VEERMATA JIJABAI TECHNOLOGICAL INSTITUTE

(VJTI)

MATUNGA, MUMBAI 400 019

(Autonomous Institute affiliated to University of Mumbai)

Curriculum
(Scheme of Instruction & Evaluation and Course contents)

For
First Year Syllabus
Bachelor of Technology (B.Tech.) Degree in Civil Engineering

Implemented from the batch admitted in Academic Year 2023-24

[NEP 2020 Based syllabus]

Program Educational Objective

PEO1	Develop a professional to pursue career as a Civil Engineer with adequate technical knowledge and skills while using modern tools for problem solving and exhibiting qualities of communication, team membership, and leadership
PEO2	Develop ability to practice ethically focusing on social relevance, environmental sustainability, optimal solutions and safety of stakeholders.
PEO3	Develop abilities of lifelong learning to continuously strive to enhance decision making abilities to investigate, design and develop complex facilities.

Program Specific Outcomes

PSO1	Able to analyze various Civil Engineering structures and systems by using basic and advanced technologies.
PSO2	Able to design civil engineering facilities and their elements and also use of modern software tools for the same.
PSO3	Able to plan, monitor and supervise construction activities to complete civil engineering facilities satisfactorily.
PSO4	Able to practice as a construction professional through ethical practice while focusing on sustainability and economy.

Program Outcomes

PO-1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering and technology to the solution of complex mechanical engineering problems.
PO-2	**Problem analysis**: Identify, formulate, review existing literature, and analyze complex engineering problems to reach substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO-3	**Design/Development of solutions**: Design solutions for mechanical engineering problems and design system components or processes that meet the specified needs with appropriate consideration for societal, economical and environmental considerations.
PO-4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO-5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex mechanical engineering activities with an understanding of the limitations.
PO-6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
PO-7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO-8	**Ethics**:Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO-9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO-10	**Communication**: Communicate effectively with the engineering community and with society at large, including the ability to comprehend, create effective reports, make effective presentations, and give and receive clear instructions.
PO-11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO-12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Credit Framework for UG Programme in Civil Engineering (Level 4.5- UG Certificate) - Semester - I

Sr.	Course Type	Course Code	Course Name	L	T	P	Hr	Cr	Examination Weightage in %		
									TA	MST	ESE
1	BSC	R5PH1011T	Physics	2	1	0	3	3	20	30	50
2	BSC	R5PH1011L	Physics – Laboratory	0	0	2	2	1	ISCE :60		40
3	BSC	R5MA1001T	Mathematics-I	2	1	0	3	3	20	30	50
4	ESC	R5ME1001T	Engineering Graphics	2	0	0	2	2	20	30	50
5	ESC	R5ME1001L	Engineering Graphics Laboratory	0	0	2	2	1	ISCE: 60		40
6	ESC	R5CE1021T	Construction Techniques and Infrastructure Project	3	0	0	3	3	20	30	50
7	ESC	R5CE1022T	Environmental Science and Engineering	3	0	0	3	3	20	30	50
8	ESC	R5CE1023L	Construction Engineering Laboratory	0	0	2	2	1	ISCE :60		40
9	VSEC	R5CE1024L	Design Thinking – Emerging Technology in Civil Engg.	0	0	3	3	1.5	ISCE :60		40
10	AEC	R5HS1001L	Bussiness and Technical Communication	1	0	2	3	2	ISCE :60		40
11	Extra-Curricular		Sports, Yoga, NSS, NCC, Co-Curricular and Extra Curricular activites	0	0	3	3	1.5	ISCE:100		
			Total	14	0	16	30	22			

Semester –I List of Co-Curricular and Extra-Curricular Courses

11	R5CE1025L A	Yoga	0	0	3	3	1.5	ISCE:100
	R5CE1025L B	Sports	0	0	3	3	1.5	ISCE:100
	R5CE1025L C	NSS/NCC	0	0	3	3	1.5	ISCE:100
	R5CE1025L D	Social Responsibility& Community Engagement	0	0	3	3	1.5	ISCE:100
	R5CE1025L E	Digital storytelling and Environment	0	0	3	3	1.5	ISCE:100
	R5CE1025L F	Graphic Design and Community	0	0	3	3	1.5	ISCE:100

Credit Framework for UG Programme in Civil Engineering (Level 4.5- UG Certificate) - Semester - II

Sr.	Course Type	Course Code	Course Name	L	T	P	Hr	Cr	Examination Weightage in %		
									TA	MST	ESE
1	BSC	R5CH1011T	Chemistry	2	1	0	3	3	20	30	50
2	BSC	R5CH1011L	Chemistry – Laboratory	0	0	2	2	1	ISCE :60		40
3	BSC	R5MA1011T	Mathematics-II	2	1	0	3	3	20	30	50
4	BSC	R5CE 1026T	Construction Materials Science	2	0	0	2	2	20	30	50
5	ESC	R5SE1001T	Engineering Mechanics	2	0	0	2	2	20	30	50
6	ESC	R5SE1001L	Engineering Mechanics Laboratory	0	0	2	2	1	ISCE: 60		40
7	ESC	R5CO1001T	Programming for Problem Solving	2	0	0	2	2	20	30	50
8	ESC	R5CO1001L	Programming for Problem Solving Laboratory	0	0	2	2	1	ISCE :60		40
9	PCC	R5SE1027T	Concrete Technology	1	0	2	2	2	20	30	50
10	VSEC	R5CE1028L	Civil Engineering Workshop	0	0	3	3	1.5	ISCE :100		
11	IKS	R5CE1029T	Ancient Civil Engineering	2	0	0	2	2	20	30	50
									Or Credit Transfer		
12	Extra-Curricular	R5CE1030L	Sports, Yoga, NSS, NCC, Co-Curricular and Extra Curricular activites	0	0	3	3	1.5	ISCE:100		
			Total	15	0	14	29	22			

Semester-II List of Co-Curricular and Extra-Curricular Courses

12	R5CE1030L A	Yoga	0	0	3	3	1.5	ISCE:100
	R5CE1030L B	Sports	0	0	3	3	1.5	ISCE:100
	R5CE1030L C	NSS/NCC	0	0	3	3	1.5	ISCE:100
	R5CE1030L D	Social Responsibility& Community Engagement	0	0	3	3	1.5	ISCE:100
	R5CE1030L E	Digital storytelling and Environment	0	0	3	3	1.5	ISCE:100
	R5CE1030L F	Graphic Design and Community	0	0	3	3	1.5	ISCE:100
	R5CE1030LG	Indian Constitution and Laws for Civil Engineering	0	0	3	3	1.5	ISCE:100

List of Exit Courses after completion of Semester I and II

1. Exit option is available for students those who have earned the total 44 credits at the End of Second Semester.
2. Student who wants to avail the exit option after first year have to **earn additional 6-8 credits** from the list of courses shown below.
3. These courses student have to complete **within summer vacation** after 1st Year.
4. After fulfilment as mentioned in 1to 3 above, Students can earn U.G Certificate and same will be issued by the Institute.

List of Exit Courses after completion of Semester I and II:B.Tech. Civil Engineering

Sr.	Course Type	Course Name	L	T	P	Hr	Cr	Examination Weightage in %		
								TA	MST	ESE
1	EC	Inplant training on construction site (4week)	0	0	0	4 week	6	ISCE: 100%		

SEMESTER – I

Semester - I		Basic Science Course						
SN	**Course Code**	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**	**ESE hours**
1	R5PH1011T	Physics	2-1-0=3	3	20	30	50	3

Course Outcome:

1. Classify, draw, describe, and distinguish crystal structures and crystallographic planes.
2. Analyze crystal structures by X-Ray diffraction.
3. Describe properties of light using interference, diffraction, polarization, and its applications.
4. Identify and summarize properties and applications of dielectric materials.
5. Classify and analyze magnetic materials.

