

SEM-III -COURSE CONTENTS

AY - 2021-22

Engineering Mathematics-III

Course Code	Course Name	
BS-BTC 301	Engineering Mathematics-III	
Course pre-requisites	Engineering Mathematics-I, Engineering Mathematics-II	
Course Objectives		
<p>The objectives of this course are</p> <ol style="list-style-type: none"> 1. To learn Laplace & Inverse Laplace transforms and its application to solve differential equations. 2. To understand concept of complex variables and conformal mapping. 3. To learn various matrices, operations and important theorems. 		
Course Outcomes		
<p>At the end of the course the students shall be able to</p> <ol style="list-style-type: none"> 1. Solve problems based on Laplace and inverse Laplace transform. Apply theory of Laplace transforms to evaluate real integrals and solve initial & boundary value problems. 2. Solve complex variable problems. 3. Find rank of matrices, Eigen values and Eigen vectors of matrices. 		
Course Content		
Module No.	Details	Hrs.
1	<p>Laplace Transforms Function of bounded variation (Statement only) Laplace Transforms of $1, e^{at}, \sin at, \cos at, \sinh at, \cosh at, t^n, \operatorname{erf}(\sqrt{t}), J_0(t),$ Shifting theorems, change of scale, $L\{t^n f(t)\}, L\left\{\frac{f(t)}{t}\right\}, L\left\{\frac{d^n f(t)}{dt^n}\right\}, L\left\{\int_0^t f(u)du\right\}$ Convolution theorem, Evaluation of real integrals using Laplace transforms.</p>	07
2	<p>Inverse Laplace Transforms Evaluation of Inverse Laplace Transforms using partial fractions, convolution theorem, shifting theorems and other properties. Application of Laplace Transform to solve initial & boundary value problems involving ordinary differential equation with one dependent variable.</p>	06
3	<p>Complex Variables & Mapping Functions of complex variable, Analytic functions, Cauchy-Riemann equations in Cartesian and polar coordinates. Harmonic functions, Analytic method and Milne Thomson</p>	07

	methods to find $f(z)$, orthogonal trajectories. Conformal mapping, Bilinear transformation, cross ratio, fixed points	
4	Matrices Orthogonal, Symmetric, Skew-symmetric, Hermitian, Skew-Hermitian & Unitary matrices and their elementary properties. Elementary operations and their use in getting the Rank, Normal form of a matrix, PAQ form, Consistency of system of linear homogeneous and non-homogeneous equations.	06
5	Eigen values & Eigen vectors Eigen-values and Eigenvectors of a matrix, Cayley- Hamilton theorem.	04

Text Books		
1. B S Grewal (2014), "Higher Engineering Mathematics", Khanna Publications, 43 rd Edition, ISBN 8174091955, 1315 Pages		
Reference Books		
1. Erwin Kreyszig (2010), "Advanced Engineering Mathematics" Wiley Eastern Limited, Singapore 10 th edition, ISBN 8126554231, 1148 Pages.		
2. Text book of Engineering Mathematics, N. P. Bali, Laxmi Publications, 9 th edition, ISBN:978-81-318-0832-0.		
Sr. No.	Examination	Module
1	T-I	1, 2(Part)
2	T-II	2(Part),3
3	End Sem	1 to 5

Text Books		
1. B S Grewal (2014), "Higher Engineering Mathematics", Khanna Publications, 43 rd Edition, ISBN 8174091955, 1315 Pages		
Reference Books		
1. Erwin Kreyszig (2010), "Advanced Engineering Mathematics" Wiley Eastern Limited, Singapore 10 th edition, ISBN 8126554231, 1148 Pages.		
2. Text book of Engineering Mathematics, N. P. Bali, Laxmi Publications, 9 th edition, ISBN:978-81-318-0832-0.		
Sr. No.	Examination	Module
1	T-I	1, 2(Part)
2	T-II	2(Part),3
3	End Sem	1 to 5

Mechanics of Materials

Course Code	Course Name
ES-BTC302	Mechanics of Materials

Course pre-requisites	ES-BT104, ES-BT154, ES-BT204
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Course Objectives

The objectives of this course are

1. To introduce the students to the behaviour of an elastic member Subjected to various types of forces such as axial force, shear force, bending moment, torsion etc.
2. To prepare the base for the students to study other structural engineering courses at a later stage.

Course Outcomes

Upon successful completion of the course, students should be able

1. To draw axial force, shear force and bending moment diagrams for determinate beams.
2. To analyse members subjected to axial force, shear force, bending moment, torsion in terms of stresses including principal stresses.
3. To estimate the stresses and strains in thin cylindrical and spherical shells.
4. To locate the shear center of thin walled cross sections.

Course Content		
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Module No.	Details	Hrs.
1	Stress & strain: Stress, yield stress, ultimate stress, shear stress, factor of safety, strain, modulus of elasticity (E), modulus of rigidity (G), bulk modulus (K), Poisson's ratio, relationship between elastic constants (No derivations), bars of varying sections, stresses in composite section, temperature stresses. Stresses due to suddenly applied axial load & impact load (including derivations). Introduction to the concept of Fatigue.	07
2	Axial force, shear force and bending moment in beams: Axial force, shear force and bending moment diagrams for statically determinate beams including beams with internal hinges for different types of loading, relationships between intensity of loading, shear force and bending moment (including derivations).	05
3	Simple theory of bending: Flexure formula for beam, simple problems involving the application of flexure formula, section modulus, moment of resistance of a section, flitched/ composite beams.	06

4	<p>Shear stress in beams:</p> <p>a) Distribution of shear stress across beam cross sections used commonly for beams. Maximum and average shear stress across the beam cross sections.</p> <p>b) Shear Connectors</p> <p>Shear Centre: Concept of shear centre, determination of shear centre for simple cross sections such as angle, tee, channel, I, etc.</p>	09
5	<p>Simple theory of torsion: Torsion equation for circular shafts (No derivations) – Application of equation to solid and hollow circular shafts, stresses in shaft when transmitting power.</p>	03
6	<p>Principal stresses: General equations for transformation of stress, principle stresses and principal planes, maximum shear stress, determination using Mohr's circle.</p>	05
7	<p>Thin cylindrical and spherical shells: Stresses and strains in thin cylindrical shells subjected to internal pressure. Stresses and strains in thin spherical shells subjected to internal pressure.</p>	03

Term Work

Term work shall comprise of

1. At least 20 (twenty) solved problems based on the above modules shall be submitted as term work.
2. Course project*

***Course Project:** There will be a course project where the students will be able to apply and integrate the knowledge gained during the course. The projects will be developed by teams of Two to Four students and will consist of design of any system having min. 5 to 6 components.

Text Books

1. Popov, Egor P, (1978), "Mechanics of materials", Englewood Cliffs, N.J: Prentice- Hall, ISBN 0135711584 , 864 pages
2. S.B. Jumnarkar (2007), "Mechanics of materials Vol-1", Charotar Publications, ISBN 8185594678, 447 pages
3. Dr.R.K.Bansal (2007), "Strength of Materials", Laxmi Publications, ISBN 8131180008, 1106 pages.
4. Bear & Johnson (2007), "Mechanics of materials", Tata McGraw-Hill,

ISBN: 0070042845, 780 pages.

5. Ramamrutham S. (2011), "Strength of Materials", Dhanpat Rai Publishing Co Pvt Ltd, ISBN 9788187433545, 1011 pages.

Reference Books

1. Timoshenko & Gere (2006), "Mechanics of materials", Tata McGraw Hill, CBS Publishers & Distributors, ISBN 8123908946, 762 pages.
2. James M. Gere, Books/cole (2012), "Mechanics of materials", Cengage Learning, ISBN 1111577730, 1056 pages.
3. G.H. Ryder (2002), "Strength of materials" Macmillan Publishers India Limited, ISBN 0333935365, 352 pages.

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4 (partly)
3	End Sem	1 to 7

Basics of Surveying

Course Code	Course Name
PC-BTC303	Basics of Surveying

Course pre-requisites	
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Course Objectives

The objectives of this course are

1. Describe the function of surveying in civil engineering construction,
2. Work with survey observations, and perform calculations,
3. Customary units of measure. Identify the sources of measurement errors and mistakes; understand the difference between accuracy and precision as it relates to distance, differential leveling, and angular measurements,
4. Be familiar with the principals of recording accurate, orderly, complete, and logical field notes from surveying operations, whether recorded manually or with automatic data collection methods,
5. Identify and calculate the errors in measurements and to develop corrected values for differential level circuits, horizontal distances and angles for open or closed-loop traverses.
6. Operate an automatic level to perform differential and profile leveling; properly record notes; mathematically reduce and check levelling measurements.
7. Understand, interpret, and Prepare plan, profile, and cross-section drawings, Work with cross-sections and topographic maps to calculate areas, volumes, and earthwork quantities

Course Outcomes

At the end of the course the students shall be able to

1. Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities.
2. Demonstrate their capability for preparing ground map at their own which is useful for their future.
3. Apply concept of surveying and its application in different construction work.

Course Content		
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<i>Module No.</i>	<i>Details</i>	<i>Hrs.</i>
1	Introduction to Surveying : Principles, Various types of surveying – based on methods and instruments, classifications ; Linear, angular and graphical methods, Survey stations, Survey lines- ranging, Bearing of survey lines, different types, compass – prismatic, surveyor, whole circle, reduced bearings, declination, local attraction;	06
2	Levelling:	05

	Principles of levelling- booking and reducing levels; differential, reciprocal leveling, profile levelling and cross sectioning. Digital and Auto Level, Difficulties in leveling work, corrections and precautions to be taken in leveling work, Errors in levelling.	
3	Contouring: Contouring: Characteristics, methods, (direct and indirect methods of contouring) uses; methods of interpolation,	04
4	Theodolite: Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Horizontal and vertical control – methods of repetition and reiteration, Different methods of running a theodolite traverse, Gales traverse table, balancing of traverse by Bow-Ditch's transit and modified transit rules, omitted measurements, Precautions in using theodolite, errors in theodolite survey	06
5	Plane table surveying, Areas and volume: Plane table surveying, Different methods of plane table surveying, Two point problem, Errors in plane table survey. Areas and volumes: Area of a irregular figure by Trapezoidal rule, average ordinate rule, Simpson's 1/3 rule, various coordinate methods, Planimeter: types of planimeter including digital planimeter, area of zero circle, use of planimeter, Computation of volume by trapezoidal and prismoidal formula, volume from spot levels.	05

Text Books

1. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010.
2. Arora, K.R., Surveying, Vol-I, and II and, Standard Book House, 2015.
3. T.P Kanetkar (2000); "Surveying and Levelling Vol I", Pune VidyarthiGrihaNew Central Book Agency. ISBN-13 9788185825113.
4. N. N. Basak (2014); "Surveying And Levelling", Mcgraw Hill Education (India) Private Limited. ISBN-13: 978-9332901537.
5. R Agor (2009); "Surveying and Leveling", Khanna Publishers. ISBN-13: 978-8174092359.
6. Dr. B.C. Punamia (2005); "Surveying Vol –I", Laxmi Publications (P) Ltd., New Delhi. ISBN-13: 978-8170088530. 536 p.
7. Dr. B.C. Punamia (2005); "Surveying Vol-II". Laxmi Publications (P) Ltd., New Delhi. ISBN-13: 978-8170088837. 658 p.
8. R. Subramanian(2007); "Surveying And Levelling", Oxford University Press. ISBN-13: 9780195684247. 970p.

Sr. No.	Examination	Module
1	T-I	1 and part of 2
2	T-II	Part of 2 and 3
3	End Sem	1 to 5

Building Drawing with CAD

Course Code	Course Name
ES-BTC 304	Building Drawing with CAD
Lecture: 02	Credit:02
Course pre-requisites	ES-BT 103,ES –BT-153.

