Under Graduate Course Structure
For
CIVIL ENGINEERING

S No	Programme Code	Programme Name	Branch	No. of Sections	No. of Students
1	01	B. Tech	Civil Engineering	01	30

Regulations – R23

Amrita Sai Institute of Science & Technology
Approved by AICTE, New Delhi; Permanently Affiliated to JNTUK, Kakinada
ISO 9001:2015 Certified Institution; Accredited by NAAC with "A" grade
Recognized by UGC under 2(f) and 12(B) of UGC 1956 Act
Amrita Sai Nagar, Paritala, NTR District Andhra Pradesh – 521 180
www.amritasai.org.in, 0866-2428399

B.Tech II Year I Semester

S.No.	Category	Title	L	T	P	Credits
1	BS	Numerical Techniques And Statistical Methods	3	0	0	3
2	HSMC	Universal human values – understanding harmony and Ethical human conduct	2	1	0	3
3	Engineering Science	Surveying	3	0	0	3
4	Professional Core	Strength of Materials	3	0	0	3
5	Professional Core	Fluid Mechanics	3	0	0	3
6	Professional Core	Surveying Lab	0	0	3	1.5
7	Professional Core	Strength of Materials Lab	0	0	3	1.5
8	Skill Enhancement Course	Building Planning and Drawing	0	1	2	2
Total			**14**	**2**	**8**	**20**
9	Audit Course	Environmental Science	2	0	0	-

B.Tech II Year II Semester

S.No.	**Category**	**Title**	**L**	**T**	**P**	**Credits**
1	Management Course-I	Managerial Economics and Financial Analysis	2	0	0	2
2	Engineering Science / Basic Science	Engineering Geology	3	0	0	3
3	Professional Core	Concrete Technology	3	0	0	3
4	Professional Core	Structural Analysis	3	0	0	3
5	Professional Core	Hydraulics &Hydraulic Machinery	3	0	0	3
6	Professional Core	Concrete Technology Lab	0	0	3	1.5
7	Professional Core	Engineering Geologylab	0	0	3	1.5
8	Skill Enhancement course	Remote Sensing &Geographical Information Systems	0	1	2	2
9	Engineering Science	Design Thinking & Innovation	1	0	2	2
Total			**15**	**1**	**10**	**21**
10	Mandatory course	Building materials and Construction	3	0	0	-
Mandatory Community Service Project Internship of 08 weeks duration during summer vacation						

II Year I Semester

L	T	P	C
3	0	0	3

NUMERICAL TECHNIQUES AND STATISTICAL METHODS

Course Objectives:

- To elucidate the different numerical methods to solve nonlinear algebraic equations
- To disseminate the use of different numerical techniques for carrying out numerical integration.
- To familiarize the students with the foundations of probability and statistical methods.
- To equip the students to solve application problems in their disciplines.

Course Outcomes:

1. Evaluate the approximate roots of polynomial and transcendental equations by different algorithms. Apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals (L3)
2. Apply numerical integral techniques to different Engineering problems. Apply different algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations (L3)
3. Apply discrete and continuous probability distributions (L3)
4. Design the components of a classical hypothesis test (L6)
5. Infer the statistical inferential methods based on small and large sampling tests (L4)

UNIT – I: Iterative Methods:

Introduction – Solutions of algebraic and transcendental equations: Bisection method – Secant method – Method of false position – Iteration method – Newton-Raphson method (One variable and simultaneous Equations)

Interpolation: Newton's forward and backward formulae for interpolation – Interpolation with unequal intervals – Lagrange's interpolation formula

UNIT – II: Numerical integration, Solution of ordinary differential equations with initial conditions:

Trapezoidal rule– Simpson's $1/3^{rd}$ and $3/8^{th}$ rule– Solution of initial value problems by Taylor's series– Picard's method of successive approximations– Euler's method –Runge-Kutta method (second and fourth order) – Milne's Predictor and Corrector Method.

UNIT – III: Probability and Distributions:

Baye's theorem – Random variables – Discrete and Continuous random variables – Distribution functions – Probability mass function, Probability density function and Cumulative distribution functions – Mathematical Expectation and Variance – Binomial, Poisson, Uniform and Normal distributions.

UNIT – IV: Sampling Theory:

Introduction – Population and Samples – Sampling distribution of Means and Variance (definition only) –Point and Interval estimations – Maximum error of estimate – Central limit theorem (without proof) – Estimation using t, χ^2 and F-distributions.

UNIT – V: Tests of Hypothesis:

Introduction – Hypothesis – Null and Alternative Hypothesis – Type I and Type II errors – Level of significance– One tail and two-tail tests – Test of significance for large samples and Small Samples: Single and difference means – Single and two proportions – Student's t- test, F-test, χ^2 -test.

Textbooks:

1. **B. S. Grewal,** Higher Engineering Mathematics, 44th Edition, Khanna Publishers.
2. **Miller and Freund's**, Probability and Statistics for Engineers,7/e, Pearson, 2008.

Reference Books:

1. **Steven C. Chapra,** Applied Numerical Methods with MATLAB for Engineering and Science,Tata Mc. Graw Hill Education.
2. **M. K. Jain, S.R.K. Iyengar and R.K. Jain,** Numerical Methods for Scientific and Engineering Computation, New Age International Publications.
3. **Lawrence Turyn,**Advanced Engineering Mathematics, CRC Press.
4. **S. C. Gupta and V.K. Kapoor**, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Publications, 2012.
5. **Shron L. Myers, Keying Ye, Ronald E Walpole,** Probability and Statistics Engineers and the Scientists,8th Edition, Pearson 2007.
6. **Jay l. Devore,** Probability and Statistics for Engineering and the Sciences, 8th Edition, Cengage.

II Year I Semester

L	T	P	C
2	1	0	3

UNIVERSAL HUMAN VALUES – UNDERSTANDING HARMONY AND ETHICAL HUMAN CONDUCT

Course Objectives:

- To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- 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 holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

Course Outcomes:

- Define the terms like Natural Acceptance, Happiness and Prosperity (L1, L2)
- Identify one's self, and one's surroundings (family, society nature) (L1, L2)
- Apply what they have learnt to their own self in different day-to-day settings in real life (L3)
- Relate human values with human relationship and human society. (L4)
- Justify the need for universal human values and harmonious existence (L5)
- Develop as socially and ecologically responsible engineers (L3, L6)

Course Topics

The course has 28 lectures and 14 tutorials in 5 modules. The lectures and tutorials are of 1-hour duration. Tutorial sessions are to be used to explore and practice what has been proposed during the lecture sessions.

The Teacher's Manual provides the outline for lectures as well as practice sessions. The teacher is expected to present the issues to be discussed as propositions and encourage the students to have a dialogue.

UNIT I Introduction to Value Education (6 lectures and 3 tutorials for practice session)

Lecture 1: Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education)

Lecture 2: Understanding Value Education

Tutorial 1: Practice Session PS1 Sharing about Oneself

Lecture 3: self-exploration as the Process for Value Education

Lecture4: Continuous Happiness and Prosperity – the Basic Human

Aspirations
Tutorial 2: Practice Session PS2 Exploring Human Consciousness
Lecture 5: Happiness and Prosperity – Current Scenario
Lecture 6: Method to Fulfill the Basic Human Aspirations
Tutorial 3: Practice Session PS3 Exploring Natural Acceptance

UNIT II Harmony in the Human Being (6 lectures and 3 tutorials for practice session)
Lecture 7: Understanding Human being as the Co-existence of the self and the body.
Lecture 8: Distinguishing between the Needs of the self and the body
Tutorial 4: Practice Session PS4 Exploring the difference of Needs of self and body.
Lecture 9: The body as an Instrument of the self
Lecture 10: Understanding Harmony in the self
Tutorial 5: Practice Session PS5 Exploring Sources of Imagination in the self
Lecture 11: Harmony of the self with the body
Lecture 12: Programme to ensure self-regulation and Health
Tutorial 6: Practice Session PS6 Exploring Harmony of self with the body

UNIT III Harmony in the Family and Society (6 lectures and 3 tutorials for practice session)
Lecture 13: Harmony in the Family – the Basic Unit of Human Interaction
Lecture 14: 'Trust' – the Foundational Value in Relationship
Tutorial 7: Practice Session PS7 Exploring the Feeling of Trust
Lecture 15: 'Respect' – as the Right Evaluation
Tutorial 8: Practice Session PS8 Exploring the Feeling of Respect
Lecture 16: Other Feelings, Justice in Human-to-Human Relationship
Lecture 17: Understanding Harmony in the Society
Lecture 18: Vision for the Universal Human Order
Tutorial 9: Practice Session PS9 Exploring Systems to fulfil Human Goal

UNIT IV Harmony in the Nature/Existence (4 lectures and 2 tutorials for practice session)
Lecture 19: Understanding Harmony in the Nature
Lecture 20: Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature
Tutorial 10: Practice Session PS10 Exploring the Four Orders of Nature
Lecture 21: Realizing Existence as Co-existence at All Levels
Lecture 22: The Holistic Perception of Harmony in Existence
Tutorial 11: Practice Session PS11 Exploring Co-existence in Existence.

UNIT V Implications of the Holistic Understanding – a Look at Professional Ethics (6 lectures and 3 tutorials for practice session)
Lecture 23: Natural Acceptance of Human Values
Lecture 24: Definitiveness of (Ethical) Human Conduct
Tutorial 12: Practice Session PS12 Exploring Ethical Human Conduct
Lecture 25: A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order
Lecture 26: Competence in Professional Ethics

Tutorial 13: Practice Session PS13 Exploring Humanistic Models in Education
Lecture 27: Holistic Technologies, Production Systems and Management Models-Typical Case Studies

Lecture 28: Strategies for Transition towards Value-based Life and Profession
Tutorial 14: Practice Session PS14 Exploring Steps of Transition towards Universal Human Order

Practice Sessions for UNIT I – Introduction to Value Education
PS1 Sharing about Oneself
PS2 Exploring Human Consciousness
PS3 Exploring Natural Acceptance

Practice Sessions for UNIT II – Harmony in the Human Being
PS4 Exploring the difference of Needs of self and body
PS5 Exploring Sources of Imagination in the self
PS6 Exploring Harmony of self with the body

Practice Sessions for UNIT III – Harmony in the Family and Society
PS7 Exploring the Feeling of Trust
PS8 Exploring the Feeling of Respect
PS9 Exploring Systems to fulfil Human Goal

Practice Sessions for UNIT IV – Harmony in the Nature (Existence)
PS10 Exploring the Four Orders of Nature
PS11 Exploring Co-existence in Existence

Practice Sessions for UNIT V – Implications of the Holistic Understanding – a Look at Professional Ethics
PS12 Exploring Ethical Human Conduct
PS13 Exploring Humanistic Models in Education
PS14 Exploring Steps of Transition towards Universal Human Order

READINGS:

Textbook and Teachers Manual

a. The Textbook

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

b. The Teacher's Manual

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

Reference Books

1. *JeevanVidya: EkParichaya*, A Nagaraj, JeevanVidyaPrakashan, Amarkantak, 1999.
2. *Human Values*, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. *The Story of Stuff* (Book).
4. *The Story of My Experiments with Truth* - by Mohandas Karamchand Gandhi
5. *Small is Beautiful* - E. F Schumacher.

6. *Slow is Beautiful* - Cecile Andrews
7. *Economy of Permanence* - J C Kumarappa
8. *Bharat Mein Angreji Raj* – PanditSunderlal
9. *Rediscovering India* - by Dharampal
10. *Hind Swaraj or Indian Home Rule* - by Mohandas K. Gandhi
11. *India Wins Freedom* - Maulana Abdul Kalam Azad
12. *Vivekananda* - Romain Rolland (English)
13. *Gandhi* - Romain Rolland (English)

Mode of Conduct:

Lecture hours are to be used for interactive discussion, placing the proposals about the topics at hand and motivating students to reflect, explore and verify them.
Tutorial hours are to be used for practice sessions.
While analyzing and discussing the topic, the faculty mentor's role is in pointing to essential elements to help in sorting them out from the surface elements. In other words, help the students explore the important or critical elements.
In the discussions, particularly during practice sessions (tutorials), the mentor encourages the student to connect with one's own self and do self-observation, self-reflection and self-exploration.

Scenarios may be used to initiate discussion. The student is encouraged to take up "ordinary" situations rather than" extra-ordinary" situations. Such observations and their analyses are shared and discussed with other students and faculty mentor, in a group sitting.

Tutorials (experiments or practical) are important for the course. The difference is that the laboratory is everyday life, and practical are how you behave and work in real life. Depending on the nature of topics, worksheets, home assignment and/or activity are included. The practice sessions (tutorials) would also provide support to a student in performing actions commensurate to his/her beliefs. It is intended that this would lead to development of commitment, namely behaving and working based on basic human values.
It is recommended that this content be placed before the student as it is, in the form of a basic foundation course, without including anything else or excluding any part of this content. Additional content may be offered in separate, higher courses. This course is to be taught by faculty from every teaching department, not exclusively by any one department.
Teacher preparation with a minimum exposure to at least one 8-day Faculty Development Program on Universal Human Values is deemed essential.

Online Resources:

1. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%201-Introduction%20to%20Value%20Education.pdf
2. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%202-Harmony%20in%20the%20Human%20Being.pdf
3. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%203-Harmony%20in%20the%20Family.pdf

4. https://fdp-si.aicte-india.org/UHV%201%20Teaching%20Material/D3-S2%20Respect%20July%2023.pdf
5. https://fdp-si.aicte-india.org/UHV-II%20Class%20Notes%20&%20Handouts/UHV%20Handout%205-Harmony%20in%20the%20Nature%20and%20Existence.pdf
6. https://fdp-si.aicte-india.org/download/FDPTeachingMaterial/3-days%20FDP-SI%20UHV%20Teaching%20Material/Day%203%20Handouts/UHV%203D%20D3-S2A%20Und%20Nature-Existence.pdf
7. https://fdp-si.aicte-india.org/UHV%20II%20Teaching%20Material/UHV%20II%20Lecture%2023-25%20Ethics%20v1.pdf
8. https://www.studocu.com/in/document/kiet-group-of-institutions/universal-human-values/chapter-5-holistic-understanding-of-harmony-on-professional-ethics/62490385
https://onlinecourses.swayam2.ac.in/aic22_ge23/preview

II Year – I Semester

L	T	P	C
3	0	0	3

SURVEYING

Course Objectives:

The objective of this course are to:

1. Know the principle and methods of surveying and measuring of horizontal and vertical- distances and angles
2. Identification of source of errors and rectification methods
3. Know surveying principles to determine areas and volumes
4. Setting out curves and use modern surveying equipments for accurate results
5. Know the basics of Photogrammetry Surveying

Course Outcomes:

Course will enable the student to:

CO	Statement	**Blooms level**
CO 1	Apply the principle and methods of surveying and measuring of horizontal and vertical- distances and angles	**L2**
CO 2	Identify the source of errors and rectification methods	**L3**
CO 3	Apply surveying principles to determine areas and volumes	**L2**
CO 4	Setting out curves and using modern surveying equipments	**L3**
CO 5	Apply the basics of Photogrammetry Surveying in field	**L4**

Course Articulation Matrix:

CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	3	-	2	1	3	-	3	3	3	-	1	1	1
CO2	3	2	-	2	2	2	-	2	2	2	-	2	2	1
CO3	3	1	-	1	1	1	-	1	2	2	-	2	3	1
CO4	3	3	-	3	3	1	-	1	1	1	-	2	1	2
CO5	3	1	-	3	3	1	-	1	1	1	-	2	3	2

Syllabus:

UNIT - I

Introduction and Basic Concepts: Introduction, Objectives, classification and principles of surveying, Surveying accessories. Introduction to Compass, leveling and Plane table surveying.

Lineardistances- Approximate methods, Direct Methods- Chains- Tapes, ranging, Tape corrections.

Prismatic Compass- Bearings, included angles, Local Attraction, Magnetic Declination, and dip –systems and W.C.B and Q.B systems of locating bearings.

UNIT - II

Leveling- Types of levels, methods of levelling, and Determination of levels, Effect of Curvature of Earth and Refraction.

Contouring- Characteristics and uses of Contours, methods of contour surveying.

Areas - Determination of areas consisting of irregular boundary and regular boundary.

Volumes -Determination of volume of earth work in cutting and embankments for level section, capacity of reservoirs.

UNIT - III

Theodolite Surveying: Types of Theodolites, temporary adjustments, measurement of horizontal angle by repetition method and reiteration method, measurement of vertical Angle, Trigonometrical leveling when base is accessible and inaccessible.

Traversing: Methods of traversing, traverse computations and adjustments, Introduction to Omitted measurements.

UNIT - IV

Curves: Types of curves and their necessity, elements of simple, compound, reverse curves. Introduction to Tacheometric Surveying.

Modern Surveying Methods: Principle and types of E.D.M. Instruments, Total station-advantages and Applications. Introduction to Global Positioning System. Introduction to Drone survey and LiDARSurvey(Light Detection And Ranging).

UNIT - V

Photogrammetry Surveying:

Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy, ground control extension for photographic mapping- aerial triangulation, radial triangulation, methods; photographic mapping- mapping using paper prints, mapping using stereo-plotting instruments, mosaics, map substitutes.

Text Books:

1. Surveying (Vol – 1 & 2) by Duggal S K, Tata McGraw Hill Publishing Co. Ltd. New Delhi, 5th edition, 2019.
2. Textbook of Surveying by C Venkatramaiah , Universities Press 1st Edition, 2011.

Reference Books:

1. Surveying (Vol – 1), by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi, 18th edition 2024.
2. Surveying (Vol – 2), by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi 17th 2022.
3. Surveying (Vol – 3), by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain-

Laxmi Publications (P) ltd., New Delhi 16th 2023.

4. Plane Surveying and Higher Surveying‖ by Chandra A M, New age International Pvt. Ltd.,Publishers, New Delhi, 3rd Edition, 2015.
5. Surveying and Levelling by N.Basak Tata McGraw Hill Publishing Co. Ltd. New Delhi, 4th edition, 2014.
6. Surveying (Vol 1, 2 & 3), by Arora K R, Standard Book House, Delhi. Edition: 12th, 2015.

Web Resources:

https://koha.srmap.edu.in/cgi-bin/koha/opac-detail.pl?biblionumber=11522&shelfbrowse_itemnumber=23066

II Year – I Semester

L	T	P	C
3	0	0	3

STRENGTH OF MATERIALS

Course Learning Objectives:

1. To impart Fundamental concepts of Strength of Material and Principles of Elasticity and Plasticity Stress
2. To impart concepts of shear force and bending moment on various types of beams and loading conditions
3. To impart concepts of stresses developed in the cross section and bending equations calculation of section modulus of sections with different cross sections.
4. To the concepts above will be utilized in measuring deflections in beams under various loading and support conditions.
5. To classify cylinders and columns based on their thickness and to derive equations for measurement of stresses across the cross section when subjected to external pressure

Course Outcomes:

At the end of completion of the course, the student will be able

CO	Statement	**Blooms level**
CO 1	To understand the basic materials behavior under the influence of different external loading conditions and the support conditions.	**L2**
CO 2	To draw the diagrams indicating the variation of the key performance features like axial forces, bending moment and shear forces in structural members.	**L3**
CO 3	To acquire knowledge of bending concepts and calculation of section modulus and for determination of stresses developed in the beams	**L2**
CO 4	To analyze the deflections due to various loading conditions.	**L3**
CO 5	To assess stresses across section of the thin, thick cylinders and columns to arrive at optimum sections to withstand the internal pressure using Lame's equation	**L4**

Course Articulation Matrix:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO1	3	2	-	2	-	-	-	-	-	2	1	3	3	1
CO2	2	1	-	1	-	-	-	-	-	1	1	2	3	1
CO3	2	2	-	1	-	-	-	-	-	2	1	2	3	2
CO4	1	2	-	1	-	-	-	-	-	2	1	1	3	2
CO5	2	1	-	2	-	-	-	-	-	1	1	2	3	2

UNIT — I:

Simple Stresses and Strains: Elasticity and plasticity — Types of stresses and strains — Hooke's law — Factor of safety, Poisson's ratio - Relationship between Elastic constants — Bars of varying section — stresses in composite bars.

UNIT — II:

Shear Force and Bending Moment: Definition of beam — Types of beams — Concept of

shear force and bending moment — Point of contra flexure — Relation between S.F., B.M and rate of loading at a section of a beam; S.F and B.M diagrams for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads, partial uniformly distributed loads, couple and combination of these loads.

UNIT — III:

Flexural and Shear Stresses:

Flexural Stresses: Theory of simple bending — Assumptions — Derivation of bending equation, Neutral axis — Determination of bending stresses — section modulus of rectangular and circular sections (Solid and Hollow), I, T, Angle and Channel sections — Design of simple beams

Shear Stresses: Derivation of formula — Shear stress distribution across various beam sections like rectangular, circular, I, T Angle sections.

Torsion – circular shafts only.

UNIT — IV:

Deflection of Beams: Double integration and Macaulay's methods — Determination of slope and deflection for cantilever, simply supported and overhanging beams subjected to point loads, uniformly distributed loads, uniformly varying loads, partial uniformly distributed loads, couple and combination of these loads. Mohr's theorems — Moment area method — application to simple cases of cantilever.

UNIT — V:

Introduction – Classification of columns – Axially loaded compression members – Euler's crippling load theory – Derivation of Euler's critical load formulae for various end conditions – Equivalent length – Slenderness ratio – Euler's critical stress – Limitations of Euler's theory – Rankine – Gordon formula – Eccentric loading and Secant formula – Prof. Perry's formula.

Thin and Thick cylindrical shells — Derivation of formula for longitudinal and circumferential stresses — hoop, longitudinal and volumetric strains — changes in diameter, and volume of thin cylinders. Lames theory for thick cylinders, Derivation of Lames formulae, distribution of hoop and radial stresses across the thickness, compound cylinders-distribution of stresses

TEXTBOOKS:

1. Strength of Materials by R. K. Bansal, Lakshmi Publications, 16th Edition, 2022.
2. Strength of Materials by B. S. Basavarajaiah and P. Mahadevappa, Universities Press 3rd Edition, 2010
3. Strength of Materials by J.K. Gupta and S.K. Gupta, Cengage publications 2nd edition ,2024

REFERENCES:

1. Advanced Mechanics of Solids, L.S Srinath, McGraw Hill Education, 2017, 3rd Edition
2. Strength of Materials - Fundamentals andApplications, T.D.Gunneswara Rao and

MudimbyAndal, Cambridge University Press, 2018, 1st Edition
3. Mechanics of Materials, Beer and Johnston, McGraw Hill India Pvt. Ltd., 2020, 8th Edition (SI Units).
4. Mechanics of Solids — E P Popov, Prentice Hall, 2nd Edition, 2015.
5. A Textbook of Strength of Materials, by R. K. Rajput, 7e (Mechanics of Solids) SI Units S. Chand & Co, NewDelhi 7th edition 2022.
6. Strength of Materials by S.S.Ratan Tata McGrill Publications 3rd Edition , 2016.

II Year – I Semester

L	T	P	C
3	0	0	3

FLUID MECHANICS

Pre-requisite:

Course Objectives:

1. To explain basics of statics, kinematics and dynamics of fluids and various measuring techniques of hydrostatic forces on objects.
2. To impart ability to solve engineering problems in fluid mechanics
3. To enable the students measure quantities of fluid flowing in pipes, tanks and channels
4. To teach integral forms of fundamental laws of fluid mechanics to predict relevant pressures, velocities and forces.
5. To strengthen the students with fundamentals useful in application-intensive courses dealing with hydraulics, hydraulic machinery and hydrology in future courses.

Course Outcomes:

On Completion of the course, the students will be able to

COs	STATEMENTS	Blooms level
CO1	Understand the principles of fluid statics, kinematics and dynamics	L2
CO2	Apply the laws of fluid statics and concepts of buoyancy	L3
CO3	Understand the fundamentals of fluid kinematics and differentiate types of fluid flows	L2
CO4	Apply the Principle of conservation of energy for flow measurement.	L3
CO5	Analyse the losses in pipes and discharge through pipe network.	L4

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	2	-	-	1	-	1	1	3	1
CO2	3	3	-	-	-	2	-	-	3	-	3	3	3	1
CO3	3	1	-	-	-	3	-	-	1	-	1	1	3	2
CO4	3	2	-	-	-	1	-	-	2	-	2	2	3	2
CO5	3	3	-	-	-	2	-	-	3	-	3	3	3	2

UNIT - I

Basic concepts and definitions: Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; Variation of viscosity with temperature, Newton law of viscosity; Vapor pressure, Boiling point, Surface tension, Capillarity, Bulk modulus of elasticity, Compressibility

UNIT – II

Fluid statics: Fluid Pressure: Pressure at a point, Pascal‘s law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U Tube Differential Manometer. Pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies

UNIT - III

Fluid kinematics:

Classification of fluid flow : steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one, two and three dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One, two and three - Dimensional continuity equations in Cartesian coordinates.

UNIT - IV

Fluid Dynamics: Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – Derivation; Energy Principle; Practical applications of Bernoulli's equation : Venturimeter, orifice meter and Pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced; Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number;

UNIT - V

Analysis Of Pipe Flow: Energy losses in pipelines; Darcy – Weisbach equation; Minor losses in pipelines; Hydraulic Grade Line and Total Energy Line; Concept of equivalent length – Pipes in Parallel and Series.

Textbooks:

1. P. M. Modi and S. M. Seth, Hydraulics and Fluid Mechanics, Standard Book House 22nd, 2019.
2. K. Subrahmanya, Theory and Applications of Fluid Mechanics, Tata McGraw Hill, 2nd edition 2018

Reference Books:

1. R. K. Bansal, A text of Fluid mechanics and hydraulic machines, Laxmi Publications (P) Ltd., New Delhi 11th edition, 2024.
2. N. Narayana Pillai, Principles of Fluid Mechanics and Fluid Machines, Universities Press Pvt Ltd, Hyderabad. 3rd Edition 2009.
3. Fluid Mechanics by Frank M. White, Henry Xue, Tata McGraw Hill, 9th edition , 2022.
4. C. S. P. Ojha, R. Berndtsson and P. N. Chadramouli, Fluid Mechanics and Machinery, Oxford University Press, 2010.
5. Introduction to Fluid Mechanics & Fluid Machines by S K Som, Gautam Biswas, S Chakraborty Tata McGraw Hill, 3rd edition 2011

Online Learning Resources:

https://archive.nptel.ac.in/courses/112/105/112105269/
https://nptel.ac.in/courses/112104118
https://nptel.ac.in/courses/105103192

II Year I Semester

SURVEYING LAB

L	T	P	C
0	0	3	1.5

Course Objectives:

By the end of this course student will be able to

1. Know about various linear and angular measuring instruments
2. Take Measurements in the linear and angular view
3. Determine the area and volume by interpreting the data obtained from surveying activities
4. Know modern equipment such as total station
5. Draft field notes from survey data

Course Outcomes:

Upon the successful completion of this course, the students will able to:

1. Handle various linear and angular measuring instruments
2. Measure the linear and angular measurements
3. Calculate the area and volume by interpreting the data obtained from surveying activities
4. Handle modern equipment such as total station
5. Prepare field notes from survey data

Course Articulation Matrix:

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	2	-	2	1	-	-	-	3	2	2	2	2	-
CO 2	2	2	-	2	1	-	-	-	3	3	3	2	2	-
CO 3	2	2	-	2	1	-	-	-	3	2	2	2	2	-
CO 4	1	2			3				3	2	2	1	1	
CO 5	2	1			-				3	2	2	1	1	

List of Field Works:

1. Chain survey of road profile with offsets in case of road widening.
2. Determination of distance between two inaccessible points by using compass.
3. Plane table survey ;finding the area of a given boundary by the method of Radiation
4. Fly levelling : Height of the instrument method (differential leveling)
5. Fly levelling: rise and fall method.
6. Theodolite survey: determining the horizontal and vertical angles by the method of repetition method
7. Theodolite survey: finding the distance between two in accessible points.
8. Theodolite survey: finding the height of far object.
9. Determination of area perimeter using total station.
10. Determination of distance between two inaccessible point by using total station.
11. Setting out a curve
12. Determining the levels of contours

II Year I Semester

L	T	P	C
0	0	3	1.5

STRENGTH OF MATERIALS LAB

Course objectives: By the end of this course student will be able to

1. To determine the tensile strength and yield parameters of mild steel
2. To find out flexural strengths of Steel/Wood specimens and measure deflections
3. To determine the torsion parameters of mild steel bar
4. To determine the hardness numbers, impact and shear strengths of metals
6. To determine the load-deflection parameters for springs

Course Outcomes:

1. Conduct tensile strength test and draw stress-strain diagrams for ductile metals
2. Perform bending test and determine load-deflection curve of steel/wood
3. Able to conduct torsion test and determine torsion parameters
4. Perform hardness, impact and shear strength tests and calculate hardness numbers, impact and shear strengths
5. Able to conduct tests on closely coiled and open coiled springs and calculate deflections

LIST OF EXPERIMENTS :

1. Tension test.
2. Bending test on (Steel/Wood) Cantilever beam.
3. Bending test on simply supported beam.
4. Torsion test.
6. Hardness test.
7. Compression test on Open coiled springs
8. Tension test on Closely coiled springs
9. Compression test on wood/ concrete
10. Izod / Charpy Impact test on metals
11. Shear test on metals
12. Use of electrical resistance strain gauges.

12. Continuous beam – deflection test.

II Year I Semester

L	T	P	C
0	0	3	1.5

BUILDING PLANNING AND DRAWING

Course Objectives:

1. Initiating the student to different building bye-laws and regulations.
2. Imparting the planning aspects of residential buildings and public buildings.
3. Giving training exercises on various signs and bonds.
4. Giving training exercises on different building units.
5. Imparting the skills and methods of planning of various buildings.

Course Outcomes:

Upon successful completion of this course the students will be able to:

1. Plan various buildings as per the building by-laws.
2. Distinguish the relation between the plan, elevation and cross section and identify the form and functions among the buildings.
3. Draw signs and bonds
4. Draw different building units
5. Learn the skills of drawing building elements and plan the buildings as per requirements.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	2	-	-	3	3	2	-	2	2	2	3	-	2
CO2	1	1	2	-	-	3	2	-	-	2	1	1	-	-	-
CO3	1	1	2	-	-	3	3	2	-	2	2	2	3	1	1
CO4	1	1	2	-	-	3	3	2	-	2	2	2	3	1	1
CO5	1	1	2	-	-	3	3	2	-	2	2	2	3	1	1

Syllabus:

1. Detailing & Drawing of Sign Conventions.
2. Detailing & Drawing of English Bond.
3. Detailing & Drawing of Flemish Bond.
4. Detailing & Drawing of Doors.
5. Detailing & Drawing of Windows.
6. Detailing & Drawing of Ventilators &Roofs.
7. Drawing of Line Diagram of Residential Buildings by using Building Bye- Laws.
8. Drawing of Plan, Elevation & Section from line diagram for a single Storey Building.
9. Drawing of Plan, Elevation & Section for Hospital Building.
10. Drawing of Plan, Elevation & Section for Industrial Building.

Text Books:

1. Planning, designing and Scheduling, Gurcharan Singh and Jagdish Singh

2. Building planning and drawing by M. Chakraborti.
3. Building drawing, M G Shah, C M Kale and S Y Patki, Tata McGraw Hill, New Delhi.

Reference Books:

1. National Building Code 2016 (Volume- I & II).
2. Principles of Building Drawing, M G Shah and C M Kale, Trinity Publications, New Delhi.
3. Civil Engineering drawing and House planning, B. P. Verma, Khanna publishers, NewDelhi.
4. Civil Engineering Building practice, Suraj Singh: CBS Publications, New Delhi, and Chennai
5. Building Materials and Construction, G. C Saha and Joy Gopal Jana, McGrawHill Education (P)India Ltd. New Delhi.

II Year I Semester

L	T	P	C
2	0	0	--

ENVIRONMENTAL SCIENCE

Course Objectives:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day-to-day activities of human life
- To save earth from the inventions by the engineers.

UNIT – I

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 – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

UNIT – II

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity and Its Conservation : Introduction and Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT – III

Environmental Pollution: Definition, Cause, effects and control measures of:

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution

f. Thermal pollution
g. Nuclear hazards

Solid Waste Management: Causes, effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT – IV

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT – V

Human Population And The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc.

Textbooks:

1. Erach Bharucha,Text book of Environmental Studies for Undergraduate Courses,Universities Press (India) Private Limited, 2019.
2. Palaniswamy, Environmental Studies, 2/e, Pearson education, 2014.
3. S.Azeem Unnisa, Environmental Studies, Academic Publishing Company, 2021.
4. K.Raghavan Nambiar, "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", SciTech Publications (India), Pvt. Ltd, 2010.

Reference Books:

1. Deeksha Dave and E.Sai Baba Reddy, Textbook of Environmental Science, 2/e, Cengage Publications, 2012.
2. M.Anji Reddy, "Textbook of Environmental Sciences and Technology", BS Publication, 2014.
3. J.P. Sharma, Comprehensive Environmental studies, Laxmi publications, 2006.
4. J. Glynn Henry and Gary W. Heinke, Environmental Sciences and Engineering, Prentice Hall of India Private limited, 1988.
5. G.R. Chatwal, A Text Book of Environmental Studies, Himalaya Publishing House, 2018.
6. Gilbert M. Masters and Wendell P. Ela, Introduction to Environmental Engineering and Science, 1/e, Prentice Hall of India Private limited, 1991.