	Course Contents	Lectures
1	**Crystal Structure of solids:** Single crystal, polycrystalline, amorphous solids; Concepts of space lattice, atomic basis, unit cell & its characteristics; Monoatomic and diatomic Crystal, ligancy, imperfection	4
2	**Crystallographic Planes and Direction**: Concept of Miller indices and its determination for Crystallographic planes and their direction, examples, Interplanar spacing in terms of miller indices.	3
3	**Determination of crystal structure using X-rays**: Bragg's law of X-ray diffraction, Bragg's spectrometer, X-ray diffraction methods: - Laue, Powder, Rotating Crystal	3
4	**Interference:** Temporal and spatial coherence, interference in parallel thin films, wedge shaped film, Michelson interferometer, antireflection coating	4
5	**Diffraction**: Fresnel and Fraunhofer diffraction, Fraunhofer diffraction at single slit, double slits and circular aperture, diffraction grating	4
6	**Polarization:** Polarization types, theory of production of Plane, circularly and elliptically polarized light, double refraction, uniaxial and biaxial crystals, Nicole prism, Dichroism, retardation plates: quarter wave and half wave, polarimeter	5
8	**Magnetic properties:** basic concepts, classification of magnetic materials, Domain theory of Ferromagnetism, Hysteresis Curve, Magnetostriction, magnetic materials.	2

Reference Books

1. Modern Physics, 3rd edition, R Serway, C Moses and C Moyer, Thomson Learning inc,
2. Material Science and Engineering: An Introduction, 6th Edn., Callister W.C. Jr., John Wiley &Sons

	3. Applied Physics I for Science and Engineering, Dattatray Wavhal, *ISBN 978-93-5267-180-9, 2016* ***4.*** Applied Physics II for Science and Engineering, Dattatray Wavhal, *ISBN 978-93-5268-289-8, 2017* A textbook of Engineering Physics, M N Avadhanulu and P. G. Kshirsagar

Semester - I		Basic Science Course						
SN	**Course Code**	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**	**ESE hours**
2	R5PH1011L	Physics Laboratory	0-0-2=2	1	ISCE: 60		40	

Course Outcome:

1. Draw and analyze unit cells, Miller planes and Miller directions.
2. Calculate radius of curvature of lens, wavelength and small thickness, velocity of sound waves using Interference.
3. Finding energy of spectral lines and grating element using diffraction phenomena.
4. Determine optical activity by polarimeter and verification of Malus Law
   Study of magnetic properties using hysteresis/curie temperature/ susceptibility

Course Contents (Any 10)

1. Crystal Structure (Unit Cells)
2. Crystal Structure (Miller planes)
3. Newton's Ring Experiment
4. Wedge shape Method
5. Michelson Interferometer
6. Ultrasonic Interferometer
7. Wavelength and energy measurement of spectral lines using spectrometer.
8. Laser diffraction method
9. Specific rotation of Cane sugar solution using polarimeter.
10. Polarization of light and verification of Malus law
11. Hysteresis of a ferromagnetic material
12. Curie temperature by two probe method
13. Susceptibility of solids by Gouy's method

Semester - I		Basic Science Course						
SN	**Course Code**	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**	**ESE hours**
3	R5MA1001T	Engineering Mathematics – I	2-1-0=3	3	20	30	50	3

Course Outcome:

1. Characterize a linear system in terms of number of solutions, whether it is consistent or not.
2. Compute eigenvalues and eigenvectors of a square Matrix and determine if it is diagonalizable
3. Calculate functional value of some point in a neighborhood using Taylor's series expansion and find the limit of a function at a point or at infinity using L'Hospital's rule.
4. Determine if an infinite series is convergent or not using suitable test.
5. Be familiar with the theorems of differentiability such as mean value theorem and interpret it geometrically.
6. Evaluate partial derivatives and implement/ apply it to find minima and maxima of a multivariate function. Also Find directional derivatives and gradient and illustrate geometric meaning with the help of sketches.
7. Apply definite integration to evaluate surface areas and volumes of revolution and evaluate improper integrals.
8. Evaluate multiple integrals for regions in a plane and find volume, area bounded by the curves, mass, center of gravity of solid geometric figures.
9. Solve linear system of equations and non -linear equations using numerical methods.
10. Apply different techniques like interpolation, numerical integration to solve different engineering problem.
11. Solve initial and boundary value problems in differential equations using numerical methods.

Module	Content	Lectures
1	**Linear Algebra:** Rank of a matrix, System of linear equations- check for consistency, Eigenvalues & eigenvectors of a matrix, Diagonalization, Cayley-Hamilton theorem, Minimal polynomial, Finding Inverse and Powers of a matrix.	8
2	**Differential Calculus:** Mean value theorem, Rolle's theorem, Indeterminate form, L'Hospital's rule, Taylor's theorem and Truncation error, Partial Derivatives, Chain rule, Total Derivative, Differentiation of an implicit function, Directional Derivative, Gradient,maxima, minima and saddle points of a multivariable function, Lagrange's multipliers method, tangent plane and normal line, Convergence of sequence and series, Tests for convergence -ratio test, root test, p-series test, comparison test, alternating series test, absolute convergence test.	9

3	**Integral Calculus:** Evaluation of definite integration to find surface areas and volumes of revolution, Introduction to Improper Integrals and Gamma functions and its properties, Multiple integrals, change of order of integration in double integrals, Change of variables (Cartesian to polar), Triple integrals (Cartesian, cylindrical and spherical co-ordinates). Applications: areas and volumes, Center of mass and Gravity (constant and variable densities).	9
4	**Numerical methods:** Numerical solutions of non-linear equations, Solutions of Linear systems of equations by numerical methods, Interpolation by Newton's and Lagrange polynomials, Integration by trapezoidal and Simpson's rule, Single and Multi-step methods for solving first order differential equations.	8

References:

- G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
- Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & sons, 2006.
- Ramana B. V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
- Veerarajan T., Engineering Mathematics for first year, Tata McGraw Hill, New Delhi 2008.
- N.P.Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint 2008.
- B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
- M.K.Jain, S.R.K. Iyengar, R.K.Jain, Numerical methods for scientific and engineering computation, Fourth Edition.

Semester - I		Engineering Science Course						
SN	**Course Code**	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**	**ESE hours**
4	R5ME1001T	**Engineering Graphics**	2-0-0=2	2	20	30	50	3

Course Outcome:

1. Represent projections of lines and solids.
2. Draw projections of solids cut by section planes.
3. Convert the pictorial view into orthographic projections.
4. Convert the orthographic projections into isometric view.

Course Contents

Introduction to Drawing & Geometrical Contraction

Introduction: Introduction and importance of engineering drawing, Drawing Instruments and their use, Drawing layout, types of lines, lettering and Dimensioning

Engineering Curves: Cycloid, Epicycloid, and Hypocycloid; Involutes.

Projection of Points and Lines

Introduction: Method of projections, Orthographic projection, Reference planes, Quadrants, Reference line etc. Projection of Points.

Projections of lines: Line inclined to both the reference planes (excluding the traces), True/Apparent lengths & inclinations.

Projection Solids, Sections of Solids

Projections of Solids: Solids (Prism, Pyramid, Cylinder, Tetrahedron, Hexahedron and cone only with their axis inclined to HP or VP only (Excluding Spheres, Composite and Hollow solids) Use change of position or Auxiliary Plane method.

Section of Solids: Section of Prism, Pyramid, Cylinder, Tetrahedron, Hexahedron & cone cut by plane. Use change of Position or Auxiliary plane method.

Orthographic Projections

Multi View Orthographic projections of simple machine parts by first angle method, Sectional views of simple machine parts (full & Half Section only)

Isomeric Projection

Isomeric scale, isometric view/Drawing of simple blocks with plain and cylindrical surfaces. (excluding spherical surface)

Note: Only FIRST ANGLE Method of projections must be used throughout the course.

Text books

1. N. D. Bhatt, Engineering Drawing, Charotar publishing house, 53rd Edition, 2014
2. N. H. Dubey, Engineering Drawing Nandu Publishers & printers, 15th Edition, 2015

Semester - I		Engineering Science Course					
SN	**Course Code**	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**
5	R5ME1001L	Engineering Graphics Laboratory	0-0-2=2	1	ISCE: 60		40

Course Outcome:

1. Draft various Geometrical Elements used in Engineering Practice using CAD software.
2. Draft projections of various objects and their representation and dimensioning using CAD software.
3. Represent objects through isometric projections. Interpret drawings of engineering parts and objects.

   Acquire drawing skills pertaining to various topics like projection of points, lines and solids.

Course Contents

Part-I

Introduction to Computer Aided sketching

Computer screen, layout of the software, standard tool bar/menus and description of most commonly used tools bars, navigational tools. Co-ordinate system and reference planes. Definitions of HP, VP. Creation of 2D/3D environment. Selection of drawing size and scale. Commands and creation of co-ordinate points, lines, axes, polylines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, offset, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz. tangency, parallelism, inclination and perpendicularity. Dimensioning, line conventions material conventions and lettering

Minimum 10 Exercises based on above mentioned topics with minimum two problems in each Exercise.

Part-II

Drawing Practice

1. Minimum 8 drawing sheets of A-3 size should be drawn based on each chapter mentioned in the syllabus for engineering graphics course

Semester - I		Engineering Science Course						
SN	**Course Code**	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**	**ESE hours**
6	**R5CE1021T**	**Construction Techniques and Infrastructure Projects**	3-0-0=3	3	20	30	50	3

Course Outcome:

1. To study various components and factors of infrastructures projects
2. To understand the procedures and techniques of construction of infrastructures projects.
3. Draw layout of various Civil Engineering Infrastructure Project.