Course Objectives
<p>Course Objectives:</p> <ol style="list-style-type: none"> 1. To understand the principle of planning for residential & Public building 2. To understand the regulations as per National Building Code 3. To identify the functional requirements and building rules 4. To understand the sketches and working drawings
Course Outcomes
<p>Upon successful completion of the course, students should be able</p> <ol style="list-style-type: none"> 1. Understand the conventions of formal Civil engineering drawing 2. Understand building rules, regulation and byelaws, Building codes 3. Examine a design critically and with understanding of CAD - The student learn to interpret drawings, develop parametric designs and to produce designs using a combination of 2D and 3D software. 4. Communicate and transform a design concept graphically/ visually 5. Get a detailed study of an engineering artefact

Course Content		
Module No.	Details	Hrs.
1	<p>INTRODUCTION Drawing practice, guidelines for building drawing, terms used in building construction, general conventions and symbols, Thumb rules for effective planning – location of rooms and sizes, Building permissions</p>	04
2	<p>BUILDING REGULATIONS, BYE-LAWS AND CODES Principle of architectural composition, Principles of Planning, Recommendations of CBRI, Roorkee, Importance of Building Codes and byelaws - plot area, built-up area, minimum size of rooms, margins, setbacks, heights, passages and corridors, ventilation, circulation, open space, water supply & sanitary, electrification, fire safety, other safety, lifts, Environment Approval procedure with respect to bye-law, Real Estate (Regulation and Development) Act, 2016 Sustainable design principles - provisions of National Building Code, ANSI, ASTM, ASHRAE, approval process, Green building principles-green building techniques-energy solutions, site solutions, exterior and interior solutions, Certification –BREEAM, GRIHA, NAHB, LEED, IGBC</p>	06
3	<p>BUILDING PLANNING</p>	10

	<p>Planning of Residential Buildings; Residential building forms, Basic areas in residential buildings, Process of planning-family requirement & analysis, conceptual plan outlines, Principles and techniques for functional planning, Climate and design considerations – orientation, Planning for service, Landscaping-concept of art, Structural system and functional classification of buildings, Creativity-role of architect and engineer.</p> <p>Planning of Public Buildings: Approach for activity analysis for public buildings such as educational institutes (schools, colleges, and institutional campus), health care centres, hospitals, office buildings or business parks, entertainment buildings – Space norms, basic areas, and functional setting areas.</p> <p>Planning of Building Services- Introduction to building services like water supply, drainage, electrification, ventilation, lightening, staircases and lifts, fire safety, acoustics and thermal insulation</p>	
4	<p>METHOD OF DRAWING</p> <p>Terms, elements of planning a building drawing, selection of scales, Developing working and submission drawings – Plans ; layout plan, floor line plan, detailed plan, foundation plan, roof or terrace plan –drainage plans, plan showing drainage, water supply and electricity lines, Elevations, Cross sections, Structural drawings, Importance and purpose of preparing the above drawings, Details to be shown and location of the details</p>	06
5	<p>PICTORIAL VIEW</p> <p>Principles of perspective drawing; Perspective view of building. Fundamentals of Building Information Modelling (BIM)</p>	04

Text Books

2. N. KumaraSwamy and A. Kameshwara Rao (2012); “Building Planning & Drawing” Charotar Publishing House; ISBN-13: 978-9380358581. 434 p
3. V.B. Sikka (2013); “A Course in Civil Engineering Drawing” S.K. Kataria & Sons; ISBN-13: 978-9350142721. 550 p.

Reference Books

3. M.G. Shah, C.M. Kale, and S.Y. Patil (2011); “Building Drawing with an Integrated Approach to Built Environment” McGraw Hill Education (India) Private Limited; ISBN-13: 978-0071077873. 408p.
4. Rangwala (2013); “Town Planning” Charotar Publishing House Pvt. Ltd.; ISBN-13: 978-9380358680. 344p.
5. B.P.Verma (2014); ‘Civil Engineering Drawing and House Planning’ Khanna Publishers; ISBN 81-7409-168-8,152p.
6. Reference Codes
National Building Code of India, 2016
IS 779-1978 Specification for water meter
IS 909-1975 Specification for fire hydrant

IS 1172-1983 Code of basic requirement for water supply ,drainage & sanitation
IS 1742-1983 code of practice for building drainage

Sr. No.	Examination	Module
1	T-I	1
2	T-II	2-3
3	End Sem	1 to 5

Engineering Geology

Course Code	Course Name
BS-BTC 305	Engineering Geology
Course pre-requisites	Applied Physics-I, Applied chemistry-I, Applied Physics-II, Applied Chemistry-II

Course Objectives
<p>The objectives of this course are</p> <ol style="list-style-type: none"> 1. To classify the various branches of geology that are applicable to civil engineering 2. To describe the geological processes of agents modifying the earth's surface, weathering, earthquakes and preventive measures for structures constructed in earthquake prone areas. 3. Explain mineralogy, petrology, geological history and structural geology of India. 4. To discuss the importance and methods of surface and sub-surface investigations and geological considerations while selecting sites for dams, reservoirs, tunnels, etc. 5. Outline Ground water and its implications for foundations in civil engineering, types, causes and preventive measures for landslide prevention.

Course Outcomes
<p>Upon successful completion of the course, students should be able</p> <ol style="list-style-type: none"> 1. Relate the processes associated with the origin and formation of various earth surface features, rock types, especially in India 2. Carry out proper geological and geotechnical investigations for major engineering projects. 3. Examine and give opinions regarding the geological hazards, erosion, flooding, dewatering and seismic investigations and its impact on structures etc.

Course Content		
Module No.	Details	Hrs.
1	<p>Introduction: Branches of geology useful to civil engineering, importance of geological studies in various civil engineering projects.</p> <p>Physical geology: Internal structure of the earth and use of seismic waves in understanding the interior, Agents modifying the earth surface, study of weathering and its significance in physical and engineering properties of rocks like strength and water tightness, durability etc., Geological action of river, wind and glaciers, erosion; transport and depositional landforms created by them. Earthquakes – earthquake waves, construction and working of seismographs, earthquake zones of India, Geological aspects earthquake resistance structures.</p>	08
2	<p>Mineralogy: Methods of mineral identification, physical properties of minerals,</p>	03

	rock forming minerals, ore forming minerals, megascopic identification of common primary and secondary minerals family.	
3	<p>Petrology: Study of igneous, sedimentary rocks, distinguishing properties between igneous, sedimentary and metamorphic rocks to identify them in field. Igneous petrology – mode of formation, textures, structures etc. Hatch’s scheme of classification, study of common igneous rocks, Sedimentary petrology – mode of formation, textures, characteristics of shallow water types, residual like lamination, bedding, current bedding etc., classification of secondary rocks, types, residual deposits, chemically formed and organically formed deposits, commonly occurring sedimentary rocks, Metamorphic petrology –mode of formation, agents and types of metamorphism, metamorphic minerals, rock cleavage, structures and textures in metamorphic rocks, classification, commonly occurring metamorphic rocks.</p>	08
4	<p>Structural geology: Structural elements of rocks – dip, strike, outcrop patterns, unconformities, outliers and inliers, study of joints, faults and folds, importance of structural elements in engineering operations.</p> <p>Stratigraphy : Principle of stratigraphy and co-relation, geological time scale, physiographic divisions of India – study of formations occurring in peninsular India.</p>	08
5	<p>Geological investigations: Preliminary geological investigations and their importance to achieve safety and economy of the projects, supporting case histories of dams and tunnel projects in Maharashtra State, Methods of surface and sub surface investigations – trial pits, trenches, drill holes, geological logging, inclined drill holes, Resistivity method and seismic methods, Use of aerial photographs and satellite imageries in civil engineering projects.</p> <p>Engineering properties of rock. Requirements of good building stone, geological factors controlling properties of good building stones, consideration of common rocks as building stones, study of different building stone from various formation in Indian peninsula, geological factors controlling location of quarries, quarrying methods and quarrying operations</p>	07
6	<p>Ground water: Sources and zones, water table, unconfined and perched, springs, Factors controlling water bearing capacity of rocks, pervious and impervious rocks, cone of depression and its use in civil engineering, Methods of artificial recharge of ground water, geology of percolation tank.</p>	04

	<p>Role of engineering geology of Dam, Tunnel and Reservoir site: Importance of geological conditions while selecting the type of dam, ideal geological conditions for dam and reservoir site, favorable and unfavorable conditions in different types of rocks in presence of various structural features, precautions to be taken to counteract unsuitable conditions, significance of faults, folds, crushed zone, dykes and fractures on the dam site and treatment giving to such structures, tail channel erosion, Improvements of sites.</p>	
7	<p>Tunneling: Importance of geological considerations while choosing sites and alignment of the tunnel, Ideal site conditions for tunneling; geological conditions to be avoided. Tunneling to various types of rocks under various geological and structural condition, difficulties during tunneling and methods to overcome the difficulties.</p> <p>Stability of hill slopes: Landslides, their types, causes and preventive measures for landslides.</p>	09

Text Books

1. Singh Parbin (2012), "Engineering & General Geology", S K Kataria and Sons Ltd. ISBN- 9350142678.
2. KesavuluChenna N. (2009), "Textbook of Engineering Geology", 2nd Edition, Trinity Press, ISBN-13: 9789380856278.
3. Winter J.D. (2011), "Principles of Igneous & Metamorphic Petrology", 2nd Edition Phi Learning Pvt. Ltd-New Delhi. ISBN-13: 9788120343979.

Fluid Mechanics

Course Code	Course Name
PC-BTC306	Fluid Mechanics

Course pre-requisites

Course Objectives

The objectives of this course are

1. To study basic properties & classification of fluids.
2. To discuss the students to the basics of fluid statics, fluid kinematics, fluid dynamics as well as various flow measuring devices.
3. To describe the laminar, turbulent flow in pipes and boundary layer theory and understand development of drag and lift forces acting on submerged bodies.

Course Outcomes

Upon successful completion of the course, students should be able

1. Use the hydrostatic principle to the floating/submerged body analysis.
2. Understand the various flow measuring devices
3. Carry out estimation of boundary layer thickness, drag forces acting over flat and curved surfaces along with the principle behind boundary layer separation.