Online Learning Resources:

- **https://onlinecourses.nptel.ac.in/noc23_hs155/preview**
- **https://www.edx.org/learn/environmental-science/rice-university-ap-r-environmental-**

science-part-3-pollution-and-resources?index=product&objectID=course-3a6da9f2-d84c-4773-8388-1b2f8f6a75f2&webview=false&campaign=AP%C2%AE+Environmental+Science++Part+3%3A+Pollution+and+Resources&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Flearn%2Fenvironmental-science

- http://ecoursesonline.iasri.res.in/Courses/Environmental%20Science-I/Data%20Files/pdf/lec07.pdf
- https://www.youtube.com/watch?v=5QxxaVfgQ3k

Course Outcomes:

COs	**Statements**	**Blooms Level**
CO1	Grasp multi disciplinary nature of environmental studies and various renewable and non-renewable resources.	L2
CO2	Understand flow and bio-geo- chemical cycles and ecological pyramids.	L2
CO3	Understand various causes of pollution and solid waste management and related preventive measures.	L2
CO4	Understand the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.	L2
CO5	Illustrate the causes of population explosion, value education and welfare programmes.	L3

II Year II Semester

L	T	P	C
2	0	0	2

MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS

Course Objectives:

- To inculcate the basic knowledge of microeconomics and financial accounting
- To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost
- To Know the Various types of market structure and pricing methods and strategy
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements.

Course Outcomes:

- Define the concepts related to Managerial Economics, financial accounting and management(L2)
- Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets (L2)
- Apply the Concept of Production cost and revenues for effective Business decision (L3)
- Analyze how to invest their capital and maximize returns (L4)
- Evaluate the capital budgeting techniques. (L5)
- Develop the accounting statements and evaluate the financial performance of business entity (L5)

UNIT - I Managerial Economics

Introduction – Nature, meaning, significance, functions, and advantages. Demand-Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting-Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.

UNIT - II Production and Cost Analysis

Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least- cost combination– Short run and long run Production Function- Isoquants and Is costs, Cost & Break-Even Analysis - Cost concepts and Cost behaviour- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems).

UNIT - III Business Organizations and Markets

Introduction – Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly- Monopolistic Competition–Oligopoly-Price-Output Determination - Pricing Methods and Strategies

UNIT - IV Capital Budgeting

Introduction – Nature, meaning, significance. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements.

Capital Budgeting– Features, Proposals, Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems)

UNIT - V Financial Accounting and Analysis

Introduction – Concepts and Conventions- Double-Entry Bookkeeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). Introduction to Financial Analysis - Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

Textbooks:

1. Varshney & Maheswari: Managerial Economics, Sultan Chand.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH.

Reference Books:

1. Ahuja Hl Managerial economics Schand.
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage.

Online Learning Resources:

https://www.slideshare.net/123ps/managerial-economics-ppt
https://www.slideshare.net/rossanz/production-and-cost-45827016
https://www.slideshare.net/darkyla/business-organizations-19917607
https://www.slideshare.net/balarajbl/market-and-classification-of-market
https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396
https://www.slideshare.net/ashu1983/financial-accounting

L	T	P	C
3	0	0	3

II Year II Semester

ENGINEERING GEOLOGY

Course Learning Objectives:

The objective of this course is:

1. To know the importance of Engineering Geology to the Civil Engineering.
2. To enable the students understand what minerals and rocks are and their formation and identification.
3. To highlight significance/ importance/ role of Engineering Geology in construction of Civil Engineering structures.
4. To enable the student realize its importance and applications of Engineering Geology in Civil Engineering constructions.
5. concepts of Groundwater and its geophysical methods.

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

1. Understand the significance of geological agents on Earth surface and its significance in Civil Engineering.
2. Identify and understand the properties of Minerals and Rocks.
3. Understand the concepts of Groundwater and its geophysical methods.
4. Classify and measure the Earthquake prone areas, Landslides and subsidence to practice the hazard zonation.
5. Investigate the project site for mega/mini civil engineering projects and site selection for mega engineering projects like Dams, Reservoirs and Tunnels.

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO.1	3	-	-	-	-	-	-	-	-	-	-	1	2	-
CO.2	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO.3	3	2	-	-	-	-	-	-	-	-	-	-	1	-
CO.4	3	3	3	2	3	-	2	-	-	-	2	2	2	2
CO.5	3	3	2	2	3	-	2	-	-	-	2	2	2	2

SYLLABUS:

UNIT-I:

Introduction: Branches of Geology, Importance of Geology in Civil Engineering with case studies, Weathering of rocks, Geological agents, weathering process of Rock, Rivers and geological work of rivers.

UNIT-II

Mineralogy And Petrology: Definitions of mineral and rock-Different methods of study of mineral and rock. Physical properties of minerals and rocks for megascopic study for the following minerals and rocks. Common rock forming minerals: Feldspar, Quartz Group, Olivine, Augite, Hornblende, Mica Group, Asbestos, Talc, Chlorite, Kyanite, Garnet, Calcite and ore forming minerals are Pyrite, Hematite, Magnetite, Chlorite, Galena, Pyrolusite, Graphite, Chromite, Magnetite and Bauxite. Classification, structures ,textures and forms of Igneous rocks, Sedimentary rocks, Metamorphic rocks, and their megascopic study of granite varieties, (pink, gray, green). Pegmatite, Dolerite, Basalt etc., Shale, Sand Stone, Lime Stone, Laterite, Quartzite, Gneiss, Schist, Marble, Khondalite and Slate.

UNIT-III

Structural Geology: Strike , Dip and Outcrop study of common geological structures associating with the rocks such as Folds, Faults, Joints and Unconformities- parts, types, mechanism and their importance in Civil Engineering.

UNIT-IV

Ground Water: Water table, Cone of depression, Geological controls of Ground Water Movement, Ground Water Exploration Techniques.

Earthquakes and Land Slides: Terminology, Classification, causes and effects, Shield areas and Seismic bells, Richter scale intensity, Precautions of building constructions in seismic areas. Classification of Landslides, Causes and Effects, measures to be taken prevent their occurrence at Landslides.

Geophysics: Importance of Geophysical methods, Classification, Principles of Geophysical study by Gravity method, Magnetic method, Electrical methods, Seismic methods, Radiometric method and Electrical resistivity, Seismic refraction methods and Engineering properties of rocks.

UNIT-V

Geology of Dams, Reservoirs and Tunnels: Types and purpose of Dams, Geological considerations in the selection of a Dam site. Geology consideration for successful constructions of reservoirs, Life of Reservoirs. Purpose of Tunnelling, effects, Lining of Tunnels. Influence of Geology for successful Tunnelling.

TEXT BOOKS:

1. Engineering Geology by N. ChennaKesavulu, Laxmi Publications . 2nd Edn 2014.
2. Engineering & General Geology by Parbin Singh Katson educational series 8th 2023

REFERENCES:

1. Engineering Geology by SubinoyGangopadhay Oxford University press 1st edition, 2012.

2. Engineering Geology by D. Venkat Reddy, Vikas Publishing, 2nd Edn , 2017,
3. Geology for Engineers and Environmental Society' Alan E Kehew, 3rd edn., 2013) Pearson publications.
4. 'Environmental Geology' (2013) K.S.Valdiya, 2nd ed., McGraw Hill Publications.

Web Materials:

1. http://nptel.iitm.ac.in/video.php?subjectId=105105106
2. http://nptel.iitm.ac.in/video.php?courseId=1055&p=1
4. http://nptel.iitm.ac.in/video.php?courseId=1055&p=3
5. http://nptel.iitm.ac.in/video.php?courseId=1055&p=4

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II Year II Semester

L	T	P	C
3	0	0	3

CONCRETE TECHNOLOGY

Course Learning Objectives

Upon successful completion of this course, the student will be able to

1. Learn materials and their properties used in the production of concrete
2. Learn the behavior of concrete at fresh stage
3. Learn the behavior of concrete at hardened stage
4. Learn the influence of elasticity, creep and shrinkage on concrete
5. Learn the mix design methodology and special concretes

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

CO1	Familiarise the basic ingredients of concrete and their role in the production of concrete and its behaviour in the field.
CO2	Test the fresh concrete properties and the hardened concrete properties. Understand the basic concepts of concrete. Design the concrete mix by BIS method.
CO3	Evaluate the ingredients of concrete through lab test results. realise the importance of quality of concrete
CO4	Understand the behaviour of concrete in various environments.
CO5	Familiarize the basic concepts of special concrete and their production and applications.

Detailed Syllabus:

UNIT- I **CEMENTS:** Portland cement – Chemical composition – Hydration, Setting of cement, Fineness of cement, Structure of hydrate cement – Test for physical properties – Different grades of cements – Admixtures – Mineral and chemical admixtures – accelerators, retarders, air entrainers, plasticizers, super plasticizers, fly ash and silica fume

AGGREGATES: Classification of aggregate – Particle shape & texture – Bond, strength & other mechanical properties of aggregates – Specific gravity, Bulk density, porosity, adsorption & moisture content of aggregate – Bulking of sand –Deleterious substances – Soundness – Alkali aggregate reaction – Thermal properties – Sieve analysis – Fineness modulus – Grading curves – Grading of fine & coarse Aggregates – Maximum aggregate size- Quality of mixing water

UNIT- II **FRESH CONCRETE:** Steps inManufacture of Concrete–proportion, mixing, placing, compaction, finishing, curing – including various types in each stage. Properties of fresh concrete-Workability – Factors affecting workability – Measurement of workability by different tests, Setting times of concrete, Effect of time and temperature on workability – Segregation & bleeding – Mixing and vibration of concrete, Ready mixed concrete, Shotcrete

UNIT- III **HARDENED CONCRETE:** Water / Cement ratio – Abram's Law – Gel/space ratio – Nature of strength of concrete –Maturity concept – Strength in tension & compression – Factors affecting strength – Relation between compression & tensile strength – Curing, Testing of Hardened Concrete:Compression test – Tension test – Factors affecting strength – Flexure test –Splitting test – Non-destructive testing methods – Codal provisions for NDT.

UNIT- IV **ELASTICITY, CREEP & SHRINKAGE** – Modulus of elasticity – Dynamic modulus of elasticity – Poisson's ratio – Creep of concrete – Factors influencing creep – Relation between creep & time – Nature of creep – Effects of creep – Shrinkage –types of shrinkage.

UNIT- V **MIX DESIGN AND SPECIAL CONCRETES:** Ready mixed concrete, Fibre reinforced concrete – Different types of fibres – Factors affecting properties of FRC, High performance concrete – Self consolidating concrete, Self healing concrete. Factors in the choice of mix proportions –Quality control of concrete- Statistical methods- Acceptance Criteria-Concepts Proportioning of concrete mixes by ACI method and IS Code method

TEXT BOOKS

1. Properties of Concrete by A.M. Neville – PEARSON – 4th edition
2. Concrete Technology by M.L. Gambhir. – Tata Mc.Graw Hill Publishers, New Delhi 5th edition 2013.
3. Concrete Technology by Job Thomas, Cengagae Publications, 1st edition, 2015

References

1. Concrete Microstructure, Properties of Materials by P.K. Mehta and Moterio. McGraw Hill 4th edition 2014
2. Concrete Technology, J.J. Brooks and A. M. Neville, Pearson, 2019, 2nd Edition.
3. Concrete Technology by M. S. Shetty. – S. Chand & Co.; 2004
4. Concrete Technology by A.R. Santha Kumar, Oxford University Press, New Delhi

II Year – II Semester

L	T	P	C
3	0	0	3

STRUCTURAL ANLAYSIS

Course Learning Objectives

Upon successful completion of this course, the student will be able to

1. Learn energy theorems
2. Learn the analysis of indeterminate structures
3. Analysis of fixed and continuous beams
4. Learn about slope-deflection method
5. Learn about Moment – distribution method

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

1. Apply energy theorems to analyze trusses
2. analyze indeterminate structures by using Castigliano‘s–II theorem
3. Analysis of fixed and continuous beams
4. Analyze continuous beams and portal frames by using slope-deflection method
5. Analyze continuous beams and portal frames by using Moment – distribution method

UNIT – I

ENERGY THEOREMS: Introduction-Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear forces – Castigliano‘s first theoremDeflections of simple beams and pin jointed trusses.

UNIT - II

ANALYSIS OF INDETERMINATE STRUCTURES: Indeterminate Structural Analysis – Determination of static and kinematic indeterminacies – Solution of trusses with upto two degrees of internal and external indeterminacies – Castigliano‘s–II theorem.

UNIT - III

FIXED BEAMS & CONTINUOUS BEAMS : Introduction to statically indeterminate beams with uniformly distributed load, central point load, eccentric point load, number of point loads, uniformly varying load, couple and combination of loads – Shear force and Bending moment diagrams – Deflection of fixed beams effect of sinking of support, effect of rotation of a support.

UNIT - IV

SLOPE-DEFLECTION METHOD: Introduction-derivation of slope deflection equations-application to continuous beams with and without settlement of supports - Analysis of single bayportal frames without sway.

UNIT - V

MOMENT DISTRIBUTION METHOD: Introduction to moment distribution method-Application to continuous beams with and without settlement of supports-Analysis of single bay storey portal frames without sway.

Textbooks:

1. Analysis of Structures – Vol-I&II by V.N.Vazirani&M.M.Ratwani, Khanna Publications,
   New Delhi.
2. Basic Structural Analysis by C.S.Reddy., Tata McGraw Hill Publishers. 3rd edition 2017.

Reference Books:

1. Structural analysis by Aslam Kassimali Cengage publications 6th edition 2020.
2. Structural analysis Vol.I and II by Dr.R.Vaidyanathan and Dr.PPerumal– Laxmi publications. 3rd 2016
3. Introduction to structural analysis by B.D.Nautiyal, New Age international publishers, New Delhi.
4. Structural Analysis – D.S.Prakasarao -Univeristy press.
5. Strength of Materials and Mechanics of Structures by B.C.Punmia, Khanna Publications,

New Delhi.

II Year II Semester

L	T	P	C
3	0	0	3

HYDRAULICS AND HYRAULIC MACHINERY

Pre-requisite: Fluid Mechanics

Course Objectives:

1. To Introduce concepts of laminar and turbulent flows
2. To teach principles of uniform flows through open channel.
3. To teach principles of non-uniform flows through open channel.
4. To impart knowledge on design of turbines.
5. To impart knowledge on design of pumps

Course Outcomes:

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

COs	STATEMENTS	Blooms level
CO1	Understand the characteristics of laminar and turbulent flows.	**L2**
CO2	Apply the knowledge of fluid mechanics to address the uniform flow problems in open channels.	**L3**
CO3	Solve non-uniform flow problems and hydraulic jump phenomenon in open channel flows.	**L3**
CO4	Evaluate the performance of impact of jets on plates and design Pelton wheel, Francis and Kaplan turbine	**L5**
CO5	Understand the principles, losses and its efficiencies of centrifugal pumps	**L2**

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	2	-	-	-	-	2	-	3	1
CO2	3	3	-	-	-	3	-	-	-	-	3	-	3	1
CO3	3	3	-	-	-	3	-	-	-	-	3	-	3	1
CO4	3	3	-	-	-	3	-	-	-	-	3	-	3	2
CO5	3	2	-	-	-	2	-	-	-	-	2	-	3	2

UNIT – I

Laminar & Turbulent flow in pipes: Laminar Flow- Laminar flow through: circular pipes, annulus and parallel plates. Stoke‘s law, Measurement of viscosity. Reynolds experiment, Transition from laminar to turbulent flow. Resistance to flow of fluid in smooth and rough pipes-Moody‘s diagram – Introduction to boundary layer theory.

UNIT - II

Uniform flow in Open Channels: Open Channel Flow - Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channels, classification of open channel flow, Velocity Distribution of channel section. Hydraulically efficient channel sections: Rectangular, trapezoidal and triangular channels, Energy and Momentum correction factors

UNIT - III

Non-Uniform flow in Open Channels: Specific energy, critical flow, discharge curve, Specific force, Specific depth, and Critical depth. Measurement of Discharge and Velocity – Gradually Varied Flow- Dynamic Equation of Gradually Varied Flow. Hydraulic Jump and classification - Elements and characteristics- Energy dissipation.

UNIT - IV

Impact of Jets: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes - Velocity triangles at inlet and outlet - Work done and efficiency Hydraulic Turbines: Classification of turbines; pelton wheel and its design. Francis turbine and its design - efficiency - Draft tube: theory - characteristic curves of hydraulic turbines. Cavitation: causes and effects.

UNIT – V

pumps: Working principles of a centrifugal pump, work done by impeller; heads, losses and efficiencies; minimum starting speed; Priming; specific speed; limitation of suction lift, net positive suction head (NPSH); Performance and characteristic curves; Cavitation effects; Multistage centrifugal pumps; troubles and remedies

TEXT BOOKS: -

1. P. M. Modi and S. M. Seth, Hydraulics and Fluid Mechanics, Standard Book House 22nd, 2019.
2. K. Subrahmanya, Theory and Applications of Fluid Mechanics, Tata McGraw Hill, 2nd edition 2018

Reference Books:

1. R. K. Bansal, A text of Fluid mechanics and hydraulic machines, Laxmi Publications (P) Ltd., New Delhi 11th edition, 2024.
2. Fluid Mechanics by Frank M. White, Henry Xue, Tata McGraw Hill, 9th edition , 2022.
3. C. S. P. Ojha, R. Berndtsson and P. N. Chadramouli, Fluid Mechanics and Machinery, Oxford University Press, 2010.
4. Introduction to Fluid Mechanics & Fluid Machines by S K Som, Gautam Biswas, S Chakraborty 3rd edition 2011

Online Learning Resources:

https://nptel.ac.in/courses/105105203
https://archive.nptel.ac.in/courses/112/106/112106300/
https://archive.nptel.ac.in/courses/112/103/112103249/

II Year II Semester

L	T	P	C
0	0	3	1.5

CONCRETE TECHNOLOGY LABORATORY

Course Learning Objectives

Upon successful completion of this course, the student will be able to

To test basic properties of ingredients of concrete fresh and hardened concrete properties

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

CO1 Outline importance of testing cement and its properties
CO2 Assess different properties of Aggregates
CO3 Assess fresh concrete properties and their relevance to hardened concrete
CO4 Assess hardened concrete properties

Detailed Syllabus:

1.Tests on Cement

Normal Consistency and Fineness of cement.
Initial setting time and Final setting time of cement.
Specific gravity and soundness of cement.
Compressive strength of cement.

2.Tests on Fine Aggregates

Grading and fineness modulus of Fine aggregate by sieve analysis.
Specific gravity of fine aggregate
Water absorption and Bulking of sand.

3.Tests on Coarse Aggregates

Grading of Coarse aggregate by sieve analysis.
Specific gravity of coarse aggregate
Water absorption of Coarse aggregates

4.Tests on fresh Concrete

Workability of concrete by compaction factor method
Workability of concrete by slump test
Workability of concrete by Vee-bee test.

5.Tests on Hardened Concrete

Compressive strength of cement concrete and Modulus of rupture
Young's Modulus and Poisson's Ratio
Split tensile strength of concrete.
Non-Destructive testing on concrete (for demonstration)

II Year II Semester

L	T	P	C
0	0	3	1.5

ENGINEERING GEOLOGY LABORATORY

Course Learning Objectives:

The objective of this course is:

- To identify the Megascopic types of Ore minerals & Rock forming minerals.
- To identify the Megascopic types of Igneous, Sedimentary, Metamorphic rocks.
- To identify the topography of the site & material selection

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

1. Identify Megascopic minerals & their properties.
2. Identify Megascopic rocks & their properties.
3. Identify the site parameters such as contour, slope & aspect for topography.
4. Know the occurrence of materials using the strike & dip problems.

Course Articulation Matrix:

	Program Outcomes												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	1	-	-	-	-	-	-	-	-	-	-	-	-
CO3	1	1	1	-	-	-	-	-	-	1	1	-	1	1
CO4	1	-	-	-	-	-	-	-	-	-	-	-	-	-

LIST OF EXPERIMENTS

1. Physical properties of minerals: Mega-scopic identification of
   a. Rock forming minerals – Quartz group, Feldspar group, Garnet group, Mica group & Talc, Chlorite, Olivine, Kyanite, Asbestos, Tourmelene, Calcite, Gypsum, etc…
   b. Ore forming minerals – Magnetite, Hematite, Pyrite, Pyralusite, Graphite, Chromite, etc…
2. Megascopic description and identification of rocks.
   a) Igneous rocks – Types of Granite, Pegmatite, Gabbro, Dolerite, Syenite, Granite Poryphery, Basalt, etc.
   b) Sedimentary rocks – Sand stone, Ferrugineous sand stone, Lime stone, Shale, Laterite, Conglamorate, etc.
   c) Metamorphic rocks – Biotite – Granite Gneiss, Slate, Muscovite &Biotiteschist, Marble, Khondalite, etc.

3. Interpretation and drawing of sections for geological maps showing tilted beds, faults, unconformities etc.
4. Simple Structural Geology problems.
5. Bore hole data.
6. Strength of the rock using laboratory tests.
7. Field work – To identify Minerals, Rocks, Geomorphology& Structural Geology.

LAB EXAMINATION PATTERN:

1. Description and identification of FOUR minerals
2. Description and identification of FOUR (including igneous, sedimentary and metamorphic rocks)
3. ONE Question on Interpretation of a Geological map along with a geological section.
4. TWO Questions on Simple strike and Dip problems.
5. Bore hole problems.
6. Project report on geology.

REFERENCES:

1. 'Applied Engineering Geology Practicals' by M T Mauthesha Reddy, New Age International Publishers, 2nd Edition.
2. 'Foundations of Engineering Geology' by Tony Waltham, Spon Press, 3rd edition, 2009.

II Year II Semester

L	T	P	C
3	0	0	3

REMOTE SENSING AND GIS

Course Learning Objectives:

The course is designed to

- Introduce the basic principles of Remote Sensing and GIS techniques and its application to Civil Engineering.
- Learn various types of sensors and platforms and understand the principles of spatial analysis techniques in GIS.
- Introduce GIS software to understand the process of digitization, creation of thematic map from toposheets and maps.

Course outcomes

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

1. Acquire knowledge about concepts of remote sensing, sensors and their characteristics.
2. familiarize with data models and data structures to introduce various Raster and Vector Analysis capabilities in GIS.
3. digitize and create thematic map and extract important features to calculate geometry.
4. perform surface analysis over Contour to develop digital elevation model.
5. use GIS software to perform simple analysis in water resources and transportation engineering.

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO. 1	2		1	1			2					2	1		1
CO. 2	2		1	1			2					2	1		1
CO. 3	1	2	2	1	2	2	3		2	2	1	3	1		2
CO. 4	1	2	2	1	2	2	3		2	2	1	3	2		2
CO. 5	1	2	2	1	2	2	3		2	2	1	3	2		2

1- Slightly; 2- Moderately; 3- Substantially

SYLLABUS:

UNIT – I

Introduction to Remote sensing: History of Remote Sensing, Electromagnetic Radiation,

Electromagnetic Spectrum, Energy Interaction with Atmosphere, Energy Interaction with the Earth Surfaces - Characteristics of Remote Sensing Systems, Sensor Resolutions, Advantages & Limitations - Platforms: Types of Sensors, Airborne Remote Sensing, Spaceborne Remote Sensing - IRS, LANDSAT, SPOT & Recent satellite.

UNIT – II

Digital Image analysis: Digital Image Characteristics, Digital Image Data Formats, Band Interleaved by Pixel (BIP), Band Interleaved by Line (BIL), Band Sequential (BSQ) - Visual Interpretation Elements, Preprocessing, Enhancement, Classification, Supervised classification, Unsupervised classification.

UNIT – III

Introduction to Geographic Information System: Principles, Components and Applications of GIS - Map projections, Spatial Data Structures, Raster and Vector Data Formats, Data Inputs, Data Manipulation, Data Retrieval, Data Analysis - Spatial data analysis: Overlay Function-Vector Overlay Operations, Raster Overlay Operations, Arithmetic Operators, Comparison and Logical Operators, Conditional Expressions - Network Analysis: Components of network, Transportation network - Optimum path analysis.

TEXT BOOKS:

1. BasudebBhatta (2021). 'Remote sensing and GIS', 3rdedn., Oxford University Press.
2. S. Kumar, (2016) 'Basics of Remote sensing & GIS', Laxmi Publications.
3. Lillesand, T.M, R.W. Kiefer and J.W. Chipman (2022) 'Remote Sensing and Image Interpretation', 7thedn., Wiley India Pvt. Ltd.
4. Demers, M.N, (2013) 'Fundamentals of Geographic Information Systems', 4thedn., Wiley India Pvt. Ltd.

List of Experiments:

Expt. 1 :Georeferencing a Toposheet or Map
Expt. 2 : Digitization and Attribute table creation.
Expt. 3 : Creation of Thematic Map
Expt. 4 : Calculation of Feature geometry – Length, Area & Perimeter.
Expt. 5 : Contour map – developing TIN & DEM from Contour.
Expt. 6 : Stream network – Stream ordering map.
Expt. 7 : Watershed - calculate Hydro-geomorphological parameters.
Expt. 8 : Transportation Network Map – Route analysis.

GIS SOFTWARE: QGIS / ArcGIS

Textbook for Practical

1. QGIS User Guide
2. ArcGIS User Manual by ESRI

REFERENCES:

1. Schowengerdt, R. A (2006) 'Remote Sensing', Elsevier publishers.
2. Burrough P A and R.A. McDonnell, (1998) 'Principals of Geographical Information Systems', Oxford University Press.
3. George Joseph (2013) 'Fundamentals of Remote Sensing', Universities Press.

Web references:

1. https://nptel.ac.in/courses/10510319

II Year II Semester

L	T	P	C
1	0	2	2

DESIGN THINKING & INNOVATION

Course Objectives: The objectives of the course are to

- Bring awareness on innovative design and new product development.
- Explain the basics of design thinking.
- Familiarize the role of reverse engineering in product development.
- Train how to identify the needs of society and convert into demand.
- Introduce product planning and product development process.

UNIT – I Introduction to Design Thinking

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT - II Design Thinking Process

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brainstorming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT - III Innovation

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT - IV Product Design

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.

Activity: Importance of modeling, how to set specifications, Explaining their own product design.

UNIT – V Design Thinking in Business Processes

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.

Activity: How to market our own product, about maintenance, Reliability and plan for startup.

Textbooks:

1. Tim Brown, Change by design, 1/e, Harper Bollins, 2009.
2. Idris Mootee, Design Thinking for Strategic Innovation, 1/e, Adams Media, 2014.

Reference Books:

1. David Lee, Design Thinking in the Classroom, Ulysses press, 2018.
2. Shrrutin N Shetty, Design the Future, 1/e, Norton Press, 2018.
3. William lidwell, Kritinaholden, &Jill butter, Universal principles of design, 2/e, Rockport Publishers, 2010.
4. Chesbrough.H, The era of open innovation, 2003.

Online Learning Resources:

- https://nptel.ac.in/courses/110/106/110106124/
- https://nptel.ac.in/courses/109/104/109104109/
- https://swayam.gov.in/nd1_noc19_mg60/preview
- https://onlinecourses.nptel.ac.in/noc22_de16/preview

Course Outcomes:

COs	Statements	Blooms Level
CO1	Define the concepts related to design thinking.	L1
CO2	Explain the fundamentals of Design Thinking and innovation.	L2
CO3	Apply the design thinking techniques for solving problems in various sectors.	L3
CO4	Analyse to work in a multidisciplinary environment.	L4
CO5	Evaluate the value of creativity.	L5

L	T	P	C
3	0	0	0

II Year II Semester

BUILDING MATERIALS AND CONSTRUCTION

Objectives of the course:

- Initiating the student with the knowledge of basic building materials and their different properties.
- Imparting the knowledge of course pattern in masonry construction and flat roofs and techniques of forming foundation, columns, beams, walls, sloped roofs and flat roofs.
- The student is to be exposed to the various patterns of floors, walls, different types of paints and varnishes.
- Imparting the students with the techniques of form work and scaffolding.
- The students should be exposed to classification of aggregates, moisture content of the aggregate.

UNIT I:

Stones, Bricks and Tiles: Properties of building stones–relation to their structural requirements, classification of stones–stone quarrying–precautions in blasting, dressing of stone, composition of good brick earth, various methods of manufacturing of bricks. Characteristics of good tile-manufacturing methods, types of tiles. Uses of materials like Aluminium, Gypsum, Glass and Bituminous materials

UNIT II:

Masonry: Types of masonry, English and Flemish bonds, Rubble and Ashlar Masonry. Cavity and partition walls. Wood: Structure– Properties-Seasoning of timber-Classification of various types of woods used in buildings- Defects in timber. Alternative materials for wood–Galvanized Iron, Fiber Reinforced Plastics, Steel, Aluminium.

UNIT III:

Lime and Cement:

Lime: Various ingredients of lime – Constituents of lime stone–classification of lime–various methods of manufacture of lime.

Cement: Portland cement- Chemical Composition – Hydration, setting and fineness of cement. Various types of cement and their properties. Various field and laboratory tests for Cement.Variousing redients of cement concrete and their importance–various tests for concrete.

UNIT IV:

Building Components: Lintels, arches, vaults, staircases–types. Different types of floors–Concrete, Mosaic, Terrazz ofloors, Pitched, flat roofs. Lean to roof, Coupled Roofs. Trussed roofs–King and Queen post Trusses. R.C.C Roofs, Madras Terrace and

Pre-fabricated roofs.

UNIT V:

Finishings: Damp Proofing and water proofing materials and uses–Plastering Pointing, white washing and distempering. Paints: Constituents of a paint–Types of paints–Painting of new/old wood-Varnish. Form Works and Scaffoldings.

Aggregates: Classification of aggregates–Coarse and fine aggregates-particle shape and texture–Bond and Strength of aggregate–Specific gravity–Bulk Density, porosity and absorption–Moisture content of Aggregate-Bulking of sands–Sieve analysis.

TEXT BOOKS:

1. Building Materials, S.S.Bhavikatti, Vices publications House private ltd.
2. Building Construction, S.S.Bhavikatti, Vices publications House private ltd.
3. Building Materials, B.C.Punmia, Laxmi Publications private ltd.
4. Building Construction, B.C.Punmia, Laxmi Publications (p) ltd.

References:

1. Building Materials, S.K. Duggal, New Age International Publications.
2. Building Materials, P.C.Verghese, PHI learning (P)ltd.
3. Building Materials, M.L.Gambhir, Tata McGraw Hill Publishing Co.Ltd. New Delhi.
4. Building construction, P.C.Verghese, PHI Learning(P)Ltd.
5. Building Materials, Construction and Planning, S.Mahaboob Basha, Anuradha Publications, Chennai

Course Outcomes:

COs	**Statements**	**Blooms Level**
CO1	The student should be able to identify different building materials and their importance in building construction.	L1
CO2	Explain the fundamentals of Design Thinking and innovation.	L2
CO3	Apply the design thinking techniques for solving problems in various sectors.	L3
CO4	Analyse to work in a multidisciplinary environment.	L4
CO5	Evaluate the value of creativity.	L5

B.Tech III Year I Semester

S.No.	Category	Title	L	T	P	Credits
1	Professional Core	Design and Drawing of Reinforced Concrete Structures	3	0	0	3
2	Professional Core	Engineering Hydrology	3	0	0	3
3	Professional Core	Geotechnical Engineering -I	3	0	0	3
4	Professional Elective-I	1. Advanced structural analysis 2. Architecture and town planning 3. Construction Technology and Management	3	0	0	3
5	Open Elective-I	OR Entrepreneurship Development & Venture Creation 1. Green Buildings 2. Construction technology and management 3. Climate Change impact on Eco system	3	0	0	3
6	Professional Core	Geotechnical Engineering Lab	0	0	3	1.5
7	Professional Core	Fluid Mechanics & Hydraulic Machines Lab	0	0	3	1.5
8	Skill Enhancement course	Estimation, Specifications & Contracts	0	1	2	2
9	Engineering Science	Tinkering Lab	0	0	2	1
10	Evaluation of Community Service Internship		-	-	-	2
Total			15	1	10	23
MC	Minor Course (Student may select from the same specialized minors pool)		3	0	3	4.5
MC	Minor Course through SWAYAM / NPTEL (Minimum 12 Week, 3 credit course)		3	0	0	3
HC	Honors Course (Student may select from the same Honors pool)		3	0	0	3
HC	Honors Course (Student may select from the same Honors Pool)		3	0	0	3

R23 B. TECH CIVIL ENGINEERING

B.Tech III Year II Semester

	Category	Title	L	T	P	Credits
1	Professional Core	Design and Drawing of Steel Structures	3	0	0	3
2	Professional Core	Highway Engineering	3	0	0	3
3	Professional Core	Environmental Engineering	3	0	0	3
4	Professional Elective-II	1. Ground Improvement Techniques 2. Repair and Rehabilitation of Structures 3 Valuation and Quantity Survey	3	0	0	3
5	Professional Elective-III	1. Finite element method 2. Bridge Engineering 3. Water Resource Engineering	3	0	0	3
6	Open Elective-II	1.Disater management 2.Sustainability in Engineering practices 3.Water Supply Systems	3	0	0	3
7	Professional Core	Environmental Engineering lab	0	0	3	1.5
8	Professional Core	High Way Engineering lab	0	0	3	1.5
9	Skill Enhancement course	CAD Lab	0	1	2	2
Total			18	1	08	23
10	Audit course	Technical paper writing & IPR	2	0	0	-
Mandatory Industry Internship of 08 weeks duration during summer vacation						

R23 B.TECH CIVIL ENGINEERING

OPEN ELECTIVES

S.NO	Category	Titles
1	Open Elective -1	1. Green Buildings 2. Construction technology and management 3. Climate Change impact on Eco system
2	Open Elective-2	1. Disater management 2. Sustainability in Engineering practices 3. Water Supply Systems
3	Open Elective-3	1. Building technology for engineers 2. Environmental impact assessment
4	Open Elective-4	1. Geo-Spatial Technologies 2. Solid waste management

Honors Degree courses

1. Introduction to Earthquake Engineering
2. Structural dynamics
3. Traffic Engineering and Management
4. Advanced Hydrology
5. Geosynthetics Engineering: In theory and practice
6. Environmental Geotechnics
7. Seismic Analysis of Structures
8. Environmental Air Pollution
9. Soil Dynamics
10. Advanced Transportation Engineering

Minors Degree

1. Surveying
2. Mechanics of solids
3. Soil Mechanics
4. Fluid Mechanics
5. Civil Engineering- Building Materials and Construction
6. Building Planning and drawing
7. Estimation and Costing
8. Sustainable Materials and Green building
9. Safety in Construction
10. Construction planning and Management

Web link for NPTEL courses: https://nptel.ac.in/courses

III Year I Semester	DESIGN AND DRAWING OF REINFORCED CONCRETE STRUCTURES	L	T	P	C
		3	0	0	3

Course Learning Objectives:

The objective of this course is:

1. Familiarize Students with different types of design philosophies.
2. Equip student with concepts of design of flexural members.
3. Understand Concepts of shear, bond and torsion.
4. Familiarize students with different types of compressions members and Design.
5. Understand different types of footings and their design.

