine aggregate
6. Moisture content , water absorption, density and Specific gravity of coarse aggregate

Part C- Concrete

7. Workability of concrete by slump cone, compaction factor, OR Vee Bee test
8. Determination of Compressive strength test of concrete by crushing and Rebound hammer.
9. Determination of Indirect tensile strength and flexural strength of hardened concrete

Assignments

10. Concrete mix design by IS code method manually and using spreadsheet/MATLAB.
11. Site visit to RMC plant and preparation of report

Reference Books:

1. Concrete Technology by A.R. Santhakumar, 2nd Edition, Oxford University Press,2018.
2. Concrete: Microstructure, Properties and Materials by P. Kumar Mehta, Paulo J. M. Monteiro, 4th Edition, McGraw-Hill Education,2014.
3. Concrete Mix Design by A. P. Remideos, Himalaya Publishing House.
4. Concrete Structures, Repair, Rehabilitation and Retrofitting by J. Bhattacharjee, 1st Edition, CBS Publishers & Distributors Pvt. Ltd,2017.

IS Codes:

IS 383:2016- Coarse and Fine Aggregate for Concrete Specification
IS 456:2000 with Reaffirmed 2016-Plain and Reinforced concrete- code of practice
IS 516 : 1959 with Reaffirmed 2018- Methods of tests for strength of concrete
IS 1489 (Part 1) : 2015(4 Revision)- Portland pozzolana cement - Specification: Part 1 fly Ash Based
IS 2386 (Part 1 to 5):1963 with Reaffirmed 2021 -Methods of Test for Aggregates for Concrete
IS 4031 (Part 1,10 to 13):1996 with Reaffirmed 2021 -Methods of physical tests for hydraulic cement
IS 9103 : 1999 (1 Revision) with Reaffirmed 2018- Specification for Concrete Admixtures
IS 1199 : Part 1 to 5: 2018 - Fresh Concrete Methods of Sampling, Testing and Analysis
IS 10262 : 2019 (2 Revision)- Concrete Mix Proportioning Guidelines
IS 13311 : Part 2 : 1992 with Reaffirmed 2018- Method of Non-destructive Testing of Concrete-methods of Test : Part1 Ultrasonic Pulse Velocity
IS 13311 : Part 2 : 1992 with Reaffirmed 2018- Method of Non-destructive Testing of Concrete-methods of Test : Part 2 Rebound Hammer

e-resources:

https://onlinecourses.nptel.ac.in/
https://www.ultratechcement.com/videos/supervising-work.1ujfe5RRhF0

Program:	B. Tech. (Civil Engineering)	Semester:	IV
Course:	Professional skills for Engineers(HSMC-4)	Code:	BHM4101

Teaching Scheme/week				Evaluation Scheme			
Lecture	Practical	Credit	Hours	IE	MTE	ETE	Total
1	2	2	3	30	-	20	50

Prior knowledge of
Basic Language Skills

Course Objectives:
This course aims at enabling students:
1. To introduce students to the fundamentals of effective communication
2. To introduce students to the skills to prepare and deliver effective presentations and learn techniques of mastering group discussions.
3. To introduce students to interview skills and corporate etiquettes
4. To introduce students to professional ethics and organizational skills

Course Outcomes:
After learning the course, the students will be able to:
1. Understand the nuances of effective communication skills at the workplace.
2. Demonstrate presentation skills and group discussions skills to excel in the professional environment.
3. Apply interview skills and corporate etiquettes effectively to hone the opportunities of employability.
4. Analyze career management skills that can lead to improved employment.