Course Content

Module No.	Details	Hrs.
1	Properties of Fluids: Mass density, weight density, specific gravity, specific volume, viscosity, compressibility, bulk modulus, surface tension, capillary action, vapour pressure, types of fluids, basic concepts.	03
2	Pressures and Head: Types of Pressure, Pascal's law of pressure at a point, Hydrostatic equation, Pressure and pressure head, Force Balance Pressure gauge, Electrical Pressure transducers.	05
3	Static Forces on Surface and Buoyancy: Fluid static, action of fluid pressure on surface, resultant force and center of pressure on a plane surface under uniform pressure, resultant force and center of pressure on a plane surface immersed in a liquid, pressure diagrams, forces on a curved surface due to hydrostatic pressure, buoyancy, equilibrium of floating bodies, stability of a submerged body, stability of floating bodies, determination of the metacentric height, determination of the position of the metacentre relative to the center of buoyancy.	05
4	Fluid Kinematics and Dynamics: Description of fluid flow: Lagrangian method, Eulerian method, Streamlines, pathlines, streaklines, and classification of fluid flows, continuity equation, rotational flow, rotation and vorticity, velocity and stream function. Circulation, flow net. Euler's equation, Introduction Navier	05

	Stokes Equation, Bernoulli's theorem, its application to real fluid, flow measuring devices, Venturimeter, Pitot tube, Orifice.	
5	Laminar and Turbulent flow through pipes: Reynold's experiment, Critical velocity, Steady laminar flow through circular pipes, Parallel plates Causes of turbulence, instability, mechanism of turbulence, Reynold's stresses, Prandtl's mixing length theory, Universal velocity distribution equation.	05
6	Boundary Layer Theory: Development of boundary layer over flat plate and curved surfaces, laminar and turbulent boundary layer, boundary layer thickness, displacement thickness, momentum thickness, energy thickness, drag forces on flat plate due to boundary layer, boundary layer separation and control. Drag and Lift forces exerted by flowing fluid on stationary body, Streamlined and bluff bodies.	05

Text Books

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| <ol style="list-style-type: none"> 1. Dr. R. K. Bansal(2005); "A Textbook of Fluid Mechanics", Laxmi publication. ISBN-13: 978-8131802946. 501p. 2. Dr. P.N. Modi and S. M. Seth(2009); "Hydraulics and Fluid Mechanics" Standard Book House ISBN-13: 978-8189401269. 250p. 3. Dr. Jain A.K (2010); "Fluid Mechanics" Khanna Publishers. ISBN-13: 978-8174091949. 4. Subramanaya K (2010); "Fluid mechanics & hydraulic Machines". McGraw Hill Education (India) Private Limited. ISBN-13: 978-0070699809. |
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Building Materials and Construction

Course Code	Course Name
PC-BTC307	Building Materials and Construction

Course pre-requisites	Engineering Materials
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Course Outcomes
<p>Upon successful completion of the course, students should be able</p> <ol style="list-style-type: none"> 1. Identify different elements or components (structural and non-structural) of a building and recognizing good materials to be used for the construction work of a building 2. Define the methods, procedures and techniques of construction of a building 3. Select the materials, design and supervise the construction work and take suitable measures 4. Draw the details of various elements or components (structural and non-structural) of a building.

Course Content		
Module No.	Details	No. of Lectures
1	<p>Building Materials Role of material in construction, Stone as building material; Requirement of good building stones, Dressing of stones, Deterioration and Preservation of stone work. Bricks: Classification, Characteristics of good bricks, Ingredients of good brick earth, Harmful substance in brick Earth, Different forms of bricks, Testing of bricks as per BIS. Defects of bricks. Blocks: Cement Concrete blocks, Stabilized Mud Blocks, Aerated concrete blocks, fly ash bricks /blocks, Sizes, and requirement of good blocks. Aggregates: Classification, Characteristics, Deleterious substances, Soundness, Alkali – aggregates reaction, Fine aggregates, Coarse aggregates, Testing of aggregates Lime: Impurities in limestone, Classification, Slaking and hydration, Hardening, Testing, Storage, Handling Cement & Concrete: Cement: OPC: Composition, PPC, Slag cement, Hydration, setting time Concrete: Types, ingredients, W/C ratio, Workability, Different grades in cement concrete, Tests on cement concrete Mortars: Classification, Uses, Characteristics of good mortar, Ingredients. Cement mortar, Lime mortar, Lime cement mortar, special mortars Wood and Wood Products: Classification of Timber, Structure, Characteristics of good timber, Seasoning of timber, Defects in Timber, Diseases of timber, Decay of Timber, Preservation of</p>	12

	<p>Timber Testing of Timber, Veneers and Laminates , Plywood, Fibre Boards, Particle Boards, Chip Boards , Black Boards, Button Board and Laminated Boards, Applications of wood and wood products</p> <p>Paints, Enamels and Varnishes: Water based and oil paints, Composition and characteristic of an ideal paint, preparation of paint, covering power of paints, Painting: Plastered surfaces, painting wood surfaces, painting metal Surfaces. Defects, Effect of weather, enamels, distemper, water wash and colour wash, Varnish , French Polish, Wax Polish, melamine Polish</p> <p>Miscellaneous Materials: Gypsum: Classification, Plaster of Paris, Gypsum wall Plasters, calcium silicate boards, Gypsum Plaster boards, Moisture resistant gypsum boards, cement boards Adhesives, Heat and sound insulating materials, Geosynthetics</p>	
2	<p>Foundation</p> <p>Function of Foundations, Essential requirement of good foundation, Types of structures based on load transfer, function and requirements of good foundation, preliminary investigation of soil, safe bearing capacity of soil, types of foundation - shallow foundations - introduction to spread, isolated, combined , strap, mat and deep foundations - pile foundation</p>	03
3	<p>Masonry</p> <p>Definition and terms used in masonry. Stone masonry, Requirements of good stone masonry, Classification, characteristics of different stone masonry, Joints in stone masonry.</p> <p>Brick masonry: Definitions, Rules for bonding, Type of bonds – stretcher bond, Header bond, English bond, Flemish Bond, Comparison of English Bond and Flemish Bond (one and one and half brick thick wall)</p> <p>Types of walls; load bearing, partition walls, cavitywalls</p>	05
4	<p>Lintels, Arches, Floors And Roofs</p> <p>Definition, function and classification of lintels, balconies, chajja and canopy. Arches; elements and stability of an arch.</p> <p>Floors, requirement of good floor, components of ground floor, selection of flooring material, laying of Concrete, mosaic, marble, granite, tile flooring, cladding of tiles – skirting, dado.</p> <p>Roof, requirement of good roof, types of roof, elements of a pitched roof, trussed roof, king post truss, queen ost truss, steel truss, different roofing materials, RCC slab</p>	03
5	<p>Doors, Windows And Ventilators</p> <p>Location of doors and windows, technical terms, Materials for doors and windows, Panelled door Flush door, Collapsible door, Rolling shutter, PVC Door, Toughened glass door, sliding door, automated door Panelled and glazed Window, Bay Window, French window. Ventilators. Sizes as per IS recommendations</p>	02

	Glazing systems - unitized, semi unitized, stick systems. Hardware and locking systems - Dead locks, mortice locks, regular or concealed door closers, hold open door closers, pivot systems, types of hinges, concealed latch, regular latch.	
6	Stairs Definitions, technical terms and types of stairs, Requirements of good stairs. Geometrical design of RCC doglegged and open-well stairs.	02
7	Plastering, Pointing And Painting Purpose, materials and methods of plastering and pointing, defects in plastering-Stucco plastering, lathe plastering Damp proofing- causes, effects and methods. Paints- Purpose, types, ingredients and defects, Preparation and applications of paints to new and old plastered surfaces, wooden and steel surfaces.	03
8	Formwork Introduction to form work, types of formwork - scaffolding, shoring, under pinning, materials for formwork, requirement of good formwork	02

Term Work

Term work shall comprise of

To prepare drawings of following works:

1. Signs and Symbols required in civil engineering drawings
2. Types of foundations
3. Types of masonry bonds
4. Types of stairs
5. Types of doors and windows
6. Types of floors and roofs
7. Types of pointing
8. Types of Damp Proofing Course
9. Types of Electrical Fittings and Plumbing Fixtures
10. Elements of building construction – typical cross section of a two storied building showing foundation, plinth, wall, lintel, chajja, door and window.

Text Books

1. S. P. Bindra, S. P. Arora, Building Construction, Dhanpat Rai Publication, New Delhi, Fourth Edition, 1988.
2. M.G. Shah, C.M. Kale, S. Y. Patki, Building Drawing, Tata McGraw Hill Publishing Company Limited, New Delhi, Third Edition, 1996

Reference Books

1. Roy Chudley, Roger Greeno, Building Construction Handbook, Butterworth-Heinemann, Tenth Edition, 2006

Mechanics of Materials (Lab)

Course Code	Course Name
ES-BTC 351	Mechanics of Materials (Lab)

Course pre-requisites	ES-BTC 302
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Course Objectives

The objectives of this course are

1. To investigate the behaviour of an elastic member subjected to various types of forces such as axial force, shear force, bending moment, torsion etc. and
2. To test material properties of hardness and toughness.

Course Outcomes

Upon successful completion of the course, students should be able

1. Develop collaborative skills to work in a team/group.
2. Experimentally determine the various material properties.

List of experiments (At least eight to be performed)

1. Tension test on mild steel / tor steel rod.
2. Transverse test on cast iron specimen.
3. Shear test on metal specimens.
4. Torsion test on mild steel / cast iron specimen.
5. Load deflection test on metal specimens.
6. Brinell hardness test on metal specimens.
7. Rockwell hardness test on metal specimens.
8. Charpy impact test on metal specimens.
9. Izod impact test on metal specimens.

*Report on experiments performed as detailed above shall be submitted as laboratory work

Text Books

1. Popov, Egor P, (1978), "Mechanics of materials", Englewood Cliffs, N.J: Prentice-Hall, ISBN 0135711584 (pbk), 864 p.
2. S.B. Junnarkar (2007), "Mechanics of materials Vol-1", Charotar Publications, ISBN 8185594678, 447 p.
3. Bear & Johnson (2007), "Mechanics of materials", Tata McGraw-Hill, ISBN: 0070042845, 780 p.

Reference Books

1. Timoshenko & Gere (2006), "Mechanics of materials", Tata McGraw Hill, CBS Publishers & Distributors, ISBN 8123908946, 762 p.
2. James M. Gere, Books/cole (2012), "Mechanics of materials", Cengage Learning, ISBN 1111577730, 1056 p.
3. G.H. Ryder (2002), "Strength of materials" Macmillan Publishers India Limited, ISBN 0333935365, 352 p.
4. William A. Nash (2005), "Strength of materials", Schaum's outline series, Tata McGraw-Hill Education, ISBN 0070601631, 216 p.

Basics of Surveying (Lab.)

Course Code	Course Name
PC-BTC 352	Basics of Surveying (LAB)

Course pre-requisites	Basics of surveying
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Course Objectives

The objectives of this course are

1. Describe the function of surveying in civil engineering construction,
2. Work with survey observations, and perform calculations,
3. Customary units of measure. Identify the sources of measurement errors and mistakes; understand the difference between accuracy and precision as it relates to distance, differential leveling, and angular measurements,
4. Be familiar with the principals of recording accurate, orderly, complete, and logical field notes from surveying operations, whether recorded manually or with automatic data collection methods,
5. Identify and calculate the errors in measurements and to develop corrected values for differential level circuits, horizontal distances and angles for open or closed-loop traverses.
6. Operate an automatic level to perform differential and profile leveling; properly record notes; mathematically reduce and check levelling measurements.
7. Understand, interpret, and Prepare plan, profile, and cross-section drawings, Work with cross-sections and topographic maps to calculate areas, volumes, and earthwork quantities.

Course Outcome

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

1. Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities.
2. Demonstrate their capability for preparing ground map at their own which is useful for their future.
3. Apply concept of surveying and its application in different construction work.

Course Content

<i>Sr. No.</i>	<i>List of Experiments</i>
1	To find internal angles of a polygon with a prismatic and a surveyor compass.
2	Level simple and compound leveling, booking methods, practice on levels Dumpy, Tilting and Auto levels. Demonstration of Digital level.
3	Measurement of Horizontal angles by Repetition method
4	Measurement of Horizontal angles by Reiteration method

5	Measurement of Bearing of line using Theodolite
6	Measurement of vertical angle using Theodolite
7	Use of digital planimeter for measuring area of irregular figures
8	Plane table survey by Radiation method.
Recommended Books	
<ol style="list-style-type: none">1. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010.2. Arora, K.R., Surveying, Vol-I, and II and, Standard Book House, 2015.3. T.P Kanetkar (2000); "Surveying and Levelling Vol I", Pune VidyarthiGrihaNew Central Book Agency. ISBN-13 9788185825113.4. N. N. Basak (2014); "Surveying And Levelling", Mcgraw Hill Education (India) Private Limited. ISBN-13: 978-9332901537.5. R Agor (2009); "Surveying and Leveling", Khanna Publishers. ISBN-13: 978-8174092359.6. Dr. B.C. Punamia (2005); "Surveying Vol –I", Laxmi Publications (P) Ltd., New Delhi. ISBN-13: 978-8170088530. 536 p.7. Dr. B.C. Punamia (2005); "Surveying Vol-II". Laxmi Publications (P) Ltd., New Delhi. ISBN-13: 978-8170088837. 658 p.8. R. Subramanian (2007); "Surveying And Levelling", Oxford University Press. ISBN-13: 9780195684247. 970p.	