Course Outcomes:

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

a. Work on different types of design philosophies
b. Carryout analysis and design of flexural members and detailing
c. Design structures subjected to shear, bond and torsion.
d. Design different type of compression members and footings

SYLLABUS:

UNIT –I

Introduction: Working stress method Design codes and handbooks, loading standards – Dead, live, wind and earthquake loads, elastic theory, design constants, modular ratio, neutral axis depth and moment of resistance, balanced, under-reinforced and over-reinforced sections, working stress method of design of singly and doubly reinforced beams.

Limit State Design: Concepts of limit state design – Basic statistical principles – Characteristic loads –Characteristic strength – Partial load and safety factors – representative stress-strain curves for cold worked deformed bars and mild steel bars. Assumptions in limit state design – stress - block parameters – limiting moment of Resistance.

UNIT –II

Design for Flexure: Limit state analysis and design of singly reinforced sections- effective depth- Moment of Resistance- Doubly reinforced and flanged (T) beam sections- Minimum depth for a given capacity- Limiting Percentage of Steel- Minimum Tension Reinforcement- Maximum Flexural Steel- Design of Flanged Sections (T)- Effective width of flange – Behavior- Analysis and Design.

UNIT – III

Design for Shear, Torsion and Bond: Limit state analysis and design of section for shear and torsion for L Beam – concept of bond, anchorage and development length, I.S. code provisions. Design examples in simply supported and continuous beams, detailing. **Limit state design for serviceability:** Deflection, cracking and code provision.

UNIT – IV

Design of Compression members: Effective length of a column, Design of short and long columns – under axial loads, uniaxial bending and biaxial bending – Braced and un-braced columns – I S Code provisions.

Footings: Different types of footings – Design of isolated footings, Square footings – Rectangular footings – circular footing – spread & sloped footings - subjected to axial loads.

UNIT – V

Slabs: Classification of slabs, design of one - way slabs, two - way slabs, and continuous slabs using IS Coefficients (conventional), design of waist-slab staircase.

NOTE: All the designs to be taught in Limit State Method. Drawing classes must be conducted every week and the Following plates should be prepared by the students.

- Reinforcement detailing of T-beams, L-beams and continuous beams and cantilevers.
- Reinforcement detailing of columns and isolated footings.
- Detailing of one-way, two-way and continuous slabs and waist-slab staircase.

FINAL EXAMINATION PATTERN:

The end examination paper should consist of Part A and Part B. Part A consists of two questions in Design and Drawing out of which one question is to be answered. Part B should consist of five questions and design out of which three are to be answered. Weightage for Part – A is 40% and Part- B is 60%.

TEXTBOOKS:

1. 'Limit State Design' by A. K. Jain
2. 'Reinforced Concrete Structures' by S. Unnikrishna Pillai &Devdas Menon, Tata Mc.Graw Hill, New Delhi.

REFERENCES:

1. 'Design of concrete structures' by N. Krishna Raju.
2. 'Reinforced Concrete Structures' by Park and Pauley, John Wiley and Sons.

IS Codes:

1) IS -456-2000 (Permitted to use in examination hall)
2) IS – 875, 3) SP-16

III Year I Semester	ENGINEERING HYDROLOGY	L	T	P	C
		3	0	0	3

Course Learning Objectives:

The course is designed to make the students,

1. Understand hydrologic cycle and its relevance to Civil engineering.
2. Learn physical processes and their interactions in hydrology.
3. Learn measurement and estimation of the components of hydrologic cycle.
4. Have an overview and understanding of Hydrographs.
5. Learn flood frequency analysis, design flood and flood routing methods.
6. Study the concepts of groundwater movement and well hydraulics.

Course Outcomes:

At the end of the course the students are expected to

a. Have a thorough understanding of the theories and principles governing the hydrologic processes.
b. Be able to quantify hydrologic components and apply concepts in hydrologic design of water resources projects.
c. Develop Intensity-Duration-Frequency and Depth-Area Duration curves to design hydraulic structures.
d. Develop design storms and carry out frequency analysis.
e. Develop flow mass curve and flow duration curve, apply hydrograph analysis in the design of water resources projects.
f. Develop unit hydrograph and synthetic hydrograph.
g. Estimate flood magnitude and carry out flood routing.
h. Determine aquifer parameters and yield of wells.

SYLLABUS:

UNIT - I

Introduction: Engineering hydrology and its applications, Hydrologic cycle, hydrological data-sources of data.

Precipitation: Types and forms, measurement, introduction to radar measurement of rain fall, rain gauge network, presentation of rainfall data, average rainfall, continuity and consistency of rainfall data, frequency of rainfall, Intensity-Duration-Frequency (IDF) curves, Depth-Area-Duration (DAD) curves, Probable Maximum Precipitation (PMP), design storm

UNIT-II

Abstractions: Initial abstractions, Evaporation: factors affecting, measurement, estimation, reduction, Evapotranspiration: factors affecting, measurement, estimation, control, Infiltration: factors affecting, Infiltration capacity curve, measurement, infiltration indices.

UNIT-III

Runoff: Factors affecting runoff, components, empirical formulae, tables and curves, stream gauging, rating curve, flow mass curve and flow duration curve.

Hydrograph analysis: Components of hydrograph, separation of base flow, effective rainfall hyetograph and direct runoff hydrograph, unit hydrograph, assumptions, derivation of unit hydrograph, unit hydrographs of different durations, principle of superposition and S-hydrograph methods, limitations and applications of unit hydrograph, dimensionless unit hydrograph, synthetic unit hydrograph, introduction to IUH.

UNIT-IV

Floods: Causes and effects, frequency analysis- Gumbel's and Log-Pearson type III distribution methods, Standard Project Flood (SPF) and Probable Maximum Flood (MPF), flood control methods and management.

Flood Routing: Hydrologic routing, channel and reservoir routing-Muskingum and Puls methods of routing.

UNIT-V

Groundwater: Occurrence, types of aquifers, aquifer parameters, porosity, specific yield, permeability, transmissivity and storage coefficient, types of wells, Darcy's law, Dupuit's equation- steady radial flow to wells in confined and unconfined aquifers, yield of an open well-recuperation test.

TEXTBOOKS:

1. 'Engineering Hydrology' by Subramanya, K, Tata McGraw-Hill Education Pvt Ltd, (2013), New Delhi.
2. 'Engineering Hydrology' by Jayarami Reddy, P, Laxmi Publications Pvt. Ltd., (2013), New Delhi
3. 'Applied hydrology' by Chow V.T., D.R Maidment and L.W. Mays, Tata McGraw Hill Education Pvt Ltd, (2011), New Delhi.
4. 'Engineering Hydrology' by Ojha C.S.P, R. Berndtsson and P. Bhunya, Oxford University Press, (2010).

REFERENCES:

1. 'Water Resources Engineering', Mays L.W, Wiley India Pvt. Ltd, (2013).
2. 'Hydrology' by Raghunath. H.M., New Age International Publishers, (2010)
3. 'Engineering Hydrology – Principles and Practice' by Ponce V.M., Prentice Hall International, (1994)
4. 'Hydrology and Water Resources Engineering' by Patra K.C., Narosa Publications, (2011).

III Year I Semester	GEOTECHNICAL ENGINEERING– I	L	T	P	C
		3	0	0	3

Course Learning Objectives:

The objective of this course is:

1. To enable the student to determine the index properties of the soil and classify it.
2. To impart the concept of seepage of water through soils and determine the discharge of water through soils.
3. To impart the principles of compaction and consolidation of soils and determine the magnitude and the rate of consolidation settlement.
4. To enable the student to understand the concept of shear strength of soils, determine the shear parameters of sands and clays and the areas of their application.

Course Outcomes:

Upon successful completion of this course, student will be able to

1: Understand soil formation, its index properties and classification.

2: Understand soil moisture and flow of water through soils and its effects.

3: Understand stress distribution in soils.

4: Understand Compressibility characteristics under partially saturated and fully saturated conditions.

5: Understand shear strength of soil at different loading & drainage conditions for different soils.

SYLLABUS:

UNIT – I

Introduction: Soil formation – Structure of Soils – Texture of Soils – Three phase system and phase relationships.

Index Properties and Classification Tests of Soils: Index properties **–** Density Index **-** Grain size analysis – Sieve and Hydrometer methods – Consistency of Clay Soils – Activity of Clays – Thixotropy of clays **-** soil Classification – Unified soil classification and I.S. Soil classification.

UNIT – II

Soil moisture and Capillarity: Soil moisture and modes of occurrence – Total, Neutral and Effective Pressures – Capillary Rise in soils.

Permeability: Flow of water through soils –**-** One dimensioned flow of water through soils – Darcy's law- permeability – Factors affecting –laboratory determination of coefficient of permeability –Permeability of layered systems.

UNIT –III

Seepage and Flow Nets: Flow net for one-dimensional flow – two-dimensional flow – Basic equation for Seepage – Flow nets & Characteristics and Uses – Quicksand condition – Seepage forces

Stress Distribution in Soils: Stresses induced by applied loads - Boussinesq's and Westergaard's theories for point loads and areas of different shapes– Newmark's influence chart – 2:1 stress distribution method. - Pressure Blubs.

UNIT – IV

Compaction: Mechanism of compaction – factors affecting – effects of compaction on soil properties - compaction control.

Consolidation: Compressibility of soils – e-p and e-log p curves – Stress history – Concept of consolidation - Spring Analogy - Terzaghi's theory of one-dimensional Consolidation – Time rate of consolidation and degree of consolidation – Determination of coefficient of consolidation (c_v) - Over consolidated and normally consolidated clays.

UNIT - V

Shear Strength of Soils: Basic mechanism of shear strength - Mohr – Coulomb Failure theories – total and effective shear strength parameters – Stress-Strain behavior of Sands - Critical Void Ratio – Stress-Strain behavior of clays – Shear Strength determination- various drainage conditions – stress paths.

TEXTBOOKS:

1. 'Soil Mechanics and Foundation Engineering by Dr. K.R. Arora, Standard Publishers and Distributors, New Delhi.
2. Basic and Applied Soil Mechanics' by Gopal Ranjan and A.S.R.Rao, New Age International Publishers.
3. 'Soil Mechanics and Foundation Engineering' by V.N.S.Murthy ,CBS publishers
4. 'Geotechnical Engineering' by C. Venkataramaiah, New Age International Publishers.

REFERENCES:

1. 'Fundamentals of Soil Mechanics' by D.W.Taylor., Wiley.
2. 'An introduction to Geotechnical Engineering' by Holtz and Kovacs; Prentice Hall
3. Principles of Geotechnical Engineering, BrajaM.Das, Cengage Learing.

III Year I Semester	ADVANCED STRUCTURAL ANALYSIS	L	T	P	C
		3	0	0	3

Course Outcomes:

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

1. Differentiate Determinate and Indeterminate Structures
2. Carry out lateral Load analysis of structures
3. Analyze Cable and Suspension Bridge structures
4. Analyze structures using Moment Distribution, Kani's Method
5. Analyze structures using Matrix method.

UNIT–I

Energy Theorems: Introduction-Strain energy in linear elastic system, expression of strain energy due to axial load, bending moment and shear forces - Castigliano's first theorem-Deflections of simple beams and pin jointed plane trusses.

INDETERMINATE TRUSSES: Determination of static and kinematic indeterminacies – Analysis of trusses having single and two degrees of internal and external indeterminacies – Castigliano's second theorem.

UNITII

Three Hinged Arches: Elastic theory of arches – Eddy's theorem – Determination of horizontal thrust, bending moment, normal thrust and radial shear – effect of temperature. Hinges with supports at different levels.

Two Hinged Arches: Determination of horizontal thrust, bending moment, normal thrust and radial shear – Rib shortening and temperature stresses, Tied arches – Fixed arches – (No analytical question)

UNIT-III Approximate Methods of Analyses: Application to building frames. (i) Portal Method (ii) Cantilever Method (iii) Substitute frame method for approximate analysis of multi-storey frames subjected to gravity loads and lateral loads. Shear force and bending moment diagrams - Elastic curve.

UNIT – IV Cable Structures and Suspension Bridges: Introduction, characteristics of cable, analysis of cables subjected to concentrated and uniformly distributed loads, anchor cable, temperature stresses, analysis of simple suspension bridge, three hinged and two hinged stiffening girder suspension bridges.

UNIT – V Moment Distribution Method: Analysis of Portal frames – including Sway-Substitute frame analysis by two cycle. Sloped eflection method: Analysis of Portal frames – including Sway. Analysis of inclined frames. Shear force and bending moment diagrams - Elastic curve.

Kani's Method: Analysis of continuous beams–including settlement of supports and single bay portal frames with and without side sway. Shear force and bending moment diagrams - Elastic curve.

Text Books:

1 Structural Analysis by R.C. Hibbeler, Pearson, New Delhi.

2 Analysis of Structures- Vol. I and II, V. N. Vazirani and M. M. Ratwani, Khanna Publishers, New Delhi**.**

References:

1. Mechanics of Structures Vol – II by H.J.Shah and S.B.Junnarkar, Charotar Publishing House Pvt. Ltd.
2. Structural Analysis by Devdas Menon, Narosa Publishing Housing Pvt. Ltd.
3. Structural Analysis: A Matrix Approach, G.S.Pandit and S.P.Gupta, Mc Graw Hill Pvt Ltd.

III Year I Semester	ARCHITECTURE AND TOWN PLANNING	L	T	P	C
		3	0	0	3

Course Learning Objectives:

The objectives of this course are:

1. Initiating the students to different architectures of the world. The distinctions between the eastern and western architecture styles are focused.
2. The salient features of Egyptian, Greek, Roman, and Indian Vedic, Indus valley civilization, Buddhist, Hindu and Indo-Sarsanic Architecture are introduced.
3. Architectural design concepts, principles of planning and composition are imparted.
4. Enabling the student to understand town planning from ancient times to modern times.
5. To impart the concepts of town planning standards, landscaping and expansion of towns.

Course Outcomes*:*

Upon the successful completion of this course, the student should be able to:

a. Distinguish architectural styles of eastern and western world.
b. Understand the importance of Orders of architecture.
c. Compose spaces of buildings using design concepts, planning principles.
d. Understand the town planning standards, landscaping features and regulations controlling expansion of the towns and the cities.

UNIT–I

History of Architecture: Western Architecture: Egyptian, Greek, Roman Architectures-Orders. Indian Architecture: Vedic age, Indus valley civilization.

Temples of Religions: Buddhist period: Stambas, Stupas, Toranas, Chaityas, Viharas – Hindu temples: Dravidian and Indo Aryan Styles-Temple of Aihole, Madurai, Bhubaneshwar, Mount Abu. Indo Sarsanic (Islamic) Architecture: Mosque - Palace - Fort - Tomb.

UNIT-II

Principles of designing and Planning: Principles of planning a residence-site selection, site orientation- aspect, prospect, grouping, circulation, privacy, furniture requirements, services and other factors.

Post-classic Architecture: Introduction of post-classic architecture-contribution of eminent architects to modern period-Edward Lutyens, Le Corbusier, Frank Lloyd Wrigt, Walter Groping.

UNIT–III

Historical Back Ground of Town Planning: Town planning in India –Town plans of mythological Manasa-Town plans of ancient towns: Harappa, Mohenjo- Daro, Pataliputra, Delhi, Acropolis (Greece), Jerusalem, Mecca, Rome, London.

UNIT–IV

Modern Town Planning: Zoning- Roads and road traffic- Housing- Slums, Parks, Play grounds- Public Utility Services- Surveys and maps for planning- Neighborhood Planning.

Standards of Town planning: Planning new towns, planning standards and specifications, national and regional planning, town planning and legislation-planning regulations and limitations.

UNIT–V

Land Scaping and Expansion of Towns: Land scaping for the towns, horizontal and vertical expansion of towns-garden cities, satellite towns-floating towns-skyscrapers-pyramidal cities.

TEXT BOOKS:

1. 'The great ages of World Architecture 'by G.K.Hiraskar.
2. 'Planning and Design of Buildings by Section of Architecture' by Y.S.Sane.
3. 'Professional Practice'by G.K. Krishnamurthy, S.V.Ravindra, PHI Learning,New Delhi.
4. 'Indian Architecture–Vol.I&II'byPercy Brown, Taraporevala Publications, Bombay.
5. 'Fundamentals of Town Planning' by G.K.Haraskar.

REFERENCES:

1. 'Drafting and Design for Architecture'by Hepler, Cengage Learning
2. 'Architect's Portable Hand book' by John Patten Guthrie–McGraw Hill International Publications.
3. 'Modern Ideal Homes for India'by R.S.Deshpande.
4. 'Town and County Planning' by A.J.Brown and H.M.Sherrard.
5. 'Town Design'by Federik Glbbard, Architectural press,London.

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III Year I Semester	CONSTRUCTION TECHNOLOGY & MANAGEMENT	L	T	P	C
		3	0	0	3

Course Learning Objectives:

The objective of this course is:

1. To introduce to the student, the concept of project management including network drawing and monitoring
2. To introduce the various equipment related to construction like earth moving equipment, trucks and handling equipment, aggregate production and construction equipment and machinery
3. To introduce the importance of safety in construction projects

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

1. Appreciate the importance of construction planning
2. Understand the functioning of various earth moving equipment
3. Know the methods of production of aggregate products and concreting
4. Apply the gained knowledge to project management and construction techniques

UNIT-I

Construction project management and its relevance – qualities of a project manager – project planning – coordination –scheduling - monitoring – bar charts – milestone charts – critical path method

UNIT-II

Project evaluation and review technique–cost analysis updating crashing for optimum cost–crashing for optimum resources–allocation of resources introduction to software's for construction management, project management using PRIMAVERA (or) equivalent.

UNIT-III

Construction equipment – economical considerations – earthwork equipment – Trucks and handling equipment – rear dump trucks – capacities of trucks and handling equipment – calculation of truck production – compaction equipment – types of compaction rollers

Hoisting and earth work equipment–hoists–cranes–tractors-bulldozers–graders–scrapers–draglines-clam shell buckets

UNIT-IV

Concreting equipment— concrete mixers– Batching plants, mobile using plants like "Ajax"etc. mixing and placing of concrete – consolidating and finishing.

UNIT-V

Construction methods – earthwork – piling – placing of concrete – form work – fabrication and erection – quality control and safety engineering. BIM for Civil Engineers (Building Information Modelling)

TEXTBOOKS:

1. 'Construction Planning, Equipment and Methods' by Peurifoy and Schexnayder, Shapira, Tata McGraw hill.
2. 'Construction Project Management Theory and Practice' by Kumar NeerajJha(2011), Pearson.
3. 'Construction Technology' by Subir K.Sarkar and Subhajit Sarasvati, Oxford University press

REFERENCES:

1. 'Construction Project Management-An Integrated Approach'by Peter Fewings,Taylor and Francis
2. 'Construction Management Emerging Trends and Technologies' by TreforWilliams , Cengage learning

III Year – I Semester	GREENBUILDINGS	L	T	P	C
		3	0	0	3

UNIT – 1:

Introduction

What is Green Building, Why to go for Green Building, Benefits of Green Buildings, Green Building Materials and Equipment in India, What are key Requisites for Constructing a Green Building, Important Sustainable features for Green Building,

UNIT – 2:

Green Building Concepts And Practices Indian Green Building Council, Green Building Moment in India, Benefits Experienced in Green Buildings, Launch of Green Building Rating Systems, Residential Sector, Market Transformation; Green Building Opportunities And Benefits: Opportunities of Green Building, Green Building Features, Material and Resources, Water Efficiency, Optimum Energy Efficiency, Typical Energy Saving Approach in Buildings, LEED India Rating System and Energy Efficiency,

UNIT-3:

Green Building Design Introduction, Reduction in Energy Demand, Onsite Sources and Sinks, Maximise System Efficiency, Steps to Reduce Energy Demand and Use Onsite Sources and Sinks, Use of Renewable Energy Sources. Eco friendly captive power generation for factory, Building
requirement,

UNIT- 4:

Air Conditioning Introduction, CII Godrej Green business centre, Design philosophy, Design interventions, Energy modeling, HVAC System design, Chiller selection, pump selection, Selection of cooling towers, Selection of air handing units, Precooling of fresh air, Interior lighting system, Key feature of the building. Eco-friendly captive power generation for factory, Building requirement.

UNIT –5:

Material Conservation Handling of non process waste, waste reduction during construction, materials with recycled content, local materials, material reuse, certified wood, Rapidly renewable building materials and furniture; Indoor Environment Quality And Occupational Health: Air conditioning, Indore air quality, Sick building syndrome, Tobacco smoke control, Minimum fresh air requirements avoid use of asbestos in the building, improved fresh air ventilation, Measure of IAQ, Reasons for poor IAQ, Measures to achieve Acceptable IAQ levels,

Text Books:

1. Handbook on Green Practices published by Indian Society of Heating Refrigerating and Air conditioning Engineers, 2009.
2. Green Building Hand Book by Tom woolley and Samkimings, 2009. Recommended References:
3. Complete Guide to Green Buildings by Trish riley
4. Standard for the design for High Performance Green Buildings by Kent Peterson, 2009

III Year I Semester	CONSTRUCTION TECHNOLOGY AND MANAGEMENT	L	T	P	C
		3	0	0	3

Course Learning Objectives:

The objective of this course is:

1. To introduce to the student, the concept of project management including network drawing and monitoring
2. To introduce the various equipment related to construction like earth moving equipment, trucks and handling equipment, aggregate production and construction equipment and machinery
3. To introduce the importance of safety in construction projects

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

1. Appreciate the importance of construction planning
2. Understand the functioning of various earth moving equipment
3. Know the methods of production of aggregate products and concreting
4. Apply the gained knowledge to project management and construction techniques

SYLLABUS:

UNIT-I

Construction project management and its relevance – qualities of a project manager – project planning – coordination –scheduling - monitoring – bar charts – milestone charts – critical path method

UNIT-II

Project evaluation and review technique–cost analysis-updating–crashing for optimum cost–crashing for optimum resources–allocation of resources introduction to software's for construction management, project management using PRIMAVERA (or) equivalent.

UNIT-III

Construction equipment – economical considerations – earthwork equipment – Trucks and handling equipment – rear dump trucks – capacities of trucks and handling equipment – calculation of truck production – compaction equipment – types of compaction rollers Hoisting and earth work equipment–hoists–cranes–tractors-bull dozers–graders–scrapers–draglines clam shell buck

UNIT-IV

Concreting equipment— concrete mixers–Batching plants, mobile using plants like "Ajax" etc. mixing and placing of concrete – consolidating and finishing.

UNIT-V

Construction methods – earthwork – piling – placing of concrete – form work – fabrication and erection – quality control and safety engineering. BIM for Civil Engineers (Building Information Modelling)

TEXTBOOKS:

1. 'Construction Planning, Equipment and Methods' by Peurifoy and Schexnayder, Shapira, Tata McGraw hill.
2. 'Construction Project Management Theory and Practice' by Kumar NeerajJha (2011), Pearson.
3. 'Construction Technology' by Subir K.Sarkarand Subhajit Sarasvati, Oxford University press

REFERENCES:

1. 'Construction Project Management-An Integrated Approach 'by Peter Fewings, Taylor and Francis
2. 'Construction Management Emerging Trends and Technologies' by Trefor Williams , Cengage learning

III Year – I Semester	CLIMATE CHANGE IMPACT ON ECO-SYSTEM	L	T	P	C
		3	0	0	3

UNIT I:

Climate System; Climate, weather and Climate Change; Overview of Earth's Atmosphere; Vertical Structure of Atmosphere; Radiation and Temperature; Laws of Radiation; Heat-Balance of Earth Atmosphere System; Random Temperature Variation; Modelling Vertical Variation in Air Temperature; Temporal Variation of Air temperature; Temperature Change in Soil; Thermal Time and Temperature Extremes.

UNIT II:

Hydrologic Cycle: Introduction; Global water balance; Cycling of water on land, a simple water balance model;

UNIT III:

Climate Variables affecting Precipitation: Precipitation and Weather, Humidity, Vapor Pressure, Forms of Precipitation, Types of Precipitation; Cloud; Atmospheric Stability; Monsoon; Wind Pattern in India; Global Wind Circulation; Evaporation and Transpiration, Processes of Vadose Zone, Surface Runoff, Stream flow

UNIT IV:

Climate Variability: Floods, Droughts, Drought Indicators, Heat waves, Climate Extremes.

UNIT V:

Climate Change: Introduction; Causes of Climate Change; Modeling of Climate Change, Global Climate Models, General Circulation Models, Downscaling; IPCC Scenarios

III Year I Semester	GEOTECHNICAL ENGINEERING LAB	L	T	P	C
		0	0	3	1.5

Learning Objectives:

The objective of this course is

1. To determine the index properties for soil classification– Grain size distribution & Atterberg's limits.
2. To determine the engineering properties–Permeability, Compaction, consolidation, shear strength parameters & CBR value.
3. To find the degree of swelling by DFS test.
4. To impart knowledge of determination of index properties required for classification of soils.
5. To teach how to determine compaction characteristics and consolidation behavior from relevant lab tests; to determine permeability of soils.
6. To teach how to determines hear parameters of soil through different laboratory tests.

Outcomes:

a) Upon successful completion of this course, student will be able to
b) Determine index properties of soil and classify them.
c) Determine permeability of soils.
d) Determine Compaction, Consolidation and shear strength characteristics.

SYLLABUS:

LISTOFEXPERIMENTS

1. Specific gravity, G
2. Atterberg's Limits.
3. Field density-Core cutter and Sand replacement methods
4. Grain size analysis by sieving
5. Permeability of soil-Constant and Variable head tests
6. Compaction test
7. Consolidation test (to be demonstrated)
8. Direct Sheartest
9. Triaxial Compression test
10. Unconfined Compression test
11. VaneSheartest
12. Differential freeswell (DFS)
13. Field Plate Load Test demo
14. Field CBR demo

Atleast **Eight** experiments shall be conducted.

LIST OF EQUIPMENT:

1. Casagrande's liquid limit apparatus.
2. Apparatus for plastic and shrink age limits
3. Field density apparatus for

a) Core cutter method

b) Sand replacement method

4. Set of sieves: 4.75mm, 2mm, 1mm, 0.6mm, 0.42mm, 0.3mm, 0.15mm, and 0.075mm.
5. Hydrometer
6. Permeability apparatus for

a) Constant head test

b) Variable head test

7. Universal auto compactor fo rI. Slight and heavy compaction tests.
8. Shaking table, funnel for sand raining technique.
9. Apparatus for CBR test
10. 10tons loading frame with proving rings of 0.5 tons and 5tons capacity
11. One dimensional consolation test apparatus with all accessories.
12. Triaxial cell with provision for accommodating 38mm dia specimens.
13. Box shear test apparatus
14. Laboratory vanesh ear apparatus.
15. Hot air ovens (rangeoftemperature50^0-150^0C)
16. Field plate load Test equipment
17. Field CBR test equipment

References:

1. 'Determination of Soil Properties'by J.E.Bowles.
2. IS Code2720 –relevant parts.

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III Year – I Semester	FLUID MECHANICS AND HYDRAULIC MACHINES LAB	L	T	P	C
		0	0	3	1.5

1. Verification of Bernoullis' equation.
2. Calibration of Venturimeter.
3. Calibration of orificemeter.
4. Determination of coefficient of discharge of a small orifice by constant head method
5. Determination of coefficient of discharge of an external cylindrical mouth piece by variable head method.
6. Calibration of a contracted rectangular notch.
7. Calibration of a triangular notch.
8. Determination of friction factor of the pipe material.
9. Determination of coefficient of dead loss due to a sudden expansion/ contraction in a pipeline.
10. Determination of head loss coefficient due to a bend in pipe line.

III Year I Semester	ESTIMATION, SPECIFICATION AND CONTRACTS	L	T	P	C
		0	1	2	2

Course Learning Objectives:

The objective of this course is to enable the students to:

1. Understand the quantity calculations of different components of the buildings.
2. Understand the rate analysis of different quantities of the buildings components.
3. Learn various specifications and components of the buildings.

Course Outcomes:

Upon the successful completion of this course:

a. The student should be able to determine the quantities of different components of buildings.
b. The student should be in a position of find the cost of various building components.
c. The student should be capable of finalizing the value of structures.

UNIT–I

Contracts–Types of contracts–Contract Documents–Conditions of contract, Valuation of buildings- concepts of e-procurement and reverse auctions. Standard specifications for different items of building construction.

UNIT–II

General items of work in Building–Standard Units Principles of working out quantities for detailed and abstract estimates –Approximate method of Estimating.

UNIT–III

Rate Analysis– Working out data for various items of work over head and contingent charges. Earthwork for roads and canals, Reinforcement bar bending and bar requirement schedules.

UNIT-IV

Detailed Estimation of Buildings using individual wall method for single, double and four roomed buildings.

UNIT-V

Detailed Estimation of Buildings using centre line method for single, double and four roomed buildings. Standard software's like building estimator etc.

TEXT BOOKS:

1. 'Estimating and Costing' by B.N.Dutta,UBS publishers, 2000.
2. 'Civil Engineering Contracts and Estimates' by B.S.Patil, Universities Press (India) Pvt. Ltd., Hyd.
3. 'Construction Planning and Technology' by Rajiv Gupta, CBS Publishers & Distributors Pvt. Ltd. New Delhi.
4. 'Estimating and Costing'by G.S. Birdie.

REFERENCES:

1. 'Standard Schedule of rates and standard data book' by public works department.
2. IS1200 (PartsItoXXV-1974/ Method of Measurement of Building & Civil Engg Works–B.I.S.)
3. 'Estimation, Costing and Specifications' by M.Chakraborthi; Laxmi publications.
4. National Building Code

III Year I Semester	TINKERING LAB	L	T	P	C
		0	0	2	1

The aim of tinkering lab for engineering students is to provide a hands-on learning environment where students can explore, experiment, and innovate by building and testing prototypes. These labs are designed to demonstrate practical skills that complement theoretical knowledge.

Course Objectives : To

1. **Encourage Innovation and Creativity**
2. **Provide Hands-on Learning**
3. **Impart Skill Development**
4. **Foster Collaboration and Teamwork**
5. **Enable Interdisciplinary Learning**
6. **Impart Problem-Solving mind-set**
7. **Prepare for Industry and Entrepreneurship**

These labs bridge the gap between academia and industry, providing students with the practical experience. Some students may also develop entrepreneurial skills, potentially leading to start-ups or innovation-driven careers. Tinkering labs aim to cultivate the next generation of engineers by giving them the tools, space, and mind-set to experiment, innovate, and solve real-world challenges.

List of experiments:

1) Make your own parallel and series circuits using breadboard for any application of your choice.
2) Demonstrate a traffic light circuit using breadboard.
3) Build and demonstrate automatic Street Light using LDR.
4) Simulate the Arduino LED blinking activity in Tinkercad.
5) Build and demonstrate an Arduino LED blinking activity using Arduino IDE.
6) Interfacing IR Sensor and Servo Motor with Arduino.
7) Blink LED using ESP32.
8) LDR Interfacing with ESP32.
9) Control an LED using Mobile App.
10) Design and 3D print a Walking Robot
11) Design and 3D Print a Rocket.
12) Build a live soil moisture monitoring project, and monitor soil moisture levels of a remote plan in your computer dashboard.
13) Demonstrate all the steps in design thinking to redesign a motor bike.

Students need to refer to the following links:

1) https://aim.gov.in/pdf/equipment-manual-pdf.pdf
2) https://atl.aim.gov.in/ATL-Equipment-Manual/
3) https://aim.gov.in/pdf/Level-1.pdf
4) https://aim.gov.in/pdf/Level-2.pdf

5) https://aim.gov.in/pdf/Level-3.pdf

Course Outcomes: The students will be able to experiment, innovate, and solve real-world challenges.