Syllabus

1. **Types of structures:**
   Framed structure & Load bearing structure. Components of a Building (Substructure, Super structure, Chajja, Corbel, Cornice, String course) , Types of Loads and load combination
2. **Excavation and foundations:**
   Excavation in different types of soils and rocks. Shoring and strutting, Scaffolding, Shuttering Formwork, underpinning dewatering, types of foundation.
3. **Masonry Construction Masonry:**
   Definitions of terms used in masonry, Materials used. Stone masonry, Brick masonry, Different bonds used for brick masonry and stone masonry, Composite masonry. Concrete blocks and light weight block, Reinforced Masonry, Paver Block-Sizes
4. **Doors & windows:**
   Location of doors and windows, Aluminium windows, types of plywood Wood Joinery Definition of technical terms, Size of doors and windows, Door frames, Types of doors and windows, Ventilators, Fixtures and fastenings.
5. **Floor and Roofs:**
   Components of a floor, materials used for floor construction, Different types of Flooring, Ground floor and upper floors, Types of roofs, Basic roofing elements and Roof coverings. Tile adhesives
6. **Vertical Transportation:**
   Stairs and Lift Materials for lifts Definition of technical terms, Location of Stairs and Lift, Types of Stairs, Design of Vertical transportation.
7. **Arches and Lintels:**
   Definition of technical terms, Classification of Arches and Lintels, Types of Arches and Lintels.
8. **Damp proofing & Fireproofing:**
   Causes and effect of dampness on buildings, Materials and methods used for damp proofing, Fire hazards, Grading of buildings according to fire resistance, Fire resisting properties of common building materials, Fire resistant construction, General methods of thermal insulation and thermal insulating materials
9. **Pointing and Plastering:**
   Terminology used in Pointing and Plastering Work, Types of Mortars for Pointing and Plastering, Methods of Pointing and Plastering, Defects in Pointing and Plastering Works
10. **Infrastructure projects:**

	Introduction, need, purpose, function, classification, various terminologies of various infrastructure projects like railways, airport, harbor, ports and docks, bridge, sewage disposal system, water treatment plant, dams and reservoir, canals and tunnel, Residential building complex
	Recommended books 1. Dr. B.C. Punmia, Building construction Laxmi publications, 10th edition 2016, (ISBN 9788131804285) 2. S. P. Bindra, S. P. Arora, Building Construction, DhanpatRai Publication, New delhi, Fourth Edition, 2010 (ISBN - 1234567144035) 3. R. Srinivasan, Harbour dock and tunnelling, Charotar publishing house private limited. (ISBN - 9385039199) 4. Saxena S.C. and Arora S. P., A Text Book of Railway Engineering, Dhanpat Rai Publications, New Delhi, 2010. (ISBN-9788189928834) 5. Khanna and Arora, Airport planning & design, Nemchand Bros, Roorkee (ISBN9788185240688) 6. S. P. Bindra, Docks and Harbour Engineering, Dhanpat Rai and Sons, 2012. (ISBN9788189928858) 7. S K Garg, Water Resources Engineering Vol. II Irrigation Engineering & Hydraulic Structures, Khanna Publishers (2017), (ISBN: 8174090479) 8. S. K. Garg, Sewage Disposal and Air Pollution Engineering, Khanna Publishers, Delhi, Thirty seventh edition, 2017. (ISBN: 9788174092304) 9. S. K. Garg, Water Supply Engineering, Khanna Publishers, Delhi, 28th edition, 2010. (ISBN: 9788174091208/8174091203) **Recommended Reading:** 1. C. Punmia, Irrigation and water power engineering, Laxmi publications [P] lt. Sixteenth edition. (ISBN – 9788131807637) 2. 2) Construction planning, equipment, and Methods-Tata McGraw- hill edition, sixth edition. 3. 3) Roy Chudley, Roger Greeno, Building Construction Handbook, Butterworth Heinemann, Tenth Edition, 2006 (ISBN - 113890709X)

Semester - I		Engineering Science Course						
SN	**Course Code**	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**	**ESE hours**
07	**R5CE1022T**	**Environmental Science and Engineering**	3-0-0=3	3	20	30	50	3

Course Outcome:

1. Identify the impact of human development on natural resources.
2. Identify the impact of environmental problems on socio economic growth and human health.
3. Identify the impact of human population on the environment and human health.

Syllabus

Unit 1: The Multidisciplinary Nature of Environmental Studies

Definition, Scope and Importance. Need for Public awareness.

Unit 2: Natural Resources Renewable and Non-renewable Resources:

Natural resources viz. Forest, Water, Mineral, Food, Energy and Land; Resources availability, degradation and optimum consumption

Sources of Water, Water demand and Potable, industrial and agricultural water requirements, Quantity- Population forecasting, different methods of population forecasting, rate of water consumption for various purposes, factors affecting demand of water, calculation of fire demand

Unit 3: Environmental Pollution

1. Definition, Causes, effects and control measures of pollution. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: Foods, earthquake, cyclone and landslides.
2. Air: Composition and properties of air Quantification of air pollutants, Monitoring of air pollutants, Air pollution - Occupational hazards, Urban air pollution: automobile pollution, Chemistry of combustion, Automobile engines, quality of fuel, operating conditions and interrelationship. Air quality standards, Control measures for Air pollution, construction and limitations
3. Noise Basic concept, measurement, effects and various control methods
4. Solid waste management: Causes, effects and control measures of urban and industrial wastes. Composition and various chemical and physical parameters of MSW, MSW management: Collection, transport, treatment and disposal of MSW

Unit 4: Social Issues and the Sustainable Environment

From unsustainable to sustainable development. Urban problems related to energy. Watershed management.

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.

	Unit 5: Environmental Sanitation Water and wastewater characterisation; Water treatment; Wastewater treatment; Water distribution systems; Wastewater conveyance systems
	Recommended books **Text Book** 1. Soli J Arceivala and Shyam R. Asolekar, Environmental Studies A Practitioner's Approach, Tata McGraw Hill Education Private Limited, New Delhi, First Edition, 2012 (ISBN-1259006050) 2. R. Rajagopalan, Environmental Studies: From Crisis to Cure, Oxford University Press, USA, Third Edition, 2016.(ISBN - 0199459754) 3. Benny Joseph, Environmental Studies, McGraw Hill Education (India) Private, Third Edition, 2017. (ISBN - 9352605179) 4. IS 10500: 2012 Drinking Water – Specification 5. IS 3025 Method of Sampling and Test (Physical and Chemical) For Water and Waste Water **Recommended Reading :** 1. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T., Environmental Encyclopedia, Jaico Publ. House, Mumbai, 2001 (ISBN - 8172247869) 2. Jadhav, H &Bhosale, V.M., Environmental Protection and Laws. Himalaya Pub. House, Delhi, 1995(ISBN- 9352028503) 3. Wanger K.D., Environmental Management. W.B. Saunders Co. Philadelphia, USA, 1998 4. H. V. N. Rao and M. N. Rao, "Air Pollution", TMH Publications. 5. S. K. Garg ,"Water Supply Engg.", Khanna Publishers - NewDelhi. 6. Peavy and Rowe, "Environmental Engg.", McGraw Hill Publications 7. Government of India's publication of laws related to air pollution. Maharashtra Pollution control Board's (MPCB) publication of standards IS relevant to air pollution monitoring definitions, standards etc 8. Solid wastes - Engineering principles and management issues. Tchobanoglous, TheissenandEliassen. McGraw Hill Book Co.

Semester - I		Engineering Science Course						
SN	**Course Code**	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**	**ESE hours**
08	**R5CE1023L**	**Construction Engineering Laboratory**	0-0-2	1	ISCE:60		40	

Course Outcome:

1. Identify the elements of civil engineering structures.
2. Draw sketches of different civil engineering structures & components.
3. Use symbols & signs required in civil engineering drawings.

Syllabus

To prepare drawings sheets of following works on half imperial sheets;

1. Elements of Civil Construction Works; cross section view of a two storied building, cross section view of road structure, cross section view of rail track, simple bridge, Gravity dam, Earthen dam.
2. Types of Foundations
3. Types of Damp Proofing Course
4. Types of masonry Bonds
5. Types of Stairs
6. Types of Doors and Windows
7. Types of Roofs
8. Types of Floors
9. Types of Electrical Fittings and Plumbing Fixtures
10. Signs and Symbols required in Civil Engineering Drawings

Recommended books

Text Books:

1. S. P. Bindra, S. P. Arora, Building Construction, DhanpatRai Publication, New delhi, Fourth Edition, 2010 (ISBN -9788089928803)
2. M.G. Shah, C.M. Kale, S. Y. Patki, Building Drawing, Tata McGraw Hill Publishing Company Limited, New Delhi, Fifth Edition, 2002, (ISBN -0074638769)
3. B C Punmia, Building Construction, Laxmi Publication, 10th Edition 2010, (ISBN-9788131804285)

Recommended Reading:

1. Roy Chudley, Roger Greeno, Building Construction Handbook, Butterworth-Heinemann, Tenth Edition, 2006 (ISBN- 113890709X)

Semester - I		Vocational and Skill Enhancement Course (VSEC)						
SN	**Course Code**	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**	**ESE hours**
09	**R5CE1024L**	**Design Thinking – Emerging Technology in Civil Engg.**	0-0-3=3	1.5	ICSE:60		40	3

Course Outcome:

1. Develop understanding of concepts and principles of Design Thinking, a creative solution-based approach to problem solving.
2. Apply the innovation cycle of Design Thinking process for developing innovative solution
3. Discuss real-time innovative civil engineering approaches, appropriate frameworks, strategies, and techniques for prototype development

Syllabus:-

Unit 1: Basics of Design Thinking

Introduction to Design Thinking – Importance of Design Thinking – History of Design Thinking- Design Thinking Framework - Design Thinking Process- Empathize, Define, Ideate, Prototype, Test

Unit 2: Assessing Empathy

Understanding Emotions: Experience & Expression, Understanding Individual differences & Uniqueness, Group Discussion and Activities to encourage the understanding, acceptance and appreciation of Individual differences

Unit 3: Being Ingenious & Fixing Problem

Understanding Creative thinking process, Understanding Problem Solving, STEEP Analysis, Ideation using SCAMPER technique, Brainstorming, Stakeholder mapping, Cost analysis

Unit 4: Prototyping & Testing

Prototyping- rapid prototyping; testing and evaluation of design; Design modifications; Freezing the design, Final solution, Testing

Unit 5: Feedback, Re-Design & Re-Create

Feedback loop, Focus on User Experience,Alignment of Customer Expectations with Design, Address ergonomic challenges, User focused design, Continuous Integration – Continuous Testing –Continuous Monitoring.