Fluid Mechanics Laboratory

Course Code	Course Name
PC-BTC353	Fluid Mechanics Laboratory

Course pre-requisites

Course Objectives

The objectives of this course are

1. To summarize various principles and fluid properties.
2. To explain calibrations of various flow measuring devices.
3. To describe the laminar flow and turbulent flow in pipes and boundary layer theory and discuss the development of drag and lift forces acting on submerged bodies, airfoils, circular and cylindrical body.

Course Outcomes

Upon successful completion of the course, students should be able

5. To utilize various properties of fluids.
6. To carry out calibrations of various flow measuring devices.
7. Understand boundary layer formation along with the principle behind boundary layer separation.

List of experiments: (preferably eight to be performed)

1. Determination of Specific Weight of Fluid by using Buoyancy/Archimedes principle.
2. Determination of Specific Gravity of Fluid by using U-Tube Manometer.
3. Verification of Bernoulli's theorem
4. Determination of metacentric height
5. Calibration of Orifice
6. Calibration of venturimeter
7. Reynolds Experiment
8. Boundary Layer Theory
9. Laminar Flow through pipes
10. Calibration of notches
11. Calibrations of weirs

Recommended Books

1. Dr. R.K. Bansal (2005); "A Textbook of Fluid Mechanics", Laxmi publication. ISBN-13: 978-8131802946. 501p.
2. Dr. P.N. Modi (2009); "Hydraulics and Fluid Mechanics" Standard Book House ISBN-13: 978-8189401269. 250p.
3. Dr. Jain A.K (2010); "Fluid Mechanics" Khanna Publishers. ISBN-13: 978-8174091949.
4. K Subramanya (2008); "Flow in Open Channels" 978-0070086951. 576p.
5. Subramanaya K (2010); "Fluid mechanics & hydraulic Machines". McGraw Hill Education (India) Private Limited. ISBN-13: 978-0070699809.

Material Testing & Evaluation (Lab.)

Course Code	Course Name
PC-BTC 354	Material Testing & Evaluation (Lab.)
Course pre-requisites	Building materials and construction
Course Objectives	
The objectives of this course are	
1. To investigate the behavior of an elastic member subjected to compression, flexure, abrasion etc. and	
2. To investigate various physical properties of cement.	
Course Outcomes	
Upon successful completion of the course, students will be able to	
1. Experimentally determine the various material properties and physical properties of cement.	
Course Content	
Sr. No.	List of Experiments
1	Water absorption and compression test of bricks.
2	Water absorption and transverse load test on tiles
3	Moisture content and flexural strength test on timber.
4	Compression test on timber (Parallel / perpendicular to the grains).
5	Physical properties of cement: Fineness, consistency, Setting time, Soundness, Compressive strength.
6	Compression test on Paver blocks
7	Water absorption, density and compression test on masonry blocks
8	Abrasion test on tiles
Recommended Books	
1. S. S. Bhavikatti (2012); "Building Materials", Vikas Publishing House Pvt Ltd. ISBN-13: 978-9325960442. 488p.	
2. Rangwala (2012); "Engineering materials", Charotar Publications. ISBN-13: 978-9380358796.	
3. S.K. Duggal (2010); "Building Materials", New Age International Publishers. ISBN-13: 978-8122433791. 616p.	
4. Varghese P. C (2005); "Building Materials" PHI. ISBN-13: 978-8120328488. 180p.	
5. M. Gambhir (2011); "Building Materials Products, Properties and Systems" McGraw Hill Education (India) Private Limited. ISBN-13: 978-0071077606.	
6. IS codes of different materials, BIS publications.	

Building Drawing with CAD (Lab.)

Course Code	Course Name
ES-BTC 355	Building Drawing with CAD (Lab)
Practical: 02hrs.	Credit:01
Course pre-requisites	ES-BTC 304

Course Objectives
1. To draft the plan elevation and sectional views of the buildings using computer software.
Course Outcomes
Upon successful completion of this course, students will be able to : <ol style="list-style-type: none"> 1. Planning and designing of residential and public building by implementing the principles of planning of buildings, Green building principles, byelaws, regulations and codes for planning 2. Preparing various working and detailed drawing of the buildings in CAD. 3. Preparing layouts of various building services.
Course Content
<p>Proposed Work:</p> <ol style="list-style-type: none"> 1. Planning and designing a residential RCC framed building and preparation of working and detailed drawings - plan, elevation, section, site plan, foundation plan, terrace plan, waterproofing treatment, typical door and window, structural drawings and other details 2. Planning and designing a public building and preparation of working and detailed drawings for a residential building - plan, elevation, section, site plan, foundation plan, terrace plan, waterproofing treatment, typical door and window, structural drawings and other details and writing out a description of the facility in about 500/700 words 3. Preparation of various layouts for building services for any one (residential or public) building – electrical services, water supply, drainage, waste water and storm water collection, gas supply, firefighting etc. 4. Perspective view of any one (residential or public) building
Text Books
<ol style="list-style-type: none"> 1. N. KumaraSwamy and A. Kameshwara Rao (2012); “Building Planning & Drawing” Charotar Publishing House; ISBN-13: 978-9380358581. 434 p 2. V.B. Sikka (2013); “A Course in Civil Engineering Drawing” S.K. Kataria & Sons; ISBN-13: 978-9350142721. 550 p. 3. Beginning AutoCAD, Cheryl Shrock, BPB Publication, 1st edition 4. Introduction to AutoCAD 2005:2D and 3D Design, Alf Yarwood
Reference Codes
<ol style="list-style-type: none"> 1. National Building Code of India, 2005 2. IS 779-1978 Specification for water meter 3. IS 909-1975 Specification for fire hydrant 4. IS 1172-1983 Code of basic requirement for water supply ,drainage & sanitation 5. IS 1742-1983 code of practice for building drainage

Engineering Geology (Lab.)

Course Code	Course Name
BS-BTC 356	Engineering Geology (Lab.)
Course pre-requisites	Engineering Geology
Course Objectives	
<p>The objectives of this course are</p> <ol style="list-style-type: none"> 1. Identification and description of physical properties of rock-forming and ore-forming minerals. 2. Identification and systematic description of megascopic features of Igneous, Sedimentary and Metamorphic rocks. 3. Description and drawing of vertical cross-section of structural geological maps and study of core samples and the engineering problems encountered on site. 	
Course Outcomes	
<p>Upon successful completion of the course, students will be able to</p> <ol style="list-style-type: none"> 1. Identify the different properties of minerals and differentiate and identify the different rock types. 2. Interpret the cross-section of the geological maps and evaluate the suitability of site for different engineering projects from study of core samples. 	
Course Content	
Sr. No.	Name of Experiments
1	Study of physical properties of the minerals.
2	Megascopic identification of rock forming minerals – crystalline, crypto-crystalline and amorphous silica and their varieties, Orthoclase, Microcline, Plagioclase, Muscovite, Biotite, Hornblende, Asbestos, Augite, Olivine, Tourmaline, Garnet, Natrolite, Actinolite, Calcite, Dolomite, Gypsum, Corundum, Talc, Fluorite, Kyanite
3	Megascopic identification of ore forming minerals - Bauxite, Graphite, Galena, Pyrite, Hematite, Magnetite, Chalcopyrite, Chromite, coal
4	Identification of rocks – <ul style="list-style-type: none"> • Megascopic identification of Igneous rocks : Granite and its varieties, Synite, Dionite, Gabbro, Pegmatite, Porphyry, Dolerite, Rhyolite, Pumice, Trachyte, Basalt and its varieties, Volcanic Breccia, Volcanic Tuffs. • Megascopic identification of Sedimentary rocks : Conglomerate, Breccia, Sandstone and its varieties, Shales, Limestone, Melliolite, Laterite, • Megascopic identification of Metamorphic rocks: Slate, Phyllite, Mica, Schists, Hornblende schists, Granite gneiss and its varieties, Augen gneiss, Marbles and quartzite.
5	Study of Structural geological maps. (at least eight).
6	Study of core samples, percentage recovery, RQD, core logging and engineering problem based on field data collected during site investigation.

Recommended Books

1. Singh Parbin (2012); "Engineering & General Geology", S K Kataria and Sons Ltd. ISBN- 9350142678.
2. Kesavulu Chenna N. (2009) "Textbook of Engineering Geology" 2nd Edition Trinity Press, ISBN-13: 9789380856278.
3. Winter (2011); "Principles Of Igneous & Metamorphic Petrology", 2nd Edition Phi Learning Pvt. Ltd-New Delhi. Isbn-13: 9788120343979.

Energy Science and Engineering

Course Code	Course Name
VA-BTC371	Energy Science and Engineering

Course pre-requisites	XII th Science
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Course Objectives

The objectives of this course are:

1. To introduce energy systems and renewable energy resources, with a scientific examination of the energy field.
2. To help students explore society's present needs and future energy demands.
3. To examine conventional energy sources and systems, including fossil fuels and nuclear energy.
4. To focus on alternatives- renewable energy sources such as solar, biomass (conversions), wind power, waves and tidal, geothermal, ocean thermal, hydro and nuclear.
5. To emphasize energy conservation methods from Civil Engineering perspective.

Course Outcomes

Students will be able to learn,

1. List and generally explain the main sources of energy and their primary applications nationally and internationally.
2. Have basic understanding of the energy sources and scientific concepts/principles behind them.
3. Understand effect of using these sources on the environment and climate.
4. Describe the challenges and problems associated with the use of various energy sources, including fossil fuels, with regard to future supply and the impact on the environment.
5. List and describe the primary renewable energy resources and technologies.
6. To quantify energy demands and make comparisons among energy uses, resources, and technologies.
7. Collect and organize information on renewable energy technologies as a basis for further analysis and evaluation.
8. Understand the Engineering involved in projects utilising these sources

Course Content

<i>Module No.</i>	<i>Details</i>	<i>Hrs.</i>
1	Introduction to Energy Science: Scientific principles and historical interpretation to place energy use in the context of pressing societal, environmental and climate issues; Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment.	04
2	Energy Sources: Overview of energy systems, sources, transformations, efficiency,	06

	and storage. Fossil fuels (coal, oil, oil-bearing shale and sands, coal gasification) - past, present & future, Remedies & alternatives for fossil fuels - biomass, wind, solar, nuclear, wave, tidal and hydrogen; Sustainability and environmental trade-offs of different energy systems; possibilities for energy storage or regeneration (Ex. Pumped storage hydro power projects, superconductor-based energy storages, high efficiency batteries).	
3	Energy & Environment: Energy efficiency and conservation; introduction to clean energy technologies and its importance in sustainable development; Carbon footprint, energy consumption and sustainability; introduction to the economics of energy; How the economic system determines production and consumption; linkages between economic and environmental outcomes; How future energy use can be influenced by economic, environmental, trade, and research policy.	05
4	Civil Engineering Projects connected with the Energy Sources: Coal mining technologies, Oil exploration offshore platforms, Underground and under-sea oil pipelines, solar chimney project, wave energy caissons, coastal installations for tidal power, wind mill towers; hydro power stations above-ground and underground along with associated dams, tunnels, penstocks, etc.; Nuclear reactor containment buildings and associated buildings, design and construction constraints and testing procedures for reactor containment buildings; Spent Nuclear fuel storage and disposal systems.	07
5	Engineering for Energy conservation: Concept of Green Building and Green Architecture; Green building concepts (Green building encompasses everything from the choice of building materials to where a building is located, how it is designed and operated); LEED ratings; Identification of energy related enterprises that represent the breath of the industry and prioritizing these as candidates; Embodied energy analysis and use as a tool for measuring sustainability. Energy Audit of Facilities and optimization of energy consumption.	06