III Year I Semester	EVALUATION OF COMMUNITY SERVICE INTERNSHIP	L	T	P	C
		-	-	-	2

III Year II Semester	DESIGN AND DRAWING OF STEEL STRUCTURES	L	T	P	C
		3	0	0	3

Course Learning Objectives:

The objective of this course is to:

1. Familiarize students with different types of connections and relevant IS codes
2. Equip student with the concepts of designing flexural members
3. Understand design concepts of tension and compression members in trusses
4. Familiarize students with different types of columns and column bases and their design
5. Familiarize students with Plate girder and Gantry Girder and their design

Course Outcomes:

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

a. Analyze and design steel structural members with relevant IS codes
b. Carryout analysis and design of flexural members and detailing
c. Design compression members of different types with connection detailing
d. Design Plate Girder and Gantry Girder with connection detailing
e. Produce the drawings pertaining to different components of steel structures

SYLLABUS:

UNIT – I

Connections: Riveted connections – definition, rivet strength and capacity, Welded connections: Introduction, Advantages and disadvantages of welding- Strength of welds-Butt and fillet welds: Permissible stresses – IS Code requirements. Design of fillet weld subjected to moment acting in the plane and at right angles to the plane of the joints.

UNIT – II

Beams: Allowable stresses, design requirements as per IS Code-Design of simple and compound beams-Curtailment of flange plates, Beam to beam connection, check for deflection, shear, buckling, check for bearing, laterally unsupported beams.

UNIT –III

Tension Members and compression members: Effective length of members, slenderness ratio-permissible stresses. Design compression members subjected to axial and eccentric loading. Design of members subjected to direct tension and bending. **Roof Trusses:** Different types of roof trusses – Design loads – Load combinations as per IS Code recommendations, structural details –Design of purlins, members and joints.

UNIT – IV

Design of Columns: Built up compression members – Design of lacings and battens. Design Principles of Eccentrically loaded columns, Splicing of columns.

Design of Column Foundations: Design of slab base and gusseted base. Column bases subjected to moment.

UNIT – V

Design of Plate Girder: Design consideration – IS Code Recommendations Design of plate girder-Welded – Curtailment of flange plates, stiffeners – splicing and connections.

Design of Gantry Girder: impact factors - longitudinal forces, Design of Gantry girders.

NOTE: Welding connections should be used in Units II – V. Drawing classes must be conducted every week and the students should prepare the following plates.

Plate 1 Detailing of simple beams
Plate 2 Detailing of Compound beams including curtailment of flange plates.
Plate 3 Detailing of Column including lacing and battens.
Plate 4 Detailing of Column bases – slab base and gusseted base
Plate 5 Detailing of steel roof trusses including joint details.
Plate 6 Detailing of Plate girder including curtailment, splicing and stiffeners.
Plate 7 Detailing of gantry girder.

FINAL EXAMINATION PATTERN:

The end examination paper should consist of Part A and Part B. part A consist of two questions in Design and Drawing out of which one question is to be answered. Part B should consist of five questions and design out of which three are to be answered. Weightage for Part – A is 40% and Part- B is 60%.

TEXTBOOKS

1. 'Steel Structures Design and Practice' by N.Subramanian, Oxford University Press.
2. 'Design of Steel Structures' by Ramachandra, Vol – 1, Universities Press.
3. 'Design of steel structures' by S.K. Duggal, Tata Mcgraw Hill, and New Delhi

REFERENCES

1. 'Structural Design in Steel' by SarwarAlamRaz, New Age International Publishers, New Delhi
2. 'Design of Steel Structures' by P. Dayaratnam; S. Chand Publishers
3. 'Design of Steel Structures' by M. Raghupathi, Tata Mc. Graw-Hill
4. 'Structural Design and Drawing' by N. Krishna Raju; University Press,

III Year II Semester	HIGHWAY ENGINEERING	L	T	P	C
		3	0	0	3

Course Learning Objectives:

The objectives of this course are:

- To impart different concepts in the field of Highway Engineering.
- To acquire design principles of Highway Geometrics and Pavements
- To acquire design principles of Intersections

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

1. Plan high way network for a given area.
2. Determine High way alignment and design high way geometrics.
3. Design Intersections and prepare traffic management plans.
4. Judge suitability of pavement materials and design flexible and rigid pavements

UNITI

Highway Planning and Alignment: Highway development in India; Classification of Roads; Road Network Patterns; Necessity for Highway Planning; Different Road Development Plans– First, second, third road development plans, road development vision 2021,Rural Road Development Plan – Vision 2025; Planning Surveys; Highway Alignment-Factors affecting Alignment-Engineering Surveys – Drawings and Reports.

UNIT – II Highway Geometric Design: Importance of Geometric Design- Design controls and Criteria- Highway Cross Section Elements- Sight Distance Elements-Stopping Sight Distance, Overtaking Sight Distance and Intermediate Sight Distance- Design of Horizontal Alignment-Design of Super elevation and Extra widening- Design of Transition Curves-Design of Vertical Alignment- Gradients- Vertical curves.

UNIT – III Traffic Engineering: Basic Parameters of Traffic-Volume, Speed and Density-Traffic Volume Studies; Speed studies –spot speed and speed & delay studies; Parking Studies; Road Accidents-Causes and Preventive measures - Condition Diagram and Collision Diagrams; PCU Factors, Capacity of Highways – Factors Affecting; LOS Concepts; Road Traffic Signs; Road markings; Types of Intersections; At-Grade Intersections – Design of Plain, Flared, Rotary and Channelized Intersections; Design of Traffic Signals –Webster Method –IRC Method.

UNIT –IV

Highway Materials: Sub grade soil: classification –Group Index–Subgrade soil strength – California Bearing Ratio–Modulus of Subgrade Reaction. Stone aggregates: Desirable properties– Tests for Road Aggregates–Bituminous Materials: Types–Desirable properties—Testson Bitumen -Bituminous paving mixes: Requirements – Marshall Method of Mix Design

UNIT–V

Design of Pavements: Types of pavements; Functions and requirements of different components of pavements; Design Factors

Flexible Pavements*:* Design factors–Flexible Pavement Design Methods–CBR method–IRC method–Burmister method–Mechanistic method–IRC Method for Low volume Flexible pavements.

Rigid Pavements: Design Considerations – wheel load stresses – Temperature stresses – Frictional stresses–Combination of stresses–Design of slabs–Design of Joints–IRC method–Rigidpavements for low volume roads – Continuously Reinforced Cement Concrete Pavements – Roller Compacted Concrete Pavements.

TEXTBOOKS:

Highway Engineering, Khanna S.K., Justo C.E.G and Veeraragavan A,Nem Chand Bros., Roorkee. Traffic Engineering and Transportation Planning, KadiyaliL. R,Khanna Publishers, New Delhi.

REFERENCES:

Principles of Highway Engineering, KadiyaliL .R,Khanna Publishers, NewDelhi

Principles of Transportation Engineering, Partha Chakraborty and Animesh Das,PHI Learning Private Limited, Delhi

III Year II Semester	ENVIRONMENTAL ENGINEERING	L	T	P	C
		3	0	0	3

Course Learning Objectives:

The course will address the following:

1. Outline planning and the design of water supply systems for a community/town/city
2. Provide knowledge of water quality requirement for domestic usage and knowledge on design of water distribution network
3. Selection of valves and fixture in water distribution systems
4. Outline the planning and design of Sewerage System for a community/town/city
5. To impart knowledge on waste water treatment and disposal

Course Outcomes:

Upon the successful completion of this course, the students will be able to:

a. Plan and design the water and distribution networks and sewerage systems
b. Able to identify the appropriate source of water based on quality and quality requirements
c. Select a suitable treatment for raw water treatment as well as sewage treatment
d. Decide the manner of disposal of wastewater

SYLLABUS:

UNIT–I

Introduction: Importance and Necessity of Protected Water Supply systems. Water borne diseases. Planning of public water supply systems. Per capita demand and factors influencing it, types of water demands and its variations, factors affecting water demand, Design Period, Factors affecting the Design period, estimation of water demand for a town or city, Population Forecasting.

Sources of Water: Various surface and subsurface sources considered for water supply and their comparison- Capacity of storage reservoirs, Conveyance of Water from the source to the point of interest: Gravity and Pressure conduits, Types of Pipes and Pipe joints.

UNIT-II

Quality and Analysis of Water: Physical, Chemical and Biological characteristics of water. Water quality criteria for different uses- Rural, Municipal, Industrial and Agricultural uses. Drinking water quality standards: IS and WHO guidelines.

Distribution of Water: Requirements- Methods of Distribution system, Layouts of Distribution networks, Pressures in the distribution layouts, Analysis of Distribution networks: Hardy Cross and equivalent pipe methods – Appurtenances of water distribution system– Laying and testing of pipe lines.

UNIT-III

Treatment of Water: Typical treatment flow of a municipal water treatment plant, Unit operations of water treatment: Theory and Design of Sedimentation, Coagulation,

flocculation, Filtration, Water conditioning and softening, Disinfection, Removal of color and odors – Removal of Iron and manganese – Fluoridation and De-fluoridation –Ion Exchange - Ultra filtration- Reverse Osmosis.

UNIT-IV

Planning and Design of Sewerage System

Characteristics and composition of sewage — population equivalent -Sanitary sewage flow estimation — Sewer materials — Hydraulics of flow in sanitary sewers — Sewer design — Storm drainage-Storm runoff estimation — sewer appurtenances — corrosion in sewers — prevention and control — sewage pumping-drainage in buildings-plumbing systems for drainage Primary Treatment of Sewage

Objectives — Unit Operations and Processes — Selection of treatment processes — Onsite sanitation — Septic tank- Grey water harvesting — Primary treatment — Principles, functions and design of sewage treatment units — screens — grit chamber-primary sedimentation tanks — Construction, Operation and Maintenance aspects.

UNIT–V

Secondary Treatment of Sewage

Objectives — Selection of Treatment Methods — Principles, Functions, — Activated Sludge Process and Extended aeration systems -Trickling filters– Sequencing Batch Reactor (SBR) — Membrane Bioreactor — UASB — Waste Stabilization Ponds — Other treatment methods -Reclamation and Reuse of sewage — Recent Advances in Sewage Treatment — Construction, Operation and Maintenance aspects.

Disposal of Sewage

Standards for– Disposal — Methods — dilution — Mass balance principle — Self purification of river - Oxygen sag curve — de-oxygenation and re-aeration — Streeter–Phelps model — Land disposal — Sewage farming — sodium hazards — Soil dispersion system.

TEXT BOOKS

1. Environmental Engineering – Howard S. Peavy, Donald R. Rowe, Teorge George Tchobanoglus – McGraw-Hill Book Company, New Delhi, 1985.
2. Water Supply Engineering. Dr. P.N. Modi, Standard Book House, Delhi.

REFERENCES

1. Elements of Environmental Engineering – K.N. Duggal, S. Chand & Company Ltd., New Delhi.
2. Water Supply Engineering.– Dr. B.C. Punmia, A.K. Jain and A.K. Jain. Laxmi Publications (P) Ltd., New Delhi.
3. Water Supply and Sanitary Engineering – G.S. Birdie and J.S. Birdie

III Year II Semester	GROUND IMPROVEMENT TECHNIQUES	L	T	P	C
		3	0	0	3

Course Learning Objectives:

The objective of this course is:

1. To make the student appreciate the need for different ground improvement methods adoptedforimprovingthepropertiesofremoldedandin-situsoilsbyadoptingdifferent techniques such as in situ densification and dewatering methods.
2. To make the student understand how the reinforced earth technology and soil nailing can obviate the problems posed by the conventional retaining walls.
3. To enable the students to know how geotextiles and geo synthetics can be used to improve the engineering performance of soils.
4. To make the student learn the concepts, purpose and effects of grouting.

Course Outcomes:

a. By the end of the course, the student should be able to possess the knowledge of various methods of ground improvement and their suitability to different field situations.
b. The student should be in a position to design are in forced earth embank ment and check its stability.
c. The student should know the various functions of Geosynthetics and their applications in Civil Engineering practice.
d. The student should be able to understand the concepts and applications of grouting.

UNIT-I

In situ densification methods- in situ densification of granular soils- vibration at ground surface and at depth, impact at ground and at depth – insitudensification of cohesive soils – pre loading – vertical drains – sand drains and geo drains – stone columns.

UNIT-II

Dewatering–sumps and interceptor ditches –single and multi-stage well points–vacuum well points, horizontal wells – criteria for choice of filler material around drains – electro osmosis

UNIT- III

Stabilization of soils – methods of soil stabilization – mechanical – cement – lime – bitumen and polymer stabilization–use of industrial wastes like fly a shand granulated blast furnace slag.

Grouting – objectives of grouting – grouts and their applications – methods of grouting – stage of grouting–hydraulic fracturing in soils and rocks –post grouttests. Introduction to Liquefaction & its effects & applications.

UNIT-IV

Reinforce earth–principles–components of reinforced earth–design principles of reinforced earth walls – stability checks – soil nailing.

UNIT-V

Geosynthetics–geotextiles–types–functions, properties and applications – geogrids, geomembranes and gabions - properties and applications.

TEXT BOOKS:

1. 'Ground Improvement Techniques' by Purus Hotham Raj, Laxmi Publications, New Delhi.
2. 'Ground Improvement Techniques' by Nihar Ranjan Patro,Vikas Publishing House(p) limited ,New Delhi.
3. 'An introduction to Soil Reinforcement and Geosynthetics' by G.L.Siva Kumar Babu, Universities Press.

REFERENC EBOOKS:

1. 'Ground Improvement 'by MP Moseley, Blackie Academic and Professional, USA.
2. 'Designing with Geosynethetics 'by RM Koerner, Prentice Hall

III Year II Semester	REPAIR AND REHABILITATION OF STRUCTURES	L	T	P	C
		3	0	0	3

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

a) Recognize the mechanisms of degradation of concrete structures and to design durable Concrete structures.
b) Conduct field monitoring and non-destructive evaluation of concrete structures.
c) Design and suggest repair strategies for deteriorated concrete structures including
d) Repairing with composites
e) Understand the methods of strengthening methods for concrete structures
f) Assessment of the service ability and residual life span of concrete structures by Visual inspection and in situ tests

UNIT:I

Materials for repair and rehabilitation-Admixtures-types of admixtures-purposes of using admixtures-chemical composition-Natural admixtures-Fibers-wraps-Glass and Carbon fiber wraps-Steel Plates-Nondestructive evaluation :Importance-Concrete behavior under corrosion, disintegrated mechanisms- moisture effects and thermal effects –Visual investigation-Acoustical emission methods-Corrosion activity measurement- chloride content–Depth of carbonation-Impact echo methods-Ultra sound pulse velocity methods- pull out tests.

UNIT:II

Strengthening and stabilization-Techniques-design considerations-Beam shear capacity strengthening- Shear Transfer strengthening-stress reduction techniques- Column strengthening-flexural strengthening-Connection stabilization and strengthening, Crack stabilization.

UNIT:III

Bonded installation techniques-Externally bonded FRP-Wetlay upsheet, bolted plate, near surface mounted FRP, fundamental debonding mechanisms-intermediate crack debonding-CDC debonding-plate end de bonding-strengthening of floor of structures post grout tests. Introduction to Liquefaction & its effects & applications.

UNIT:IV

Fiber reinforced concrete-Properties of constituent materials-Mix proportions, mixing and casting methods-Mechanical properties of fiber reinforced concrete-applications of fiber reinforced concretes-Light weight concrete-properties of light weight concrete-No fines concrete-design of light weight concrete-Fly ash concrete-Introduction-classification of fly ash-properties and reaction mechanism of fly ash-Properties of fly ash concrete in fresh state and hardened state-Durability of fly ash concretes

UNIT:IV

High performance concretes-Introduction-Development of high performance concretes-Materials of high performance concretes-Properties of high performance concretes-Self Consolidating concrete-properties-qualifications.

TEXT BOOKS

1. Maintenance Repair Rehabilitation & Minor works of Buildings -P.C.Varghese, PHI Publications
2. Repair and Rehabilitation of Concrete Structures–P.I.Modi,C.N.Patel,PHI Publications
3. Rehabilitation of Concrete Structures-B.Vidivelli,Standard Publishers Distributors
4. Concrete Bridge Practice Construction Maintenance & Rehabilitation-V.K.Raina, Shroff Publishers and Distributors.

REFERENCE:

1. Concrete Technology Theory and Practice-M.S.Shetty,SChandand Company
2. Concrete Repair and Maintenance illustrated-PeterHEmmons
3. Concrete Chemical Theory and Applications-Santa Kumar A.R.,Indian Society for Construction Engineering and Technology, Madras
4. Hand book on Repair and Rehabilitation of RC Buildings published by CPWD, Delhi

III Year II Semester	VALUATION AND QUANTITY SURVEY	L	T	P	C
		3	0	0	3

Outcomes

a) Define basic terms related to estimation, quantity surveying and contract document
b) Interpret the item of work from drawings and explain its general specification and unit of measurement
c) Make use of given data from CPWDDAR/DSR for calculating the unit rate of different items of work associated with building Construction
d) Develop detailed measurement (including BBS) and BoQofa various work like buildings, earth work for road, sanitary and water supply work
e) Explain various basic terms related to valuation of land and Building
f) Develop valuation of buildings using different methods of valuation.

UNIT I

Introduction- Quantity Surveying- Basic principles, Role/responsibility of Quantity surveyor at various stages of construction. Estimate-Details required, Type of estimate, purposes. Contingencies, Work-charge establishment, Tools and Plant, centage charge, Day work, Prime cost, Provisional sum & provisional Quantity, Overhead charges, Cost index, Contract documents (Brief description only)Bill of Quantity-Typical format-use Item of works-Identifyvariousitemofworkfromthedrawings-unitsofmeasurementofvarious materials and works (focus may give to RCC residential building) General rule & method of measurement with reference to Indian Standard Specifications- IS1200.

UNIT II

Introduction to the use of CPWD schedule of rates as per latest DSR and Analysis of rate as per latest DAR. Specifications-Generalspecificationofallitemsofaresidentialbuilding.Detailed specification (CPWD specifications) of major item of work like Earth work excavation in foundation, masonry, Reinforced cement concrete, finishing of building work Analysis of rates for Earth work in excavation for foundation, mortars, reinforced cement concrete Works, finishing work, masonry work, stone works, flooring with reference to latest DSR and latest DAR (Data should be given).

UNIT III

Detailed Estimate- Preparation of detailed measurement using Centre line method & Short wall long wall (separate wall) method for RCC single storied building (Flat roof) including stair cabin- Residential/office/school building. BOQ preparation of a single storied RCC building work. Material quantity calculation of the items of work (Rubble, Brick work, Concrete work, Plastering) in detailed estimate prepared for building work. (Data for unit quantity should be provided from DAR)

UNIT IV.

Bar Bending Schedule- Preparation of BBS of RCC beams, slabs, Column footings, Retaining wall. Roadestimation-Estimationofearthworkfromlongitudinalsection-metaledroad.Estimation of sanitary and water supply work -Water tank, Septic tank, Manhole *(No Detailed estimate needed-concept of item of work, its general specification and unit of measurement*).(Valuation – purpose, factor affecting, introduction to terms-Value, Cost, Price, kinds of values Income- Gross income, net income, outgoings, annuity, sinking fund, Year's purchase, Depreciation, obsolescence -Free hold and leasehold properties.)

UNIT V

Methods of calculating depreciation – straight line method – constant percentage method, sinking fund method and quantity survey method.

Methods of valuation–rental method, direct comparison of capital cost, valuation based on profit, depreciation method. Various method of valuation of land (Brief description only)

Text Books:

1. B.N.Dutta, Estimation and costing in civil engineering, UBS publishers
2. Rangwala, Estimation Costing and Valuation, Charotar publishing house pvt.ltd
3. Dr. S. Seetha Raman, M.Chinna swami, Estimation and quantity surveying, Anuradha publications Chennai.
4. M Chakraborthy, Estimating, Costing, Specification and valuation, published by the author, 21 B, Babanda Road, Calcutta 26

References:

1. BS Patil, Civil Engineering contracts and estimates, university press
2. VNVazirani & SPChandola, Civil Engineering Estimation and Costing, Khanna Publishers
3. IS1200-1968; Methods of measurement of building & civil engineering works
4. CPWDDAR2018andDSR2018orlatest
5. CPWDSpecificationsVol1&2(2019orlatestedition)

III Year II Semester	FINITE ELEMENT METHOD	L	T	P	C
		3	0	0	3

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

a) Develop finite element formulations of 1degree of freedom problems and solve Them
b) Understand any Finite Elements of ware to perform stress, thermal and modal Analysis
c) Compute the stiffness matrices of different elements and system
d) Interpret displacements, strains and stress resultants
e) Analyze planar structural systems using finite element modeling

UNIT I

Introduction: Review of stiffness method-Principle of Stationary potential energy-Potential energy of anelastic body-Rayleigh-Ritz method of functional approximation-variational approaches- weighted residual methods

UNIT II

Finite Element formulation of truss element: Stiffness matrix-properties of stiffness matrix –Selection of approximate displacement functions-solution of a planetruss-transformation matrix and stiffness matrix for a 3-D truss- Inclined and skewed supports-Galerkin's methodfor1-Dtruss– Computation of stress in a truss element.

UNIT III

Finite element formulation of Beam elements: Beam stiffness-assemble age of beam stiffen matrix- Examples of beam analysis for concentrated and distributed loading-Galerkin's method – 2 Darbitrarily oriented beam element–inclined and skewed supports–rigid plane frame examples

UNIT IV

Finite element formulation for plane stress, plane strain and axi symmetric problems-Derivation of CST and LST stiffness matrix and equations-treatment of body and surface forces-Finite Element solution for plane stress and axi-symmetric problems-comparison of CST and LST elements– convergence of solution-interpretation of stresses

UNIT V

Iso-parametric Formulation: Iso-parametric bar element- plane bilinear Iso-parametric element – quadratic plane element-shape functions, evaluation of stiffness matrix, consistent modalload vector- Gauss quadrature-appropriate order of quadrature–element and mesh instabilities–spurious zero energy modes, stress computation-patch test.

TEXTBOOKS

1. A first course in the Finite Element Method–Daryl L.Logan, Thomson Publications.
2. Concepts and applications of Finite Element Analysis–Robert D.Cook, Michael EPlesha, JohnWiley & Sons Publications

REFERENCES:

1. Introduction to Finite Elements in Engineering-Tirupati R.Chandrupatla, Ashok D. Belgunda, PHI publications.
2. Finite Element Methods (For Structural Engineers)Wail N Rifaie, Ashok K Govil, New Age International(P)Limited

III Year II Semester	BRIDGE ENGINEERING	L	T	P	C
		3	0	0	3

Course Learning Objectives:

The objective of this course is to:

1. Familiarize students with different types of Bridges and IRC standards
2. Equip student with the concepts and design of Slab Bridges,T Beam Bridges,Box Culverts
3. Understand concepts of design of Plate Girder Bridges
4. Familiarize with different methods of inspection of bridges and their maintenance

Course Outcomes:

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

a. Explain different types of Bridges with diagrams and Loading standards
b. Carry out analysis and design of Slab bridges, T Beam bridges, Box culvers and suggest structural detailing
c. Carry out analysis and design of Plate girder bridges
d. Organize for attending inspections and maintenance of bridges and prepare reports.

SYLLABUS:

UNIT-I

General Introduction to types of Bridges- (Slab bridges, TBeam, Arch bridges, Cable Stayed bridges, pre stressed concrete bridges, Truss Bridges, Culverts) - Nomenclature- Selection of Bridge Site- Economical span- Abutments pier and end connections- types of foundations- Open, Pile, Well Foundations, Bearings – Types- Introduction to Loading standards- Railway and IRC Loading

UNIT-II

Slab bridges- Wheel load on slab- effective width method- slabs supported on two edges- cantilever slabs-dispersion length-Design of interior panel of slab-Guyon's–Massonet Method–Hendry-Jaegar Methods- Courbon's theory- Pigeaud's method

UNIT-III

T-Beam bridges- Analysis and design of various elements of bridge–Design of deck slab, longitudinal girders, Secondary beams- Reinforcement detailing

UNIT-IV

Plate Girder Bridges: Elements of plate girder and their design-web- flange- intermediate stiffener- vertical stiffeners- bearing stiffener- Splices, Design problem with detailing.

UNIT-V

Box Culverts: Loading–Analysis and Design-Reinforcement detailing.

Inspection and Maintenance of Bridges: Procedures and methods for inspection–Testing of bridges- Maintenance of Sub Structures and Super structures-Maintenance of bearings-Maintenance Schedules.

TEXTBOOK

1. 'Essentials of Bridge Engineering 'by Johnson Victor D
2. 'Design of Bridge Structures' by T.R. Jagadeesh, M.A. Jayaram, PHI
3. 'Design of RC Structures' by B. C.Punmai, Jain & Jain, Lakshmi Publications

REFERENCES:

1. 'Design of Concrete Bridges' by Aswini, Vazirani,Ratwani
2. 'Design of Steel Structures' by B.C.Punmai, Jain & Jain, Lakshmi Publications
3. 'Design of Bridges' by Krishna Raju

III Year II Semester	WATER RESOURCES ENGINEERING	L	T	P	C
		3	0	0	3

Course Learning Objectives:

The course is designed to make the students,

1. Learn the types of irrigation systems.
2. Understand the concepts of planning and design of irrigation systems.
3. Study the relationships among soil, water and plant and their significance in planning an irrigation system.
4. Understand design principles of erodible and non-erodible canals.
5. Know the principles of design of weirs on permeable foundations.
6. Know the concepts for analysis and design of storage head works.
7. Learn design principles of canal structures.

Course Outcomes

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

a. Estimate irrigation water requirements.
b. Design irrigation canals
c. Design irrigation canal structures
d. Plan and design diversion head works
e. Analyze stability of gravity and earth dams.
f. Design hydraulic ogee spillways

SYLLABUS:

UNIT-I

Irrigation: Necessity and importance, principal crops and crop seasons, types, methods of application, soil-water-plant relationship, soil moisture constants, consumptive use, estimation of consumptive use, crop water requirement, duty and delta, factors affecting duty, depth and frequency of irrigation, irrigation efficiencies, water logging and drainage, standards of quality for irrigation water, crop rotation.

UNIT-II

Canals: Classification, design of non-erodible canals - methods of economic section and maximum permissible velocity, economics of canal lining, design of erodible canals - Kennedy's silt theory and Lacey's regime theory, balancing depth of cutting.

UNIT- III

Canal Structures:

Falls: Types and location, design principles of Sarda type fall and straight glacis fall. (Description only)

Regulators: Head and cross regulators, design principles (Description only)

Cross Drainage Works: Types, selection, design principles of aqueduct, siphon aqueduct and super passage. (Description only)
Outlets: Types, proportionality, sensitivity and flexibility
River Training: Objectives and approaches

UNIT-IV
Diversion Head Works: Types of diversion head works, weirs and barrages, layout of diversion head works, components. causes and failures of weirs on permeable foundations, Bligh's creep theory, Khosla's theory, design of impervious floors for subsurface flow, exit gradient.

UNIT-V
Reservoir Planning: Investigations, site selection, zones of storage, yield and storage capacity of reservoir, reservoir sedimentation.
Dams: Types of dams, selection of type of dam, selection of site for a dam.
Gravity dams: Forces acting on a gravity dam, causes of failure of a gravity dam, elementary profile and practical profile of a gravity dam, limiting height of a dam, stability analysis.
Earth Dams: Types, causes of failure, criteria for safe design, seepage, measures for control of seepage-filters.
Spillways: Types, design principles of Ogee spillways, types of spillways crest gates.

TEXTBOOKS:

1. 'Irrigation and Waterpower Engineering' by Punmia B C, P.B.B Lal, A.K. Jain and A.K. Jain (2009), Laxmi Publications Pvt. Ltd., New Delhi
2. 'Irrigation and Water Resources Engineering' by Asawa G L (2013), New Age International Publishers
3. 'Irrigation Engineering' by Raghunath H.M (2012), Wiley India.
4. 'Irrigation Water Resources and Waterpower Engineering' by Modi P N (2011), Standard Book House, New Delhi

REFERENCES:

1. 'Water Resources Engineering' by Mays L.W (2013), Wiley India Pvt. Ltd, New Delhi.
2. 'Irrigation Engineering' by Sharma R.K. and Sharma, T. K (2012), S. Chand & Co Publishers.
3. 'Water Resources Engineering' by Satyanarayana Murthy Challa (2008), New Age International Publishers.

III Year II Semester	DISASTER MANAGEMENT	L	T	P	C
		3	0	0	3

Course Learning Objectives:
The objective of this course is:

1. Develop an understanding of why and how the modern disaster manager is involved with pre- disaster and post-disaster activities.
2. Develop an awareness of the chronological phases of natural disaster response and refugee relief operations. Understand how the phases of each are parallel and how they differ.
3. Understand the 'relief system' and the 'disaster victim.'
4. Describe the three planning strategies useful in mitigation.
5. Identify the regulatory controls used in hazard management.
6. Describe public awareness and economic incentive possibilities.
7. Understand the tools of post-disaster management.

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

a. Affirm the usefulness of integrating management principles in disaster mitigation work
b. Distinguish between the different approaches needed to manage pre- during and post- disaster periods
c. Explain the process of risk management
d. Relate to risk transfer

SYLLABUS:
UNIT-I

Natural Hazards and Disaster Management: Introduction of DM – Inter disciplinary nature of the subject– Disaster Management cycle – Five priorities for action. Case study methods of the following: Vegetal Cover floods, droughts – Earthquakes – landslides – global warming, cyclones & Tsunamis – Post Tsunami hazards along the Indian coast.

UNIT-II
Man Made Disaster and Their Management Along With Case Study Methods Of The Following: Fire hazards – transport hazard dynamics – solid waste management – post disaster – bio terrorism -threat in mega cities, rail and aircraft accidents, ground water, industries - Emerging infectious diseases and Aids and their management.

UNIT-III
Risk and Vulnerability: Building codes and land use planning – Social Vulnerability – Environmental vulnerability – Macro-economic management and sustainable

development, Climate change risk rendition – Financial management of disaster – related losses.

UNIT-IV

Role of Technology in Disaster Managements: Disaster management for infra structures, taxonomy of infra structure – treatment plants and process facilities-electrical substations-roads and bridges- mitigation programme for earth quakes – flowchart, geospatial information in agriculture drought assessment - Multimedia Technology in disaster risk management and training - Transformable Indigenous Knowledge in disaster reduction – Role of RS & GIS.

UNIT-V

Multi-sectional Issues, Education and Community Preparedness: Impact of disaster on poverty and deprivation - Climate change adaptation and human health - Exposure, health hazards and environmental risk-Forest management and disaster risk reduction -The Red cross and red crescent movement - Corporate sector and disaster risk reduction- Education in disaster risk reduction- Essentials of school disaster education - Community capacity and disaster resilience-Community based disaster recovery - Community based disaster management and social capital-Designing resilience- building community capacity for action.

TEXT BOOKS:

1. An Introduction of Disaster Management- Natural Disasters & Vulnerable Hazards– S.Vaidyanathan: CBS Punblishers& Distributors Pvt.Ltd.
2. Natural Hazards & Disaster Management, Vulnerability and Mitigation by RB Singh- Rawat Publications
3. ‘Disaster Science & Management’ by Tushar Bhattacharya, Tata McGraw Hill Education Pvt. Ltd., NewDelhi.
4. ‘Disaster Management – Future Challenges and Opportunities’ by Jagbir Singh (2007), I K International Publishing House Pvt.Ltd.

REFERENCE BOOKS:

1. ‘Disaster Management’ edited by H K Gupta (2003), Universitiespress.
2. ‘Disaster Management – Global Challenges and Local Solutions’ by Rajib shah & R R Krishnamurthy (2009), Universitiespress.R. Nishith, Singh AK,
3. “Disaster Management in India: Perspectives, Issues and strategies” New Royal BookCompany.”

III Year –II Semester	SUSTAINABILITY IN ENGINEERING PRACTICES	L	T	P	C
		3	0	0	3

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

CO1: Explain sustainable development and different environmental agreements and protocols

CO2: Discuss real time activities causing environmental issues and different methods to use renewable energy resources

CO3: Explain local and global environmental issues

CO4: Differentiate between carbon emissions for regular and sustainable cities and explain different practices to move industries towards sustainability

CO5: Discuss different renewable energy resources and explain methods to implement green technology

UNIT-I

Introduction to Sustainable Engineering- Sustainable development, concepts of sustainable development: three pillar model, egg of sustainability model, Atkisson's pyramid model, prism model, principles of sustainable development, sustainable engineering, threats for sustainability.

Environmental Ethics and Legislations – Environmental ethics and education, multilateral environmental agreements and protocols, enforcement of environmental laws in India – The Water Act, The Air Act, The Environment Act.

UNIT-II

Local Environmental Issues- Solid waste, impact of solid waste on natural resources, zero waste concept and three R concept, waste to energy technology: thermo-chemical conversion, biochemical conversion.

Global Environmental Issues- Resource degradation: deterioration of water resources, land degradation, air pollution, climate change and global warming, ozone layer depletion, carbon footprint, carbon trading.

UNIT-III

Tools for Sustainability - Environmental management System (EMS), concept of ISO14000, life cycle assessment (LCA): basic components, advantages, disadvantages, case study. Environmental impact assessment (EIA), environmental auditing, bio mimicking, case studies.