Detail Syllabus:

Unit	Description	Duration(H)
1.	**Introduction and Fundamentals of Communication:** Need for effective communication, Functions of Communication, Organizational Communication, Verbal-Oral and Written communication, Non-verbal communication, Barriers to Effective Communication	11
2.	**Presentation Skills:** 4Ps (Planning, Preparation, Practice, Presentation), guidelines for developing PPT, Outlining, Effective use of A/V aids and Modes of Delivery **Mastering Group Discussion skills:** Skills evaluated in Group discussion, Types of Group discussion- Factual, Abstract, Controversial and Case studies, Do's and Don'ts in Group Discussion	12
3.	**Interview Skills:** Interview Process, Types of Interview: Job interview, Appraisal Interview, Exit, Interview, Panel Interview; Self Introduction, Pre and Post interview activities, Skills evaluated in interview, Do's and Don'ts during Interview **Cover letter & Resume**: Job Application letter, Difference between CV and Resume Writing skills, Resume writing, Writing SOPs **Corporate Etiquettes:** Dressing Etiquettes, Dining Etiquettes, Telephonic etiquette, Business card Etiquettes, Email etiquettes	11
4.	**Professional Ethics:** Integrity, Objectivity, Professional competence and due care, Confidentiality Professional behavior. **Organizational Skills:** Physical Organization, Digital Organization, Planning, Time management & Communication	11
	Total	45

Text Book:
1. R.Gajendra Singh Chauhan and Sangeeta Sharma, "Soft Skills-An integrated approach to maximize personality", Wiley Publication, ISBN: 987-81-265-5639-7

Reference Books:
1. Muralikrishna C., Sunita Mishra, Communication Skills for Engineers 2nd edition, Pearson, 2. New Delhi 2010
2. Indrajit Bhattacharya, An Approach to Communication Skills, DhanpatRai, Delhi, 2008 4.
3. Simon Sweeney, English for Business Communication, Cambridge University Press.
4. Sanjay Kumar and Pushpa Lata, Communication Skills, Oxford University Press.
5. Barun K.Mitra, Personality Development & Soft Skills, Oxford University Press, 2012 New Delhi.

E-sources:
1. https://nptel.ac.in/courses/109107121
2. https://nptel.ac.in/courses/122106031https://www.coursera.org/learn/principles-of-management (Ethics)

Program:	B. Tech. (All branches)			Semester:	IV		
Course :	Life Skills-4			Code :	BHM4940		
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	Hours	TW	PR	OR	Total
2	0	0	2	-	-	-	-

Prior knowledge: Nil

Objectives:

1. To learn about the social functioning and diverse culture in the country.
2. To be aware and improve interpersonal behavioral patterns.
3. To inculcate caring and serving qualities towards family, society and environment at large.

Outcomes:

After Successfully completing the course the students should be able to:

1. Apply social work practices in the context of diverse cultures.
2. Develop a broad understanding of Indian culture through various art forms.
3. Apply effective ways of interpersonal behavioural patterns eliminating their unhelpful thoughts, feelings and actions.
4. Develop skills which are necessary to initiate ideas and pursue them for holistic development of the individual.

Detailed Syllabus:

Unit	Description	Duration (Hrs)
1.	**Social Welfare** Environment awareness such as Tree Plantation, Natural resources awareness etc, Donation Camp, Visit to Orphanage, Old Age home and Villages, Contribution in social activity like Pani Foundation, Swaccha Bharat Abhiyan, Save Girl Child/Animals/Birds/Trees etc., Activity based on societal projects / Project Exhibitions etc. **Cultural Awareness** Divisions of Indian classical music: Hindustani and Carnatic, Dances of India, Various Dance forms: Classical and Regional, Rise of modern theatre and Indian cinema. **or** **Transaction Analysis** Introduction to TA, Basic Assumptions of TA, Theory of Personality Ego States, Strucural and Functional, Ego States Diagnosis, Egogram, Structural Pathology, Contamination, Theory of Communication, Types of Transactions, Strokes, Stroke Economy, Theory of Life Positions, Injunctions	**12**
2.	**Caring and service** Hospital Caring, Personal Safety, First Aid, Disaster Management Gardening, Organic farming, Cooking, etc	**12**
	Total	**24**

Reference Books:

1. K. Singh, "An introduction to Social Work", 14 April 2011.
2. Bishnu Mohan Dash, Mithilesh Kumar, D. P. Singh, Siddheshwar Shukla, "Indian Social Work", 1 October 2020.
3. Martin Davies, "Social work with Children and Families", 20 March 2012.
4. Anita Kainthla, "Baba Amte – A Biography", 1 January 2006.
5. Aroup Chatterjee , "Mother Teresa – The untold story", 1 January 2006.
6. Improving Behaviour and Raising Self-Esteem in the Classroom, A Practical Guide to Using Transactional Analysis, Giles Barrow, Emma Bradshaw, Trudi Newton, David Fulton Publishers, 1 October 2001.
7. Transactional Analysis, 100 Key Points and Techniques, Mark Widdowson, 8 September 2009.
8. Benjamin Colodzin, "Helping ourselves by Helping Others", 3 August 2020.
9. Smith Mark K. "The Art of Helping Others", Jessica Kingsley Publishers,15 April 2008.
10. Chip Heath, "Decisive: How to Make Better Choices in Life and Work", March 26, 2013.

Program:	B. Tech. (Civil Engineering)			Semester:			IV
Course:	Analysis and design of water supply network using WaterGEMS (Proficiency Course 1)			Code:			BCI4911A
Teaching Scheme/week				Evaluation Scheme			
Practical	Tutorial	Credit	H	IE	MTE	ETE	Total
2	-	-	2	-	-	-	Grade

Course Objectives:

1. To impart knowledge of flow through Water distribution system
2. To make aware of pipe flow analysis using WaterGEMS

Course Outcomes:

After learning the course, the students should be able to:

1. Apply appropriate techniques, resources, and modern engineering and IT tools for pipe flow analysis
2. Apply knowledge to assess societal issues like water management
3. Analyze flow through pipe networks using software

Detailed Syllabus:

Unit	Description	Duration(H)
1.	Introduction to Water Supply Networks, Modelling Fundamentals and Hydraulics Review,	5
2.	Introduction to WaterGEMS, Building a Network with Fire Flows, Importing Basic Model Data,	5
3.	Modelling Pumps, Tanks and Pressure Regulating Valves(PRVs), Model Applications and System Planning,	5
4.	System Design Improvements, Model Calibration, Fire Flow Analysis, Criticality Analysis	5
	Total	20

Reference

1. **:** https://youtube.com/playlist?list=PLLCOESNdmKSJAaqcqkfZJqw4eIEpB-NAC

Program:	B. Tech. (Civil Engineering)			Semester:			IV
Course:	Slope Stability Analysis Software (Proficiency Course 1)			Code:			BCI4911B
Teaching Scheme/week				Evaluation Scheme			
Practical	Tutorial	Credit	H	IE	MTE	ETE	Total
2	-	-	2	-	-	-	Grade

Course Objectives:

1. To provide the knowledge of slope stability analysis Software for slopes.
2. To bridge the skill gaps and make students industry ready.

Course Outcomes:

After learning the course, the students will be able to:

1. Explain the main features of the slope stability analysis software
2. Analyze the stability of soil slopes

Detailed Syllabus:

Unit	Description	Duration (H)
1	Introduction to slope stability analysis software and its different modules, Intuitive software allowing fast data input.	04
2	Modeling of reinforcement elements with anchors, Modeling of reinforcement elements with rock bolts, Modeling of reinforcement elements geotextiles.	12
3	Application of partial factors, Varying pore water pressure distribution within the slope.	02
4	Comprehensive post processing with detailed reporting, Attractive graphical outputs for use in reports.	02
	Total	20

Reference Books:

1. Slope Tutorial Manual: Oasys Slope
2. Geotechnical Engineering by Shashi K. Gulhati & Manoj Datta, Tata McGraw Hill, 2017.
3. Principles of Soil Mechanics and Foundation Engineering by V.N.S. Murthy, UBS Publishers, 2018.
4. Soil Mechanics and Foundation Engineering by K. R. Arora, Standard Publisher, 7th Edition, 2019.
5. Soil Mechanics and Foundation Engineering by B. C. Punmia, Laxmi Publications, 16th Edition, 2017.

Program:	B. Tech. (Civil Engineering)			Semester:			IV
Course:	Analysis of Structures by STAAD-PRO Software (Proficiency Course 1)			Code:			BCI4911C
Teaching Scheme				Evaluation Scheme			
Practical	Tutorial	Credit	H	IE	MTE	ETE	Total
2	-	-	2	-	-	-	Grade

Course Objectives:

1. To impart the knowledge of STAAD – PRO software.
2. To develop ability of analyzing structures using STAAD – PRO software.