Unit 6: Emerging Technologies in Civil Engineering

Applications in civil engineering projects- virtual reality, 3D printing, BIM, AI and ML.

Unit 7: Practice of Design Thinking in Civil Engineering Problems

	Insight to solving Practical Engineering Problems through Innovative Design & Creative Solution. Discuss real time examples from Infrastructure and Environmental projects. Group discussions/ Presentations.
	Recommended books **Text/Reference Books:** 1. E Balaguruswamy (2022), Developing Thinking Skills (The way to Success), Khanna Book Publishing Company. 2. Haik, Y. And Shahin, M. T., Engineering Design Process (2011), Cengage Learning, ISBN-13:978-0-495-66816-9. 3. Balmer, R. T., Keat, W. D., Wise, G., and Kosky, P., Exploring Engineering: An Introduction to Engineering and Design, 5th Edition (2020), ISBN: 9780128150740. **Recommended Reading** 1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation (2009), HarperCollins Publishers Ltd. 2. Design thinking guidebook (2017), https://www.rcsc.gov.bt/wp-content/uploads/2017/07/dt-guide-book-master-copy.pdf

Semester - I		Ability Enhancement Course (AEC)						
SN	**Course Code**	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**	**ESE hours**
10	**R5HS1001L**	**Business & Technical Communication**	1-0-2=3	1.5	ICSE:60		40	3

Course Outcome:

1) Apply the principles and practices of business communication for communicating in a professional environment.
2) Design a technical document with correctness of language, appropriate vocabulary and style.
3) Display competence in oral and visual communication.
4) Demonstrate capabilities for self -assessment and development.

Module 1: Foundations of Business English

- Introduction to Business English and its importance in the professional world.
- Business Vocabulary and commonly used expressions.
- Business Idioms at the workplace.

Module 2: Business and Technical Writing

- Understanding Business writing language, style and tone.
- Crafting clear and concise business documents: Instruction Manuals/Brochures.
- Developing Email Etiquette.

Module 3 Business Grammar and Language Usage

- Review of essential English grammar rules.
- Identifying commonly made errors in Indian English.

Module 4: Group Discussion

- Basics of a Group Discussion.
- Understanding the different types of Group Discussions.
- Practical tips and suggestions for a GD.

Module 5: Presentation Skills

- Structuring a compelling business presentation.
- Engaging an audience and using visual aids effectively.

Module 6: Introduction to Public Speaking for Engineers

- Techniques to manage and reduce public speaking anxiety.
- Crafting a clear and concise speech outline.
- Tailoring the message for different audiences.

Module 7: Critical Thinking Skills

- Introduction to the processes of logical reasoning to interpret arguments
- Evaluating information from a lens of fact checking, evidentiary support, confirmation biasand language analysis.

Text Books

1. H. S. Mukherjee, Business Communication: Connecting at Work, Oxford University Press;Pap/Cdr edition (26 November 2012), (ISBN: 9780198073475)

2. A. Rizvi, Effective Technical Communication, McGraw Hill Education; 1 edition (27 June2005), (ISBN: 0070599521)

3. M. Raman, P. Singh, Business Communication, Oxford; Second edition (6 August 2012),(ISBN: 9780198077053)

Recommended Reading:

1. E. H. Mcgrath, Basic Managerial Skills for All, Prentice Hall India Learning Private Limited;9 edition (2011), (ISBN: 9788120343146)

2. R. Subramanian, Professional Ethics, Oxford University Press; Second edition (17 April2017), (ISBN: 0199475075)

Semester - I		Co-Curricular and Extra Curricular Course					
SN	**Course Code**	**Course Title**	**L-T-P (Hrs/Week)**	**Credit**	**TA**	**MST**	**ESE**
11	**R5CE1025LA**	**Yoga**	0-0-3	1.5	ISCE: 100%		

Course Outcome:

1. Understand and perform skill of Yog asanas
2. Gain knowledge and benefits about Pranayam and Dhyan
3. Increase the awareness regarding healthy living and yogic diet.

Syllabus- (YOGA)

1. Fundamental concepts: Meaning and definition of health, various dimensions of health like , Physical, mental, social and spiritual health, Relationship of yog and health, Physical fitness, importance of yogic diet.
2. Concept of stress according to yog, meaning of mental health, yogic perspective of mental health, causes and consequences of stress, stress management through yog.
3. Yoga and Ayurvedic: relationship, similarities, and differences, Ayurvedic concept of Yoga. Ayurveda concept of Tridoshas,Dhatus and Malas. Yogic Impact on their healthy nature.
4. Yoga and Naturopathy: relationship, similarities and differences, Naturopathic concept of foreign matter, un-natural living style and Yoga impact on it.
5. Meaning, Causes, symptoms and therapeutic value of Yoga practices, different types and benefits of Asanas, Pranayam and Dhyan, Relevance of yog in modern age and scope
6. Breathing: Difference between pranayama and deep breathing.

Practicals:

1. ASANAS
2. PRANAYAMA
3. BANDHAS AND MUDRAS
4. KRIYAS

Weblinks:

1. Arhanta Yoga Ashrams: Yoga Teacher Training & Certification https://www.arhantayoga.org
2. Morarji Desai National Institute of Yoga (MDNIY) http://www.yogamdniy.nic.in
3. Courses in Yoga and Naturopathy | Ministry of Ayush | GOI https://main.ayush.gov.in
4. YCB Certified Yoga teacher - Under Ayush ..https://www.arogyayogshala.com

Suggested equivalent online courses: Sthapana, Yoga Foundation

Semester - I		Co-Curricular and Extra Curricular Course					
SN	**Course Code**	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**
	R5CE1025D	**Social Responsibility& Community Engagement**	0-0-3=3	1.5	ISCE:100%		

After completion of course, student will be able to :

1 Gain an understanding of rural life, culture and social realities
2 Develop a sense of empathy and bonds of mutuality with local community
3 Appreciate significant contributions of local communities to Indian society and economy
4 Learn to value the local knowledge and wisdom of the community
5 Identify opportunities for contributing to community's socio-economic improvements

Syllabus: -

1. Appreciation of Rural Society, Community/Rural lifestyle, rural society, caste and gender relations, rural value s with respect to community, nature and resources, elaboration of "soul of India lies in villages' (Gandhi), rural infrastructure, Community Map Technique preparation (physical, visual or digital)

2. Understanding rural community and local economy & livelihood, local business, rural Agriculture, farming, landownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets, migrant labour, Analysis of rural household economy, its challenges and possible pathways to address them. Circular economy and migration patterns focus

3. Rural and local Institutions, Traditional rural & community organisations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram Panchayat, Standing Committees), Nagarpalikas & municipalities, local civil society, local administration.

4. Rural& National Development Programmes, History of various/development in India, current national programmes: Sarva Shiksha Abhiyan,Beti Bachao, Beti Padhao, AyushmanBharat, Swatchh Bharat, PM AwaasYojana, Skill India,Gram Panchayat Decentralised Planning, NRLM, MNREGA, SHRAM, JalJeevan Mission, SFURTI, AtmaNirbharBharat,etc.