UNIT-IV

Sustainable Habitat - Concept of green building, green building materials, green building certification and rating: green rating for integrated habitat assessment(GRIHA),leader ship in energy and environmental design (LEED) rating, energy efficient buildings, sustainable

cities, sustainable transport, sustainable pavements, case studies in sustainability engineering: Green building, sustainable city, sustainable transport system.

Sustainable Industrialization and Urbanization – Sustainable urbanization, industrialization, material selection, pollution prevention, industrial ecology, industrial symbiosis, poverty reduction.

UNIT-V

Renewable energy resources- Conventional and non- conventional forms of energy, solar energy, fuel cells, wind energy, small hydroplants, biogas systems, biofuels, energy from ocean, geothermal energy, conservation of energy**.**

Green technology and Green Business: Sustainable business, green technology, green energy, green construction, green transportation, green chemistry, green computing

Text Book:

R.L. Ragand Lekshmi Dinachandran Remesh. *Introduction to Sustainable Engineering*. 2nd Edition, PHI Learning Pvt. Ltd., 2016.

References:

1. D.T.AllenandD.R.Shonnard.*SustainabilityEngineering:Concepts,DesignandCaseStudies*, 1st Edition, Prentice Hall, 2011.
2. A.S.Bradley,A.O.Adebayo,P.Maria.*Engineeringapplicationsinsustainabledesignand development*, 1st Edition, Cengage learning, 2016.

III Year –II Semester	WATER SUPPLY SYSTEMS	L	T	P	C
		3	0	0	3

Course Outcomes:

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

CO1: Outline of the various facets of water usage in daily life

CO2: Explain the origin of Natural waters and also to synthesize it for regular use

CO3: Discuss the utilization of non-potable water

CO4: Describe water supply system from a reservoir

CO5: Explain the characteristics of wastewater

UNIT-I

WATER AND LIFE:

Necessity of water – Domestic demand – Public demand – Irrigation – Transportation – Sanitation – Dilution of waste waters – Dust palliative – Recreation – Fire protection.

UNIT-II

SOURCES OF WATER:

Surface sources – Ground sources – Water from atmosphere – Desalination – Recycling of waste water – Recharging of aquifers.

UNIT-III

DUAL SUPPLY OF WATER:

Potable and non-potable water – Protected water – Grey water – Black water – Water bornediseases – water related diseases – Sewage Irrigation.

UNIT-IV

DISTRIBUTION OF WATER:

Based on topography – Gravity distribution – Direct pumping – Combined pumping and gravity flow. Service Reservoirs – Continuous supply – Intermittent supply – Networks of distribution– Emergency water supply as in case of fire accidents – Valves, hydrants and meters.

UNIT-V

INDUSTRIAL WATER:

Location of Industry with reference to surface sources of water – Quality of water required for industrial operations – characteristics of waste water produced – Standards for letting industrial effluents into sources of water.

TEXT BOOKS:

1. K.N. Duggal, "Elements of Environmental Engineering", 7th Edition, S. Chand Publishers, 2010.
2. Hammer and Hammer "Water and wastewater Technology", 4th Edition, Prentice hall of India, 2003.
3. Howard S. Peavy, Donand P. Rowe, George Technobanoglous, "Environmental Engineering", 1st Edition Mc Graw –Hill Publications, Civil Engineering Series, 1985.

REFERENCES:

1. B.C.Punmia, "Water Supply Engineering", Vol. 1, "Waste water Engineering Vol. II", 2nd Edition, Ashok Jain &Arun Jain, Laxmi Publications Pvt.Ltd, New Delhi, 2008.
2. Fair, Geyer and Okun, "Water and Waste Water Engineering", 3rd Edition, Wiley, 2010.
3. Metcalf and Eddy, "Waste Water Engineering", 3rd Edition, Tata Mc Graw Hill, 2008.

III Year – II Semester	ENVIRONMENTAL ENGINEERING LAB	L	T	P	C
		0	0	3	1.5

Learning Objectives:

The course will address the following:

1. Estimation of some important characteristics of water and wastewater in the laboratory
2. It also gives the significance of the characteristics of the water and wastewater

Outcomes:

Upon the successful completion of this course, the students will be able to:

a. Estimate some important characteristics of water and wastewater in the laboratory
b. Draw some conclusion and decide whether the water is suitable for construction or not, drinking or not; ultimate disposal as per effluent standards or not.
c. Decide whether the water body is polluted or not with reference to the state parameters in the list of experiments
d. Estimate and study the strength of the raw and treated effluents in terms of BOD, COD, pH, TDS and chloride of the neutralization tank treating effluents from Chemistry lab or Environmental Engineering Laboratory

SYLLABUS:

List of Experiments

1. Determination of pH and Electrical Conductivity (Salinity) of Water and Soil.
2. Determination and estimation of Total Hardness–Calcium & Magnesium.
3. Determination of Alkalinity/Acidity
4. Determination of Chlorides in water and soil
5. Determination and Estimation of Total Solids, Organic Solids and Inorganic Solids and Settleable Solids by Imhoff Cone.
6. Determination of Iron.
7. Determination of Dissolved Oxygen with D.O. Meter &Wrinklers Method and B.O.D.
8. Determination of N, P, K values in solid waste
9. Physical parameters – Temperature, Colour, Odour, Turbidity, Taste.
10. Determination of C.O.D.
11. Determination of Optimum coagulant dose.
12. Determination of Chlorine demand.
13. Presumptive Coliform test.
14. Visit a Water Treatment Plant and give a technical report.

NOTE: At least 10 of the above experiments are to be conducted.

List of Equipments

1) pH meter

2) Turbidity meter
3) Conductivity meter
4) Hot air oven
5) Muffle furnace
6) Dissolved Oxygen meter
7) U–V visible spectrophotometer
8) COD Reflux Apparatus
9) Jar Test Apparatus
10) BOD incubator
11) Autoclave
12) Laminar flow chamber
13) Hazen's Apparatus

Textbooks

1. Standard Methods for Analysis of Water and Waste Water – APHA
2. Chemical Analysis of Water and Soil by KVSG Murali Krishna, Reem Publications, New Delhi

Reference

1. Relevant IS Codes.

Chemistry for Environmental Engineering by Sawyer and Mc. Carty

III Year – II Semester	HIGHWAY ENGINEERING LAB	L	T	P	C
		0	0	3	1.5

Course Learning Objectives:

The objectives of this course are:

1. To test crushing value, impact resistance, specific gravity and water absorption, attrition value, abrasion value, flakiness index and elongation index for the given road aggregates.
2. To know penetration value, ductility value, softening point, flash and fire point, viscosity and stripping for the given bitumen grade.
3. To test the stability for the given bituminous mix
4. To carry out surveys for traffic volume, speed and parking.

Course outcomes:

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

a. Test aggregates and judge the suitability of materials for the road construction
b. Test the given bitumen samples and judge their suitability for the road construction.
c. Obtain the optimum bitumen content for Bituminous Concrete
d. Determine the traffic volume, speed and parking characteristics.
e. Draw highway cross sections and intersections.

SYLLABUS:

I. ROAD AGGREGATES:

1. Aggregate Crushing value Test
2. Aggregate Impact Test.
3. Specific Gravity and Water Absorption Test
4. Attrition Test
5. Abrasion Test.
6. Shape tests

II. BITUMINOUS MATERIALS:

1. Penetration Test.
2. Ductility Test.
3. Softening Point Test.
4. Flash and fire point tests.
5. Stripping Test
6. Viscosity Test.

III. BITUMINOUS MIX:

1. Marshall Stability test.

IV. TRAFFIC SURVEYS:

1. Traffic volume study at mid blocks.
2. Traffic Volume Studies (Turning Movements) at intersection.
3. Spot speed studies.
4. Parking study.

V. DESIGN & DRAWING

1. Earthwork calculations for road works
2. Drawing of road cross sections
3. Rotary intersection design

LIST OF EQUIPMENT:

1. Apparatus for aggregate crushing test.
2. Aggregate Impact testing machine
3. Pycnometers
4. Los angles Abrasion test machine
5. Deval's Attrition test machine
6. Elongation and thickness gauges
7. Bitumen penetration test setup.
8. Bitumen Ductility test setup.
9. Ring and ball apparatus
10. Viscometer.
11. Marshal Mix design apparatus.
12. Enoscope for spot speed measurement.
13. Stop Watches

TEXTBOOKS:

1. 'Highway Material Testing Manual' by S.K. Khanna, C.E.G Justo and A.Veeraraghavan, Neam Chan Brothers New Chand Publications, New Delhi.

REFERENCE BOOKS:

1. IRC Codes of Practice
2. Asphalt Institute of America Manuals
3. Code of Practice of B.I.S.

III Year –II Semester	CAD LAB	L	T	P	C
		0	1	2	2

Course Objectives: The objectives of the course are to

1. **Learn** the usage of any fundamental software for design
2. **Create** geometries using pre-processor
3. **Analyze** and Interpret the results using post processor
4. **Design** the structural elements

Course Outcomes

After the completion of the course student should be able to

a) Model the geometry of real-world structure Represent the physical model of structural element/structure
b) Perform analysis
c) Interpret from the Post processing results
d) Design the structural elements and a system as per ISCodes

LISTOFEXPERIMENTS

1. Analysis & Design determinate structures using a software
2. Analysis &Design of fixed &continuous beams using a software
3. Analysis & Design of Plane Frames
4. Analysis & Design of space frames subjected to DL & LL
5. Analysis & Design of residential building subjected to all loads (DL, LL,WL,EQL)
6. Analysis & Design of Roof Trusses
7. Design and detailing of built up steel beam
8. Developing a design program for foundation using EXCEL Spread Sheet
9. Detailing of RCC beam and RCC slab
10. Detailing of Steel built up compression member

Note: Drafting of all the exercises is to be carried out using commercially available designing software's.

III Year –II Semester	AUDIT COURSE TECHNICAL PAPER WRITING & IPR	L	T	P	C
		2	0	0	-

Course Objective:

1. The course will explain the basic related to writing the technical reports and understanding the concepts related to formatting and structuring the report. This will help students to comprehend the concept of proofreading, proposals and practice

Unit I: Introduction: An introduction to writing technical reports, technical sentences formation, using transitions to join sentences, Using tenses for technical writing.
Planning and Structuring: Planning the report, identifying reader(s), Voice, Formatting and structuring the report, Sections of a technical report, Minutes of meeting writing.

Unit II: Drafting report and design issues: The use of drafts, Illustrations and graphics.
Final edits: Grammar, spelling, readability and writing in plain English: Writing in plain English, Jargon and final layout issues, Spelling, punctuation and Grammar, Padding, Paragraphs, Ambiguity.

Unit III: Proofreading and summaries: Proofreading, summaries, Activities on summaries.
Presenting final reports: Printed presentation, Verbal presentation skills, Introduction to proposals and practice.

Unit IV: Using word processor: Adding a Table of Contents, Updating the Table of Contents, Deleting the Table of Contents, Adding an Index, Creating an Outline, Adding Comments, Tracking Changes, Viewing Changes, Additions, and Comments, Accepting and Rejecting Changes, Working with Footnotes and Endnotes, Inserting citations and Bibliography, Comparing Documents, Combining Documents, Mark documents final and make them read only., Password protect Microsoft Word documents., Using Macros,

Unit V: **Nature of Intellectual Property:** Patents, Designs, Trade and Copyright. Process of **Patenting and Development:** technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property

Text Books:

1. Kompal Bansal & Parshit Bansal, "Fundamentals of IPR for Beginner's", 1st Ed., BS Publications, 2016.
2. William S. Pfeiffer and Kaye A. Adkins, "Technical Communication: A Practical Approach", Pearson.
3. Ramappa,T., "Intellectual Property Rights Under WTO", 2nd Ed., S Chand, 2015.

Reference Books:

1. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.
2. Day R, how to Write and Publish a Scientific Paper, Cambridge University Press(2006)

E-resources:

1. https://www.udemy.com/course/reportwriting/
2. https://www.udemy.com/course/professional-business-english-and-technical-report-writing/
3. https://www.udemy.com/course/betterbusinesswriting/

B.Tech IV Year I Semester

S.No.	Category	Title	L	T	P	C
1	Professional Core	Geotechnical Engineering-2	3	0	0	3
2	Management Course- II	Advance Construction management	2	0	0	2
3	Professional Elective-IV	1. Pre-stressed Concrete 2. Advanced Environmental Engineering 3. Design & drawing of Irrigation Structures	3	0	0	3
4	Professional Elective-V	1. Advanced Structural Engineering 2 Environmental Impact Assessment 3 Railways and Airport Engineering	3	0	0	3
5	Open Elective - III		3	0	0	3
6	Open Elective-IV	Quantum Science and Technology	3	0	0	3
7	Skill Enhancement Course	Skills on Civil Engineering software. (STAAD-Pro/E tabs/CAD/Revit/ BIM)	0	1	2	2
8	Audit Course	Constitution of India	2	0	0	-
9	Internship	Evaluation of Industry Internship	-	-	-	2
Total			**19**	**1**	**02**	**21**

B. Tech. IV Year II Semester

S.No.	Category	Title	L	T	P	Credits
1	PR	Internship and Project	**-**	**-**	**24**	**12**

IV Year I Semester	PROFESSIONAL CORE GEOTECHNICAL ENGINEERING- II	L	T	P	C
		3	0	0	3

Course Learning Objectives:

The objective of this course is:

1. To impart to the student knowledge of types of shallow foundations and theories required for the determination of their bearing capacity.
2. To enable the student to compute immediate and consolidation settlements of shallow foundations.
3. To impart the principles of important field tests such as SPT and Plate bearing test.
4. To enable the student to imbibe the concepts of pile foundations and determine their load carrying capacity.

Course Outcomes:

Upon the successful completion of this course:

CO1: Able to understand Soil exploration methods and field tests.

CO2: Able to understand earth pressure theories.

CO3: Able to understand stability of slopes.

CO4: Able to analyze the shallow foundations.

CO5: Able to analyze the deep foundations.

SYLLABUS:

UNIT – I

Soil Exploration: Need – Methods of soil exploration – Boring and Sampling methods – Plate load test – Standard Penetration and cone penetration. Earth Pressure theories: Rankine's & Coulomb's theory of earth pressure – Culmann's graphical method - earth pressures in layered soils.

UNIT – II

Stability of Slopes: Infinite and finite earth slopes in sand and clay – types of failures – factor of safety of infinite slopes – stability analysis by Swedish arc method, standard method of slices – Bishop's method -- Taylor's Stability Number-Stability of slopes of dams and embankments - different conditions.

Shallow foundations – Terzaghi's and Meyerhoff's bearing capacity theories, effect of water table; Combined footing and raft foundation; Contact pressure; Settlement analysis in sands and clays.

UNIT-III

Shallow Foundations – Bearing Capacity Criteria: Types of foundations and factors to be considered in their location - Bearing capacity – criteria for determination of bearing capacity

– factors influencing bearing capacity – analytical methods to determine bearing capacity – Terzaghi's theory Meyerhof theory- IS Methods – effect of water table.

UNIT-IV

Shallow Foundations – Settlement Criteria: Safe bearing pressure based on N- value – allowable bearing pressure; safe bearing capacity and settlement from plate load test – Types of foundation settlements and their determination - allowable settlements of structures.

Design of Shallow Foundations:

Proportioning of footings for Equal Settlement — Combine footing -- Rectangular, Trapezoidal and Strap footing – Principles of Design of Raft Foundation.

UNIT -V

Pile Foundation: Types of piles – Load carrying capacity of piles based on static pile formulae – Dynamic pile formulae– Pile load test – Pile under lateral loading -- Load carrying capacity of pile groups in sands and clays – Negative Skin Friction.

TEXTBOOKS:

1. 'Principles of Foundation Engineering' by Das, B.M., - (2011) –6th edition (Indian edition) Cengage learning
2. 'Basic and Applied Soil Mechanics' by Gopal Ranjan& ASR Rao, New Age International Pvt. Ltd, (2004).
3. Soil mechanics & foundation engineering by Arora

REFERENCES:

1. Foundation Analysis and Design' by Bowles, J.E., (1988) – 4th Edition, McGraw-Hill Publishing Company, Newyork.
2. 'Theory and Practice of Foundation Design' by N.N.SOM & S.C.DAS PHI Learning Private limited.

IV Year I Semester	MANAGEMENT COURSE-II ADVANCED CONSTRUCTION MANAGEMENT	L	T	P	C
		2	0	0	2

Course Learning Objectives:

- To Impart to the Student, Knowledge of Core Quality Management and Quality assurance and Quality Control differentiation and know when and how to apply each effectively.
- To impart to the Student knowledge of Application of different Cost estimation techniques, understanding of key Components of Project budget, implementation of cost control techniques
- To Impart to the Student knowledge about Key functions of materials management, inventory management, Selection & Suppliers, Material requirement planning
- To import to the Student knowledge about fundamental Concepts of Building Information modelling, understanding the integration of BIM with other project documentation Etc.,
- To Impart to the Student knowledge about Core principals & Sustainable Construction and green building, including energy efficiency, Water Conservation and waste seduction, Sustainable techniques and practices, knowledge about GRIHA rating, IGEC rating, LEED rating etc,

Course Outcomes:

1. Able to apply Quality assurance principles, implement Safety protocols, perform Risk Assessment, manage documentation etc
2. Able to develop accurate cost estimates, Analyse Project costs, Analyse project costs, Implement Cost Control methods, Utilize Predictive Models.
3. Able to utilize BIM for data integration, improve Collaboration, perform clash detection, Apply BIM for Sustainability analysis.
4. Able to Incorporate Green Building Principles, Reduce Environmental Impacts, Implement green building Strategies, address Sustainability Challenges

SYLLABUS:

UNIT-I

Quality and Safety Management, Quality assurance and Control Principles and managing On-Site safety procedure to minimize risks

UNIT-II

Cost Estimation and Control methods for calculating project cost, managing budgets, and performing economic analysis such as benefit cost analysis

UNIT-III

Material and machinery management optimizing the procurement, use and maintenance of construction materials and heavy equipment.

UNIT-IV

Building Information Modeling (BIM)- The use of 3D Modeling and other technologies to improve Project Management, Collaboration and efficiency

UNIT-V

Sustainable Construction and Green Buildings techniques and Practices for reducing a project's Environmental impacts, including Green Building certification and waste management strateg

Text Books:-

1. Construction Safety Management, 1st Edition by Neeraj and Amarjit
2. Construction Quality management: Principles and practice by Tim Howrath
3. Estimating and Costing in Civil Engineering by B.N.Dutta
4. Construction Management and Machinery by B.Gupta
5. BIM for Dummies by Stefen Mordue, Paul Swaddle and David Philip
6. GRIHA Manual

References:

1. Safety management in Construction (Principles and Practices) by Sk. Bhattacharjee
2. Construction Quality Management Principles and Practice by Tim Howrath
3. Cost management of Construction Projects by Donald Towey
4. BIM and Construction Management: Proven tools, methods and work flocas by Brad Hurdin and Daure Mccod
5. Sustainable Construction: Green building design and delivery by Charles J. Kibert

IV Year I Semester	PROFESSIONAL ELECTIVE IV PRESTRESSED CONCRETE	L	T	P	C
		3	0	0	3

Course Learning Objectives

- To understand the flexure, shear and Torsional stresses in prestressed concrete Members
- To Understand important concepts in designing continuous beams
- To Understand role of end block and different types and their design procedures
- To Apply the concepts to statically indeterminate structure.
- To Apply the concepts to design composite construction

Course Outcomes

1. Design of sections for flexure, Axial Tension, Compression and bending, shear, bond
2. Analysis and design of continuous beams and procedure for calculation of deflections
3. Analysis and design of end blocks adopting different methods of anchoring procedure for calculation of stresses
4. Understand and Design of Continuous Prestressed Concrete Beams and Portal Frames
5. Understand and concept of composite and continuous construction using pre stressed concrete

Unit I

Flexural, shear; Torsional resistance and design of Prestressed concrete section. Types of flexural failure– code procedures- shear and principal stresses– Prestressed concrete members in torsion– Design of sections for flexure, Axial Tension, Compression and bending, shear, Bond

Unit II

Analysis of continuous beams –Elastic theory- Linear transformation and Concordant tendons-Deflections of pre-stressed concrete beams: Importance of control of deflections-factors influencing deflections -short term deflections of un-cracked member–prediction of long term deflections.

Unit III

Analysis of end blocks: By Guyon's method and Magnel's method, Anchorage zone stresses-Approximate method of design-anchorage zone reinforcement-transfer of prestresses-pretensioned members-Composite sections: Introduction Analysis for stresses- differential shrinkage- general design considerations.

Unit IV

Statically Indeterminate Structures: Advantages of Continuous Members—Effect of Prestressing Indeterminate Structures--Methods of Achieving Continuity--Definitions of Common Terms--Methods of Analysis of Secondary Moments---Concordant Cable Profile- Guyon's Theorem-- Effect of Axial Deformation and Tertiary Moments---Ultimate Load Analysis of Continuous Prestressed Members ---Determination of Concordant Tendon Profile-- Design of Continuous Prestressed Concrete Beams---Design of Prestressed Portal Frames.

Unit V

Composite Construction of Prestressed and in situ Concrete: Composite Structural Members Types of Composite Construction --Analysis of Stresses--Differential Shrinkage ---Deflection of Composite Members -- Stresses at Serviceability Limit State---Flexural Strength of Composite Sections -- Shear Strength of Composite Sections -- Design of Composite Sections.

Text books

1. Prestressed Concrete, 4 e by N. Krishna Raju, McGraw Hill Pu
2. Prestressed Concrete by N. Rajagopalan, Narosa Publishing
3. Prestressed Concrete by S. Ramamrutham, Dhanpatrai Publishing Company References
1. Prestressed Concrete Analysis and Design, Antone E.Naaman2e,TechnoPress3000
2. Design of Prestressed Concrete-T.Y.Lin, Ned H. Burns 3e,Wiley Publications

IV Year I Semester	PROFESSIONAL ELECTIVE- IV ADVANCED ENVIRONMENTAL ENGINEERING	L	T	P	C
		3	0	0	3

Course Objectives:

- To explain the importance of self-purification of streams and to derive Streeter- Phelps equation and to discuss the effects of various pollutants on receiving streams.
- To introduce new concepts in biological treatment like nitrogen and phosphorous removal, anaerobic filters, RBC and U-tube aeration systems, their working principles and suitability.
- To understand the characteristics and the treatment and disposal methods of liquid wastes produced in Dairy industry, Sugar industry and Pulp & paper industry.
- To introduce various functional elements of urban solid waste management and to introduce various methods of solid waste treatment methods with special emphasis on recovery and reuse of solid waste.
- To introduce sources, global effects and the effects on human health, plants and materials of air pollution.
- To discuss about the effects of various meteorological parameters on air pollution and to explain various equipment for controlling particulate pollution and their suitability.
- To introduce sources, effects and controlling measures of noise pollution and to discuss noise rating systems and acceptable noise levels for various places.

Course Outcomes:

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

1. Understand the importance of self-purification and the effects of various pollutants on receiving streams.
2. Determine the critical D.O. deficit and the degree of treatment required for wastewater at the treatment plant to maintain a minimum D.O. at any point in the stream.
3. Update his knowledge in biological treatment with new and more advanced treatment methods.
4. Understand the characteristics and suggest suitable methods of treatment and disposal of industrial wastewater.
5. Suggest suitable methods for collection, transport, recovery, reuse and treatment of urban solid waste.
6. Understand global implications of air pollution and suggest suitable methods of control of particulate pollution depending on concentration and size of the particulate matter.
7. Acquire knowledge on noise pollution and suggest suitable noise control techniques according to the situation.

UNIT – I

Stream Sanitation Introduction; Self-purification in streams; factors affecting self-purification; Dissolved Oxygen Balance in streams; Streeter-Phelps's Dissolved Oxygen

Model; Zones of Self-purification; Impact of pollutants on stream waters and usage of stream water with special reference to flora and fauna.

Unit- II

New Concepts in Biological Waste Treatment (theory only)

Introduction; Nitrogen removal by biological nitrification and de-nitrification; Phosphate removal from the activated sludge process; Rotating Disc Biological Contactor; Anaerobic filters; U-Tube aeration systems.

UNIT – III

Industrial Wastewater Treatment

Introduction to Industrial Wastewater treatment;

Sugar Plant: Quantity of liquid waste; Characteristics of liquid waste; Methods of its treatment and disposal. Dairy Industry: Quantity of liquid waste; Characteristics of liquid waste; Methods of its treatment and disposal. Pulp and Paper Industry: Quantity of liquid waste; Characteristics of liquid waste; Methods of its treatment and disposal.

UNIT – IV

Urban Solid Waste Management

Sources; Quantities and characteristics; Classification; Collection and transportation; Recovery and reuse; Treatment methods such as compositing, incineration, sanitary landfill and pyrolysis. Sources and Classification of Air Pollution Stationary and mobile sources; Primary and secondary pollutants; Natural contaminants;

Particulate matter; Aerosols; Gaseous pollutants. Meteorology and Air Pollution Atmospheric stability and temperature inversions; Maximum Mixing Depth; Wind direction and speed; Plume behaviour; Gaussian Dispersion Model; Plume rise; Wind rose.

UNIT – V

Effects of Air Pollution

Global Effects: Global warming; Ozone depletion; Acid rains; Effects of air pollutants on human health; Effects on plants; Economical effects.Control of Air Pollution

Objectives; Types of collection equipment: Settling chamber; Inertial separators; Cyclones; Filters; Electrostatic Precipitators; Scrubbers. Noise Pollution

Introduction; Levels of noise; Noise rating systems; Measurement of noise; Sources of noise and their noise levels; Acceptable noise levels; Effects of noise; Control of noise.

TEXT BOOKS

1. Wastewater Treatment by M.N. Rao and A.K. Datta; Oxford & IBH Publishing Co. Pvt. Ltd., 2008.
2. Environmental Pollution Control Engineering by C.S. Rao, New Age International, 2006.

IV Year I Semester	PROFESSIONAL ELECTIVE- IV DESIGN & DRAWING OF IRRIGATION STRUCTURES	L	T	P	C
		3	0	0	3

Course Learning Objectives:

1. The course is designed to make the students learn the hydraulic design principles of irrigation structures.

Course Outcomes:

1. At the end of the course the student will be able to understand, design and draw hydraulic structures of Surplus weir, Tank sluice with a tower head, Canal drop-Notch type, Canal regulator, Syphon aqueduct type III

SYLLABUS:

Unit I:
Design and drawing of Surplus weir
Unit II:
Design and drawing of Tank sluice with a tower head
Unit III:
Design and drawing of Canal drop-Notch type
Unit IV:
Design and drawing of Canal regulator
Unit V:
Design and drawing of Syphon aqueduct type III

Final Examination pattern: Any two question of the above five designs may be asked out of which the candidate has to answer one question. The duration of the examination is three hours.

TEXT BOOKS:

1. Water Resources Engineering – Principles and Practice by C. Satyanarayana Murthy, New age International Publishers.

REFERENCE BOOKS:

1. Irrigation Engineering and Hydraulic Structures by S.K. Garg, Standard Book House.
2. Irrigation and Water Power Engineering by B.C Punmia & Lal, Lakshmi Publications pvt. Ltd., New Delhi.

IV Year I Semester	PROFESSIONAL ELECTIVE- V ADVANCED STRUCTURAL ENGINEERING	L	T	P	C
		3	0	0	3

Course Learning Objectives:

- The objective of this course is to:
- Familiarize students with the analysis and design of Raft Foundations and Retaining walls
- Equip student with the concepts of designing different types of RCC water tanks
- Understand concepts of flat slabs
- Familiarize different types of Bunkers, Silos and Chimneys
- Understand different types of transmission towers

Course Outcomes:

1. At the end of this course, the student will be able to
2. Design raft foundations and different types of RCC retaining walls
3. Carryout analysis and design of different types of RCC water tanks
4. Solve the problems regarding design of RCC Bunkers, Silos and Chimneys
5. Understand the concepts of prefabricated construction.

SYLLABUS:

UNIT – I

Analysis and Design of Raft Foundations – Design of RCC Retaining walls: Cantilever and Counter fort

UNIT – II

Analysis and Design of RCC Water Tanks, Circular and Rectangular types- Intze tank including staging.

UNIT – III

Analysis and Design of Flat Slabs- Direct Design and Equivalent Frame Methods- Check for Punching shear

UNIT – IV

Analysis and Design of RCC Chimney, Concepts of loading

UNIT-V

Analysis and design of Pressed Steel Tanks

TEXT BOOKS:

1. ‘Reinforced Concrete Structures’ Vol-2 by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, Laxmi, publications Pvt. Ltd., New Delhi
2. ‘Reinforced Concrete Structures’ by N. Subramanian, Oxford Publishers
3. ‘Design Drawing of Concrete and Steel Structures’ by N. Krishna Raju University Press 2005.

REFERENCES:

1. 'Essentials of Bridge Engineering' by D. Johnson Victor, Oxford and IBM publication Co., Pvt. Ltd.
2. 'Reinforced concrete design' by S. U, Pillai and D. Menon, Tata Mc.Grawhill Publishing Company
3. Codes: Relevant IS: codes.

IV Year-I Semester	PROFESSIONAL ELECTIVE- V ENVIRONMENTAL IMPACT ASSESSMENT	L	T	P	C
		3	0	0	3

Course Learning Objectives:

The objective of this course is:

- To impart knowledge on different concepts of Environmental Impact Assessment
- To know procedures of risk assessment
- To learn the EIA methodologies and the criterion for selection of EIA methods
- To know pre-requisites for ISO 14001certification
- To know the procedures for environmental clearances and audit
- To appreciate the importance of stakeholder participation in EIA

Course Learning Outcomes

1. Upon successful completion of this course, the students will be able to:
2. Prepare EMP, EIS and EIA report, estimate cost benefit ratio of a project
3. Selection of an appropriate EIA methodology
4. Evaluation of impacts on environment
5. Evaluation of risk assessment
6. Know the latest acts and guidelines of MoEF & CC

UNIT-I:

Basic concepts of EIA: Elements of EIA-factors affecting EIA-Initial Environmental Examination- life cycle analysis preparation of Environmental Base map- Classification of environmental parameters – role of stakeholders in the EIA preparation – stages in EIA, Environmental economics, Cost/benefit Analysis - EIS and EMP. Identification of activities-application of remote sensing and GIS for EIA.

UNIT-II:

EIA Methodologies: Introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods. Impact of Developmental Activities and Land use: Introduction and Methodology for the assessment of soil and ground water, Delineation of study area.

UNIT-III

Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures - E I A with reference to surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, generalized approach for assessment of Air pollution Impact.

UNIT-IV:

Assessment of Impact of development Activities on Vegetation and wildlife,
Environmental Impact of Deforestation. Environmental Risk Assessment and Risk management in EIA: Risk assessment and treatment of uncertainty-key stages in performing an Environmental Risk Assessment- Advantages of Environmental Risk Assessment

UNIT-V

EIA: MoEF&CC Acts, Notifications and Guidelines: Provisions in the EIA notification, procedure for environmental clearance, and procedure for conducting environmental impact assessment report- evaluation of EIA report. Environmental legislation objectives, evaluation of Audit data and preparation of Audit report. Post Audit activities, Concept of ISO and ISO14000. Environmental compliance reports. Case studies and preparation of EIA statement for various Industries.

Text Books:

1. Environmental Impact Assessment, Canter Larry W., McGraw-Hill education Edi (1996)
2. Environmental Impact Assessment Methodologies, Y. Anjaneyulu, B. S. Publication, Sultan Bazar, Hyderabad.

References:

1. Environmental Science and Engineering, J. Glynn and Gary W. Hein Ke Prentice Hall Publishers
2. Environmental Science and Engineering, Suresh K. Dhaneja, S. K. Katania& Sons Publication, New Delhi.
3. Environmental Pollution and Control, H. S. Bhatia, Galgotia Publication (P) Ltd, Delhi

IV Year I Semester	PROFESSIONAL ELECTIVE- V RAILWAY AND AIRPORT ENGINEERING	L	T	P	C
		3	0	0	3

Course Learning Objectives:

The objectives of this course are:

- To know various components and their functions in a railway track
- To acquire design principles of geometrics in a railway track.
- To know various techniques for the effective movement of trains.
- To acquire design principles of airport runway geometrics and pavements.
- To know the planning, construction and maintenance of Docks and Harbours.

Course Outcomes:

At the end of course, Student will be able to

1. Design geometrics in a railway track.
2. Plan track layouts and control movement of trains
3. Design airport geometrics and airfield pavements.
4. Plan, construct and maintain Docks and Harbours.

UNIT- I

Components of Railway Engineering: Permanent way components – Railway Track Gauge - Cross Section of Permanent Way - Functions of various Components like Rails, Sleepers and Ballast –Rail Fastenings – Creep of Rails- Theories related to creep – Adzing of Sleepers- Sleeper density – Rail joints.

UNIT – II

Geometric Design of Railway Track: Alignment – Engineering Surveys - Gradients- Grade Compensation- Cant and Negative Super elevation- Cant Deficiency – Degree of Curve – safe speed on curves – Transition curve – Compound curves – Reverse curves – Extra clearance on curves – widening of gauge on curves – vertical curves – cheek rails on curves.

UNIT – III

Turnouts & Controllers: Track layouts – Switches – Design of Tongue Rails – Crossings – Turnouts – Layout of Turnout – Double Turnout – Diamond crossing – Scissors crossing.
Signal Objectives – Classification – Fixed signals – Stop signals – Signalling systems – Mechanical signalling system – Electrical signalling system – System for Controlling Train Movement – Interlocking – Modern signalling Installations.