Life Science

Course Code	Course Name	
VA-BTC 372	Life Science	
Course pre-requisites		XII th Science
Course Content		
Module No.	Details	Hrs.
1	Plant Physiology - Transpiration; Mineral nutrition. Ecology- Ecosystems- Components, types, flow of matter and energy in an ecosystem; Community ecology- Characteristics, frequency, life forms, and biological spectrum; Ecosystem structure- Biotic and a-biotic factors, food chain, food web, ecological pyramids	06
2	Population Dynamics- Population ecology- Population characteristics, ecotypes; Population genetics- Concept of gene pool and genetic diversity in populations, polymorphism and heterogeneity.	06
3	Environmental Management- Principles: Perspectives, concerns and management strategies; Policies and legal aspects- Environment Protection Acts and modification, International Treaties; Environmental Impact Assessment- Case studies (International Airport, thermal power plant).	06
4	Molecular Genetics- Structures of DNA and RNA; Concept of Gene, Gene regulation, e.g. Operon concept. Biotechnology- Basic concepts: Totipotency and Cell manipulation; Plant & Animal tissue culture- Methods and uses in agriculture, medicine and health; Recombinant DNA Technology- Techniques and applications.	06
5	Biostatistics - Introduction to Biostatistics:-Terms used, types of data; Measures of Central Tendencies- Mean, Median, Mode, Normal and Skewed distributions; Analysis of Data- Hypothesis testing and ANNOVA (single factor)	06

Text Books
<ol style="list-style-type: none"> 1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd. 2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons 3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company. 4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher. Subramanaya K (2010); "Fluid mechanics & hydraulic Machines". McGraw Hill Education (India) Private Limited. ISBN-13: 978-0070699809.

5. Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

Life Science (Lab)

Course Code	Course Name
VA-BTC 372	Life Science (Lab)

Course pre-requisites	XII th Science
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Course Contents

Laboratory & Fieldwork Sessions-

- a) Comparison of stomatal index in different plants; Study of mineral crystals in plants;
- b) Determination of diversity indices in plant communities; To construct ecological pyramids of population sizes in an ecosystem;
- c) Determination of Importance Value Index of a species in a plant community; Seminar (with PPTs) on EIA of a Mega-Project (e.g., Airport, Thermal/Nuclear Power Plant/ Oil spill scenario);
- d) Preparation and extraction of genomic DNA and determination of yield by UV absorbance;
- e) Isolation of Plasmid DNA and its separation by Gel Electrophoresis; Data analysis using Biostatistical tool

Text Books

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd.
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons
3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company.
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher.
5. Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

Introduction to Civil Engineering

Course Code	Course Name
VA-BTC 373	Introduction to Civil Engineering

Course pre-requisites

Course Objectives

The students will learn about –

1. To give an understanding to the students of the vast breadth and numerous areas of engagement available in the overall field of Civil Engineering.
2. To motivate the student to pursue a career in one of the many areas of Civil Engineering with deep interest and keenness.
3. To expose the students to the various avenues available for doing creative and innovative work in this field by showcasing the many monuments and inspiring projects of public utility.
4. To providing a foundation for the student to launch off upon an inspired academic pursuit into this branch of engineering

Course Outcomes

The students will be able to:

1. Learn what constitutes Civil Engineering
2. Identify the various areas available to pursue and specialize within the overall field of Civil Engineering
3. Highlight the depth of engagement possible within each of these areas
4. Explore the various possibilities of a career in this field.
5. Understand the vast interfaces this field has with the society at large.
6. Showcase the many monuments, heritage structures, nationally important infrastructure, and impressive projects to serve as sources of inspiration.
7. Highlight possibilities for taking up entrepreneurial activities in this field.

Course Content

Module No.	Details	Hrs.
1	Basic Understanding: What is Civil Engineering/ Infrastructure? Basics of Engineering and Civil Engineering; Broad disciplines of Civil Engineering; Importance of Civil Engineering, Possible scopes for a career. History of Civil engineering: Early constructions and developments over time; Ancient monuments & Modern marvels; Development of various materials of construction and methods of construction; Works of Eminent civil engineers.	04
2	Overview of National Planning for Construction and Infrastructure Development : Position of construction industry vis-à-vis other industries, five year plan outlays for construction; current budgets for infrastructure works.	06

	<p>Fundamentals of Architecture & Town Planning: Aesthetics in Civil Engineering, Examples of great architecture, fundamentals of architectural design & town 06 34 planning; Building Systems (HVAC, Acoustics, Lighting, etc.); LEED ratings; Development of Smart cities</p>	
3	<p>Fundamentals of Building Materials: Stones, bricks, mortars, Plain, Reinforced & Prestressed Concrete, Construction Chemicals; Structural Steel, High Tensile Steel, Carbon Composites; Plastics in Construction; 3D printing; Recycling of Construction & Demolition wastes Basics of Construction Management & Contracts Management: Temporary Structures in Construction; Construction Methods for various types of Structures; Major Construction equipment; Automation & Robotics in Construction; Modern Project management Systems; Advent of Lean Construction; Importance of Contracts Management</p>	06
4	<p>Environmental Engineering & Sustainability: Water treatment systems; Effluent treatment systems; Solid waste management; Sustainability in Construction; Geotechnical Engineering: Basics of soil mechanics, rock mechanics and geology; various types of foundations; basics of rock mechanics & tunnelling Hydraulics, Hydrology & Water Resources Engineering: Fundamentals of fluid flow, basics of water supply systems; Underground Structures; Underground Structures Multipurpose reservoir projects Ocean Engineering: Basics of Wave and Current Systems; Sediment transport systems. Ports & Harbours and other marine structures Power Plant Structures: Chimneys, Natural & Induced Draught Colling towers, coal handling systems, ash handling systems; nuclear containment structures; hydro power projects Surveying & Geomatics: Traditional surveying techniques, Total Stations, Development of Digital Terrain Models; GPS, LIDAR;</p>	07
5	<p>Structural Engineering: Types of buildings; tall structures; various types of bridges; Water retaining structures; Other structural systems; Experimental Stress Analysis; Wind tunnel studies. Traffic & Transportation Engineering: Investments in transport infrastructure development in India for different modes of transport; Developments and challenges in integrated transport development in India: road, rail, port and harbour and airport sector; PPP in transport sector; Intelligent Transport Systems; Urban Public and Freight Transportation; Road Safety under heterogeneous traffic; Sustainable and resilient pavement materials, design, construction and management; Case studies and examples.</p>	06
6	<p>Repairs & Rehabilitation of Structures:</p>	06

	Basics of corrosion phenomena and other structural distress mechanisms; some simple systems of rehabilitation of structures; Non-Destructive testing systems; Use of carbon fibre wrapping and carbon composites in repairs.	
7	Computational Methods, IT, IoT in Civil Engineering: Typical software used in Civil Engineering- Finite Element Method, Computational Fluid Dynamics; Computational Geotechnical Methods; highway design (MX), Building Information Modelling. Highlighting typical available software systems (SAP, STAAD, ABAQUS, MATLAB.	
Reference Books		
<ol style="list-style-type: none"> 1. Patil, B.S.(1974), Legal Aspects of Building and Engineering Contract 2. The National Building Code, BIS, (2017) 3. RERA Act, (2017) 4. Meena Rao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset 5. Chandiramani, Neelima (2000), The Law of Contract: An Outline, 2nd Edn. Avinash Publications Mumbai 6. Avtarsingh (2002), Law of Contract, Eastern Book Co. 7. Dutt (1994), Indian Contract Act, Eastern Law House 8. Anson W.R.(1979), Law of Contract, Oxford University Press 9. Kwatra G.K.(2005), The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration, Indian Council of Arbitration 10. Avtarsingh (2005), Law of Arbitration and Conciliation, Eastern Book Co. 11. Wadhwa (2004), Intellectual Property Rights, Universal Law Publishing Co. 12. P. S. Narayan (2000), Intellectual Property Rights, Gogia Law Agency 13. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House 14. Bare text (2005), Right to Information Act 15. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers 16. K.M. Desai(1946), The Industrial Employment (Standing Orders) Act 		

SEM-IV-COURSE CONTENTS

AY - 2021-22

Probability and Statistics

Course Code	Course Name	
BS-BTC401	Probability and Statistics	
Course pre-requisites	Engineering Mathematics-I, Engineering Mathematics-II	
Course Objectives		
The students will learn about – <ol style="list-style-type: none"> 1. To provide an overview of probability and statistics to engineers 2. Introduce Statistical methods and probability distributions 3. Introduce testing of hypothesis. 		
Course Outcomes		
The students will be able to: <ol style="list-style-type: none"> 1. Solve problems in basic statistics and probability distribution 2. Solve problems based on testing of hypothesis. 3. Apply statistical methods for analysing experimental data. 		
Course Content		
Module No.	Details	Hrs.
1	Statistics: Correlation, Karl Pearson coefficient & Spearman's rank Correlation coefficient, linear regression, lines of regression, Curve fitting by the method of least squares.	08
2	Discrete Random Variables: Random variables, Probability distribution for discrete random variables, Expected value and Variance, Binomial Distribution and Poisson Distribution.	06
3	Continuous Random Variables: Probability Density Function for continuous random variable, Normal Distribution	04
4	Sampling Theory: Sampling distribution. Test of Hypothesis. Level of significance, critical region. Large and small samples. Test of significance for Large samples: Test for significance of the difference between sample mean and population means, Test for significance of the difference between the means of two samples. Test for significance of the difference between sample S.D and population S.D, Test for significance of the difference between the S.D of two samples.	06
5	T-Test Student's t-distribution and its properties. Test of significance of small samples: Test for significance of the difference between sample mean and population means, Test for significance of the difference between the means of two samples, Chi-square distribution and its properties.	06

Reference Books

7. N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2010.
8. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2000.
9. T. Veerarajan, "Engineering Mathematics", Tata McGraw-Hill, New Delhi, 2010.
10. Murray Spiegel, "Schaum's Outline of Probability and Statistics", 4th Edition, Tata McGraw-Hill 2012.

Sr. No.	Examination	Module
1	T-I	1, 2(Part)
2	T-II	2(Part),3
3	End Sem	1 to 5

Structural Mechanics

Course Code	Course Name
PC-BTC402	Structural Mechanics

Course pre-requisites	ES-BT104, ES-BT154, ES-BT204, ES-BTC 302, ES-BTC351
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Course Objectives

The objectives of this course are

1. To introduce the students to the behaviour and analysis of various determinate structures.
2. To prepare the base for the students to study other structural engineering courses at a later stage.

Course Outcomes

Upon successful completion of the course, students should be able to

1. Analyse for bending moment combined with axial loading and unsymmetrical bending.
2. Draw axial force, shear force and bending moment diagrams for rigid jointed frames and state the general theorems and write the expression for strain energy and find/calculate strain energy stored.
3. Find deflection in beams, rigid jointed and pin jointed frames using different methods.
4. Analyse column for buckling.