	Field work & Assessment 1. Visit a rural village, engage the community and map the needs 2. Analyse the data, plan a social welfare project 3. Map stakeholder hierarchy at local level for the above project implementation 4. Identify the bottleneck and challenges 5. Presentations using visual aids
	Recommended Readings Books: 1. Singh, Katar, Rural Development : Principles, Policies and Management, Sage Publications, New Delhi, 2015. 2. A Hand book on Village Panchayat Administration, Rajiv Gandhi Chair for Panchayati Raj Studies, 2002. 3. United Nations, Sustainable Development Goals, 2015 un.org/sdgs/ 4. M.P.Boraian, Best Practices in Rural Development, Shanlax Publishers, 2016

Semester - I		Co-Curricular and Extra Curricular Course					
SN	**Course Code**	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**
11	**R4CE1025LE**	Digital storytelling and Environment	0-0-3=3	1.5	ISCE:100%		
	After completion of course, student will be able to: Learning Outcomes Course Learning Outcomes 1 On successful completion of this course students will be able to: 2 Demonstrate developed knowledge of the principles and concepts of framing, sound, composition, visual storytelling, digital storytelling, and culture 3 Communicate and critique project ideas with classmates in workshop activities, consultations and screenings 4 Demonstrate critical thinking around digital storytelling, online media production, and the social and cultural media environment						
	Learning Activities Summary WEEK LECTURE TOPIC 1 Introduction to digital storytelling 2 How stories work, and how they inform our lives 3 Technologies for digital storytelling: software, hardware, film-making techniques, sound and music 4 Case studies – digital storytelling in practice: education, marketing, journalism 5 Digital storytelling in a global media environment 6 Giving voice to ourselves 7 Digital storytelling futures **Assignments**: Work should be submitted through Canvas (Links to an external site.) Learning Activities Summary Digital Photography Creative Thinking and Practice Creative Design; Digital Production Service Innovation Design Projects Layout and Composition; Digital Production Service Innovation; Service Innovation Design Projects User Experience Design; Digital Production Reflection on Learning Process						

Semester - I	Co-Curricular and Extra Curricular Course					
Course Code	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**
R4CE1025LF	Graphic Design and Community	0-0-3=3	1.5	ISCE: 100%		

After completion of course, student will be able to :
Interaction
1 To learn and apply foundational principles of graphic design in Canva, including logo design, Instagram post creation, and mockup creation for T-shirts, Mugs, etc.
2 To develop expertise in using Canva's features, tools, and functions to create professional designs for diverse purposes.
3 Explore design elements, colour theory, and composition techniques to enhance visual impact and create cohesive designs.
4 Understand Canva's extensions/plugins, integrating them into workflows for increased efficiency and innovative design approaches.

Syllabus: -

1. Basic Preview , dashboard , templates ,Downloading your work , Working with text , Photo backgrounds
   Shapes Illustrations, icons and lines Finding stock photos for free
   Layouts and using frames Adding pages to a design
   Paid elements within Canva
2. Apply design principles to produce well-crafted logos, engaging Instagram posts, and other projects using Canva's capabilities.
3. Demonstrate mastery over Canva's tools, effectively manipulating layers and elements to achieve desired design outcomes.
4. Create designs that communicate messages through font selection, layout, and color while understanding design aesthetics.
5. Utilise extensions/plugins to enhance the design process, tackle challenges creatively, and adapt designs for various contexts.

SEMESTER – II

Semester - II		Basic Science Course						
SN	**Course Code**	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**	**ESE hours**
1	R5CH1021T	Engineering Chemistry	2-1-0=3	3	20	30	50	3

Course Outcome:

1. Correlate the different chemical reaction mechanisms with rate of reaction that are used in the industrial synthesis of organic molecules and drugs.
2. Rating the chemical fuels based on their chemical composition, and properties. Choosing the alternate energy sources.
3. Analyze the basic cause of corrosion, its reactions & corrective preventive measure to reduce the rate and adopt suitable method of treatment suitable for various industrial applications.
4. Analyse functional material based on their structure, and performance.Rationalize the concept Sustainability and adopt green chemistry approach
5. Select appropriate separation methods required in manufacturing industries by understanding the basic concept of chromatographic techniques. Choose the spectroscopic techniques for characterization of materials.

Course Content:

1	**Reactions, Mmechanisms & Kinetics:** Introduction to Chemical reactions, Material balance for organic reactions, Mass balance and stoichiometry, SN1, SN2 Reactions, Chemical Kinetics, Energy profile diagram, Synthesis of drug molecule.	5
2	**Energy Sources:** Types of **Chemical fuels**, Calorific value, Determination of calorific value, combustion calculations, Analysis of coal, proximate and ultimate analysis, Fuels for IC engines, Effect of Chemical composition of fuel on knocking, anti-knocking agents. Limitations of fossil fuels, **Alternative fuels**: Power alcohol, biomass, biogas, biodiesel, Green hydrogen.	5
3	**Science of Corrosion:** Direct chemical corrosion, Electrochemical corrosion and its reaction mechanisms, Types of electrochemical corrosion, (differential aeration, galvanic, concentration cell), Electrochemical corrosion like Pitting, Intergranular, Soil, Waterline. Factors affecting corrosion, Protection of corrosion, Applications with few practical problems of corrosion.	5
4	**Functional Materials for Engineers:** **Plastic, Elastomeric, & Fiber** forming polymers, structural requirement, molecular weight determination, effect of structure, bonding, molecular weight, degree of polymerization on the performance of the polymers. **Glass transition** temperature, Structure property relationship. **Lubricants:** Types of lubricants, Mechanism of lubrication, Physical and Chemical properties of lubricants, selection oflubricants. **Cementations Materials**: Chemical composition of cement, Admixtures used in concrete,	6

	Chemical reactions involved, bitumen emulsions.	
5	**Identification, Separation & Purification:** Types of Separation techniques: Column Chromatography, Thin layer chromatography, Paper chromatography. Spectroscopic principles and its applications, U.V. Spectroscopy, Fourier Transform Infra-Red Spectroscopy, Flame photometry. Determination of hardness of water by EDTA method and removal of hardness by ion exchange and zeolite method.	5
6	**Sustainable Engineering Chemistry:** Concept of sustainability and its significance, Waste minimization, Atom Economy, Reduction of Materials and Energy requirement, Green Chemistry approach, Industrial applications of green chemistry.	4
	Text Books: 1. Engineering Chemistry by Jain and Jain, Danpatrai publications;16th edn. (2013) 2. Engineering Chemistry by Dr.S.S.Dara,Dr.S.S.Umare, S.Chand&CompanyLtd,12thed. 3.A Text Book of EngineeringChemistry by ShashiChawla, Danpatrai publications;4thedn;(2010) **Reference Books:** 1. Polymer Science Billmayer, F.John Willey&Sons,N.Y.;3rdedn(1984) 2. Introduction to Material Science William Callister, John Willey & Sons, N.Y.; 9th edn;(2013) 3. Engineering .Chemistry- NPTEL web- book, by T.L. Tembe, Kamaluddin and M.S.Krishnan 4. Fundamentals of Molecular spectroscopy: Colin N.Banwell& Elaine M.McCash, Tata McGraw-Hill 4th edn. 5. Fundamentals of Electrochemistry, Second Edition, V. S. Bagotsky, Wiley Interscience (2006).	

Semester - II		Basic Science Course					
SN	**Course Code**	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**
2	R5CH1021L	Engineering Chemistry Laboratory	0-0-2=2	1	ISCE: 60		40

Course Outcome:

Determine the quality of water suitable for different sectors.

2. Determine physical and chemical characteristics of lubricating oils.
3. Synthesis of Biodiesel, Chalcones and calculating atom economy..
4. Analysis of coal by proximate method.
5. Separate and analyze by Chromatographic techniques

Title of the Experiment: (Any 10 experiments)

1. Saponification value of oils
2. Acidvalue of an Oil
3. Viscosity&Viscosity Index by Redwood Viscometer
4. Flash Point by Abel's & Pensky-Marten's Apparatus
5. Conductometric titrations
6. Analysis Of fuel: Proximate analysis of coal sample
7. Determinationof adulteration in transport fuels
8. Separation by TLC & Paper chromatography
9. Determination of alkali metals by Flame photometry
10. Synthesis of Biodiesel to find out Atom Economy.
11. Synthesis of drug molecule
12. Determination of hardness of water by EDTA method.

Reference :

1. Lab. Manual for Engineering Chemistry - Dr.S.K.Basin& Dr. S.K. Rani, Dhanapat Rai Publishing Company; (2009)
2. Practical Manual for Chemistry of Engineering Materials - D.D. Shah, Nandu Publication, Mumbai
3. Post Graduate Practical Chemistry - H.N. Patel, S.P. Turakhia, S.S. Kelkar, S.R. Puniyani, Himalaya Publishing House, 5thedn; (2008)
4. A Manual of Practical Engineering chemistry Sudha Jain & Shradha Sinha ,S.Chand Company Ltd 1st edn(2002)

Semester - II		Basic Science Course						
SN	**Course Code**	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**	**ESE hours**
3	**R5MA1011T**	Applied Mathematics – II	2-1-0=3	3	20	30	50	3

Course Outcome:

1. Formulate Differential equations from the given physical problems and solve first order Differential equations using different techniques.
2. Find the complete solution of a differential equation with constant coefficients in terms of complementary function and particular integral.
3. Develop better understanding of scalar and vector fields and apply gradient to solve problems involving normal vectors to level surfaces.
4. Apply the integral theorems such as Stoke's theorem, Green's theorem and Gauss divergence theorem to evaluate line, surface and volume integrals and give physical interpretation of curl and divergence of a vector field.
5. Model physical phenomena using partial differential equations such as heat and wave equation and solve them using separation of variables method.
6. Find the Fourier series representation of a periodic function and evaluate the value of a series of real numbers.