UNIT – IV

Airport Planning & Design: Airport Master plan – Airport site selection – Air craft characteristics – Zoning laws – Airport classification – Runway orientation – Wind rose

diagram – Runway length – Taxiway design – Terminal area and Airport layout – Visual aids and Air traffic control.

UNIT – V

Runway Design: Various Design factors – Design methods for Flexible pavements – Design methods for Rigid pavements – LCN system of Pavement Design – Airfield Pavement Failures – Maintenance and Rehabilitation of Airfield pavements – Evaluation & Strengthening of Airfield pavements – Airport Drainage – Design of surface and subsurface drainage.

TEXT BOOKS:

1. Railway Engineering by Satish Chandra and Agarwal M.M., Oxford University Press, New Delhi
2. Airport Engineering by Khanna & Arora - Nemchand Bros, New Delhi.
3. Docks and Harbour Engineering by Bindra S.P. - Dhanpathi Rai & Sons, New Delhi.

REFERENCES:

1. ‘Railway Engineering’ by Saxena & Arora - Dhanpat Rai, New Delhi.
2. ‘Transportation Engineering Planning Design’ by Wright P.H. & Ashfort N.J. - John Wiley & Sons.
3. ‘Airport Engineering’ by Virendra Kumar, Dhanpat Rai Publishers, New Delhi.
4. ‘Transportation Engineering’ by Srinivasa Kumar R, University Press, Hyderabad
5. ‘Highway, Railway, Airport and Harbour Engineering’ by Subramanian KP, Scitech Publications (India) Pvt Limited, Chennai

IV Year – I Semester	QUANTUM SCIENCE AND TECHNOLOGY	L	T	P	C
		3	0	0	3

Prerequisites: Basic Physics, Linear Algebra, and Introduction to Modern Physics

Course Objectives:

1. To introduce fundamental concepts of quantum mechanics and its mathematical formalism.
2. To explore quantum computing and communication principles and technologies.
3. To understand the physical implementation and limitations of quantum systems.
4. To enable students to relate quantum theory to practical applications in computing, cryptography, and sensing.
5. To familiarize students with the emerging trends in quantum technologies.

Course Outcomes:

After completing this course, students will be able to:

CO1. Explain core principles of quantum mechanics and their technological implications.
CO2. Analyze quantum phenomena like superposition and entanglement.
CO3. Apply mathematical tools to model and solve quantum systems.
CO4. Demonstrate understanding of quantum algorithms and quantum circuits.
CO5. Evaluate potential applications and challenges in quantum communication and sensing.

Unit 1: Fundamentals of Quantum Mechanics: Historical background: Blackbody radiation, photoelectric effect, and Compton scattering; Dual nature of light and matter; De Broglie hypothesis; Schrödinger equation; Free particle, infinite potential well, step potential; Operators and observables: position, momentum, Hamiltonian; Commutation relations and uncertainty principle; Quantum postulates and measurement theory; Eigenvalues, eigenfunctions.

Unit 2: Quantum Information Theory: Classical vs. quantum information; Qubit representation using Bloch sphere; Quantum superposition and quantum entanglement; Dirac notation (bra-ket), tensor products, and composite systems; Bell states and EPR paradox; Quantum gates: Pauli-X, Y, Z; Hadamard; Phase; T; CNOT; Quantum circuit models and notation; Measurement in computational basis; Quantum teleportation and no-cloning theorem; Quantum state tomography (introductory)

Unit 3: Quantum Computing: Classical computing review and limitations; Quantum parallelism and interference; Deutsch and Deutsch-Jozsa algorithms; Grover's search algorithm, Oracle and amplitude amplification; Shor's factoring algorithm (overview and significance); Quantum Fourier Transform (QFT); Quantum error correction: Bit-flip, phase-flip, and Shor's 9-qubit code; Introduction to quantum programming: Qiskit, Cirq, IBM

Quantum Experience (overview)

Unit 4: Quantum Communication: Introduction to quantum cryptography; Quantum key distribution (QKD): BB84 protocol; Entanglement-based QKD: Ekert protocol (E91); Eavesdropping and security of QKD; Quantum teleportation (circuit and protocol); Quantum dense coding; Quantum networks and entanglement swapping; Role of quantum repeaters; Single-photon sources and detectors; Implementation challenges (loss, decoherence, noise)

Unit 5: Quantum Technologies and Applications: Quantum sensors: magnetometry, gravimetry; Quantum metrology: standard time, atomic clocks; Quantum imaging and lithography; Quantum materials: topological insulators, graphene, quantum dots; NV centers in diamonds for sensing; Hardware platforms: Superconducting qubits, Trapped ions, Photonic quantum processors; Quantum supremacy and NISQ era; Global initiatives: IBM, Google, D-Wave, IonQ, India's NQM; Ethical concerns and future prospects

Text Books:

1. **"Quantum Computation and Quantum Information"** by Michael A. Nielsen and Isaac L. Chuang
2. **"Quantum Mechanics: Concepts and Applications"** by Nouredine Zettili

Online Learning Resources:

1. https://nptel.ac.in/courses/104104082
2. https://nptel.ac.in/courses/115104096
3. https://nptel.ac.in/courses/122106034

IV Year I Semester	SKILL ENHANCEMENT COURSE SKILLS ON CIVIL ENGINEERIG SOFTWARE	L	T	P	C
		0	1	2	2

1. Introduction to ETABS
2. 3D analysis of multi-storey buildings
3. Analysis of continuous beams
4. Analysis of portal frames
5. Analysis of trusses

IV Year I Semester	AUDIT COURSE CONSTITUTION OF INDIA	L	T	P	C
		2	0	0	-

Course learning Objectives:

- Understand the concept of Indian constitution directive principle of state policy Analyze the History, features Evaluate Preamble Fundamental Rights and Duties
- Understand the structure of Indian government
- Understand the structure of state government role of Governor and Chief Minister Secretariat Differentiate between structure and functions of state secretariat
- Understand the local Administration district administration Mayer and elected representatives of Municipalities Zillapanchayat block level organization
- Know the role of Election Commission role of Chief Election commissioner and Commissionarate state election commission SC/ST/OBC and women

Course Outcomes

1. Understand historical background of the constitution making and its importance for building a democratic India.
2. Understand the functioning of three wings of the government ie., executive, legislative and judiciary.
3. Understand the value of the fundamental rights and duties for becoming good citizen of India.
4. Analyze the decentralization of power between central, state and local self-government.
5. Apply the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.

UNIT-I

Introduction to Indian Constitution: Constitution meaning of the term, Indian Constitution - Sources and constitutional history, Features - Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.

UNIT-II

Union Government and its Administration Structure of the Indian Union: Federalism, Centre-State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, LokSabha, RajyaSabha, The Supreme Court and High Court: Powers and Functions;

UNIT-III

State Government and its Administration Governor - Role and Position - CM and Council of ministers, State Secretariat: Organization, Structure and Functions

UNIT-IV

A.Local Administration - District's Administration Head - Role and Importance, Municipalities - Mayor and role of Elected Representative - CEO of Municipal Corporation PachayatiRaj: Functions PRI: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Block level Organizational Hierarchy - (Different departments), Village level - Role of Elected and Appointed officials - Importance of grass root democracy

UNIT-V

Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission:, Functions of Commissions for the welfare of SC/ST/OBC and women

References:

1. Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi
2. SubashKashyap, Indian Constitution, National Book Trust
3. J.A. Siwach, Dynamics of Indian Government & Politics
4. D.C. Gupta, Indian Government and Politics
5. H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
6. J.C. Johari, Indian Government andPolitics Hans

References

1. J. Raj IndianGovernment and Politics
2. M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi
3. Noorani, A.G., (South Asia Human Rights Documentation Centre), Challenges to Civil Right),
4. Challenges to Civil Rights Guarantees in India, Oxford University Press 2012 resources:
5. nptel.ac.in/courses/109104074/8
6. nptel.ac.in/courses/109104045/
7. nptel.ac.in/courses/101104065/
8. www.hss.iitb.ac.in/en/lecture-details
9. www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

IV Year I Sem	OPEN ELECTIVE III BUILDING METERIALS FOR ENGINEERS	L	T	P	C
		3	0	0	3

Objectives of the Course:

- Initiating the student with the knowledge of basic building materials and their properties.
- Imparting the knowledge of course pattern in masonry construction and flat roofs and techniques of forming foundation, columns, beams, walls, sloped and flat roofs.
- The student is to be exposed to the various patterns of floors, walls, different types of paints and varnishes.
- Imparting the students with the techniques of form work and scaffolding.
- The students should be exposed to classification of aggregates, moisture content of the aggregate.

Course Outcomes:

1. Upon the successful completion of the course:
2. The student should be able to identify different building materials and their importance in building construction.
3. The student is expected to differentiate brick masonry, stone masonry construction and use of lime and cement in various constructions.
4. The student should have learnt the importance of building components and finishings.
5. The student is expected to know the classification of aggregates, sieve analysis and moisture content usually required in building construction.

UNIT I:

Stones, Bricks and Tiles:

Properties of building stones – relation to their structural requirements, classification of stones – stone quarrying – precautions in blasting, dressing of stone, composition of good brick earth, various methods of manufacturing of bricks. Characteristics of good tile - manufacturing methods, types of tiles. Uses of materials like Aluminium, Gypsum, Glass and Bituminous materials

UNIT II

Masonry:

Types of masonry, English and Flemish bonds, Rubble and Ashlar Masonry. Cavity and partition walls. Wood: Structure – Properties- Seasoning of timber- Classification of various types of woods used in buildings- Defects in timber. Alternative materials for wood – Galvanized Iron, Fiber Reinforced Plastics, Steel, Aluminium.

UNIT III:

Lime and Cement: Lime: Various ingredients of lime – Constituents of lime stone – classification of lime – various methods of manufacture of lime.Cement: Portland cement-Chemical Composition – Hydration, setting and fineness of cement. Various types of cement and their properties. Various field and laboratory tests for Cement. Various ingredients of cement concrete and their importance – various tests for concrete.

UNIT IV:

Building Components:

Lintels, arches, vaults, stair cases – types. Different types of floors – Concrete, Mosaic, Terrazzo floors, Pitched, flat roofs. Lean to roof, Coupled Roofs. Trussed roofs – King and Queen post Trusses. R.C.C Roofs, Madras Terrace and Pre fabricated roofs.

UNITV:

Finishings and Aggregates:

Damp Proofing and water proofing materials and uses – Plastering Pointing, white washing and distempering. Paints: Constituents of a paint – Types of paints – Painting of new/old wood-Varnish. Form Works andScaffoldings. Aggregates - Classification of aggregate – Coarse and fine aggregates- particle shape and texture – Bond and Strength of aggregate – Specific gravity – Bulk Density, porosity and absorption – Moisture content of Aggregate-Bulking of sand – Sieve analysis.

Text Books:

1. Building Materials, S. S. Bhavikatti, Vices publications House private ltd.
2. Building Construction, S. S. Bhavikatti, Vices publications House private ltd.
3. Building Materials, B. C. Punmia, Laxmi Publications private ltd.
4. Building Construction, B.C. Punmia, Laxmi Publications(p)ltd.

References:

1. Building Materials, S. K. Duggal, New Age International Publications.
2. Building Materials, P. C. Verghese, PHI learning(P)ltd.
3. Building Materials, M. L. Gambhir, Tata McGraw Hill Publishing Co. Ltd. NewDelhi.
4. Building construction, P. C. Verghese, PHI Learning(P)Ltd.
5. Building Materials, Construction and Planning, S.Mahaboob Basha, Anuradha Publications, Chennai.

IV Year I sem	OPEN ELECTIVE III ENVIRONMENTAL IMPACT ASSESSMENT	L	T	P	C
		3	0	0	3

Course Learning Objectives:

The objective of this course:

- To impart knowledge on different concepts of Environmental Impact Assessment
- To know procedures of risk assessment
- To learn the EIA methodologies and the criterion for selection of EIA methods
- To know pre-requisites for ISO14001certification
- To know the procedures for environmental clearances and audit
- To appreciate the importance of stakeholder participation in EIA

Course Learning Outcomes

1. Upon successful completion of this course, the students will be able to:
2. Prepare EMP, EIS and EIA report, estimate cost benefit ratio of a project
3. Selection of an appropriate EIA methodology
4. Evaluation of impacts on environment
5. Evaluation of risk assessment
6. Know the latest acts and guidelines of MoEF & CC

SYLLABUS:

UNIT-I:

Basic concepts of EIA: Elements of EIA-factors affecting EIA-Initial environmental Examination- life cycle analysis preparation of Environmental Base map- Classification of environmental parameters – role of stakeholders in the EIA preparation – stages in EIA, Environmental economics, Cost/benefit Analysis - EIS and EMP. Identification of activities-application of remote sensing and GIS for EIA.

UNIT-II:

EIA Methodologies: Introduction, Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods. Impact of Developmental Activities and Land use: Introduction and Methodology for the assessment of soil and ground water, Delineation of study area.

UNIT-III

Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures - E I A with reference to surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, Generalized approach for assessment of Air pollution Impact.

UNIT-IV:

Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation. Environmental Risk Assessment and Risk management in EIA: Risk assessment and treatment of uncertainty-key stages in performing an Environmental Risk Assessment- Advantages of Environmental Risk Assessment

UNIT-V

EIA: MoEF&CC Acts, Notifications and Guidelines: Provisions in the EIA notification, procedure for environmental clearance, procedure for conducting environmental impact assessment report- evaluation of EIA report. Environmental legislation objectives, evaluation of Audit data and preparation of Audit report. Post Audit activities, Concept of ISO and ISO14000. Environmental compliance reports. Case studies and preparation of EIA statement for various Industries.

Text Books:

Environmental Impact Assessment, Canter Larry W., McGraw-Hill education Edi (1996)
Environmental Impact Assessment Methodologies, Y. Anjaneyulu, B. S. Publication, Sultan Bazar, Hyderabad.

References:

1. Environmental Science and Engineering, J. Glynn and Gary W. Hein Ke – Prentice Hall Publishers
2. Environmental Science and Engineering, Suresh K. Dhaneja, S. K. Katania& Sons Publication., NewDelhi.
3. Environmental Pollution and Control, H. S. Bhatia, Galgotia Publication (P) Ltd,Delhi.

IV Year I sem	OPEN ELECTIVE III INTELLIGENT TRANSPORTATION SYSTEMS	L	T	P	C
		3	0	0	3

Course Learning Objectives:

- To know the fundamentals of ITS
- To study sensor technologies and Data requirements of ITS
- To know ITS functional areas and user services
- To study various kinds of ITS architecture
- To study ITS applications in various fields of transportation engineering

Course Outcomes:

1. Identify the benefits of ITS from various types
2. Determine various sensor applications and ITS data collection techniques
3. Identify ITS user services and functional areas
4. Determine various ITS models, evaluation methods and ITS planning.
5. Determine the suitable ITS technology and assess its effectiveness to solve transportation problems

SYLLABUS

UNIT-I

Fundamentals of ITS: Definition of ITS s, the historical context of ITS from both public policy and market economic perspectives, Types of ITS; Historical Background, Benefits of ITS.

UNIT-II

Sensor technologies and Data requirements of ITS: Importance of telecommunications in the ITS system, Information Management, Traffic Management Centers (TMC). Application of sensors to Traffic management; Traffic flow sensor technologies; Transponders and Communication systems; Data fusion at traffic management centers; Sensor plan and specification requirements; Elements of Vehicle Location and Route Navigation and Guidance concepts; ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), GIS, video data collection.

UNIT-III

ITS functional areas – Advanced Traffic Management systems (ATMS), Advanced Trav Information systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control systems (AVCS), Advanced Public Transportation systems (APTS), Advanced Rural Transportation systems (ARTS).

ITS User Needs and Services – Travel and Traffic management, Public Transportation Management, Electronic Payment, Commercial Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management.

UNIT-IV

ITS Architecture – Regional and Project ITS architecture; Concept of operations; ITS Models and Evaluation Methods; Planning and human factor issues for ITS, Case studies on deployment planning and system design and operation; ITS and safety, ITS and security, ITS as a technology deployment program, research, development and business models, ITS planning.

UNIT-V

ITS applications: Traffic and incident management systems; ITS and sustainable mobility, travel demand management, electronic toll collection, ITS and road-pricing.; Transportation network operations; commercial vehicle operations and intermodal freight; public transportation applications; ITS and regional strategic transportation planning, including regional architectures: ITS and changing transportation institutions Automated Highway Systems- Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries

TEXT BOOKS:

1. Fundamentals of intelligent transportation systems planning By Mashrur A. Chowdhury, Adel Wadid Sadek
2. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.

REFERENCES:

1. Sussman, J. M., Perspective on ITS, Artech House Publishers, 2005.
2. National ITS Architecture Documentation, US Department of Transportation, 2007

IV Year I sem	OPEN ELECTIVE IV GEO-SPATIAL TECHNOLOGIES	L	T	P	C
		3	0	0	3

Course Objectives:

- Understand the various spatial and non-spatial data types, and data base management techniques
- Develop the concepts and professional skills in utility of geo spatial techniques
- Improve the working knowledge of geospatial techniques in field problems

Course Outcomes:

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

1. Understand the geospatial technology relating to the data acquiring and processing that is associated with geographic locations
2. Apply Geospatial techniques in the decision support systems useful for decision makers and community services.
3. Ability to solve the problems related to the natural resource management, environment, urban planning and Infrastructure development, etc.
4. Able to generate the thematic maps using Geospatial techniques
5. Apply the concept of Geospatial Techniques to the Civil Engineering problems

UNIT I

Introduction – Basic concepts, socioeconomic challenges, fundamentals of geographical information systems (GIS), history of geographical information system, components of geographical information systems.

Projections and Coordinate Systems – Map definitions, representations of point, line, polygon, common coordinate system, geographic coordinate system, map projections, transformations, map analysis.

UNIT –II

Data Acquisition:Data Types, Spatial, Non-Spatial (Attribute) Data, Data Format – Vector and Raster Data, Manual Digitizing, Scanner, Aerial Photographic Data, Remotely Sensed Data, Digital Data, Cartographic Database, Digital ElevationData.

Data Management:Data Storage and Maintenance, Data Compression, Data Quality and Standards, Precision, Accuracy, Error – Geometric errors and corrections, Radiometric errors and corrections, types of Systematic and Non-systematic errors.

UNIT –III

Data Modeling: Spatial Data Analysis, Data Retrieval Query, Simple Analysis, Recode Overlay, Vector Data Model, Raster Data Model, Digital Elevation Model, Cost and Path Analysis, Knowledge Based System.

GIS Analysis and Functions: Organizing data for analysis, analysis function, maintenance and analysis of spatial data, buffer analysis, overlay analysis, transformations, conflation, edge matching and editing, maintenance and analysis of spatial and non-spatial data.

UNIT –IV

Applications of GIS: Environmental and Natural Resource Management, Soil and Water Resources, Agriculture, Land Use Planning, Geology and Municipal Applications, Urban Planning and Project Management, GIS for decision making under Uncertainty, standard GIS packages, Introduction to Global Positioning Systems (GPS) and its applications.

UNIT – V

Introduction to Remote Sensing: General background of Remote Sensing Technology, Objectives and Limitations of Remote Sensing, Electro-Magnetic Radiation, Characteristics, Interaction with Atmosphere and Earth Surface, Remote Sensing Platforms and Sensors, Satellite Characteristics, Digital Image Processing, IRS Series and High Resolution Satellites, Remote Sensing Applications to Watershed Modeling, Environmental Modeling, Urban Planning and Management.

Text book:

1. Demers, M.N, (2013). 'Fundamentals of Geographic Information Systems' Wiley India Pvt. Ltd,.
2. Burrough, P.A., and Mc Donnell R.A.(1998). Principles of Geographical Information Systems. Oxford University Press, New York.
3. Kang-tsung Chang. (2006). Introduction to Geographical Information Systems. Tata McGraw- Hill Publishing Company Ltd., Third Edition, NewDelhi.
4. George Joseph, (2013). 'Fundamentals of Remote Sensing' Universities Press.

References:

1. Sabins F.F. Jr. (1978). Remote Sensing Principles and Interpretations. W.H. Freeman and Company, SanFrancisco.
2. Tor Bernhardsen. (2002). Geographical Information System. Wiley India (P) Ltd., Third Edition, NewDelhi.
3. Hoffman-Wellenhof, B, et al. (1997). GPS Theory and Practice. Fourth Edition, Springer Wein, New York.
4. Lilys and T.M., and Kiefer R.W. (2002). Remote Sensing and Image Interpretation. John Wiley and Sons, Fourth Edition, NewYork.
5. Choudhury S., Chakrabarti, D., and Choudhury S. (2009). An Introduction to Geographic Information Technology. I.K. International Publishing House (P) Ltd, NewDelhi.

IV Year I sem	OPEN ELECTIVE IV SOLID WASTE MANAGEMENT	L	T	P	C
		3	0	0	3

UNIT I

Introduction: Definition of solid waste – waste generation-sources and types of solid waste – sampling and characterization – Determination of composition of Municipal Solid Waste – Onsite storage and handling of solid waste – Future changes in waste composition, major legislation, monitoring responsibilities.

UNIT II

Collection and Transport of Solid Waste: Type and methods of waste collection systems, analysis of collection systems-Optimization of collection routes– alternative routes for collection system. Transfer and Transport: Need for transfer operation, transport means and methods, transfer station types and design requirements. Separation and Processing and Transformation of Solid Waste- Waste as a Resource- Disposable Materials, Recycling, Collection, Processing, and Potential for Reuse.

UNIT III

Processing and disposal: unit operations used for separation and processing, Materials Recovery facilities, Source reduction and waste minimization, Metal Separation & Recovery Waste transformation through combustion and composting, anaerobic methods for materials recovery and treatment – Energy recovery – biogas generation and cleaning– Incinerators.

UNIT IV

Landfills: Classification, Site selection, design and operation, methods of filling, drainage and leachate collection systems –designated waste landfill remediation, reclamation, environmental closure.

UNIT V

Hazardous Waste Management: Definition and identification of hazardous wastes-sources and characteristics – hazardous wastes in Municipal Waste – Hazardous wastes regulations – minimization of Hazardous Waste-compatibility, handling and storage of hazardous waste-collection and transport, e-waste - sources, collection, Design and operation of facilities for physical, chemical and thermal treatment of hazardous waste – Solidification, chemical fixation and encapsulation, incineration – reuse after treatment.

References:

1. George Techobanoglous “Integrated Solid Waste Management”, McGraw Hill Publication, 1993.
2. Charles A. Wentz; “”Hazardous Waste Management”, McGraw Hill Publication, 19

IV Year I sem	OPEN ELECTIVE IV APPLIED MECHANICS	L	T	P	C
		3	0	0	3

Course Objectives:

1. To solve the resultant of any force system.
2. To analyze the types of frication for moving bodies and problems related to friction.
3. To determine the centroid of an area and center of gravity of body.
4. To understand the concept of area moment and mass moment about any axes.
5. Understand the work-energy principle

Course Outcomes: After completion of the course the student is able to

1. Determine the resultant of coplanar concurrent and special force systems and analyse the bodies for equilibrium to find the unknown forces.
2. Analyze the bodies on rough horizontal and inclined planes and connected Bodies
3. Determine the centroid of composite areas, centre of gravity of composite bodies
4. Determine the moment of inertia of simple areas and mass moment of inertia of simple bodies.
5. Apply work-energy principle to solve the rigid body problems.
6. Appraise the influences of human factor considerations on engineering design.

UNIT - I

Introduction to Mechanics: Basic Concepts, system of Forces Coplanar Concurrent Forces - Components in Space -Resultant -Moment of Forces and its Application - Couples and Resultant of Force Systems. Equilibrium of system of Forces: Free body diagrams, Equations of Equilibrium of Coplanar Systems and Spatial Systems.

UNIT - II

Friction: Types of friction -Limiting friction -Laws of Friction -static and Dynamic Frictions – Types of friction – Dry friction – Ladder friction – Wedge friction – Screw friction – Simple Screw Jack

UNIT - III

Centroid and Center of Gravity: Introduction – Centroids of lines – Centroids of area - Centroids of Composite figures - Theorem of Pappus -Centre of Gravity - Center of gravity of composite bodies.

UNIT - IV

Area moments of Inertia: Introduction – Definition of Moment of Inertia -Polar Moment of Inertia – Radius of gyration - Transfer Theorem for moment of inertia – Moments of inertia by integration - Moments of Inertia of Composite Figures.

Mass Moment of Inertia: Introduction - Moment of Inertia of Masses – Radius of gyration - Transfer Formula for Mass Moments of Inertia – Mass moments of inertia by integration - Mass moment of inertia of composite bodies – Product of Inertia.

UNIT - V

Kinetics of Rigid Bodies: Types of motion, D"Alemberts principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; kinetic of rigid body rotation.

TEXT BOOKS:

1. Engineering Mechanics by R.K.Bansal, Laxmi Publications (P) Ltd.
2. Engineering Mechanics by S.S. Bhavikatti and K.G.Rajashekarappa, New Age International (P) Ltd Publishers.

REFERENCES:

1. Engineering Mechanics by S.P. Timoshenko & D.H. Young, J.V.Rao, Sukumar Pati, McGraw Hill Education.
2. Engineering Mechanics Statics and Dynamics by R.C. Hibbeler, Pearson Education India.
3. Engineering Mechanics Statics and Dynamics by Tayal A.K, Umesh Publications.
4. Engineering Mechanics: Statics and Dynamics by S.Rajasekaran and G.Sankarasubramaniam, Vikas Publishing house Pvt Ltd.

IV Year II sem	INTERNSHIP AND PROJECT	L	T	P	C
					12

HONOURS DEGREE COURSES

GEO TECHNICAL ENGINEERING

Honor Course	ADVANCED FOUNDATION ENGINEERING	L	T	P	C
		3		0	

Course Outcomes:

CO1	Know the process of the soil exploration and sample collection, preservation and transportation of samples to the laboratory.
CO2	Interpret the results of field tests.
CO3	Determine the bearing capacity of soils for shallow foundations
CO4	Make the choice of foundation based on sub soil conditions.
CO5	Determine the settlement of foundations in different soils.

SYLLABUS:

Unit: 1

Soil Exploration – Importance, Terminology - Geophysical methods. Borings Location, spacing and depth, Methods of Boring including Drilling, Stabilization of Boreholes, Methods of sampling Types of Samples and Samplers - Cleaning of Bore holes, Preservation, Labeling and Shipment of Samples - Design Considerations of Open Drive Samplers.

Unit: 2

Field tests - The Standard Penetration Test – its limitations and Corrections – Cone Penetration Test – Field Vane Shear Test – Borehole Shear Test – Dilatometer Test – Pressure metertest – Planning of exploration – Preparation of Soil Report– Bore log.

Unit: 3

Shallow Foundations – Bearing capacity –Terzaghi's, Meyerhof's, Hansen's and Vesic's Bearing Capacity Theories – IS method of Bearing Capacity - Factors - Bearing Capacity of Stratified Soils - Bearing Capacity Based on Penetration Resistances - Safe Bearing Capacity and Allowable Bearing Pressure

Unit: 4

Types of foundations and the choice of the type of foundations. Design Considerations including Location and Depth, Proportioning of Shallow Foundations - Isolated and Combined Footings and Mats –Design Procedure for Mats. Floating Foundation – Fundamentals of Beams on Elastic Foundations.

Unit: 5

Settlement Analysis – Elastic settlement in granular soils – Meyerhof's, De Beerand Marten' sand Scheuerman's equations - Elastic settlements of surface and subsurface footings in clays - Skempton and Bjerrum's pseudo three dimensional approach to consolidation settlement, settlement from insitu tests, Tolerable settlements.

REFERENCES:

1. Principles of Foundation Engineering by BrajaM. Das.
2. Soil Mechanics in Engineering Practice by Terzagi and Peck
3. Foundation Design by Wayne C.Teng, JohnWiley & Co.,
4. Foundation Analysis and Design by J.E. Bowles Mc Graw Hill Publishing Co.,
5. Analysis and Design of substructures by Swami Saran
6. Design Aids in Soil Mechanics and Foundation Engineering by Shanbaga R.Kaniraj,Tata Mc Graw Hill.
7. Foundation Design and Construction by MJ Tomlinson –Longman Scientific
8. A short course in Foundation Engineering by Simmons and Menzes ELBS

Honor Course	PAVEMENT ANALYSIS, DESIGN AND EVALUATION	L	T	P	C
		3		0	

Course Outcomes:

CO1	Understand the design parameters of pavement design
CO2	Design flexible and rigid pavements for different field conditions
CO3	Compute the stress distribution in different pavement layers
CO4	Evaluate the pavements and design overlay systems

SYLLABUS:

Unit: 1

Pavement Types, Wheel Loads and Design Factors: Definition of Pavement Types, Comparison of Highway pavements, Wheel Loads, Tyre pressure, Contact pressure, Design Factors: Traffic and Loading, Environment, Materials, Failure criteria, Reliability.

Unit: 2

Stresses in Pavements: Layered System Concepts: One Layer System: Boussinesq's Theory. Two Layer Theory:Burmister's Theory. Three Layer System. Stresses in Rigid Pavements. Relative Stiffness of Slabs, Modulus of Sub grade Reaction, Stresses due to Warping, Stresses due to Friction, Stresses due to Load, IRC Recommendations.

Unit: 3

Pavement Design: IRC Method of Flexible Pavement Design, AASHTO Method of Flexible Pavement Design, IRC Method for Rigid Pavements, use of Geo synthetics in pavements.

Unit: 4

Pavement Inventories: Serviceability Concepts, Visual Rating, Pavement Serviceability Index, Roughness Measurements, Measurement of Distress Modes Cracking, Rutting, Rebound Deflection using Benkleman Beam Deflection Method, Load Man Concept, Skid Resistance Measurement.

Unit: 5

Pavement Evaluation: Functional Pavement Performance Evaluation: AASHTO Method, Psycho Physical and Psycho Metric Scaling Techniques, Deduct Value Method. Structural Conditional Evaluation Technique: Benkelman Beam Deflection Method, Pavement Distress Rating Technique. Design of Overlays by Benkelmen Beam Deflection Methods as per IRC – pavements on problematic soils.

REFERENCES:

1. Yoder and Witzorack, "Principles of Pavement Design", John Willey and Sons.
2. Yang, H.Huang, "Pavement Analysis and Design", Prentice Hall Publication,

Englewood Cliffs, New Jersy.
3. Sargious, M.A. Pavements and Surfacings for Highways and Airports – Applied science Publishers limited
4. Ralps Hass and Hudson, W.R. “Pavement Management System” Mc Graw Hill Book Company.
5. IRC codes of practice.

Honor Course	EARTH RETAINING STRUCTURES	L	T	P	C
		3		0	

Pre Requisites: Soil Mechanics

Course Outcomes:

CO1	Quantify the lateral earth pressures associated with different earth systems
CO2	Evaluate the mechanical properties of geo synthetics used for soil reinforcement
CO3	Identify the merits and demerits of different earth retaining systems.
CO4	Select the most technically appropriate type of retaining wall for the application from a thorough knowledge of available systems
CO5	Design of retaining structures using appropriate design methods, factors of safety, earth Pressure diagrams and field verification methods
CO6	Aware of current guidelines regarding the design of earth retaining structures.
CO7	Design retaining structures considering both external and internal stability aspects

SYLLABUS:

Unit: 1

Earth pressures – Different types and their coefficients - Classical Theories of Earth pressure – Rankine's and Coulomb's Theories for Active and Passive earth pressure –Computation of Lateral Earth Pressure in Homogeneous and Layered soils – Graphical solutions for Coulomb's Theory in active and passive condition.

Unit: 2

Retaining walls – different types – Type of Failures of Retaining Walls – Stability requirements - Drainage behind Retaining walls – Provision of Joints –Relief Shells.

Unit: 3

Sheet Pile Structures – Types of Sheetpiles – Cantilever sheet piles in sands and clays– Anchored sheet piles– Free earth and Fixed earth support methods – Rowe's moment reduction method – Location of anchors and Design of Anchorage system.

Unit: 4

Soil reinforcement – Reinforced earth – Different components – their functions –Design principles of reinforced earth retaining walls.

Unit:5

Braced cuts and Coffer dams: Lateral Pressure in Braced cuts– Design of Various Components of a Bracedcut–Stability of Braced cuts –Bottom Heavein cuts.– types of cofferdam, suitability, merits and demerits–Design of single – wall coffer dams and their stability aspects –TVA method and Cummins' methods.

REFERENCES

1. Principles of Foundation Engineering by Braja M. Das.
2. Foundation analysis and design – Bowles, JE– Mc Graw Hill
3. Soil Mechanics in Engineering Practice– Terzaghi,K and Rolph,B. peck 2ndEdn.– JohnWiley&Co
4. Analysis and Design of Foundations and Retaining Structures, Prakash, S–Saritha Prakashan, Mearut.