Course Content

<i>Module No.</i>	<i>Details</i>	<i>Hrs.</i>
1	Bending moment combined with axial loads: Application to members subjected to eccentric loads, core of the section. Problems on chimneys, retaining walls.	05
2	Unsymmetrical bending: Moment of inertia about rotated axes, principal axes and principal moment of inertia, flexural stresses due to bending in two planes for symmetrical sections, bending of unsymmetrical sections.	05
3	Axial force, shear force and bending moment in frames: Axial force, shear force and bending moment diagrams for statically determinate frames.	05
4	General theorems: Strain energy in elastic structures due to axial load, bending moment, shear force and twisting moment. Complementary energy. Principle of superposition, Principle of virtual work, Castigliano's theorems, Betti's Law and Maxwell's reciprocal theorem.	05
5	Deflection of statically determinate structures: Deflection of cantilever and simply supported beams by Double Integration	03

	Method, Macaulay's Method. Deflection of cantilever and simply supported beams due to loads using Moment area method, Conjugate beam method.	05
6	Deflection of statically determinate structures: Deflection of cantilever and simply supported beams for different types of loadings using Principle of virtual work (unit load method) and Castigliano's theorem. Deflection of determinate pin jointed and rigid jointed frames by principle of virtual work (unit load method) and Castigliano's theorem.	08
7	Columns and Struts: Short and long/slender columns, Concept of buckling in slender columns subjected to axial loads, Euler's and Rankine's design formulae for columns with different support conditions.	04

Term Work

Term work shall comprise of

1. At least 20 (twenty) solved problems based on the above modules shall be submitted as term work.
2. Course project*

***Course Project:** There will be a course project where the students will be able to apply and integrate the knowledge gained during the course. The projects will be developed by teams of Two to Four students and will consist of design of any system having min. 5 to 6 components.

Text Books

1. Popov, Egor P, (1978), "Mechanics of materials", Englewood Cliffs, N.J: Prentice Hall, ISBN 0135711584, 864 pages.
2. Bear & Johnson (2007), "Mechanics of materials", Tata McGraw-Hill, ISBN: 0070042845, 780 pages.
3. Reddy C.S. (1999), "Basic Structural Analysis", Tata McGraw hill, ISBN 0070702764, 540 pages.
4. Junnarkar S.B. (2013), "Structural Analysis, Vol. II" Charotar Publishers ISBN 9380358703, 986 pages.
5. S S Bhavikatti (2011), "Structural Analysis", Vikas Publishing House PVT. Ltd.Noida, ISBN 8125942696, 436 pages.
6. Devdas Menon (2009), "Structural Analysis", Narosa Book Distributors Pvt Ltd- New Delhi, ISBN 8173197504, 685 pages.

Reference Books

1. Timoshenko & Gere (2006), "Mechanics of Materials", Tata McGraw Hill, CBS Publishers & Distributors, ISBN 8123908946, 762 pages.
2. Stephen P. Timoshenko, Donovan H. Young (1965), "Theory of Structures", Tata McGraw Hill, ISBN 0070648689, 629 pages.
3. John Benson Wilbur , Senol Utku , Charles H. Norris (1990), "Elementary Structural Analysis", Tata McGraw Hill, ISBN 9780070659339, 829 pages.
4. Harold I. Laursen (2007), "Structural Analysis", Tata McGraw Hill Higher Education, ISBN 0070366438, 468 pages.
5. B.G. Neal (1963), "Structural Theorems and Their Applications", Pergamon Press ISBN 0080108717, 208 pages.
6. Russell C. Hibbeler (2012), "Structural Analysis", Prentice Hall, IBN 013257053X, 695 pages.
7. Alexander Chajes (1982), "Structural Analysis", Longman Higher Education, ISBN 0138534080, 352 pages.
8. Aslam Kassimali (2014), "Structural Analysis", Cengage Learning, ISBN 1133943896, 613 pages.
9. Dr. Ramachandran Vaidyanathan, Dr. P. Perumal (2006), "Comprehensive Structural Analysis", Laxmi Publications, ISBN 8170088917, 466 pages.

Sr. No.	Examination	Module
1	T-I	1, 2 and Part of 3
2	T-II	Part of 3, 4 and 5
3	End Sem	1 to 7

Concrete Technology

Course Code	Course Name	
PC-BTC403	Concrete Technology	
Course pre-requisites	PC-BTC307, PC-BTC354	
Course Objectives		
The objectives of this course are: <ol style="list-style-type: none"> 1. To introduce the ingredients of concrete and types of admixtures. 2. To understand the behaviour of concrete and its types. 3. To introduce laboratory and non-destructive testing methods for concrete 		
Course Outcomes		
Upon successful completion of the course, students should be able <ol style="list-style-type: none"> 1. Test properties of fresh and hardened concrete. 2. Design concrete mix. 3. Analyze a situation and recommend the suitable type of concrete and admixtures. 		
Course Content		
Module No.	Details	Hrs.
1	Ingredients of Concrete: Cement: Types of cement and their use, physical properties of 33 Grade, 43 Grade, 53 Grade 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, Hydration of cement. Grades of concrete: Manufacturing process, Concrete for ordinary work, light weight concrete, high density concrete, workability, durability and strength requirements, effect of w/c ratio, acceptability criteria, laboratory testing of fresh and hardened concrete, concreting under special conditions, work in extreme weather conditions, under-water concreting. Aggregates: Properties of coarse and fine aggregates and their influence on concrete. Micro structure of concrete Admixtures: Plasticizers, retarders, accelerators and other admixtures, test on admixtures, chemistry and compatibility with concrete.	12
2	Concrete mix design: Mix design for compressive strength by I.S. methods, road note method and British method, mix design for flexural strength. Self-Learning: Mix Design by road note method and British method.	05
3	High performance concrete: Constituents of high grade concrete, various tests and application of high performance concrete.	03

4	Production of Concrete: Production, transportation, compaction and curing of concrete, Requirements of RMC, transit mixer details, mix design of RMC.	05
5	Non-Destructive testing of concrete: Hammer test, ultrasonic pulse velocity test, load test, carbonation test, half-cell potentiometer test, and corrosion of steel test, core test and relevant provision of I.S. codes, pH test of concrete, chlorides & sulphates in concrete as per IS 456.	03
Term Work		
Term work shall comprise of		
<ol style="list-style-type: none"> Exercises on the above topics. Examination (MCQ) based on topics mentioned in latest GATE syllabus 		

Text Books	
<ol style="list-style-type: none"> R. Santhakumar (2006), "Concrete Technology", Oxford University Press (Rs), Isbn 0195671537, 771 pages. Shetty M. S. (30 November 2000), "Concrete Technology - Theory and Practice", S Chand & Co Ltd, ISBN 8121903483, 658 pages. 	
Reference Books	
<ol style="list-style-type: none"> O.P. Jain & Jaikrishna (2007), "Plain & Reinforced Concrete -Vol. I", Nem Chand & Brothers ISBN 8185240086. A. M. Neville (2012), "Properties Of Concrete", Trans-Atlantic Publications, Inc., ISBN 0273755803, 846 pages. I.S. 10262 code, IS 456 & Relevant I.S. Codes. Special Publication Of ACI On Polymer Concrete And FRC: Proceedings Of International Conferences Polymer Concrete And FRC Concrete Micro structure and properties by P.K. Meheta. 	

Sr. No.	Examination	Module
1	T-I	1
2	T-II	2, 3
3	End Sem	1 to 5

Surveying & Geomatics

Course Code	Course Name
PC-BTC404	Surveying & Geomatics

Course pre-requisites

Course Objectives

The objectives of this course are

1. Effectively communicate with team members during field activities; identify appropriate safety procedures for personal protection; properly handle and use measurement instruments.
2. Be able to identify hazardous environments and take measures to insure one's personal and team safety,
3. Measure horizontal, vertical, and zenith angles with a transit, theodolite, total station or survey grade GNSS instruments.
4. Calculate azimuths, latitudes and departures, error of closure; adjust latitudes and departures and determine coordinates for a closed traverse,
5. Perform traverse calculations; determine latitudes, departures, and coordinates of control points and balancing errors in a traverse, Use appropriate software for calculations and mapping.
6. Operate a total station to measure distance, angles, and to calculate differences in elevation. Reduce data for application in a geographic information system,
7. Work as a team member on a surveying party to achieve a common goal of accurate and timely project completion,
8. Calculate, design and layout horizontal and vertical curves,

Course Outcomes

Upon successful completion of the course, students should be able

1. Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities.
2. Translate the knowledge gained for the implementation of civil infrastructure facilities.
3. Relate the knowledge on Surveying to the new frontiers of science like Hydrographic surveying, construction surveying, Electronic Distance Measurement, Global Positioning System, Photogrammetry and Remote Sensing.

Course Content		
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Module No.	Details	Hrs.
1	<p><i>Tacheometric surveying:</i> Principles and uses, advantages, stadia formula, different methods of tacheometer, subtense bar method, location details by tacheometer, stadia diagram and tables, error and accuracy in tacheometry survey work.</p> <p><i>Setting Out Curves:</i> Elements of simple and compound curves, office and field work, linear methods of setting out of curves, Angular methods for setting out of curves, two Theodolite and Rankine's deflection angle methods. Elements of Reverse curve.</p>	06

2	<i>Transition and Vertical Curves:</i> design of transition curves, shift, spiral angle, Composite curves – office and field work, setting out of curve by angular method, composite curve problems ; Vertical curves definitions, geometry and types, tangent correction and chord gradient methods, sight distance on a vertical curve	06
3	<i>Modern Field Survey Systems:</i> Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat, Total Station Parts of a Total Station – Accessories –Advantages and Applications; Field Procedure for total station survey, Errors in Total Station Survey; Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations.	04
4	<i>Remote Sensing and Photogrammetry Surveying:</i> Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing. <i>Photogrammetry:</i> 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.	07
5	<i>Triangulation and Trilateration:</i> methods -triangulation -network- Signals. Baseline - choices - instruments and accessories - extension of base lines - corrections - Satellite station - reduction to centre - Intervisibility of height and distances - Trigonometric leveling - Axis single corrections.	03
6	<i>Hydrographic surveying:</i> General, methods of hydrographic surveying; tides; tide gauges; sounding; equipment for sounding; locating the sounding; stream gauging.	05
7	<i>Construction surveying:</i> General, positioning of structure, setting out works for building; culvert; bridge; sewer line; tunnel surveys; surface and subsurface survey; transfer of tunnel alignment and Reduced level through shaft.	05

Text Books

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|---|
| <p>4. Anji Reddy, M., Remote sensing and Geographical information system, B.S.Publications, 2001.</p> <p>5. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015.</p> |
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6. Bhavikatti, S.S., Surveying and Levelling, Vol. I and II, I.K. International, 2010.
7. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.
8. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006..
9. N. N. Basak (2014); “Surveying And Levelling”, Mcgraw Hill Education (India) Private Limited. ISBN-13: 978-9332901537.
10. R Agor (2009); “Surveying and Leveling”, Khanna Publishers. ISBN-13: 978-8174092359.
11. Dr. B.C. Punamia (2005); “Surveying Vol-II”. Laxmi Publications (P) Ltd., New Delhi. ISBN-13: 978-8170088837.

Sr. No.	Examination	Module
1	T-I	1, 2
2	T-II	3, 4
3	End Sem	1 to 7

Hydraulic Engineering

Course Code	Course Name
PC-BTC405	Hydraulic Engineering

Course pre-requisites

Course Objectives

The objectives of this course are:

1. To describe the types of flow, pipe flow system and to learn about concepts of hydraulics in dynamic state and its applications.
2. To exemplify the fundamentals of impulse momentum principle and to explain the working of various hydraulic machines.
3. To summarize the uniform and non uniform flow applied to open channel flow.
4. To explain dimensional analysis techniques.

Course Outcomes

Upon successful completion of the course, students should be able

1. understand fundamentals of pipe flow, losses in pipe and analysis of pipe network in various conditions and able to differentiate between types of flow.
2. implement the dynamics and impulse momentum principle hydraulic machines and design the components of hydraulic turbines and Centrifugal pumps.
3. design hydraulically efficient open channels, appraise varied flow and understand the formation of hydraulic jump in open channels.
4. test the dimensional homogeneity in hydraulic engineering.