Course Outcomes:

After learning the course, the students will be able to:

1. Perform basic modeling in STAAD-Pro software.
2. Analyze the structures using STAAD-Pro software.

Detailed Syllabus:

Unit	Description	Duration (Hrs.)
1.	**Introduction of STAAD-PRO Software –** Types of structures, analysis and design of structure, use of STAAD-PRO software in structural domain.	05
2.	**Overview of geometry & modelling tabs –** Use of geometry commands, support specification, member specification, and assigning member property.	05
3.	**Creating geometry and applications of various loads and supports –** Assigning different types of loads like Point Load, UDL, UVL, Trapezoidal Load and different types of supports.	05
4.	**Analysis of results for beams and frames –** Checking of values of bending moment, shear force, deflections and stresses.	05
	Total	20

Reference Books:

1. STAAD Pro V8i for Beginners by T. S. Sarma, 1st Edition, 2014.
2. Principles of Structural Analysis – Static and Dynamic Loads, by Krishnan Sathia, 2nd Edition, 2021.
3. Analysis and Design of Structures - A Practical Guide to Modeling, by D.Trevor Jones, 1st Edition, 2012.
4. STAAD Pro : Reference Guide by C S Changeriya, 1st Edition, 2010.

Program:	B. Tech. (Civil Engineering)			Semester:	IV		
Course:	MATLAB (Proficiency Course- 1)			Code:	BCI4911D		
Teaching Scheme/week				Evaluation Scheme			
Practical	Tutorial	Credit	H	IE	MTE	ETE	Total
2	-	-	2	-	-	-	Grade

Course Objectives:

1. To impart the knowledge to the students about the MATLAB environment.
2. To carry out simple numerical computations and data interpretation using MATLAB.
3. To demonstrate problem solving approaches to improve the computational skill.
4. To present data in a systematic way using plots and graphs.

Course Outcomes:

After learning the course, the students will be able to:

1. Understand the main features of the MATLAB and its use to solve computational problems.
2. Implement their algorithms in MATLAB to solve scientific and mathematical problems.

Detailed Syllabus:

Unit	Description	Duration (H)
1.	**MATLAB Fundamentals:** User interface, variables, commands and data types, operators and elementary operations, loops and conditional statements, matrices and arrays.	10
2.	**Introduction to Programming with MATLAB:** Files, scripts and functions, plotting and program output, Numerical Differentiation and Integration, linear algebra.	10
	Total	**20**

Text Books:

1. Beginning MATLAB and Simulink, Sulaymon Eshkabilov Apress 2019.
2. Learning to program with MATLAB: Building GUI Tool, Craig S. Lent, Wiley Publications 2013.
3. A Guide to MATLAB: For beginners and experienced users, Brian R. Hunt, Ronald L. Lipsman, Jonathan M. Rosenberg 3rd edition.

Reference Books:

4. Introduction to MATLAB, Delores M Etter, 4th edition, Pearson Publication.
5. Practical MATLAB: Basics for Engineers, Misza Kalechman, CRC Press, Taylor & Francis Group.

https://www.mathworks.com/help/releases/R2014b/pdf_doc/matlab/getstart.pdf

Program:	B. Tech. (Civil Engineering)			Semester:			IV
Course:	Building planning, design and modeling using Revit (Proficiency Course- 1)			Code:			BCI4911E
Teaching Scheme/week				Evaluation Scheme			
Practical	Tutorial	Credit	H	IE	MTE	ETE	Total
2	-	-	2	-	-	-	Grade

Course Objectives:

To introduce the students with various features of building planning, design and modeling software

Course Outcomes:

After learning the course, the students will be able to:

1. Plan and design a building using Revit software.
2. Prepare a model of a building using Revit software.

Detailed Syllabus:

Unit	Description	Duration (H)
1.	Introduction to Revit software, basic tools, setting levels, grid etc.	5
2.	Modeling of various components like walls, columns, doors, windows etc.	5
3.	Working with views-setting display etc.	5
4.	Modeling with roofs, stairs introduction to creating construction documents	5
	Total	**20**

Text Books:

1. Autodesk Revit 2023 Architecture Basics by E Moss
2. Design Integration Using Autodesk Revit 2023 by by DJ Stine

e resources:
Online Help: http://docs.autodesk.com/REVIT/2011/ENU/landing.html
Video Tutorial: http://usa.autodesk.com/adsk/servlet/item?siteID=123112&id=16104692
User Guide: http://usa.autodesk.com/adsk/servlet/item?siteID=123112&id=14997002
Workbook and Data Sets:http://usa.autodesk.com/adsk/servlet/index?siteID=123112&id=8029689&linkID=9243097

Program:	B. Tech. (All branches)			Semester:	IV		
Course:	Audit Course 1-Environmental Sciences			Code:	BHM9961		
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	Hours	IE	MTE	ETE	Total
1	-	-	1	-	-	-	Grade

Course Objectives:

1. To gain an understanding on the concepts and strategies related to sustainable development and identify and analyse various conservation methods for renewable and non-renewable resources.
2. To examine biotic and abiotic factors within an ecosystem and to identify energy flow in ecosystem.
3. To understand the value of biodiversity and identify current efforts for it's conservation at national and local level
4. To provide comprehensive overview of environmental pollution and technology associated with monitoring and control.

Course Outcomes:

After learning the course, the students will be able to:

1. Demonstrate an integrative approach to environmental issues with a focus on sustainability and identify the role of organism in energy transfer in different ecosystem.
2. Distinguish between renewable and non-renewable resources and analyse consumption of resources
3. Identify key threats to biodiversity and develop appropriate policy options for it's conservation.
4. Analyze the impact of environmental pollution and the science behind those problems and potential solutions.

Detailed Syllabus:

Unit	Description	Duration (H)
1.	**Multidisciplinary nature of environmental studies:** Definition, scope and importance, Need for Public awareness, Natural Resources: Renewable and non-renewable resources: Natural resources and associated problems a) Forest b)Water c)Mineral d)Food e) Land f) Energy, Role of an individual in conservation of natural resources, Use of resources for sustainable lifestyle.	3
2.	**Ecosystems:** Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposer, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Characteristic features, Case study on Forest ecosystem, Aquatic ecosystem.	3
3.	**Biodiversity and its conservation:** Introduction – Definition: genetic, species and ecosystem diversity, Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic values, Biodiversity at global, national and local levels, India as a mega-diversity nation, Hotspots of biodiversity, Threats to biodiversity, Conservation of biodiversity, Case study on any one Hotspot of biodiversity.	3
4.	**Environmental Pollution:** Definition, Cause, effects and control measures of different pollution: a. Air b. Water c. Soil d. Noise e. Thermal f. Nuclear hazards, Solid waste management, Relevance of environmental ethics for environmental protection, Social Issues and the Environment: From Unsustainable to Sustainable development ,Urban problems related to energy ,Water conservation, Impact of Climate change, Innovative ideas for creating public environmental awareness.	3
	Total	12

Text Books:

1. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T., "Environmental Encyclopedia", Jaico Publications House, 1st edition, 2000, ISBN-13: 978-8172247867

2.Agarwal, K.C, "Environmental Biology", Nidhi Publishers, 2nd edition ,2008, ISBN-13978-8189153021

Reference Books:

1.BharuchaErach, "The Biodiversity of India", Mapin Publishing Pvt. Ltd., 1st edition, 20021, ISBN-108188204064

Program:	B. Tech. (All branches)			Semester:		IV	
Course:	Audit Course 1- Constitution of India			Code:		BHM9962	
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	H	IE	MTE	ETE	Total
1	-	-	1	-	-	-	Grade

Course Objectives:

1. To enable the student to understand the importance of constitution
2. To identify individual role and ethical responsibility towards nation.
3. To understand human rights and its implications
4. To know about central and state government functionalities in India.