Module	Content	Lectures
1	**Ordinary Differential Equations:** First order equations – Exact, linear and Bernoulli's equations, higher order linear differential equations with constant coefficients; Complementary function and Particular integral by operator method, method of variation of parameters, Method of Undetermined coefficients, Euler-Cauchy equation; initial and boundary value problems;	12
2	**Partial Differential Equations:** Classification of second order linear PDEs, Method of Separation of variables, Solutions of one-dimensional Heat equation, First and second order wave equation, Two- dimensional Laplace equation,	6
3	**Vector calculus:** Vector functions- Limits, continuity and differentiation, scalar and vector fields, gradient, divergence and curl, Line integrals, Surface integrals, Volume integrals, Stoke's theorem, Gauss Divergence theorem, Green's theorem.	8
4	**Fourier Series:** Definition of Fourier series, Dirichlet's conditions, Evaluation of Fourier series of periodic function of arbitrary period 2l, series of Even and odd Functions, Half range series, Parseval's identity	6

References:

- G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
- Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & sons, 2006.
- Ramana B. V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
- Veerarajan T., Engineering Mathematics for first year, Tata McGraw Hill, New Delhi 2008.
- B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
- Susan Jane Colley, Vector Calculus, 4th Edition,2012.

Semester - II		Basic Science Course						
SN	**Course Code**	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**	**ESE hours**
04	**R5CE 1026T**	**Construction Materials Science**	2-0-0=2	2	20	30	50	3

Course Outcome:

1. To develop and implement the conceptual knowledge of building materials in the construction industry
2. To describe properties of various materials
3. To develop understanding to use construction materials in civil infrastructure.

Syllabus:

Building Materials

1. **Binding Construction Materials:**
   a. **Lime:** Chemical composition, classification and usage.
   b. **Cement:** Chemical composition; Manufacturing; Grades; Hydration of cement; Physical properties as per BIS code; Effects of chemical constituents on the properties of cement; Different types of cement: Chemical composition, properties as per relevant IS codes and their applications. Field and laboratory testing.
   c. **Bitumen and Tar:** Manufacturing; Grade; Methods of testing as per relevant IS code.
2. **Rocks and Stones:** Types of rocks (Igneous, Sedimentary and Metamorphic); Use in infrastructural projects; Quarrying, dressing, seasoning and preservative treatments of stones; Methods of testing as per relevant IS code.
3. **Aggregates:** Classification, physical and mechanical properties and their influence on the properties of concrete, gradation, Alkali aggregate reaction. Methods of testing as per relevant IS code.
4. **Brick:** Raw materials; Manufacturing processes; Classification; Tests as per BIS codes.
5. **Mortar:** Types, ingredients, proportions and suitability
6. **Admixtures:** Definition and purposes, types of mineral and chemical admixtures. Test on admixtures: chemistry and compatibility with concrete.
7. **Study of Ferrous and Nonferrous Substance:** Structure of iron and steel; Phase diagrams; Properties of reinforcing steel and structural steel; Corrosion; Properties and applications of Al and Cu.
8. **Wood/Timber:** Structure of wood; processing of timber for construction; defects and deterioration of wood; properties and applications of glass

Other Building Material

1. **Flooring/Tiling material:** Types of tiles (Ceramic Tiles, Porcelain Tiles, Vitrified Tiles, Onyx Tiles, Vinyl Tiles, Stone Composite Polymer Tiles, Mosaic Tiles, Terrazzo Tiles, Marble Tiles, Granite Tiles etc.); key features; size and application. Methods of testing as per relevant IS code.
2. **Paints, Enamels and Varnishes:** Composition. Painting on: plastered surfaces, wood

	surfaces, metal surfaces. Effect of weather on: Enamels, distemper, white wash and colour, varnish, French polish, Wax Polish. 3. **Composite Materials / FRP / Polymers and Plastics**: Particulate and fiber reinforced composites; structure and behavior of polymers and plastics 4. **Glass**: Properties; Types; Uses. **Miscellaneous Materials** 1. Gypsum, Plaster of Paris, Heat and sound insulating materials 2. Damp proofing, waterproofing and termite proofing materials
	Recommended books 1. A Building Construction: S.C. Rangwala, Charotar Publications, Gujarat, India. 2. Building Construction: S.P. Arora, Dr.S.P. Bindra,DhanpatRai Publication, New Delhi. 3. Building Construction: Dr. B.C. Punmia, A.K.Jain, A.R.Jain,Laxmi Publication., New Delhi 4. Building Materials: S.K. Duggal, New Age International Publishers **Recommended Reading:** Indian Standard Code: 1. IS 5454: 1978- Methods of sampling of clay building bricks 2. IS 3495 (Part 1 to 4)1992 - Methods of tests of burnt clay building bricks 3. IS 2430:1986, IS 2386 (Part 1 to5): 1963- Methods for Sampling of Aggregates for Concrete 4. IS 1201(1978) - Methods for Testing Tar 5. Bituminous Materials IS 1220: 1978- Methods for Testing Tar and Bituminous Materials

Semester - II	Engineering Science Course						
Course Code	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**	**ESE hours**
R5SE1001T	**Engineering Mechanics**	2-0-0 = 2	2	20	30	50	3

Course Outcome: Students will be able to

1. Analyse the force system and relate it to the Engineering Applications.
2. Calculate centroids and centre of gravity of plane areas and volumes.
3. Analyse the different motions of a particle and apply principles of work, energy, impulse & momentum.

Content

1. **Fundamental of Mechanics:**
   Review of basic concepts – mass, space, time and force: Particles and rigid bodies: Scalars and vectors: Free, sliding, fixed and unit vectors: Addition, subtraction and multiplication of two vectors. Definition of a force: Classification of forces: Principles of transmissibility, etc.
2. **Force Systems:**
   Introduction to different force systems, Composition of forces, triangle, parallelogram and polygon law of forces, addition of two parallel forces, Resolution of forces, moment of a force, Varignon's Theorem, Couple of forces, force – couple systems, Resultant of a force system, Equilibrium conditions for a force system, Free body diagram, Different types of supports, etc.
3. **Distributed Forces.**
   Line, area and volume distributions of forces, Centre of gravity, Centre of mass, Centroid of plane figures, Cerntroid of composite figures, Moment of Inertia, Area and mass moments of inertia, Perpendicular and parallel axes theorems of moment of inertia, Radius of gyration, etc.
4. **Dry Friction**
   Laws of dry friction, Co-efficient of friction, Angle and cone of friction, Angle of repose, Applications of friction to wedges and screw jacks, etc.
5. **Virtual Work**
   Work done by forces and couples, Virtual displacement and virtual work, Principle of virtual work for equilibrium bodies in equilibrium, Active force diagram, Degree of freedom, etc.
6. **Kinematics of Particles:**
   Differential equations of kinematics, plane, rectilinear and curvilinear motions, Cartesian co-ordinate system, Normal and tangent co-ordinate system, projectile motion, etc.
7. **Kinetics of Particles:**
   Newton's second law of motion, Work and energy principle, Gravitational-potential energy, elastic-potential energy, kinetic energy, power, efficiency, Principle of impulse and momentum, Impact motion, Direct central impact, etc.

Recommended books

1. A textbook of Engineering Mechanics, Dr. Sadhu Singh (S. Chand publishing)
2. Tayal A.K., Mechanics for Engineering, Statics and Dynamics, Umesh Publication, N.

Delhi, 2008.
3. Engineering Mechanics, K. L. Kumar, Veenu Kumar, McGrow Higher Education.

Additional Reading

1. Shames I.H, Engineering Mechanics, P.H.I. India 1980.
2. Kumar K. L., Engineering Mechanics, McGraw Hill publishing company New Delhi 2008.
3. Beer and Johnston, Mechanics for Engineers, McGraw Hill, 2009.
4. Timoshenko and Young, Mechanics for Engineers, McGraw Hill, 2010.
5. Mclean and Nelson, Mechanics for Engineers, Schaum Outline Series 2010.
6. Hibbeler R.C., Mechanics for Engineers, Pearson Education, 2012.

Semester-II	Engineering Science Course					
Course Code	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**
R5SE1001L	**Engineering Mechanics Laboratory**	0-0-2 = 2	1	ISCE: 60		40

Course Outcome: Students will be able to

1. Experimentally verify the Laws of static equilibrium including friction.
2. Analyse the experimental errors and comment on possible reasons for the errors.

List of Practical's (Any 10)

1. **Bell Crank Lever:**
   - Study the equilibrium conditions of a bell crank lever under different loads and angles.
   - Calculate the mechanical advantage and efficiency of the bell crank lever.
2. **Simple Beam:**
   - Determine the reactions at the supports of a simple beam loaded with various point loads and distributed loads.
   - Verify the principles of equilibrium and deflection calculations for the beam.
3. **Simple Jib Crane:**
   - Analyze the forces acting on a simple jib crane and calculate the reactions at its base.
4. **Link Chain:**
   - Study the forces acting on a link chain when subjected to a load.
   - Determine the tension in different segments of the chain and its equilibrium conditions.
5. **Screw Jack (Friction):**
   - Investigate the working of a screw jack, considering frictional forces.
   - Calculate the input force required to lift a given load using the screw jack.
6. **Shear Leg Apparatus:**
   - Set up and analyze a shear leg apparatus to lift a load using multiple ropes and pulleys.
   - Calculate the forces in the ropes and verify equilibrium conditions.
7. **'g' by Falling Weight Method:**
   - Measure the acceleration due to gravity using the falling weight method.
   - Analyze the motion of a freely falling weight and calculate 'g' from the recorded data.
8. **Plane Motion of Bodies:**
   - Investigate the motion of bodies on inclined planes under the influence of gravity.
   - Determine the acceleration, time of motion, and distance covered on the inclined plane.
9. **Moment of Inertia (M.I.) of Flywheel:**
   - Determine the moment of inertia of a flywheel experimentally using rotational

dynamics.
- Compare experimental results with theoretical calculations.