Course Content

<i>Module No.</i>	<i>Details</i>	<i>Hrs.</i>
1	Dimensional analysis: Dimensional homogeneity, Buckingham's II theorem, Rayleigh's method, Dimensionless groups, similitude, model studies, distorted and undistorted models, scale effects.	03
2	Flow through Pipes: Darcy-Weisbach's equation, major and minor losses, Hydraulic gradient and total energy line, Pipes in series and parallel, Power transmission through pipes and nozzles. Siphon pipe. Water hammer in pipes, Analysis of pipe network: Hardy cross method, three reservoir problem. Momentum and moment of momentum principle, its application.	05
3	Impact of Jet: Impulse momentum principle, Jet striking flat plates, stationary and moving normal, inclined plates, curved vanes, series of plates and vanes mounted on wheel. Jet propulsion of ships. Heads and efficiencies of turbines, Classification, working of Impulse turbine, Pelton wheel, Reaction turbine, Francis turbine, Kaplan turbine.	05
4	Hydraulic Machines: Heads and efficiencies of turbines, Classification, working of Impulse turbine Pelton wheel, Reaction	05

	turbine, Francis turbine, Kaplan turbine, Design of Pelton Wheel	
5	Centrifugal Pump: Centrifugal Pumps: Work done, Head and efficiency, priming, minimum starting speed, pumps in series and parallel, multistage pumps, Characteristics curves.	04
6	Flow through open Channels: Classification, Uniform flow, Chezy's and Manning's equation, Prismatic and non-prismatic channels, hydraulically efficient channels, Notches and weirs, Venturiflume, Concept of Specific energy and specific force, applications of specific energy, momentum principle to open channels, Introduction to Gradually flow, Flow Profiles, Rapidly varied flow, hydraulic jump,	06

Text Books

1. [Dr. P.N. Modi](#) and S. M. Seth (2009); "Hydraulics and Fluid Mechanics" Standard Book House ISBN-13: 978-8189401269. 250p
2. Dr. Jain A.K (2010); "Fluid Mechanics" Khanna Publishers. ISBN-13: 978-8174091949.
3. [K Subramanya](#) (2008); "Flow in Open Channels" 978-0070086951. 576p
4. Subramanaya K (2010); "Fluid mechanics & hydraulic Machines". McGraw Hill Education (India) Private Limited. ISBN-13: 978-0070699809.
5. K.G. Ranga Raju. (1993) : Flow through open channels, New Delhi : Tata McGraw-Hill, c1993.
6. *Rajesh Srivastava* (2007): *Flow Through Open Channels*. Oxford University Press, 2007, pbk, 432 p, ISBN : 0195690385

Transportation Engineering

Course Code	Course Name	
PC- BTC406	Transportation Engineering	
Course pre-requisites	Building materials and construction, Materials testing and evaluation (Lab)	
Course Objectives		
<ol style="list-style-type: none"> 1. To discuss and Compute orientation of Runway & taxiway, its geometric design, drainage, Gate and Gate positions, marking and lighting on Runway and taxiway, aircraft parking system, Terminal area & airport layout. 2. To summarize cross section of permanent way and track components, Computation of number of sleepers, fish plate, fish bolt, geometric elements of railway, Points and switches. 		
Course Outcomes		
<p>At the end of this course, the students will be able to</p> <ol style="list-style-type: none"> 1. To Analyze and Design orientation of Runway & taxiway, its geometric design, drainage, Gate and Gate positions and able to prepare project report for new airport construction. 2. To acquire the knowledge of cross section of permanent way, function of each component and Geometric Design of Railway track including turnout signals, points and switches, selection of materials and method of Construction. 		
Course Content		
Module No.	Details	Hrs.
1	Introduction: Role of transportation in Society, objectives of transportation system, planning & coordination of different modes of transportation systems for Indian conditions.	03
2	Airport Engineering <ol style="list-style-type: none"> i. Aircraft component parts and its function, aircraft characteristics and their influence on airport planning. ii. Airport planning: topographical and geographical features, existing airport in vicinity, air traffic characteristics, development of new airports, factors affecting airport site selection. iii. Airport obstruction: zoning laws, classification of obstructions, imaginary surfaces, approach zones, turning zones. 	06

3	<ul style="list-style-type: none"> i. Airport layout: runway orientation, wind rose diagrams, basic runway length, corrections for runway length, airport classification, geometric design, airport capacity, runway configuration, taxiway design, geometric standards, exit taxiways, holding aprons, location of terminal buildings, aircraft hangers and parking. ii. Marking and lighting of runways, taxiway, approach and other areas. Terminal area & airport layout: terminal area, planning of terminal buildings, apron: size of gate position, number of gate position, aircraft parking system, hanger, general planning considerations and blast considerations. <p>Airport drainage: requirement of airport drainage, design data, surface drainage design.</p>	06
4	<p>Railway Engineering</p> <ul style="list-style-type: none"> i Merits of rail transportation, railway gauges and problems due to non-uniformity of gauges. ii Cross section of permanent way and track components, sleeper – functions and types, sleeper density, ballast functions and different ballast materials. iii Rails: coning of wheels and tilting of rails, rail cross sections, wear and creep of rails, rail fastenings. 	04
5	<ul style="list-style-type: none"> i Cross section of permanent way and track components, sleeper – functions and types, sleeper density, ballast functions and different ballast materials. ii Geometric elements: gradients, transition curves, widening of gauge on curves, cant and cant deficiency. iii Points and crossing: design of turnouts, description of track junctions, different types of track junctions. iv Yards: details of different types of railway yards and their functions. 	06
Term Work		
At least 10 assignments covering entire syllabus shall be submitted as term work.		
Reference Books		

1. Saxena S C and Arora S P (2010); “A text book of Railway Engineering”, Dhanpat Rai and Sons, New Delhi. ISBN-13: 978-8189928834.
2. Khanna & Arora (1999); “Airport Planning and Design” Nemchand Bros, Roorkee. ISBN-13: 978-8185240688.
3. Horonjeff and Mckelrey (1994); “Planning and Design of Airport”, McGraw-Hill Professional. ISBN-13: 978-0070453456.
4. Rao G V (1992); “Airport Engineering”, Tata McGraw-Hill Publishing Company ISBN -13: 9780074603178

Sr. No.	Examination	Module
1	T-I	1,2(Part)
2	T-II	2(Part),3
3	End Sem	1 to 5

Environmental Engineering - I

Course Code	Course Name	
PC BTC 407	Environmental Engineering - I	
Course pre-requisites	Applied Chemistry I and II; Fluid Mechanics	
Course Objectives		
The objectives of this course are <ol style="list-style-type: none"> 1. Prepare a general layout of a water supply scheme and discuss the components of the water treatment plant on the basis of topography and source. 2. Design various units of Water treatment system. 		
Course Outcomes		
Upon successful completion of the course, students should be able <ol style="list-style-type: none"> 1. Analyse and interpret the data related to water quality. 2. Design of water supply scheme for rural and urban areas. 3. Design of water treatment units such as flocculator, sedimentation tank, filtration, ion exchange units 4. Evaluate and understand various eco-friendly technologies to facilitate conservation and regeneration of the natural resources. 		
Course Content		
Module No.	Details	Hrs.
1	Water Engineering : Quality and Quantity Water supply systems: need for planned water supply schemes, components of water supply system and determination of their design capacities, water distribution network, types of intake structure.(NBC norms) Quality of water: wholesomeness and palatability, physical, chemical, microbial standards.; Introduction to drinking water standard (BIS standard), standard for bathing water, recreation and industrial water standards.	07
2	Water Treatment-Removal of Turbidity <ol style="list-style-type: none"> i. Sedimentation: factors affecting efficiency, design values of various parameters, tube settlers. Advantages and Disadvantages ii. Coagulation and flocculation: mechanisms, common coagulations; Advantages and Disadvantages iii. Rapid mixing and flocculating devices, G and GT values, Jar test, coagulant aids- polyelectrolyte etc. Advantages and Disadvantages iv. Filtration: classification, slow and rapid sand filters, dual media filters, sand, gravel and under-drainage system, mode of action, cleaning, limitations, operational difficulties, performance, basic design consideration, pressure filters: construction and operation. 	16

3	Water Treatment- Removal of Pathogens Disinfection: chlorination, chemistry of chlorination, kinetics of disinfection, chlorine demand, free and combined chlorine, break point chlorination, superchlorination, dechlorination, chlorine residual, use of iodine, ozone, ultraviolet rays and chlorine dioxide as disinfectants, well water disinfection.	03
4	Advanced water Treatment i. Water softening: Basis, lime soda and Base Exchange processes, principle reactions, design considerations, sludge disposal. ii. Miscellaneous treatments: removal of iron and manganese, taste, odour, colour, defloridation, Iron and Manganese removal, principles technology.	05
5	Newer and emerging Technologies in water treatment Membrane filtration- Low and high filtration membranes Reverse osmosis, types, issues related to RO, advancements in Reverse osmosis, UV Irradiation Technology, RO/MEE Ozone with hydrogen peroxide.	05

Theory Examination

1. Question paper will consist of total seven questions carrying 20 marks each.
 2. Only five questions need to be attempted.
- In question paper, weightage of each module may be proportional to the number of respective lecture hours as mentioned in the syllabus.

Reference Books

11. Nathanson J.A (2014) "Basic Environmental Technology: Water Supply, Waste Management and Pollution Control". Prentice Hall. ISBN-13: 978-0132840149. 456p.
12. J.W. Clark, W.Veisman, M.J.Hammer (2008); "Water Supply and Pollution Control" Prentice Hall. ISBN-13: 978-0132337175. 864p.
13. Gilbert Masters (2013); "Introduction to Environmental Engineering and Science" Pearson Education. ISBN 13 9781292025759. 700p.
14. S.K. Garg (2010); "Water Supply Engineering", Khanna Publications. ISBN 13: 978-8174091208. 300p.
15. Vesilind (2013); "Introduction to Environmental Engineering", PWS Publishing Company. ISBN 13: 9780534378127.
16. Peavy, Rowe, Tchobanoglous (2013); "Environmental Engineering", Tata Mc Graw Hill. ISBN-13: 978-9351340263. 736p.
17. Manual on Water Supply and Treatment, (latest Ed.): Ministry of & Housing. New Delhi
18. Manual on municipal Solid waste Management: Ministry of Urban Development, New Delhi
19. Relevant Indian Standard Specifications, BIS Publications
20. CPHEEO Manual on Water Supply & Treatment.
21. CPHEEO Manual on Sewage & Treatment.

Sr. No.	Examination	Module
1	T-I	1, 2 Partial
2	T-II	2,3

Sardar Patel College of Engineering, Andheri (West), Mumbai 400058
Year: 2021-22

3	End Sem	1 to 5
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Concrete Technology (LAB)

Course Code	Course Name
PC-BTC451	Concrete Technology (LAB)

Course pre-requisites	PC-BTC403
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Course Objectives

The students will learn to:

1. To determine properties of cement, aggregates and concrete.

Course Outcomes

Upon successful completion of the course, students should be able:

1. Develop collaborative skills to work in a team/group.
2. Test physical properties of cement, aggregates and concrete.
3. Evaluate the effects of admixtures on physical properties of concrete.
4. Design the concrete mix.