Course Outcomes:

After learning the course, the students will be able to:

1. Understand the functions of the Indian government and get acquainted with knowledge of Constitutional Amendments.
2. Identify and explore the basic features, modalities about Indian constitution and assessment of the Parliamentary System in India.
3. Differentiate and relate the functioning of Indian Political system at the Central and State level.
4. Comprehend the fundamental rights and abide the rules of the Indian constitution.

Detailed Syllabus:

Unit	Description	Duration (H)
1.	**Introduction to Constitution:** Meaning of the constitution law and constitutionalism, making of constitution, Salient features and characteristics of the Constitution of India, Preamble, Fundamental Rights, Directive Principles of State Policy, Fundamental Duties and it's legal status, Citizenship.	3
2.	**System of Government- Centre & State level and local level** Structure and Function of Central Government, President, Vice President, Prime Minister, Cabinet, Parliament, Supreme Court of India, Judicial Review, Federal structure and distribution of legislative and financial powers between the Union and the States, local self-government	3
3.	**Judiciary:** Governor, Chief Minister, Cabinet, State Legislature Judicial System in States, High Courts and other Subordinate Courts, Parliamentary Form of Government in India.	3
4.	**Constitution Functions:** Indian Federal System and it's characteristics, Center& State Relations, President's Rule, Constitutional Amendments and powers, Constitutional Functionaries, Emergency Provisions, Assessment of working of the Parliamentary System in India	3
	Total	12

Text Books:

1. Durga Das Basu, "Introduction to the Constitution of India ", Prentice Hall of India, New Delhi,24th edition, 2020, ISBN-109388548868
2. Clarendon Press, Subhash C, Kashyap, "Our Constitution: An Introduction to India's Constitution and constitutional Law", NBT, 5th edition, 2014, ISBN-9781107034624

Reference Books:

1. Maciver and Page, "Society: An Introduction Analysis ", Laxmi Publications, 4th edition, 2007, ISBN-100333916166
2. PM Bhakshi, "The constitution of India", Universal Law Publishing - An imprint of Lexis Nexis, 14th edition, 2017, ISBN-108131262375

Program:	B. Tech. (All branches)	Semester:	IV
Course:	Audit Course 1- Emotional Intelligence	Code:	BHM9963

Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	H	IE	MTE	ETE	Total
1	-	-	1	-	-	-	Grade

Course Objectives:

1. To develop an awareness of Emotional Intelligence models
2. To understand intelligence and develop emotional competence
3. To understand how you use emotion to facilitate thought and behaviour
4. To know and utilize the difference between reaction and considered response

Course Outcomes:

After learning the course, the students will be able to:

1. Understand how to manage emotions, behaviour and self-control in any situation resulting in better productivity
2. Employ emotional intelligence competencies to effectively interact with people, colleagues and employees in building stronger relationships at work and at home
3. Articulate emotions using the right verbal and non-verbal language
4. Use tools to regulate their emotions and recognise and respond appropriately to emotions in self and others.

Detailed Syllabus:

Unit	Description	Duration (H)
1.	**Introduction to Emotional Intelligence (EI):** What is Emotional Intelligence, Emotional Intelligence and various EI models, The EQ competencies of self-regulation, motivation, empathy and interpersonal skills, Understand EQ and its importance in life.	3
2.	**Self-awareness (SA):** Seeing the other side, giving in without giving up. **Tools :** Think, Feel, Act Cards, Plutchik's Wheel of Emotions& Emotional intelligence test **Self-Regulation/Managing Emotions:** The science of Emotions, Self-emotional quotient	3
3.	**Gaining Control:** Use of Coping Thoughts and Relaxation Techniques to manage emotions, **Activities:** Be the Fog, Temperament Analysis. **Emotion recognition in others:** The universality of emotional expression, perceiving emotions accurately in others to build empathy **Activities :** Mindful Listening, Perceptual Positions	3
4.	**Emotional Intelligence at Work place:** Importance of Emotional Intelligence at Work place, role of empathy and trust in relationships, building effective work relationships, conflict resolution strategy, Cohesive team building, Tests : My Colored Hat, "I Am" Circle, Empathy Cards	3
	Total	12