Honor Course	APPLICATIONS OF GEO SYNTHETICS	L	T	P	C
		3		0	

Pre Requisites: None

Course Outcomes:

CO1	Use geo synthetic materials in the field of geo technical construction works.
CO2	Assess the properties of different materials of Geo synthetics
CO3	Distinguish and describe various manufacturing methods of geo textiles, geo grids, geo membranes and geo-composites
CO4	Understand concepts and design the geo synthetics for the functions of separation, reinforcement, stabilization, filtration, drainage and moisture barriers
CO5	Design reinforced earth retaining walls, gabions, pond liners, covers for reservoirs, canal liners, Landfill liners, caps and closures, dams and embankments etc
CO6	Distinguish survivability requirements of geo composites and design geo webs, geo cells, Sheet drains, strip drains and moisture barriers etc

SYLLABUS :

Unit 1:

Geosynthetics and Properties and Testing Methods: Introduction to Geosynthetics – Basic description –History – Manufacturing methods – Uses and Applications. Properties and Testing methods of Geo textiles –Geogrids– Geo membranes – Geo composites.

Unit 2:

Geo textiles: Designing for Separation – Reinforcement – Stabilization – Filtration – Drainage and Moisture barriers.

Unit 3:

Geo grids: Designing for Reinforcement– Stabilization – Designing Gabions – Construction methods – Design of retaining walls.

Unit 4:

Geo membranes: Survivability Requirements – Pond Liners – Covers for Reservoirs – Canal Liners – Landfill Liners– Caps and Closures – Dams and Embankments.

Unit 5:

Geocomposites: Geocomposites – Overview an added advantage –Geo composites in Separation–Reinforcement – Filtration – Geocomposites as Geowebs and Geocells – Sheet drains – Strip drains and Moisturebarriers.

REFERENCE:

1. "Designing with Geosynthetics" by Robert M. Koerner Prantice Hall, Eaglewood Cliffs, NJ 07632.2."Construction and Geotechnical Engineering using Synthetic Fabries" by Robert M. Koerner and Josoph P.Welsh.JohnWilley andSons, NewYork.
2. "Engineering with Geosynthetics", by G. Venkatappa Rao and GVS Suryanarayana Raju – Tata McGraw Hill Publishing Company Limited, New Delhi.
3. "Foundation Analysis and Design" by J.E.Bowles Mc Graw Hill Publications.

Honor Course	SOIL DYNAMICS & MACHINE FOUNDATIONS	L	T	P	C
		3		0	

Pre Requisites: None

Course Outcomes:

CO1	Use theory of vibrations to find the behavior of soil under dynamic loading
CO2	Design machine foundations under different loads and soil conditions
CO3	Understand the liquefaction phenomena
CO4	Conduct various laboratory and filed tests to determine the dynamic soil properties and its Interpretation
CO5	Design vibration isolators under any vibratory machines

SYLLABUS:

Unit: 1

Introduction: Types of motion- SHM - Fundamental definitions - SDOF systems - Free and forced vibration with and without damping- Types of damping - Equivalent stiffness of springs in series and parallel-Principles of vibration measuring devices - Introduction to two and multi degree freedom systems

Unit: 2

Theories of Vibration Analysis- EHS Theory and lumped parameter model-Different modes of vibration - Natural frequency of foundation soil system – Barkan and IS methods – Pressure bulb concept – Reisner Theory – Limitations of Reisner theory–Sung's solutions - Pauw's Analogy–Heigh's Theory.

Unit: 3

Dynamic properties of soils, Determination of E, G and Poisons ratio from field and laboratory tests, recommendations of Indian codes-Stress waves in bounded elastic medium-Use of wave theory in the determination of elastic properties, Elastic coefficients of soils and their determination-damping factor from free and forced vibration tests.

Unit: 4

Machine Foundations: Classification based on the type of dynamic force and structural form, design data, design criteria, foundations for reciprocating, impact and high speed machined like turbo generators-IS code provisions for the design of the same

Unit: 5

Vibration Isolation and Special Topics: Transmissibility, Principles of isolation-Methods of isolation-Vibration isolators-Types and their characterizes -Liquefaction of soils, Dynamic bearing capacity, Earth retaining structures under dynamic loads - Pile foundations

REFERENCES:

1. Vibrations of Soils and Foundations– Richart Hall and Woods
2. Vibration Analysis and Foundation Dynamics, NSVKameswaraRao, WheelerPublishing, NewDelhi.
3. Foundations of Machines- Analysis and Design – Prakash and Puri
4. Analysis and design of Foundations for Vibrations- PJMoore
5. Fundamentals of Soil Dynamics - BMDas
6. Dynamics of bases and Foundations – Dbarkar

Honor Course	1.f) EXPANSIVESOILS	L	T	P	C
		3		0	

Pre Requisites: None

Course Outcomes:

CO1	Understand the behavior of expansive soils
CO2	Assess the foundation practices on expansive soils
CO3	Perform the methods of stabilization expansive soils
CO4	Select additives and the methodology for stabilization
CO5	Apply the gained knowledge for suitable performance

SYLLABUS:

Unit: 1

Clay mineralogy- Nature of soils-clay mineral structures- cation exchange- soil water-soil structure soil water interaction.

Unit: 2

Swelling characteristics: swelling - factors affecting swelling-swell potential - swelling pressure- methods of determination – factors affecting swell potential and swelling pressure – Heave factors affecting heave methods of determination of heave.

Unit: 3

Foundation Practices in Expansive Clays – Sand cushion – Belled Piers – CNS layer technique – Under –reamed pile foundations – Construction techniques – design specifications – Load - carrying capacity in compression and uplift of single and multi– under reamed piles in clays and sands–granular pile Anchors.

Unit: 4

Lime soil columns and Lime slurry pressure injection – Stabilization with admixtures –Pre ponding – Vertical and Horizontal Moisture Barriers.

Unit: 5

Shear strength of expansive soils-Katti's concept of bilinear strength envelope-Stress state variables in partly saturated soils- Fred lund's strength parameters-determination of matrix suction by axis translation technique-field suction measurement

REFERENCES:

1. F.H.Chen, Foundations on Expansive Soils , Eleveir Scientific Publishing Company, Newyork.
2. J.D.Nelson and D.I. Miller, Expansive soils-Problems and Practice in Foundation and Pavement Engineering by, JohnWiley & Sons,Inc.
3. D.G.Fredlund and H.Rahardjo,Soil Mechanics for Unsaturated Soils, WILEY Interscience Publication, JohnWiley &Sons, Inc
4. D.R.Katti,ARKatti, Behaviour of Saturated Expansive Soils and Control methods, Taylor and Francis Gopal Ranjan and ASRao, Basic and Applied Soil Mechanics, New Age International Publishers,
5. HandBook on Under reamed and Bored Compaction Pile Foundations– CBRI, Roorkee.IS:2720(Part XLI)– 1977Measurement of Swelling Pressure of Soils.

Honor Course	EARTHERN DAMS	L	T	P	C
		3		0	

Pre Requisites: None

Course Outcomes:

CO1	Understand the basic concepts of earth fill dams and rock fill dams and identify the site Topography and foundations conditions
CO2	Identify basic design requirements and causes of failures of dams, distinguish foundation types and the different fill materials
CO3	Estimate seepage through dam sections, foundations and select core and shell materials
CO4	Understand and design the methods to control seepage through different units of dams
CO5	Able to undertake slope stability analysis of dams
CO6	Distinguish different types of instruments like piezometers, settlement gauges and inclinometers to install for performance studies of dams

SYLLABUS:

Unit: 1

BASIC CONCEPTS AND MISCELLANEOUS TOPICS: Evolution–Types of Dams–Earth fill Dams–Rock fill Dams–Selection of Type of Dam–Site Topography–Foundation Conditions–Basic Design Requirements–Causes of Failure and Deterioration of Dams – Design Investigations – Fill Material – Foundations – Design Studies.

Unit: 2

SEEPAGE THROUGH DAM SECTION AND ITS CONTROL: Estimation of Seepage through Dam Section and foundation– Considerations in selection and design of core and determination of shell material Drains: – Pervious Downstream Shell – Chimney Drains – Rock Toe and Drains – Use of Geo textiles as Filter Material.

Unit: 3

CONTROL OF SEEPAGE THROUGH FOUNDATIONS: General Considerations – different types of cutoff walls –Provision of d/saprons– relief wells SLOPE PROTECTION – Necessity with respect to u/s and d/s slopes – u/s slope protection by Dumped Riprap – Hand placed Riprap – Soil Cement Slope Protection – Downstream Slope Protection by providing berms grassturfing.

Unit: 4

STABILITY ANALYSIS OF SLOPES OF EARTH DAMS: Slope stability analysis techniques –Methods of Slices, Fellenius' Method, Simplified Bishop method, Taylor's method, Simplified Janbu's Method; Stability of earth dam slopes – u/s slope during sudden drawdown, d/s slope during steady seepage, stability of u/s and d/s slopes during and after construction.

Unit: 5

INSTRUMENTATION: – Purpose -Types of Instruments and Brief Description – Installation – piezometers – Casagrande and Vibration wire Settlement gauges–Inclinometers.

REFERENCE:

1. Earth Dams by HD Sharma
2. Earth and Rock fill Dams HD Sharma & Bharat Singh

Honor Course	1.h) GEO ENVIRONMENTALENGINEERING	L	T	P	C
		3		0	

Pre Requisites: None

Course Outcomes:

CO1	Understand various ground contaminations, pollution transport phenomena.
CO2	Collect pollutant data
CO3	Apply principles to get the information about the transport through the unsaturated soil
CO4	Develop various models for contamination transport.

SYLLABUS:

Unit: 1

Introduction- Ground water contamination, pollutant transport and ground water remediation. Sources and Types of ground water contamination–underground storage tanks, Landfills, surface impoundments, waste disposal injection wells, Septic system, Agricultural wastes, Land application, radioactive contamination, other sources of contamination.

Unit: 2

Data Collection methods: Introduction, Geological data acquisition – Drilling methods – Solid flight auger drilling – Hollow stem auger drilling – Wet rotating drilling – Hand auger soil boring – sample collection – Soil core logging– Cone penetration testing –Geophysical methods; Hydrologic data acquisition –monitoring well construction – well material – Screen interval selection – Installation procedure – Survey specification –Protective casing requirements – Well development procedures; Acquisition of soil and Ground water quality data.

Unit: 3

Contaminant Transport Mechanisms: Introduction – Advection process – Diffusion – Dispersion process –Diffusion – Mass transport Equations : Derivation of advection dispersion equation for solute transport; One Dimensional Models – Continuous source in one dimension – Instantaneous source in one dimension –Adsorption effects–Transport in one dimensional with first order decay–Sorption: The concept of sorption, Factors influencing sorption – Contaminant characteristics, Soil characteristics, Fluid media characteristics. Sorption Isotherm: Linear sorption Isotherm – Freundlich Sorption isotherm – Langmuir Sorption Isotherm, Sorption effects on fate and transport of pollutants.

Unit: 4

Flow and Transport of Pollutants in Unsaturated zone: Capillarity, soil water characteristic curves, Unsaturated Hydraulic conductivity, Governing equation for unsaturated flow, measurement of soil properties.

Unit: 5

Non – Aqueous Phase Liquids (NAPLs): Introduction – Comparison of fate of dissolved mass versus NAPL mass Types of NAPLs– LNAPL– DNAPL; NAPL Transport– general process– NAPL transport at the pore level-Downward Migration of DNAPLs in saturated zone– NAPL movement through Vadose zone– LNAPL behavior at the water table–NAPL Transport at the site level– LNAPL conceptual models–DNAPL conceptual models, NAPL transport.

TEXT BOOKS:

1. Ground water Contamination (Transport and Remediation) ByPhilip.B.Bedient, Hanadi, S.Rifai & Charles.J. Newell, Prentice Hall PTR, Upper Saddle River, NJ07458.

REFERENCES:

1. Geo environmental Engineering by R.Krishna Reddy -JohnWiley& Sons,Inc.
2. Geo technical Engineering by Gulahati, S.K. and Datta, M.–Tata McGraw Hill Publishing Company
3. Geo technical Engineering Principles and Practices by Coduto –Pearson Education(PHI)
4. Geo environmental engineering by Reddy, L.NandInyang, I.H. – MarcelDrekker,2000.
5. Environmental geo techniques by Sarsby, R. – Thompson Telford, 2000.Geotechnical Practices for Waste Disposal by Daniel,D.E., 1993

STRUCTURAL ENGINEERING

Honor Course	THEORY OF ELASTICITY AND PLASTICITY	L	T	P	C
		3		0	

Course Outcomes:

CO1	Comprehend the basic concepts of continuum mechanics of solids like stresses strains compatibility and equations of equilibrium, understand how to utilize the constitutive equations and generalized hooks' law
CO2	Ability to solve 2D problems in rectangular coordinates and application to bending of simple beams.
CO3	Applying polar co ordinates in analyzing stressed and strains in circular section
CO4	Applications of 3D continuum mechanics to solve for stresses and strains, compatibility conditions
CO5	Solving torsion in prismatic and non prismatic sections through energy principles

SYLLABUS:

Unit: 1

Elasticity– Notation for forces and stresses – components of stresses and strains–Hooke's Law Plane Stress– Plane strain–Differential Equations of equilibrium – Boundary conditions – Compatibility Equations Stress function– Boundary Conditions

Unit: 2

Two dimensional problems in rectangular coordinates – Solution by polynomials – Saint Venant's principle – Determination of displacements – Bending of simple beams – Application of Fourier series for two dimensional problems for gravity loading

Unit: 3

Two dimensional problems in polar coordinates General equations in polar coordinates – Stress distribution for problems having symmetrical about an axis -Strain components in polar coordinates– Displacements for symmetrical stress distributions -Stresses for plates with circular holes subjected to far field tension – stress concentration factor.

Unit: 4

Analysis of stress and strain in three dimensions -Principal stresses – Stress ellipsoid and stress director surface – Determination of principal stresses -Maximum shear stress – Homogeneous Deformation –General Theorems -Differential equations of equilibrium – Conditions of compatibility– Equations of equilibrium in terms of displacements – Principle of superposition – Uniqueness of solution –Reciprocal theorem.

Unit: 5

Torsion of Prismatic bars – Bars with elliptical cross section – Other elementary solution–

Membrane analogy–Torsion of rectangular bars – Solution of Torsional problems by energy method

TEXTBOOKS:

1. Theory of Elasticity Stephen Timoshenko & J.N.Goodier, Mc.Graw hill Publishers
2. Advanced Mechanics of Solids L.S. Srinath, Mc Graw Hill Publisher

REFERENCES:

1. Elasticity: Theory, Applications and Numeric Martin H.Sadd, Wiley Publishers
2. Theory of Elasticity-Sadhu Singh 3rd Edition, Khanna Publishers

Honor Course	STRUCTURAL DYNAMICS	L	T	P	C
		3		0	

Course Outcomes:

CO1	Understand fundamental objectives, types of loadings and degrees of freedom
CO2	Understand SDOF systems and behaviour of structures under SDOF systems
CO3	Understand MDOF systems and response to various types of loading
CO4	Evaluation of response of structures considering continuous systems
CO5	Understand earth quake forces and design of earthquake resistant structures

SYLLABUS:

Unit: 1

Introduction to Structural Dynamics: Fundamental objectives of dynamic analysis -Types of prescribed loading - Methods of discretization – Formulation of equations of motion by different methods Theory of vibrations: Introduction - Elements of vibratory system - Degrees of Freedom - Continuous System - Lumped mass idealization – Oscillatory motion - Simple Harmonic motion – Victorian representation of S.H.M.

Unit: 2

Single Degree of Freedom Systems: Free vibrations of single degree of freedom system – un damped and damped vibrations – critical damping- Logarithmic decrement –Forced vibration of SDOF systems - Harmonic excitation - Vibration Isolation -Dynamic magnification factor – Phase angle. Formulation and solution of the equation of motion - Free vibration response - Response to Harmonic, Periodic, Impulsive and general dynamic loadings - Duhamel integral

Unit: 3

Multi Degree of Freedom Systems: Selection of the degrees of Freedom - Evaluation of structural property matrices - Formulation of the MDOF equations of motion –Undamped free vibrations - Solutions of Eigen value problem for natural frequencies and mode shapes - Analysis of Dynamic response – Normal co-ordinates - Uncoupled equations of motion - Orthogonal properties of normal modes - Mode superposition procedure

Unit: 4

Continuous Systems: Introduction - Flexural vibrations of beams - Elementary case – Derivation of governing differential equation of motion - Analysis of undamped free vibrations of beams in flexure – Natural frequencies and mode-shapes of simple beams with different end conditions-Principles of application to continuous beams.

Unit: 5

Introduction to Earthquake Resistant Design: Seismology- Seismic waves and propagation- Measurement scales- Seismic Resistant architecture- Objective of ERD- Codal provisions

TEXTBOOKS:

1. Structural Dynamics Anil K Chopra, 4 edition, Prentice Hall Publishers
2. Structural Dynamics Theory & Computation–Mario Paz, CBS Publishes and Distributors
3. Dynamics of Structures by Clough & Penzien3e, Computers & Structures Inc.

REFERENCES:

1. Theory of Vibration-William T Thomson, Springer Science
2. Earthquake Resistant Design of Structures- Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India New Delhi

Honor Course	BRIDGE ENGINEERING	L	T	P	C
		3		0	

Course Outcomes:

CO1	Design theories Masonry Arch Bridges
CO2	Design of RCC slab and T beams bridges
CO3	Understand the behaviour of plate girder bridge
CO4	Posses the knowledge to design pre stressed concrete bridges
CO5	Analyze the abutments piers and design of pipe culvert

SYLLABUS:

Unit:1

Concrete Bridges: Introduction-Types of Bridges-Economic span length-Types of loading-Dead load-live load-Impact Effect-Centrifugal force-wind loads-Lateral loads-Longitudinal Forces-Seismic loads- Frictional resistance of expansion bearings-Secondary Stresses-Temperature Effect-Erection Forces and effects-Width of roadway and footway-General Design Requirements.

Unit: 2

Pigeaud's method design of longitudinal girders-Guyon Messonet method-Hendry Jaegar method-Courbon's theory. (Ref: IRC 21), voided slabs, Super Structure: Slab bridge-Wheel load on slab-effective width method-slabs supported on two edges-cantilever slabs-dispersion length-Design of interior panel of slab-T Beam bridges.

Unit: 3

Box Culverts- Single Cell Box Culvert– Design Loads, Design Moments, Shears and Thrusts. Design of Critical sections.

Unit: 4

Plate girder bridges- Elements of plate girder and their design- web -flange-intermediate stiffener- vertical stiffeners -bearing stiffener - design problem

Unit: 5

Sub structure -Abutments-Stability analysis of abutments-piers-loads on piers – Analysis of piers-Design problem (Ref: IRC 13, IRC 21, IRC 78) -Pipe culvert-Flow pattern in pipe culvers-culvert alignment culvert entrance structure-Hydraulic design and structural design of pipe culverts-reinforcements in pipes. (Ref: IRC: SP 13)

TEXT BOOKS:

1. Essentials of Bridge Engineering JhonsonVictorD,7e,Oxford IBH Publications
2. Design of Concrete Bridges M.G.Aswini, V.N.Vazirani, M.M Ratwani, Khanna

Publishers
3. Bridge Engineering by S. Ponnuswamy, McGraw hill Publications

REFERENCES:

1. Design of Bridges by N.Krishna Raju CBS Publishers and Distributors
2. Concrete Bridge Design and Practice-V.K.Raina, Tata Mc Graw-Hill Publishing Company Limited
3. IRC6-2016Standard Specifications and Code of Practice for Road bridges
4. IRC21-2009StandardSpecificationsandcodeofpractice for Road Bridges Section III

Honor Course	EARTHQUAKE RESISTANT DESIGN	L	T	P	C
		3		0	

Course Outcomes:

CO1	To learn the fundamentals of seismology and basic earthquake mechanisms, tectonics types of ground motion, and propagation of ground motion. Understand qualitative and quantitative representations of earthquake magnitude
CO2	Determine the natural frequency of a single degree of freedom dynamic system for given mass, stiffness and damping properties.
CO3	Determine the maximum dynamic response of an elastic vibrating structure to a given forcing function. Distribute the static base shear to the structure based on vertical distribution of mass horizontal distribution of mass, and centres of rigidity.
CO4	Learn the fundamentals of building code based structural design
CO5	Recognize special conditions such as irregular buildings, building separation, P-delta

SYLLABUS:

Unit: 1

Engineering seismology– rebound theory– plate tectonics–seismic waves - earthquake size and various scales– local site effects– Indian seismicity– seismic zones of India– theory of vibrations– near ground and far ground rotation and their effects.

Unit: 2

Seismic design concepts – EQ load on simple building – load path– floor and roof diaphragms – seismic resistant building architecture – plan configuration – vertical configuration–pounding effects–mass and stiffness irregularities – torsion in structural system-Provision of seismic code (IS1893&13920)–Building system–frames–shear wall–braced frames–layout design of Moment Resisting Frames(MRF)–ductility of MRF–In fill wall– Non structural elements

Unit: 3

Calculation of EQ load– modelling of building systems and analysis (theory only) Evaluation of lateral forces using seismic coefficient method, Response Spectrum method and Dynamic analysis method. Design and ductile detailing of Beams and columns of frames Concept of strong column weak beams, Design and ductile detailing

Unit: 4

Cyclic loading behaviour of RC, elements – modern concepts – Base isolation–Adaptive systems– case studies – Codal provision for load calculation

Unit: 5

Retrofitting and restoration of buildings subjected to damage due to earthquakes - effects of earthquakes–factors related to building damages due to earthquake – methods of seismic retrofitting -restoration of buildings

TEXTBOOKS:

1. Earthquake Resistant Design of Structures Pankaj Agarwal and Manish Shrikhande, Prentice Hall of India 2007, New Delhi
2. Earthquake Resistant Design of Structures-S.K.Duggal, Oxford Publications

REFERENCES:

1. Introduction to the Theory of Seismology, Great Britain atthe University Printing houses, Cambridge UniversityPress1996
2. Earthquake Resistant Design and Risk Reduction-David Dowrick
3. IS 4326-1998: Earthquake Resistant Design and Construction of Buildings
4. IS 1893(Part1to5)-2002:General Provisions and Building
5. IS 4928–1993:Code of practice for Earthquake Resistant Design and Construction of Buildings
6. IS 13920-1997: Code of Practice for Ductile Detailing of Reinforced Concrete Structures subjected to Seismic Forces
7. IS 13935-1993: Guidelines for Repair and Seismic Strengthening of Building

Honor Course	MATRIX ANALYSIS OF STRUCTURES	L	T	P	C
		3		0	

Course Outcomes:

CO1	Perform the structural analysis of determinate and indeterminate structures using classical compatibility methods, such as method of consistent displacements, force and equilibrium Methods
CO2	Understand stiffness Method with applications on pin jointed truss, continuous beams and rigid jointed plane frames
CO3	Perform structural analysis using the stiffness method and apply on solving different complex application problems
CO4	Understand effective finite element analysis techniques to reduce computational efforts
CO5	Solve multiple degree of freedom plane frames including sides way single storey single bay gable frames using flexibility method

SYLLABUS:

Unit: 1

Introduction of matrix methods of analysis – Static and kinematic indeterminacy– Degree of freedom– Structure idealization stiffness and flexibility methods – Suitability: Element stiffness matrix for truss element, beam element and Torsional element - Element force displacement equations.

Unit: 2

Stiffness method – Element and global stiffness equation – coordinate transformation and global assembly–structure stiffness matrix equation –analysis of simple pin jointed trusses–continuous beams–rigid jointed plane frames

Unit: 3

Stiffness method for Grid elements – development of stiffness matrix – coordinates transformation. Examples of grid problems – tapered and curved beams

Unit: 4

Additional topics in stiffness methods –discussion of bandwidth–semi band width – static condensation – sub structuring –Loads between joints - Support displacements-inertial and thermal stresses - Beams on elastic foundation by stiffness method.

Unit: 5

Analysis of plane truss- continuous beams with and without settlement - plane frame including side sway single storey, single – bay and gable frame by flexibility method using system approach

TEXT BOOKS:

1. Matrix analysis of structures, Robert E Sennet – Prentice Hall - Englewood Cliffs -New Jercy
2. Structural Analysis Matrix Approach- Pandit and Gupta, Mc Graw hill Education
3. Advanced structural analysis, P.Dayaratnam – Tata Mc Graw hill publishing company limited.

REFERENCES:

1. Indeterminate Structural analysis, CK Wang, Amazon Publications
2. Analysis of Tall buildings by force –displacement –Method M. Smolira Mc. Graw Hill.
3. Foundation Analysis and design, J.E.Bowls, 5e, Amazon Publications

Honor Course	STABILITY OF STRUCTURES	L	T	P	C
		3		0	

Course Outcomes:

CO1	Determine the critical moments and deflection and critical loads for beam columns under different loading and end conditions
CO2	Determine the critical loads in straight column and bulking of frames under different loading and end conditions
CO3	Asses lateral bulking of beams
CO4	Assess the bulking of thin-walled bars of open cross section along with flexure

SYLLABUS:

Unit: 1

Beam columns: Differential equation for beam columns–Beam column with concentrated loads–continuous lateral load– couples–Beam column with built in ends–continuous beams with axial load – Application of Trigonometric series–Determination of allowable stresses

Unit: 2

Elastic buckling of bars: Elastic buckling of straight columns – Effect of shear stress on buckling – Eccentrically and laterally loaded columns –Sway &Non-Sway mode -Energy methods – Buckling of a bar on elastic foundation – Buckling of bar with intermediate compressive forces and distributed axial loads – Buckling of bars with change in cross section– Effect of shear force on critical load–Built-up columns– Effect of Initial curvature on bars– Buckling of frames–Sway & Non Sway mode

Unit: 3

In elastic buckling: Buckling of straight bars–Double modulus theory Tangent modulus theory. Experiments and design formulae: Experiments on columns – Critical stress diagram– Empirical formulae of design–various end conditions–Design of columns based on buckling. Mathematical Treatment of stability problems: Buckling problem orthogonality relation–Ritz method Stiffness method and formulation of Geometric stiffness matrix Applications to simple frames

Unit: 4

Torsional Buckling: Pure torsion of thin-walled bars of open cross section– Non uniform torsion of thin-walled bars of open cross section - Torsional buckling–Buckling of Torsion and Flexure

Unit: 5

Lateral Buckling of simply supported Beams: Beams of rectangular Cross section subjected for pure bending, Buckling of I Section subjected to pure bending

TEXT BOOKS:

1. Theory of Stability of Structures by Alexander Cha Jes
2. Theory of Elastic Stability by S.P.Timoshenko & J.M.Gere – Mc Graw Hill Publications

REFERENCES:

1. Fundamentals of Structural Stability by George J Simitses & Dewey H. Hodges, Elsevier Publications
2. Elastic Stability of Structural Elements, N.G.R.Ayyangar Macmillan Publications

Honor Course	ADVANCED REINFORCED CONCRETE STRUCTURES	L	T	P	C
		3		0	

Course Outcomes:

CO1	Estimate the deflection of Concrete beams and slabs
CO2	Estimate crack width and its affects
CO3	Design flats labs, bunkers, silos and chimneys
CO4	Understand the thermal effect on concrete members

SYLLABUS:

Unit: 1

Limit Analysis of R C Structures: Rotation of a plastic hinge, Redistribution of moments, moment rotation characteristics of RC member, I.S. code provisions, loading pattern, Bending Moment Envelop, Application for Fixed Beams and Continuous Beams. In elastic Analysis of Slabs, Moment Redistribution in Columns, Limit analysis with Torsinal Hinges**.**

Unit: 2

Yield line analysis for slabs: Yield line criterion – Virtual work and equilibrium methods of analysis – For square circular, Rectangular, Triangular and Hexagonal with simple and continuous end conditions.

Unit: 3

Ribbed slabs: Analysis of the Slabs for Moment and Shears, Ultimate Moment of Resistance, Design for shear, Deflection, arrangement of Reinforcements.

Flat slabs: Direct design method – Distribution of moments in column strips and middle strip-moment and shear transfer from slabs to columns – Shear in Flat Slabs-Check for one way and two-way shears- Introduction to Equivalent frame method. Limitations of Direct design method, Distribution of moments in column strips and middle strip sketch showing reinforcement details.

Unit: 4

Design of Reinforced Concrete Deep Beams & Corbels: Steps of Designing Deep Beams, Design by IS 456. Checking for Local Failures, Detailing of Deep Beams, Analysis of Forces in a Corbels, Design of Procedure of Corbels, Design of Nibs.

Unit: 5

Design of Slender Columns – Slenderness limits, Methods of Design of Slender Columns, Additional Moment Method and Procedure for Design of Slender Columns. Eccentrically Loaded columns- development of interaction Diagrams

TEXT BOOKS:

1. Advanced Reinforced Concrete Design by P.C.Varghese Prentice Hall India Limited
2. Design of Reinforced Concrete Structures by N.Subramanian, Oxford University Press.
3. Reinforced Concrete Design, by S. Unnikrishnan Pillai & Devdas Menon Tata Mc. Graw-Hill Publishing Company Ltd. New Delhi 2010.
4. Design Reinforced Concrete Foundations P.C.Varghese Prentice Hall of INDIA Private Ltd.

REFERANCE:

1. Limit State Theory and Design of Reinforced Concrete S. R. Karve and V.L Shah. Standard Publishers
2. Reinforced concrete structural elements – behaviour, Analysis and design by P. Purushottam, Tata McGraw-Hill, 1994
3. Design of concrete structures – Arthus H. Nilson,David Darwin, and Chorles W. Dolar, Tata Mc. Graw-Hill, 3rd Edition, 2005.
4. Reinforced Concrete design by Kennath Leet,Tata Mc.Graw – Hill International, editions, 2nd edition, 1991
5. IS 456 - 2000 Plain and Reinforced concrete book of Practice.
6. SP 16 - Design Aids for Reinforced Concrete to IS 456
7. SP 34 - Hand Book as Concrete Reinforcement and retaining

Honor Course	THEORY OF PLATES AND SHELLS	L	T	P	C
		3		0	

Course Outcomes:

CO1	Have knowledge about various plate theories due to bending. Gain the knowledge of Navier's solution, Levy's solution and solve for the rectangular and square plates
CO2	Analyze circular plates with various boundary conditions
CO3	Gain the knowledge on singly ruled and doubly ruled and focus on membrane and bending theory
CO4	Ability to solve governing equation's pertaining to cylindrical shells and design principles
CO5	Understand the behaviour of the behaviour & geometry and membrane analysis of special shaped shells

SYLLABUS:

Unit: 1
Derivation of governing differential equation for plate– in plane bending and transverse bending effects-rectangular plates: Plates under various loading conditions like concentrated, uniformly distributed load and hydrostatic pressure. Navier's and Levy's type of solutions for various boundary condition.

Unit: 2
Circular plates: Symmetrically loaded, circular plates under various loading conditions, annular plates

Unit: 3
Introduction to Shells – Single and double curvature –Equations of Equilibrium of Shells: Derivation of stress resultants, Principles of Membrane theory and bending theory

Unit: 4
Cylindrical Shells: Derivation of the governing DKJ equation for bending theory, details of Schorer's theory. Application to the analysis and design of short and long shells. Use of ASCE Manual coefficients for the design.

Unit: 5
Beam theory of cylindrical shells: Beam and arch action. Design of diaphragms – Geometry analysis and design of elliptic Paraboloid, Conoidal and Hyperbolic Paraboloid shapes by membrane theory.

TEXT BOOKS:

1. Theory of Plates and Shells 2e – S.Timoshenko and S.Woinowsky Krieger, McGraw Hill book company, INC, New York.

2. Reinforced Concrete Shells and Folded Plates by P.C.Varghese, Prentice Hall India Publications
3. Analysis of Thin Concrete Shells by K. Chandrasekhar, New Age International (P) Ltd.

REFERANCE:

1. Theory and Analysis of Elastic Plates and Shells by J.N. Reddy, CRS Press
2. A Text Book of Shell Analysis –Bairagi, K,Khanna Publisher, New Delhi.
3. Design and Construction of Concrete Shell Roofs–Ramaswamy, G.S,Mc Graw Hill, New York

ENVIRONMENTAL AND WATER RESOURCES ENGINEERING

Honor Course	COMPUTATIONAL HYDRAULICS	L	T	P	C
		3		0	

Course Outcomes:

CO1	Solve uniform and non-uniform open channel flow problems.
CO2	Apply the principals of dimensional analysis and similitude in hydraulic model testing.
CO3	Select suitable pumps and turbines.

SYLLABUS:

UNIT: 1

UNIFORM FLOW IN OPEN CHANNELS: Types of channels – Types of flows –Velocity distribution –Energy and momentum correction factors – Chezy's and Manning's formulae for uniform flow – Most Economical sections, Critical flow: Specific energy-critical depth – computation of critical depth

UNIT: 2

NON-UNIFORM FLOW IN OPEN CHANNELS: Steady Gradually Varied flow – Dynamic equation, Mild, Critical, Steep, horizontal and adverse slopes-surface profiles direct step method- Rapidly varied flow, hydraulic jump, energy dissipation.

UNIT: 3

HYDRAULIC SIMILITUDE: Dimensional analysis - Rayleigh's method and Buckingham's pi theorem-study of Hydraulic models – Geometric, kinematic and dynamic similarities-dimensionless numbers – model and prototype relations.

UNIT: 4

IMPACT OF JETS: Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes, jet striking centrally and at tip, velocity triangles at inlet and outlet, expressions for work done and efficiency- angular momentum principle

CENTRAIFUGAL-PUMPS: Pump installation details-classification-work done- Manometric head- minimum starting speed-losses and efficiencies-specific speed, multistage pumps-pumps in parallel and series - performance of pumps-characteristic curves- NPSH-Cavitation.