10. **Compound Pendulum:**
    - Study the behaviour of a compound pendulum and analyze its oscillations.
    - Calculate the period of oscillation and verify the principles of simple harmonic motion.
11. **Torsional Pendulum:**
    - Set up a torsional pendulum and measure the torsional constant of the material.
    - Calculate the moment of inertia of the pendulum and analyze its oscillations.
12. **Principle of Conservation of Energy (Connected Bodies with Flywheel):**
    - Study the energy transfer and conservation principles in a system of connected bodies with a flywheel.
    - Analyze the changes in potential and kinetic energy and validate the principle of conservation of energy.
13. **Stiffness of Spring:**
    - Determine the stiffness (spring constant) of a spring experimentally.
    - Analyze the relationship between force and displacement for the spring.

Semester - II	Engineering Science Course						
Course Code	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**	**ESE hours**
R5CO1001T	**Programming for Problem Solving**	2-0-0 = 2	2	20	30	50	3

Course Outcome: Students will be able to

1. Interpret the concepts of the C++ programming language.
2. Use control structures such as loops and conditional statements to control the flow of programs.
3. Develop simple C++ programs to solve computational problems using fundamental programming constructs.
4. Use file handling to store and retrieve data efficiently from files.
5. Develop problem-solving skills by applying C++ programming techniques to real-world scenarios and challenges.

Content

1. **Introduction to Programming and C++:**
   Elements of a computer systems, DOS Commands & Linux environment, Overview of programming languages, Introduction to C++ and its features, Setting up a C++ development environment, Language Processors, Object Oriented Programming Paradigm and benefits, Applications of Object Oriented programming.
2. **Beginning with C++:**
   Tokens, Expressions, Control Structures, Array, Functions, Structures, Unions and pointers, String Manipulation.
3. **C++ Programming Features:**
   Classes, Objects, Constructors, Destructors, Inheritance and Polymorphism, Virtual Base Classes, Abstract Classes.
4. **Working with Files:**
   Classes for File Stream Operations and I/O stream operation, Opening and Closing a File, Detecting end-of-file, more about Open(): File Modes, Sequential Input and Output operations.
5. **Case Studies of C++ Programming:**
   Number Conversions, Telecom Billing System, Logistic management of solid waste, Design of a scientific calculator, Library Management System, Rock Paper Scissor Game, Tariff Calculation, Electronic circuit analyzer etc.

Recommended books

1. The C++ Programming Language, Fourth Edition by Bjarne Stroustrup, Addison-Wesley Educational Publishers Inc
2. Object-Oriented Programming with C++, 8th edition, by E Balagurusamy, Publisher McGraw Hill.
3. How to Solve It: A New Aspect of Mathematical Method, by G. Polya, Princeton University Press, 2015

Additional Reading

4. Effective C++, 3rd edition, by Scott Meyers, Addison-Wesley Educational Publishers Inc.
5. Solving Mathematical Problems: A Personal Perspective, Illustrated Edition, by Terence Tao, Oxford University Press, 2006.

Semester - II	Engineering Science Course					
Course Code	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**
R5CO1001L	**Programming for Problem Solving Laboratory**	0-0-2 = 2	1	ISCE: 60		40

Course Outcome: Students will be able to

1. Understand Linux Environment, basic Linux commands and computer elements.
2. Demonstrate proficiency in writing basic C++ programs, including understanding data types, variables, control structures, and functions.
3. Implement classes and objects, understand inheritance and polymorphism, and apply OOP principles in their code.
4. Apply C++ knowledge to design and implement complete software solutions for specific problem domains.
5. Develop their ability to manipulate strings, including concatenation, substring extraction, and other string operations.
6. Read from and write to files in C++, enabling them to process data from external sources.

Practical No.	Aim of Practical
1.	Study of Linux Commands, language processor and Computer Elements.
2.	Study of Input and Output operations in C++ - Write a program in C++ for entering the detailed information of student and print all details of student.
3.	Study of for loop in C++ - Write a program in C and C++ to print Fibonacci series of any number inputted by person. Additional Program for practice - Write a program in C++ to find binary values of integer using for loop.
4.	Study of if-else loop in C++ - Write a program in C++ to check whether entered character is a vowel or not using if-else statement.
5.	Study of if – else if - else loop in C++ - Write a C++ program to accept marks of 5 subjects for a student. Calculate the total and percentage of marks, also decide grade of student depending on the percentage using if-else-if-else statements. Study of while loop and do-while in C++ - Write a C++ program to display numbers from 1 to 10 with the help of a while loop and do-while loop.
6.	Study of switch case in C++ - Write a program in C++ to make a menu driven

calculator.

Additional Program for practice: Write a menu driven program in C++ to find sum of positive numbers, sum of negative numbers & avg of all numbers in an array.

7. Study of arrays and structures in C++

   (a) Write a program in C++ to display the information of 10 employees using array of structure variable.
   (b) Write a program in C++ to illustrate use of array within structure.
   (c) Write a program in C++ to illustrate use of nested structure.

8. Study of Classes and Objects in C++ - Write a program in C++ to add two integers using classes.

   Additional Program for practice: Read and Print Student Information using class Student.

9. (a) Study of Function Overloading in C++.

   (b) Study of Operator Overloading in C++ (Overloading unary and binary operators).

10. Study of Constructors and Destructors in C++ -

    Write a program in C++ with class Rectangle with the data fields width, length, area and colour. The length, width and area are of double type and colour is of string type. The methods are get_length(), get_width(), get_colour() and find_area(). Create two objects of Rectangle and compare their area and colour. If the area and colour both are the same for the objects then display "Matching Rectangles", otherwise display "Non-matching Rectangle". Use Constructors.

    Additional Program for Practice - Write a program in C++ to implement Stack. Design the class for stack and the operations to be performed on stack. Use Constructors and destructors.

11. Study of Inheritance, virtual class and virtual function in C++ - Create a base class called shape. Use this class to store two double type values that could be used to compute the area of figures. Derive two specific classes called triangle and rectangle from the base shape. Add to the base class, a member function get_data() to initialize base class data members and another member function display_area() to compute and display the area of figures. Make display_area() as a virtual function and redefine this function in the derived classes to suit their requirements.

12. Study of friend class and friend function in C++.

13. Study of String Manipulation in C++ - Write a program in C++ to perform string operations by using predefined string functions.

14.	Study of File Handling in C++ -Write a program in C++ to open, read and close a file using file stream operations.

Recommended books

4. The C++ Programming Language, Fourth Edition by Bjarne Stroustrup, Addison-Wesley Educational Publishers Inc
5. Object-Oriented Programming with C++, 8th edition, by E Balagurusamy, Publisher McGraw Hill.
6. How to Solve It: A New Aspect of Mathematical Method, by G. Polya, Princeton University Press, 2015

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7. Effective C++, 3rd edition, by Scott Meyers, Addison-Wesley Educational Publishers Inc.
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Semester - II		Program Core Course (PCC)						
SN	**Course Code**	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**	**ESE hours**
10	**R5SE1027T**	**Concrete Technology**	1-0-2 = 3	2	20	30	50	3

Course Outcome:

1. Determine the properties of concrete ingredients i.e., cement, sand, coarse aggregate, admixtures by conducting different tests.
2. Carry out field and laboratory tests on concrete in plastic and hardened stage & various concrete operations like batching, mixing etc.
3. Supervise various concreting operations.