Text Books:

1. Daniel Goleman, "Emotional Intelligence – Why It Matters More Than IQ,", Bantam, 10th Anniversary edition, 2005, ISBN: 978-0553383713
2. Steven C. Hayes, Spencer Smith, "Get Out Of Your Mind And Into Your Life: The New Acceptance and Commitment Therapy", Read How You Want, [Large Print] edition, 2009, ISBN-13 : 978-1458717108

Reference Books:

1. Steven Stein, "The EQ Edge", Jossey-Bass, 3rd edition, 2011, ISBN-13: 978-0470681619
2. Drew Bird , "The Leader's Guide to Emotional Intelligence", Createspace Independent Pub, Kindle Edition, 2016, ISBN-13 : 978-1535176002

Program:	B. Tech. (All branches)			Semester:	IV		
Course:	Audit Course 1- Entrepreneurship Development			Code:	BHM9964		
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	H	IE	MTE	ETE	Total
1	-	-	1	-	-	-	Grade

Course Objectives:

1. To inspire students and help them imbibe an entrepreneurial and start-up mind-set
2. To develop and strengthen entrepreneurial quality among students.
3. To understand the abilities to become an Entrepreneur.
4. To acquaint with legalities in product development, IPR, Trademarks, Copyright and patenting
5. To know the facets of Business plans, Entrepreneurial Finance

Course Outcomes:

After learning the course, the students will be able to:

1. Develop an entrepreneurial mind-set by learning key skills such as product design, salesmanship, marketing and interpersonal skills.
2. Interpret their own business plan and analyse factors that contributed to the failure of a start-up
3. understand how to determine the best source of capital for a company and how to find revenue and expense assumptions
4. Understand the legalities in product development, IPR, Trademarks, Copyright and patenting

Detailed Syllabus:

Unit	Description	Duration (H)
1.	**Concept and Scope:** Entrepreneurship as a career, Traits of Successful Intrapreneur/ Entrepreneur, Why to become entrepreneur, Entrepreneurship Development Phases, Problem Solving and Ideation Process, Design Validation, Types of Start-ups	3
2.	**Creating Entrepreneurial Venture** : Sources of Innovation, methods of generating ideas, Prototype preparation and validation, Legal Issue, Private/Public Limited Company formation requirements, Intellectual Property Protection: Patents Trademarks and Copyrights, **Entrepreneurial Failure** : Case study of patterns, Early failures: Good idea bad planning, False start , False positive, Late-stage failures: Speed trap, Cascading miracle , False confidence	3
3.	**Business Plan Preparation:** Sources of product for business: Feasible study, Ownership, capital, budgeting, Marketing plan for the new venture, steps in preparing marketing plan, Business Model Canvas (BMC), Financial plan- proforma income statements, Ratio Analysis.	3
4.	**Financial Modeling and Metrics:** Spreadsheets, Benchmarks, Revenue assumptions, expense assumptions, Metrics customer Acquisition cost and life time model, Metrics viral coefficient, Funnel Analysis, **Entrepreneurial Finance:** venture capital, financial institutions supporting entrepreneurs, Lease Financing; Funding opportunities for Start-ups in India, Crowd funding, Angel investing	3
	Total	12

Text Books:

1. Kumar Arya, "Entrepreneurship: Creating and Leading an Entrepreneurial Organization", Pearson Education India, First edition, 2012, ISBN-10: 8131765784; ISBN-13: 978-8131765784
2. S.S.Khanka, "Entrepreneurial Development", S Chand and Company Limited, Revised 2012th edition, 2012, ISBN : 81-219-1801-4

Reference Books:

1. Taneja, Gupta, Entrepreneur Development New Venture Creation", Galgotia Publishing Company, 2nd edition. 2017, ISBN: 9788185989594
2. Charantimath, Poornima, "Entrepreneurship Development and Small Business Enterprises" Pearson Education, 3rd edition, 2018, ISBN: 8177582607, 9788177582604
3. Blake Masters and Peter Thiel, "Zero to One", Plata Publishing, 2nd edition, 2014, ISBN-10 : 9780804139298 - ISBN-13 : 978-0804139298