UNIT: 5

HYDRAULIC TURBINES – I: Layout of a typical Hydropower installation – Heads and efficiencies-classification of turbines. Pelton wheel - Franci'sturbine – Kaplan turbine-

working, working proportions, velocity diagrams, work done and efficiency, hydraulic design, draft tube–theory and efficiency. Governing of turbines-surgetanks- unit and specific quantities, selection of turbines, performance characteristics-geometric similarity- cavitation.

TEXT BOOKS:

1. Open Channel flow, K.Subramanya, Tata Mc Graw Hill Publishers
2. Flow through Open channels by K.G.RangaRaja, Tata Mc Graw Hill Publishers
3. Fluid Mechanics and hydraulic machine, Rajput, SChand Publications.
4. Hydraulics and Fluid Mechanics including Hydraulic machinery By P.N. Modi, S.MSeth, Standard book house.

REFERENCES:

1. Open channel hydraulics by Ven Te Chow. Mc Graw Hill Companies
2. Fluid Mechanics by V.L.Streeter, Mc Graw Hill
3. Companies Fluid Mechanics by K.L. Kumar, S. Chand publications.

Honor Course	URBAN HYDROLOGY	L	T	P	C
		3		0	

Course Outcomes:

CO1	Develop intensity duration frequency curves for urban drainage systems
CO2	Develop design storms to size the various components of drainage systems.
CO3	Apply best management practices to manage urban flooding.
CO4	Prepare master drainage plan for an urbanized area.

SYLLABUS:

UNIT: 1

Introduction: Urbanization and its effect on water cycle – urban hydrologic cycle – trends in urbanization – Effect of urbanization on hydrology

Precipitation Analysis: Importance of short duration of rainfall and runoff data, methods of estimation of time of concentration for design of urban drainage systems, Intensity-Duration-Frequency (IDF) curves, design storms for urban drainage systems.

UNIT: 2

Approaches to urban drainage: Time of concentration, peak flow estimation approaches, rational method, NRCS curve number approach, runoff quantity and quality, wastewater and storm water reuse, major and minor systems.

UNIT: 3

Elements of drainage systems: Open channel, underground drains, appurtenances, pumping and source control.

UNIT: 4

Analysis and Management: Storm water drainage structures, design of storm water network-Best Management Practices – detention and retention facilities, swales, constructed wetlands, models available for storm water management.

UNIT: 5

Master drainage plans: Issues to be concentrated upon – typical urban drainage master plan, interrelation between water resources investigation and urban planning processes, planning objectives, comprehensive planning, and use of models in planning

TEXT BOOKS:

1. Geiger W.F, JMarsalek, W.J.RawlsandF. C.Zuidema,(1987 – 2 volumes), UNESCO,
2. Manual on Drainage in Urbanized area Hall MJ(1984), Elsevier Applied Science Publisher.
3. Urban Hydrology Wanielista M P and Eaglin (1997), Wiley and Sons.
4. Hydrology – Quantity and Quality Analysis,

5. Akan A.O and R.L. Houghtalen (2006), Wiley International, Urban Hydrology, Hydraulics and Storm water Quality: Engineering Applications and Computer Modelling,

REFERENCES:

1. Storm water Detention for Drainage, Stahre P and Urbonas B (1990), Water Quality and CSO Management, Prentice Hall.
2. Urban water cycle processes and interactions, Marsaleket.al.(2006), Publication No. 78, UNESCO, Paris(http://www.bvsde.paho.org/bvsacd/cd63/149460E.pdf)
3. Frontiers in Urban Water Management – Deadlock or Hope, by Maksimovic C andJ A Tejada-Guibert (2001), IWA Publishing.

Honor Course	GROUND WATER MODELING AND MANAGEMENT	L	T	P	C
		3		0	

Course Outcomes:

CO1	Basic concepts of Role of ground water in hydrological cycle and aquifer properties
CO2	Understanding the governing equations of Ground water flows
CO3	Knowledge about the imparts exposure towards well design and practical problems of ground water aquifers
CO4	Analyze the Ground water conservation and Ground water quality
CO5	Explain about Ground water flow modelling

SYLLABUS:

Unit: 1

Introduction: Role of groundwater in hydrological cycle, groundwater bearing formations, classification of aquifers, flow and storage characteristics of aquifers, Darcy's law, anisotropy and heterogeneity.

Unit: 2

Governing Equations for Groundwater Flow : Dupuit - Forchheimer assumptions, general differential equations governing groundwater flows, analytical solutions.

Unit: 3

Wells and Well Hydraulics: Types of wells, construction of wells, steady and unsteady state solutions for confined, unconfined and leaky aquifers, effect of boundaries, image well theory, interference of wells, well losses, pumping and recovery test analysis.

Unit: 4

Groundwater Conservation: Regional groundwater budget; resource assessment; estimation of recharge, Indian practice for artificial recharge,
Groundwater Quality: Contamination of groundwater, sources, remedial and preventive measures, seawater intrusion in coastal aquifers.

Unit: 5

Groundwater Flow Modeling: Role of groundwater flow models, Hele-Shaw and analog models, introduction to numerical modeling – boundary conditions, Planning of Groundwater Development: constraints, optimal groundwater development.

Text Books:

1. Groundwater Hydrology by Todd and Mays
2. Groundwater Hydrology by H M Raghunath
3. Introduction to Groundwater by Schwartz and Hubao Zhang
4. Hand book of Groundwater by Jcques Delluer
5. Groundwater Assessment, Development and Management by K R Karant

Honor Course	AIR POLLUTION AND CONTROL	L	T	P	C
		3		0	

Course Outcomes:

CO1	To evaluate the fundamentals of air pollution control
CO2	To design the operation of various air pollution control devices

Unit: 1

Introduction: Definition-Sources and classification of Air Pollutants –Photochemical smog-Effects of air pollution on health of Human & Animals, vegetation & materials, air quality standards, Global effects of air pollution.

Unit: 2

Meteorology and Dispersion of air pollutants: Temperature lapse rates and Stability, Wind velocity and turbulence, WindRose, plume behavior, Measurement of meteorological variables. Dispersion of Air pollutants: Gaussian Dispersion model - Equations for the estimation of pollutant concentrations of emissions - PlumeRise–Effective stack height and mixing depths.

Unit: 3

Sampling, Analysis and Particulate Pollution Control Methods: Ambient air quality monitoring - High volume sampler- stack monitoring train and stack monitoring - Principles and design aspects of different types of particulate pollution control equipment– Settling chambers, Cyclone separators, Scrubbers, Filters and Electrostatic precipitators.

Unit: 4

Gaseous pollution control methods and automobile pollution: Gaseous pollutants' sampling and analysis- Types of gaseous pollution control methods – absorption, adsorption and combustion processes. Automobile pollution, sources of pollution, composition of auto exhausts, Control methods.

Unit: 5

Noise Pollution: Definitions – Significance - sources, measurement - effects and control measures, legislations

REFERANCE:

1. Air Pollution by M.N.Rao, Tata Mc Graw Hill Publication.
2. "Air pollution and control by KVSG MuraliKrishna, Laxmi Publications, NewDelhi, 2016.
3. Air Pollution by H.C.Perkins.
4. Environmental Engineering by Peavy and Rowe, Mc Graw Hill Publication.
5. Air Pollution Control Engineering by N.D.Nevers,Mc Graw Hill Publication.
6. Air Pollution control engineering by Noelde Nevers, Mc Graw Hill Publication and New York.

7. Fundamentals of Air Pollution by Richard W.Boubeletal, Academic Press, NewYork.
8. Air Pollution: Physical and Chemical Fundamentals by John H.Seinfeld, McGraw Hill book Co. 1988.

Honor Course	INDUSTRIAL WASTE WATER MANAGEMENT	L	T	P	C
		3		0	

Course Outcomes:

CO1	Know the quality and quantity of water for various industries and Advanced water treatment methods
CO2	Learn the common methods of treatment of wastewaters and Biological treatment methods
CO3	Study of methods to reduce impacts of disposal of wasters into environment and CETPs.
CO4	Study of methods of treatment of wastewaters from specific industries like steel plants, refineries, and power plants, that imply biological treatment methods
CO5	Study of methods of treatment of wastewaters from industries like Aqua, dairy, sugar plants, and distilleries that imply biological treatment methods

SYLLABUS:

Unit: 1

Industrial water Quantity and Quality requirements: Boiler, Cooling, Domestic/Canteen and Process waters for Textiles, Food processing, Dairy, Aqua industry, Sugar mills, Brewery and distillery Industries, Fertilizer industry, Power plants. Advanced water treatment - Adsorption, Reverse Osmosis, Ion Exchange, Ultra filtration, Freezing, elutriation, Removal of Iron and Manganese, Removal of Color and Odor. Use of Municipal waste water in Industries.

Unit: 2

Basic theories of Industrial Wastewater Management: Industrial waste survey - Measurement of industrial wastewater Flow-generation rates – Industrial wastewater sampling and preservation of samples for analysis - Wastewater characterization- Toxicity of industrial effluents- Common methods of Treatment of wastewaters - Unit operations and processes- Volume and Strength reduction –Neutralization – Equalization and proportioning-recycling, reuse and resources recovery. Miscellaneous Treatment: Biological treatment of sewage- Primary, secondary and Tertiary treatment of sewage.

Unit: 3

Industrial wastewater disposal management: Discharges into Sewers, Streams- Oxygen sag curve, Lakes-eutrophication and oceans and associated problems, Land treatment – sewage sickness, Common Effluent Treatment Plants: advantages and suitability, Limitations and challenges- Recirculation of Industrial Wastewaters- Effluent Disposal Method.

Unit: 4

Process and Treatment of specific Industries-1: Manufacturing Process and origin, characteristics, effects and treatment methods of liquid waste from Steel plants, Fertilizers, Textiles, Paper and Pulp industries, Oil Refineries, Coal and Gas based Power Plants. Case studies.

Unit: 5

Process and Treatment of specific Industries-2: Manufacturing Process and origin, characteristics, effects and treatment methods of liquid waste from Tanneries, Sugar Mills, Distillers, Dairy and Food Processing industries, Aqua industry, Pharmaceutical Plants. Case studies.

TEXT BOOKS:

1. Industrial Wastewater Treatment by KVSG Murali Krishna, Paramount Publishers, Visakhapatnam,2019
2. Wastewater Treatment by M.N. Rao and A.K. Dutta, Oxford & IBH,NewDelhi.
3. Industrial Wastewater treatment by A.D. Patwardhan, PHILearning,Delhi
4. Wastewater Treatment for Pollution Control and Reuse, by Soli. J Arceivala, Shyam R solekar, Mc-Graw Hill, New Delhi;3rd Edition

REFERENCES:

1. Industrial Water Pollution Control by W. Wesley Eckenfelder, Mc-Graw Hill, Third Edition
2. Wastewater Engineering by Metcalf and EddyInc, Tata McGraw-Hill., NewDelhi
3. Wastewater Treatment- Concepts and Design Approach by G.L. Karia &R.A. Christian, Prentice Hall of India.
4. Unit Operations and Processes in Environmental Engineering by Reynolds. Richard, Cengage Learning.

Honor Course	WATER AND AIR QUALITY MODELLING	L	T	P	C
		3		0	

Course Outcomes:

CO1	At the end of the course, the student will be able to:
CO2	Explain the characteristics and importance of a model building
CO3	Discuss the basics of modeling stratified lakes and reservoirs
CO4	Explain the modelling concepts of seawater intrusion
CO5	Assess the concentration of pollutant at different receptor locations using plume dispersion modelling

SYLLABUS:

Unit: 1

MODELING CONCEPTS: Casual and statistical models-Characteristics- Steps in model development - Importance of model building.- conservation of mass and mass balance – calibration and verification of models; Transport phenomena – Advection, diffusion, dispersion, simple transport models; chemical reaction kinetics – Law of mass action, Rate constants, reaction order, types of reactions, equilibrium principles.

Unit: 2

SURFACE WATER QUALITY MODELING: Water quality models – Historical development – Mass balance equation – Streeter - Phelps Equation – Modification to Streeter – Phelps Equation – Waste load allocations – Dissolved oxygen in Rivers and estuaries; Lake Water Quality Models; Models for Nitrogen, Bacteria, Phosphate and toxicants.

Unit: 3

GROUNDWATER QUALITY MODELING: Mass transport of solutes, degradation of organic compounds, application of concepts to predict groundwater contaminant movement, seawater intrusion – basic concepts and modelling.

Unit: 4

AIR QUALITY MODELS: Types of modeling technique, modeling for non-reactive pollutants, single source, short term impact, multiple sources and area sources, Fixed box models- diffusion models – Gaussian plume derivation- modifications of Gaussian plume equation- long term average-multiple cell model- receptor oriented and source-oriented air pollution models, model performance, accuracy and utilization.

Unit: 5

WATER QUALITY INDEX: Categories of water quality index. Determination of water quality index (WQI): Industrial and municipal effluent index, ambient water quality index, combined water quality index and Delphi method.

AIR QUALITY INDEX: Categories of air quality index. Determination of air quality index (AQI): National AQI, Extreme value indices, Regional indices.

TEXT BOOKS:

1. Steven C. Chapra, "Surface Water Quality Modeling", Tata McGraw-Hill Companies, Inc., New Delhi, 1997.
2. R.W.Boubel, D.L. Fox, D.B. Turner & A.C. Stern, "Fundamentals of Air Pollution", Academic Press, New York, 1994.

REFERENCES:

1. Reckhow & Chapra, "Engineering Approaches for Lake Management", Volumes 1 & 2, Butterworths Publ., 1983.
2. E.V. Thomson, "Principles of Surface Water Quality Modeling and Control", Happer and Row Publishers New York, 1987.
3. J.L. Schnoor, "Environmental Modeling Fate and Transport of Pollutants in Water, Air and Soil", John Wiley & Sons Inc., New York, 1996.

Honor Course	CLIMATE CHANGE IMPACT ON ENVIRONMENT	L	T	P	C
		3		0	

SYLLABUS:

Unit: 1
Climate System; Climate, weather and Climate Change; Overview of Earth's Atmosphere; Vertical Structure of Atmosphere; Radiation and Temperature; Laws of Radiation; Heat-Balance of Earth Atmosphere System; Random Temperature Variation; Modelling Vertical Variation in Air Temperature; Temporal Variation of Air temperature; Temperature Change in Soil; Thermal Time and Temperature Extremes.

Unit: 2
Hydrologic Cycle: Introduction; Global water balance; Cycling of water on land, a simple water balance model;

Unit: 3
Climate Variables affecting Precipitation: Precipitation and Weather, Humidity, Vapor Pressure, Forms of Precipitation, Types of Precipitation; Cloud; Atmospheric Stability; Monsoon; Wind Pattern in India; Global Wind Circulation; Evaporation and Transpiration, Processes of Vadose Zone, Surface Runoff, Streamflow.

Unit: 4
Climate Variability: Floods, Droughts, Drought Indicators, Heat waves, Climate Extremes.

Unit: 5
Climate Change: Introduction; Causes of Climate Change; Modeling of Climate Change, Global Climate Models, General Circulation Models, Downscaling; IPCC Scenarios

Honor Course	**ENVIRONMENTAL SYSTEM ENGINEERING**	**L**	**T**	**P**	**C**
		3		**0**	

MINORS COURSE

Minor Course - II/IV	SURVEYING	L	T	P	C
		3		0	

SURVEYING & GEOMATICS

SYLLABUS:

Unit: 1
Introduction to Surveying: Definition, Classification, Principles, Survey stations and Survey lines; Introduction to measurement of distance, direction and elevation; Ranging and it methods, Meridians and Bearings, Methods of levelling, Booking and reducing levels, Reciprocal levelling, distance of visible horizon, Profile levelling and cross sectioning, Errors in levelling; Introduction to methods of plane table surveying; Contouring: Characteristics, methods, uses, computation of areas and volumes. Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Methods of horizontal and vertical control, Triangulation: Figures or systems, Signals, Satellite station, Baseline and its importance, corrections, Trigonometric levelling: Accessible and inaccessible objects.

Unit: 2
Curves: Elements of simple circular curves, Theory and methods of setting out simple circular curves, Transition curves- types, characteristics and equations of various transition curves; Introduction to vertical curves.

Unit: 3
Modern Field Survey Systems: Principle and types of Electronic Distance Measurement systems and instruments, Total Station- its advantages and applications; Global Positioning Systems Segments, working principle, errors and biases. Geographic Information System: Concepts and data types, data models, data acquisition. GIS applications in civil engineering.

Unit: 4
Photogrammetric Survey: basic principles, aerial camera, scale of a vertical photograph, relief displacement of a vertical photograph, height of object from relief displacement, flight planning for aerial photography, selection of altitude, interval between exposures, crab and drift, stereoscope and stereoscopic views, parallax equations. Introduction to digital photogrammetry.

Unit: 5
Remote Sensing: Concepts and physical basis of Remote Sensing, Electromagnetic spectrum, atmospheric effects, image characteristics. Remote sensing systems, spectral signatures and characteristics spectral reflectance curves. Salient features of some of Remote Sensing satellites missions. Digital image processing: Introduction, image rectification and restoration, image enhancement, image transformation, image classification. Applications of remote sensing to civil engineering.

BOOKS AND REFERENCES:

1. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.

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

Minor Course - II/IV	MECHANICS OF SOLIDS	L	T	P	C
		3		0	

SOLID MECHANICS

SYLLABUS:

Unit: 1

Simple stress and strains: Concept of stress and strain, types of stresses and strains, Hook's law, stress and strain diagram for ductile and brittle metal. Lateral strain, Poisson ratio, volumetric strain, elastic moduli and relation between them. Bar of varying cross section, composite bar and temperature stress. Strain energy for gradual, sudden and impact loading. Compound stress and strains: Normal stress and strain, shear stress and strain, stresses on inclines sections, principal stress and strain, maximum shear stress, Mohr's stress circle, three-dimensional state of stress & strain, equilibrium equations, generalized Hook's law-3D, Theories of failure and factor of safety.

Unit: 2

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

Unit: 3

Flexural Stresses-Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections. Torsion- Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections.

Unit: 4

Deflection of Beams: Slope and deflection- Relationship between moment, slope and deflection, Moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for determinant beams. Short Columns and Struts: Buckling and stability, slenderness ratio, combined bending and direct stress, middle third and middle quarter rules.

Unit: 5

Helical and Leaf Springs Deflection of springs by energy method, helical springs under axial load and under axial twist (respectively for circular and square cross sections) axial load and twisting moment acting simultaneously both for open and closed coiled springs. Thin cylinders, Thick cylinders & Spheres: Introduction, difference between thin walled and thick-walled pressure vessels, thin-walled spheres and cylinders, hoop and axial stresses and strain,

volumetric strain. Radial, axial and circumferential stresses in thick cylinders subjected to internal or external pressures, compound cylinders.

BOOKS AND REFERENCES:

1. Mechanics of Materials by Hibbeler, Pearson.
2. Mechanics of material by Gere, Cengage Learning
3. Mechanics of Materials by Beer, Jhonston, DeWolf and Mazurek, MCGRAW HILL INDIA
4. Strength of Materials by Pytel and Singer, Harper Collins
5. Strength of Materials by Ryder, Macmillan.
6. Strength of Materials by Timoshenko and Yσungs, East West Press.
7. Introduction to Solid Mechanics by Shames, Pearson
8. Mechanics of material by Pytel, Cengage Learning
9. An Introduction to Mechanics of Solids by Crandall, MCGRAW HILL INDIA
10. Strength of Materials by Jindal, Pearson Education
11. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi.
12. Kazmi, S. M. A., “Solid Mechanics” TMH, Delhi, India Date: 5th & 6th March 2022

Minor Course - II/IV	SOIL MECHANICS	L	T	P	C
		3		0	

GEOTECHNICAL ENGINEERING – I

SYLLABUS:

Unit: 1
Introduction: Soil formation – soil structure and clay mineralogy – Adsorbed water – Mass-volume relationship –Relative density
Index Properties of Soils: Grain size analysis – Sieve and Hydrometer methods – consistency limits and indices – Various Types of soil Classifications – Unified soil classification and I.S. Soil classification.

Unit: 2
Permeability: Soil water – capillary rise – One dimensioned flow of water through soils – Darcy's law- permeability – Factors affecting –laboratory determination of coefficient of permeability – Permeability of layered systems.
Geostatic Stresses: Total, neutral and effective stresses –quick sand condition Seepage: 2-D flow and Laplace's equation-Seepage through soils–Flow nets: Characteristics and Uses.

Unit: 3
Stress Distribution In Soils: Stresses induced by applied loads - Boussinesq's and Westergaard's theories for point loads and areas of different shapes– Newmark's influence chart – 2:1 stress distribution method.

Unit: 4
Compaction: Mechanism of compaction – factors affecting – effects of compaction on soil properties - compaction control. Consolidation: Compressibility of soils –e-p and e-log p curves – Stress history – Concept of consolidation - Spring Analogy - Terzaghi's theory of one-dimensional Consolidation – Time rate of consolidation and degree of consolidation – Determination of coefficient of consolidation (cv) - Over consolidated and normally consolidated clays.

Unit: 5
Shear Strength of Soils: Basic mechanism of shear strength -Mohr – Coulomb Failure theories – Stress-Strain behavior of Sands - Critical Void Ratio – Stress-Strain behavior of clays – Shear Strength determination- various drainage conditions.

TEXT BOOKS:

1. Gopal Ranjan and A.S.R.Rao, "Basic and Applied Soil Mechanics", New Age International Publishers.
2. V.N.S.Murthy, "Soil Mechanics and Foundation Engineering", CBS publishers
3. M.Palani Kumar, "Soil Mechanics", PHI Learning

REFERENCES:

1. D.W.Taylor, “Fundamentals of Soil Mechanics”, Wiley.
2. Holtz and Kovacs, “An introduction to Geotechnical Engineering” Prentice Hall
3. Donald P. Coduto, Man-chu Ronald Young and William A. Kitch.

Minor Course - II/IV	FLUID MECHANICS	L	T	P	C
		3		0	

SYLLABUS:

Unit: 1

Introduction: Dimensions and units – Physical properties of fluids - specific gravity, viscosity, surface tension, vapour pressure and their influences on fluid motion, pressure at a point, Pascal's law, Hydrostatic law -atmospheric, gauge and vacuum pressures-measurement of pressure. Pressure gauges, Manometers: Differential and Micro Manometers. Hydrostatics: Hydrostatic forces on submerged plane, Horizontal, Vertical, inclined and curved surfaces – Center of pressure.

Unit: 2

Fluid Kinematics: Description of fluid flow, Streamline, path line and streak line and stream tube. Classification of flows: Steady, unsteady, uniform, non-uniform, laminar, turbulent, rotational and ir rotational flows – Equation of continuity for one, two, three dimensional flows – stream and velocity potential functions, flow net analysis. Fluid Dynamics: Surface and body forces – Euler's and Bernoulli's equations for flow along a streamline - Momentum equation and its application – forces on pipe bend.

Unit: 3

Laminar Flow and Turbulent Flows: Reynold's experiment – Characteristics of Laminar & Turbulent flows, Shear and velocity distributions, Laws of Fluid friction, Hagen - Poiseuille Formula, Flow between parallel plates, Flow through long tubes, hydro-dynamically smooth and rough flows. Closed Conduit Flow: Darcy-Weisbach equation, Minor losses – pipes in series – pipes in parallel – Total energy line and hydraulic gradient line, variation of friction factor with Reynold's number – Moody's Chart, Pipe network problems, Hazen-William's formula, Hard-Cross Method,

Unit: 4

Measurement of Flow: Pitot tube, Venturi meter and Orifice meter – classification of orifices, small orifice and large orifice, flow over rectangular, triangular, trapezoidal and stepped notches, Broad crested weirs and Ogee weirs.

Unit: 5

Boundary Layer Theory: Boundary layer (BL) – concepts, Prandtl contribution, Characteristics of boundary layer along a thin flat plate, Vonkarman momentum integral equation, laminar and turbulent Boundary layers (no deviations)- BL in transition, separation of BL, Control of BL, flow around submerged objects-Drag and Lift- Magnus effect.

TEXTBOOKS:

1. Modi P.N and Seth S.M. (2018), "Fluid mechanics", Standard book house, New Delhi
2. A text of Fluid mechanics and hydraulic machines, R.K. Bansal – Laxmi Publications (P) ltd., New Delhi

REFERENCES:

1. K. Subramanian, Fluid mechanics and hydraulic machines Mc Graw hill education, II edition

2. Fluid Mechanics and Machinery, C.S.P. Ojha, R. Berndtsson and P.N. Chandramouli, Oxford Higher Education. Principle of fluid mechanics and fluid machines III edition, university press

Minor Course - II/IV	BUILDING MATERIALS AND CONSTRUCTION	L	T	P	C
		3		0	

SYLLABUS:

Unit: 1

Stones, Bricks and Tiles: Properties of building stones – relation to their structural requirements, classification of stones – stone quarrying – precautions in blasting, dressing of stone, composition of good brick earth, various methods of manufacturing of bricks. Characteristics of good tile - manufacturing methods, types of tiles. Uses of materials like Aluminum, Gypsum, Glass and Bituminous materials

Unit: 2

Masonry: Types of masonry, English and Flemish bonds, Rubble and Ashlar Masonry. Cavity and partition walls. Wood: Structure – Properties- Seasoning of timber- Classification of various types of woods used in buildings- Defects in timber. Alternative materials for wood – Galvanized Iron, Fiber Reinforced Plastics, Steel, Aluminum.

Unit: 3

Lime and Cement: Lime: Various ingredients of lime – Constituents of lime stone – classification of lime – various methods of manufacture of lime. Cement: Portland cement- Chemical Composition – Hydration, setting and fineness of cement. Various types of cement and their properties. Various field and laboratory tests for Cement. Various ingredients of cement concrete and their importance – various tests for concrete. Building Components: Lintels, arches, vaults, stair cases – types. Different types of floors – Concrete, Mosaic, Terrazzo floors, Pitched, flat roofs. Lean to roof, Coupled Roofs. Trussed roofs – King and Queen post Trusses. R.C.C Roofs, Madras Terrace and Pre-fabricated roofs.

Unit: 4

Finishings and Aggregates: Damp Proofing and water proofing materials and uses – Plastering Pointing, white washing and distempering. Paints: Constituents of a paint – Types of paints – Painting of new/old wood- Varnish. Form Works and Scaffoldings. Aggregates - Classification of aggregate – Coarse and fine aggregates- particle shape and texture – Bond and Strength of aggregate – Specific gravity – Bulk Density, porosity and absorption – Moisture content of Aggregate- Bulking of sand – Sieve analysis.

TEXT BOOKS:

1. Building Materials, S. S. Bhavikatti, Vices publications House private ltd.
2. Building Construction, S. S. Bhavikatti, Vices publications House private ltd.
3. Building Materials, B. C. Punmia, Laxmi Publications private ltd. 4. Building Construction, B.C. Punmia, Laxmi Publications (p)ltd.

REFERENCES:

1. Building Materials, S. K. Duggal, New Age International Publications.

2. Building Materials, P. C. Verghese, PHI learning (P)ltd.
3. Building Materials, M. L. Gambhir, Tata McGraw Hill Publishing Co. Ltd. New Delhi.
4. Building construction, P. C. Verghese, PHI Learning (P)Ltd.
5. Building Materials, Construction and Planning, S. Mahaboob Basha, Anuradha Publications, Chennai.

Minor Course - II/IV	BUILDING PLANNING AND DRAWING	L	T	P	C
		3		0	

SYLLABUS:

Unit: 1

Concepts to be studied Introduction to CAD software: Basic commands of CAD to draw, modify 2D drawings

Unit: 2

Building Byelaws: Introduction – Terminology – Objectives of building byelaws – Principles under laying building bye laws – Types of Buildings.

Unit: 3

Regulations: Introduction – Development Control Rules of buildings – General Building Requirements as per NBC – Open space, Lighting and ventilation requirements – Floor area ratio & Floor space index.

Unit: 4

Conventions, signs and symbols: Conventions as per IS 962-1989, signs and symbols for earthwork, brickwork, stonework, concrete, woodwork and glass used in civil engineering. Construction, Graphical symbols for door and window, Abbreviations, symbols for sanitary and electrical installations.

Unit: 5

Types of lines and scales: Types of lines- visible lines, centre line, hidden line, section line, dimension line, extension line, pointers, arrow head or dots. Appropriate size of lettering and numerals for Titles, sub titles, notes and dimensions. Types of scale- Monumental, Intimate, criteria for Proper Selection of scale for various types of drawing. Sizes of various standard papers/sheets.

Minor Course - II/IV	ESTIMATION AND COSTING	L	T	P	C
		3		0	

SYLLABUS:

Unit: 1
Contracts – Types of contracts – Contract Documents – Conditions of contract, Valuation of buildings- concepts of e-procurement and reverse auctions. Standard specifications for different items of building construction.

Unit: 2
General items of work in Building – Standard Units Principles of working out quantities for detailed and abstract estimates –Approximate method of Estimating.

Unit: 3
Rate Analysis – Working out data for various items of work over head and contingent charges. Earthwork for roads and canals, Reinforcement bar bending and bar requirement schedules.

Unit: 4
Detailed Estimation of Buildings using individual wall method for single, double and four roomed buildings.

Unit: 5
Detailed Estimation of Buildings using centre line method for single, double and four roomed buildings. Standard software's like building estimator etc.

TEXT BOOKS:

1. 'Estimating and Costing' by B.N. Dutta, UBS publishers, 2000.
2. Civil Engineering Contracts and Estimates by B. S. Patil, Universities Press (India) Pvt. Ltd., Hyd.
3. 'Construction Planning and Technology' by Rajiv Gupta, CBS Publishers & Distributors Pvt. Ltd.
4. New 'Estimating and Costing' by G.S. Birdie.

REFERENCES:

1. 'Standard Schedule of rates and standard data book' by public works department.
2. IS 1200 (Parts I to XXV-1974/ Method of Measurement of Building & Civil Eng Works – B.I.S.)
3. 'Estimation, Costing and Specifications' by M. Chakraborthi; Laxmi publications. National Building Code

Minor Course - II/IV	SUSTAINABLE MATERIALS AND GREEN BUILDINGS	L	T	P	C
		3		0	

SYLLABUS:

Unit: 1

Green Buildings: History of Green Building Movement; Environmental Impact and Resource Consumption; Introduction to concept of green buildings; Benefits of Green Building and its Productivity.

Unit: 2

Indoor Built Environment: Problem of Existing Buildings and Built Environment; Energy use in buildings; Greenhouse Gas Emissions and Indoor Air pollution; Building Water Use; Land use and consumption; Construction Materials; Construction, Operation and Demolition Waste.

Unit: 3

Green Building Design: Passive Design Strategies: Optimum Design, Performing Insulation Solution, Ventilation; Active Strategies: Equipment, Renewable Energy; Retrofitting; Net Zero Building Design; Embodied Energy Estimation; Life Cycle Assessment Analysis.

Unit: 4

Green Building Assessment: Green Building Organizations, Green Building Rating Tools, Green building certification procedure Learning

TEXT BOOKS:

1. Green Building Technology Guide: Volume 1 - Residential, Fred Andreas, Academic Press Inc., 2020, First Edition.
2. The Idea Of Green Building, A. K. Jain, Khanna Publishers, 2014, First Edition.
3. Green Building Guidance: The Ultimate Guide for IGBC Accredited Professional Examination, Karthik Karuppu, Notion Press, 2019, First Edition.

REFERENCE BOOKS

1. Sustainable Construction: Green Building Design and Delivery, Charles Kibert, John Wiley & Sons, 2005.
2. Energetics Perspective on the Environmental and Human Impact of Buildings, Teodora Melania Soimosan and Ligia Mihaela Moga, Business Science Reference, 2020.
3. Alternative Energy Systems in Building Design, Peter Gevorkian, McGraw-Hill Education, 2009, First Edition.

Minor Course - II/IV	CONSTRUCTON PLANNING AND MANAGEMENT	L	T	P	C
		3		0	

SYLLABUS:

Uint: 1
Construction project management and its relevance – qualities of a project manager – project planning – coordination –scheduling - monitoring – bar charts – milestone charts – critical path method

Unit: 2
Project evaluation and review technique – cost analysis - updating – crashing for optimum cost – crashing for optimum resources – allocation of resources introduction to software's for construction management, project management using PRIMAVERA (or) equivalent.

Unit: 3
Construction equipment – economical considerations – earthwork equipment – Trucks and handling equipment – rear dump trucks – capacities of trucks and handling equipment – calculation of truck production – compaction equipment – types of compaction rollers Hoisting and earthwork equipment – hoists – cranes – tractors - bulldozers – graders – scrapers– draglines - clamshell buckets

Unit: 4
Concreting equipment — concrete mixers – Batching plants, mobile using plants like "Ajax" etc. mixing and placing of concrete – consolidating and finishing.

Unit: 5
Construction methods – earthwork – piling – placing of concrete – form work – fabrication and erection – quality control and safety engineering. BIM for Civil Engineers (Building Information Modelling)

TEXT BOOKS:

1. 'Construction Planning, Equipment and Methods' by Peurifoy and Schexnayder, Shapira, Tata McGraw hill.
2. 'Construction Project Management Theory and Practice' by Kumar Neeraj Jha (2011), Pearson.
3. 'Construction Technology' by Subir K. Sarkar and Subhajit Sarasvati, Oxford University press

REFERENCES:

1. 'Construction Project Management - An Integrated Approach' by Peter Fewings , Taylor and Francis
2. 'Construction Management Emerging Trends and Technologies' by Trefor Williams, Cengage learning