Content:

1. **Ingredients and their properties**
   Properties of coarse and fine aggregates and their influence on concrete, types of cement and their use, Grades of ordinary Portland cement, Portland pozzolana cement, rapid hardening Portland cement, Hydrophobic cement, Low heat Portland cement and sulphate resisting Portland cement as per relevant I.S. codes. Types of aggregates and their properties, Testing of aggregates as per relevant IS Codes, etc.
2. **Properties of fresh and hardened concrete**
   Workability, Factors affecting workability,Measurement of workability, Slump test and types of slumps, Compaction factor test, Flow test, Flow table test, Vee-Bee consistometer Test,Segregation, Bleeding, Temperature of concrete, Compressive strength, durability, impermeability, Elastic properties of concrete, modulus of elasticity of concrete, Creep, factors affecting creep, shrinkage, factors affecting shrinkage, Water cement ratio, selection of water cement ratio, maximum w/c ratio for different grades of concrete for different exposure conditions, etc.
3. **Manufacturing of concrete:**
   Manufacturing process of concrete, Batching, Weigh batching and volumetric batching, Quantity estimates of materials, Mixing, Hand mixing and machine mixing, transporting, Pumping, Selection of pump, Placing, Compacting, Types and use of vibrators, Over-vibration, Curing, Curing methods, Finishing of concrete, Ready mix concrete (RMC), Concrete Mix Design as per IS 10262.
4. **Admixtures:**
   Plasticizers, Retarders, Accelerators and other Admixtures, Test on Admixtures, Chemistry and Compatibility with concrete, GGBS, fly Ash, Metakaolin, Silica Fumes, crush sand, etc.
5. **Non-destructive testing of concrete**
   Rebound hammer test, Ultrasonic pulse velocity test, Magnetic particle testing, Liquid penetration testing, Visual testing, Laser Testing methods,carbonation test, Half-cell potentiometer and corrosion of steel, Core test and relevant provisions of I.S. codes, etc.
6. **Concrete for Repair and Rehabilitation**
   High Performance concrete, Polymer Concrete, Fiber Reinforced Concrete, Light

	weight concrete and its manufacture, Polymer Impregnated Cement Concrete, Polymer Modified cement concrete and Ferro Cement, Special Tests for concrete used for repairs and rehabilitation, etc.
	Recommended books 1. M.L. Gambhir, Concrete Technology, McGraw Hill Book Company, Fifth Edition, 2017. (ISBN-1259062554, 978-1259062551). 2. M.S. Shetty, Concrete Technology, Theory and Practice, S. Chand Publication, Sixth Edition, 2018. (ISBN- 9788121900034,978-8121900034) 3. B.L. Gupta and A. Gupta, Concrete Technology, Jain Book Agency, 2013. (ISBN:8180140407, 978-8180140402). **Recommended Reading** 1. A.R. Santhakumar, Concrete Technology, Oxford University Press, New Delhi, 2018. (ISBN:9780195671537, 978-0195671537). 2. A.M. Neville, Properties of Concrete, Pearson Publication, London, 2012. (ISBN-978- 0273755807, 9780273755807). 3. IS 10262-(2019) Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 2019. 4. IS269 (2015), Ordinary Portland Cement (33 Grade). 5. IS12269 (2013), Ordinary Portland Cement (53 Grade). 6. IS650 (1991), Specification of Standard Sand. 7. IS383 (1970), Specification for Coarse and Fine aggregate

Semester - II		Vocational and Skill Enhancement Course (VSEC)					
SN	**Course Code**	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**
8	**R5CE1028L**	**Civil Engineering Workshop**	0-0-3	1.5	ISCE :100		

Course Outcome:

After completion of course, student will be able to :

1. Perform lab experiments for determining the properties and behavior of construction materials.
2. Perform masonry, plumbing job activities
3. Able to identify finishing jobs (plastering, coloring) related to building construction
4. Able to identify the various components of typical civil structures like road, culvert/bridges

Syllabus

1. **Overview of Construction Activities:** To study about tools used for the construction activities, Workmanship and Safety precautions

Civil & Environmental Engineering Department

2. **Methods of Test for Aggregates**, IS 2386 (Part 1 to 5): 1963: Aggregate Crushing Value, Aggregate Impact Value, Los Angeles Aggregate Abrasion Value, Aggregate Specific Gravity, Water Absorption Test, Shape Test: Flakiness and Elongation Index, Sieve Analysis, Fineness Modulus.
3. **Methods for Testing Tar and Bituminous Materials**, IS 1201 to IS 1220, 1978: Penetration Test, Ductility Test, Softening Point Test, Viscosity Test, Specific Gravity
4. **Demonstration lab on Plumbing Services:**
    1. Study of Pipe Joints and Plumbing Fixtures.
5. **Masonry and Concreting:**
    1. Construction of 1-1⁄2 and 2 brick thick walls in English Bond in cement mortar
    2. Demonstration lab: Plastering, Pointing, Formwork, Scaffolding, Centring and Shuttering
6. **Finishing Works:**
    1. Plastering and Finishing: To plaster the wall using the cement mortar and finishing it.
    2. Application of wall putty and painting a wall.
7. **Demonstration of Roads/culverts/bridges using civil engineering infrastructure models.**

Micro-project: prepare cement/concrete mortar, samples of bricks (different suppliers) and do testing, conduct survey for available brands of paints, flooring tiles and list out as per IS specifications.

	Structure Engineering Department 9. **Plywood Testing:** Compression test on wood, Tensile test on wood specimen, Flexural test on wood 10. **Methods of Tests of Burnt Clay Building Bricks,** IS 3495 (Part 1 to 4): 1992: Compressive Strength Test, Water Absorption Test 11. **Methods for Sampling of Aggregates for Concrete,** IS 2430: 1969 12. **Tests on Cement:** fineness of cement, consistency test, soundness, specific gravity 13. **Steel Testing:** Tension test on: mild steel bar, tor steel bar, steel plates, Shear test on mild steel bar, Flexural test on steel plates, Bend and re-bend test on mild and tor steel, Torsion test on mild and tor steel, Brinnel's Hardness tests on metal specimen, Impact test on metal
	Recommended books 1. PWD- Standard Data Book for Building Work, PWD, Government of Maharashtra. Mumbai 2. CPWD Specifications (Vol.-I and II), CPWD, Govt, of India. New Delhi. 3. The Practical design of Structural Elements in Timber Bull, J.W Gower Press, London, 1989, ISBN: 9780566090288 4. A To Z Of Practical Building Construction and its Management, Mantri Sandeep Satya Prakashan, New Delhi; 2015; ISBN: 9788176842051

Semester - II		Indian Knowledge System (IKS)						
SN	**Course Code**	**Course Title**	**L-T-P (Hours/Week)**	**Credit**	**TA**	**MST**	**ESE**	**ESE hours**
11	**R5CE1029T**	**Ancient Civil Engineering**	2-0-0=2	2	20	30	50	3
	Course Outcome: 1.To learn the various aspects of civil engineering practices in ancient structure . 2.To explore the environmental and construction practices adopted in ancient and historical structures.							
	Syllabus: **1.** Indus Valley Civilisation: Mohenjo daro, Urban Planning, Construction **2.** Ancient Structure: Hawa Mahal, Taj Mahal, Temples, Kailasa Temple Ellora cave, Hampi city **3.** Water Conservation: Traditional methods of water conservation, Fort Water Conservation structure, Ancient Step Well: Barav, Construction, Applications. **4.** City and infrastructure planning :- Dholavira (Gujarat) **5.** Ancient Bridge: Shahi Bridge, (Jaunpur), History, Construction. **6.** Ancient dam: Kallanai dam, Location, Construction, Structure, Historical and Cultural Significance **7.** Nahar System Aurangabad, Aqua-duct, Construction, Utility, Advantage 8. Sarnath Iron pillar ,The Great Stupa at Sanchi , Pagoda structure							
	Recommended books: 1. Gazetter of Aurangabad - H. H. The Nizam's Government 1884. (Chapter XI page 805 - 877) http://www.aqueductdsr.com/ 2. Architecture of Ancient Tamil Nadu - The Kallanai Dam Story Satyajit Ghosh (Author), Manu Jaiswal (Author)							

Semester - II		Co-curricular course 2					
SN	**Course Code**	**Course Title**	**L-T-P (Hrs/Week)**	**Credit**	**TA**	**MST**	**ESE**
12	**R5CE1030LG**	**Indian Constitution and Laws for Civil Engineering**	0-0-3	1.5	ISCE :100		

Course Outcome:

1. Acquire knowledge regarding Indian legal system and its relevance for civil engineering works.
2. Identify risk and opportunities arising out of legal knowledge.

Syllabus:

1. **Introduction to Indian Legal System:**
   Constitution of India, Sources of law, judicial system, Income Tax Act, Direct and indirect taxes, Forms of entities and stakeholders in construction.
2. **Indian Contract Act:**
   Basic definition and introduction: Offer, Acceptance, Contract, Agreement, Consideration.Types of contracts as per Indian contract act
3. **Dispute Resolution Mechanism:**
   Arbitration and Reconciliation Act, Industrial Dispute Act, 1947.
4. **Environment & heritage Laws:**
   Heritage laws, Environment protection act, CRZ regulations,Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act,Solid Waste Management Rule, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation,public awareness.
5. **Construction and Employment Laws:**
   Building Bye-laws,Partnership Act,Labour laws, Health and safety of construction workers, Compensation Act,Inter-State Migrant Workmen (Regulation of Employment and Conditions of Service) Act 1979,The Workmen's Compensation Act 1923 and The Minimum Wages Act 1948, NOCs for construction.

Recommended books:

Text Books :

1. L.S. Ranaga Rao Contract Management and Dispute Resolutions Engineering, Staff College of India January 2008.
2. C. J. Schexnayder and R. E. Mayo, Construction Management Fundamentals,McGraw Hill, New Delhi.2003
3. Dr. Avtar Singh Law of Contract Eastern Book Co. (EBC); 2017 edition (ISBN: 9788193547274)

Recommended Reading:

1. General Conditions of Contract,Central Public Works Department, New Delhi,2010
2. D.S. Berrie and B.c.Paulson, Professional Construction Management including C.M.,Design Construct and general Contracting, McGraw Hill InternationaL,Third Edition 1992..
3. V. K. Raina,Construction& Contract Management Practices, SPD, New Delhi (ISBN - 0074518763)