Program:	B. Tech. (All branches)			Semester:	IV		
Course:	Audit Course 1- Research Article Writing			Code:	BHM9965		
Teaching Scheme				Evaluation Scheme			
Lecture	Tutorial	Credit	H	IE	MTE	ETE	Total
1	-	-	1	-	-	-	Grade

Course Objectives:

1. To understand about how to write effective research article
2. To create awareness about grammar, lexical choices, citations in the text
3. To develop a full-length article, proposal or conference presentation.
4. To familiarize the basic methods and techniques of research writing

Course Outcomes:

After learning the course, the students will be able to:

1. Understand necessary traits to write effective research article with appropriate grammatical and lexical choices in text
2. Comprehend the importance of citations, indexing, indexed articles and plagiarism
3. Develop an ability of critical thinking necessary to analyze a research reports
4. Write a research article, review article, thesis chapter and other related academic research text effectively and demonstrate importance of revising and proofreading for writing research article

Detailed Syllabus:

Unit	Description	Duration (H)
1.	**Introduction to Research Writing:** What is a research article? Understanding what is _Research Writing', Qualities and skills required in a Research writer, Types of Research writing, choosing a suitable journal/conference/book chapter, How to conduct an effective Research, Abstract Writing, Selection of keywords, defining problem statement.	3
2.	**Sources of citations**: Understanding of giving citation to other works, Identifying relevant citations, Understanding impact factor, Importance of Indexing and Indexed articles, learning to scan research articles quickly and effortlessly, Using Your Sources Wisely**:** what to cite, where to find good sources and how to use them, avoiding plagiarism **Plagiarism tools**: iThenticate, Grammarly **Citation Tools :**Mendeley, ,BibMe, Citefast, APA, MLA	3
3.	**Drafting**: Structure of a basic research paper, stages of writing and research, learn to write the first draft, Understanding the components of an article: Abstract, Introduction, Preliminary concepts, proposed system, Experimental section, result analysis and discussion, Conclusion, Reference.	3
4.	**Revising and Editing:** Importance of revision, Understanding the comments of reviewer, Point-to-Point address of reviewer comments, What/Whatnot to revise, Emphasis on Journal formats, Proper usage of Grammar and sentence formatting, Steps for submitting the revised manuscript/article.	3
	Total	12

Text Books:

1. Charles A. MacArthur , ―Handbook of Writing Research‖, The Guilford Press; 2nd edition, 2016, ISBN-10: 1462529313, ISBN-13: 978-1462529315
2. Margaret Cargill, Patrick O'Connor, ―Writing Scientific Research Articles‖, Wiley-Blackwell, 2nd Edition, 2013, ISBN: 978-1-118-57070-8

Reference Books:

1. Booth W., Colomb G. and Williams J., ―The Craft of Research‖, University of Chicago Press,4th edition, 2016, ISBN-13: 978-0226239736
2. Jennifer Peat, Elizabeth Elliott, Louise Baur, Victoria Keena ,―Scientific Writing Easy when you know how‖, Wiley & Sons, Inc, 2nd edition, 2013, ISBN:9780727916259

Vision and Mission of the Civil Engineering Department

Vision of the Department

To be recognized as one of the leading department in respect of professional education and innovation in the western region.

Mission of the Department

To develop a multidisciplinary approach to relate civil engineering challenges to social and human context through team spirit, right attitude, morals, and higher education.

PEOs of Civil Engineering

I. To impart sound academic fundamentals among the students to formulate, analyze and solve civil engineering problems.
II. To develop student's ability to adopt and apply recent trends in civil engineering.
III. To prepare students for the challenging needs of civil engineering profession and higher academic pursuits.
IV. To develop professional ethics among students for functioning as an individual or in a team for betterment of society and environment.

PSOs of Civil Engineering

I. The graduate will be able to apply necessary Civil Engineering skill sets for quality construction work in industrial and infrastructural development.
II. The graduate will be able to demonstrate skill sets required for entrepreneur in Civil Engineering