List of Experiments

1. Study of properties of fine and coarse aggregates.
2. Physical properties of cement.
3. Effect of w/c ratio on workability (slump cone, compaction factor, V-B test, flow table)
4. Effect of w/c ratio on strength of concrete.
5. Mix design in laboratory.
6. Non-destructive testing of concrete – some applications (hammer, ultrasonic)
7. Secant modulus of elasticity of concrete & indirect tensile test on concrete.
8. Study of admixtures & their effect on workability and strength of concrete.
9. Modulus of rupture of concrete.
10. Permeability test on concrete.
11. Tests on polymer modified concrete/mortar.
12. Tests on fibre-reinforced concrete.

Recommended Books

1. R. Santhakumar (2006), “Concrete Technology”, Oxford University Press (Rs), Isbn 0195671537, 771 p.
2. Shetty M. S. (30 November 2000), “Concrete Technology - Theory and Practice”, S Chand & Co Ltd, Isbn 8121903483, 658 p.
3. O.P. Jain & Jaikrishna (2007), “Plain & Reinforced Concrete -Vol. I”, Nem Chand & Brothers Isbn 8185240086.
4. A. M. Neville (2012), “Properties Of Concrete”, Trans-Atlantic Publications, Inc., Isbn 0273755803, 846 p.
5. Relevant I.S. Codes.
6. Special Publication Of Aci On Polymer Concrete And Frc:
7. Proceedings Of International Conferences On Polymer Concrete And FRC

Surveying & Geomatics (Lab)

Course Code	Course Name
PC-BTC452	Surveying & Geomatics (Lab)

Course pre-requisites	Surveying and Geomatics
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Course Objectives

Students will learn :

1. Effectively communicate with team members during field activities; identify appropriate safety procedures for personal protection; properly handle and use measurement instruments.
2. Be able to identify hazardous environments and take measures to insure one's personal and team safety.
3. Measure horizontal, vertical, and zenith angles with a transit, theodolite, total station or survey grade GNSS instruments.
4. Calculate azimuths, latitudes and departures, error of closure; adjust latitudes and departures and determine coordinates for a closed traverse.
5. Perform traverse calculations; determine latitudes, departures, and coordinates of control points and balancing errors in a traverse, Use appropriate software for calculations and mapping.
6. Operate a total station to measure distance, angles, and to calculate differences in elevation. Reduce data for application in a geographic information system,
7. Work as a team member on a surveying party to achieve a common goal of accurate and timely project completion.
8. Calculate, design and layout horizontal and vertical curves.

Course Outcomes

Students will be able to

1. Apply the knowledge, techniques, skills, and applicable tools of the discipline to engineering and surveying activities.
2. Translate the knowledge gained for the implementation of civil infrastructure facilities.
3. Relate the knowledge on Surveying to the new frontiers of science like Hydrographic surveying, Electronic Distance Measurement, Global Positioning System, Photogrammetry and Remote Sensing.
4. Perform setting out foundation plan for load bearing and framed structure with surveying instruments.

Course Content

<i>Sr. No.</i>	<i>List of Experiments</i>
1	Determination of Tacheometric constants.
2	Height and distance calculation using tacheometric formulae.
3	To set out circular curves by linear method (offset from tangent and from long chord)
4	To set out circular curve by angular method (Rankine's and two Theodolite method)
5	Determination of RL and horizontal distance of object by one plane method.

6	Determination of RL and horizontal distance by of object by two plane method.
7	Setting out a simple foundation plan in the field.
8	Use of total station to determine co-ordinates of points, MLM, REM.
9	Determination of co-ordinates of points using GPS and preparing Map.
In Semester Evaluation	
<p>Report on experiments conducted, the term work shall comprise of: Three A1 size drawing sheets comprising practical work on: L section and cross section block contouring, Tacheometric survey. Office and field work for minimum two types of curves by angular method, plotting of a contour plan on computer using suitable software,</p> <p>Assessment criteria for laboratory/Tutorial work. i.e. weightage for assessment shall be as follows:</p> <ol style="list-style-type: none"> i. Attendance in Laboratory/Tutorial = 20%, ii. Journal/Drawing sheet/Sketch book = 40%, iii. MCQ/Oral/Test = 40%. 	
Text Books	
<ol style="list-style-type: none"> 1. Anji Reddy, M., Remote sensing and Geographical information system, B.S.Publications, 2001. 2. Arora, K.R., Surveying, Vol-I, II and III, Standard Book House, 2015. 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. Madhu, N, Sathikumar, R and Satheesh Gobi, Advanced Surveying: Total Station, GIS and Remote Sensing, Pearson India, 2006.. 6. N. N. Basak (2014); “Surveying And Levelling”, Mcgraw Hill Education (India) Private Limited. ISBN-13: 978-9332901537. 7. R Agor (2009); “Surveying and Leveling”, Khanna Publishers. ISBN-13: 978-8174092359. 8. Dr. B.C. Punamia (2005); “Surveying Vol-II”. Laxmi Publications (P) Ltd., New Delhi. ISBN-13: 978-8170088837. 1. Vasant N. Deesai (2004) A manual on Theodolite Surveying and Total Station. 	

Hydraulic Engineering (Lab)

Course Code	Course Name
PC-BTC453	Hydraulic Engineering (Lab)
Course pre-requisites	
Course Objectives	
<p>Students will learn :</p> <ol style="list-style-type: none"> 1. To describe the types of flow and pipe flow system and discuss the concepts of fluid dynamics and its applications. 2. To exemplify the fundamentals of impulse momentum principle and explain the working of various hydraulic machines To summarize the uniform and non uniform flow applied to open channel flow. 	
Course Outcomes	
<p>At the end of this course, students will be able to:</p> <ol style="list-style-type: none"> 1. Use the fundamentals of pipe flow, losses in pipe and analysis of pipe network in various conditions and differentiate between types of flow. 2. Implement the dynamics and impulse momentum principle hydraulic machines and understand the components of hydraulic turbines and Centrifugal pumps Evaluate GVF and RVF in the formation of hydraulic jump in open channels. 	
Course Content	
Sr. No.	List of Experiments
Group A (preferably Four from group A to be performed)	
1	Losses in pipes
2	Impact of jet, flat plate, inclined plate, curved vanes
3	Performance of Pelton turbine
4	Performance of Francis Turbine
5	Performance of Kaplan Turbine
6	Performance of Centrifugal pumps
7	Pumps in series and parallel
Group B (preferably Four from group B to be performed)	
1	Chezy's roughness factor
2	Specific energy
3	Hydraulic Jump
4	Calibration of Broad crested weir
5	Calibration of Venturiflume
(Minimum Eight to be performed =any Four from Group A + any Four from Group B)	
Text Books	

1. Dr. P.N. Modi and S.M. Seth (2009); "Hydraulics and Fluid Mechanics" Standard Book House ISBN-13: 978-8189401269. 250p
2. Dr. Jain A.K (2010); "Fluid Mechanics" Khanna Publishers. ISBN-13: 978-8174091949
3. K Subramanya (2008); "Flow in Open Channels" 978-0070086951. 576p
4. Subramanaya K (2010); "Fluid mechanics & hydraulic Machines". McGraw Hill Education (India) Private Limited. ISBN-13: 978-0070699809

Reference Books

R. K. Rajput (2010): Fluid Mechanics and Hydraulic Machinery, S. Chand and Company.

Disaster Preparedness and planning

Course Code	Course Name
VA-BTC-471	Disaster Preparedness and planning

Course pre-requisites	
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Course Objectives

The students will learn to:

1. An exposure to disasters, their significance, types & Comprehensive understanding on the concurrence of Disasters and its management.
2. Understanding of the relationship between vulnerability, disasters, disaster prevention, risk reduction and the basic understanding of the research methodology for risk reduction measures.
3. The data, methods, tools, and geospatial techniques (including GIS) that can enhance vulnerability assessments and knowledge building and competencies to utilize mapping in mitigation planning and response operations

Course Outcomes

The students will be able to:

1. Applying management concepts and ideas to disaster
2. Analyzing relationship between development and disasters
3. Ability to understand categories of disasters
4. Realization of the responsibilities to society

Course Content

<i>Module No.</i>	<i>Details</i>	<i>Hrs.</i>
1	Introduction Concepts and definitions: Disaster, hazard, vulnerability, risk, severity, frequency and details, capacity, impact, prevention, mitigation	03
2	Disasters: Disasters classification; natural disasters (floods, drought, avalanches, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, flash floods, cloud burst, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); Disasters in global context, hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility, recent case studies	05
3	Disaster Impacts: Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.	05

4	Disaster Risk Reduction (DRR): Disaster management cycle – its phases; prevention – significance of preventive action and measures, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.	10
5	Disasters, Environment and Development: Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land use changes, urbanization etc.) – case studies, sustainable and environmental friendly recovery; reconstruction and development methods.	08
6	Hazard, Vulnerability Risk Assessment (HVRA) Definitions; risk, hazard, vulnerability, severity, exposure, Rating scale or classification of levels of exposure, vulnerability, threat, hazard, Hazard probability, Risk calculation, Hazard mapping, Risk mapping - use of geoinformatics for HVRA.	05

Text Books

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| <ol style="list-style-type: none"> 1. Singh B.K., 2008, Handbook of Disaster Management: Techniques & Guidelines, Rajat Publication. 2. Ghosh G.K., 2006, Disaster Management, APH Publishing Corporation. |
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Reference Books

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| <ol style="list-style-type: none"> 1. http://ndma.gov.in/ (Home page of National Disaster Management Authority) 2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs). 3. Pradeep Sahni, 2004, Disaster Risk Reduction in South Asia, Prentice Hall. |
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Civil Engineering – Societal & Global Impact

Course Code	Course Name
VA-BTC 472	Civil Engineering – Societal & Global Impact

Course pre-requisites	
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Course Objectives

The students will learn about :

1. To create awareness of the importance of Civil Engineering and the impact it has on the Society and at global levels.
2. To create awareness of the impact of Civil Engineering for the various specific fields of human endeavour.
3. To think innovatively to ensure Sustainability.

Course Outcomes

The students will be able to:

1. The impact which Civil Engineering projects have on the Society at large and on the global arena and using resources efficiently and effectively.
2. The extent of Infrastructure, its requirements for energy and how they are met: past, present and future.
3. The Sustainability of the Environment, including its Aesthetics.
4. The potentials of Civil Engineering for Employment creation and its Contribution to the GDP.
5. The Built Environment and factors impacting the Quality of Life.
6. The precautions to be taken to ensure that the above-mentioned impacts are not adverse but beneficial.
7. Applying professional and responsible judgement and take a leadership role.

Course Content

Module No.	Details	Hrs.
1	Introduction to Course and Overview: Understanding the past to look into the future: Pre-industrial revolution days, Agricultural revolution, first and second industrial revolutions, IT revolution; Recent major Civil Engineering breakthroughs and innovations; Present day world and future projections.	05
2	Past Impacts: Ecosystems in Society and in Nature; the steady erosion in Sustainability; Global warming, its impact and possible causes; Evaluating future requirements for various resources; GIS and applications for monitoring systems; Human Development Index and Ecological Footprint of India Vs other countries and analysis.	05
3	Understanding the importance of Civil Engineering in shaping and impacting the world; The ancient and modern Marvels and	04

	Wonders in the field of Civil Engineering; Future Vision for Civil Engineering.	
4	Infrastructure: Habitats, Megacities, Smart Cities, futuristic visions; Transportation (Roads, Railways & Metros, Airports, Seaports, River ways, Sea canals, Tunnels (below ground, under water); Futuristic systems (ex, Hyper Loop)); Energy generation (Hydro, Solar (Photovoltaic, Solar Chimney), Wind, Wave, Tidal, Geothermal, Thermal energy); Water provisioning; Telecommunication needs (towers, above-ground and underground cabling); Awareness of various Codes & Standards governing Infrastructure development; Innovations and methodologies for ensuring Sustainability.	05
5	Environment: Traditional & futuristic methods; Solid waste management, Water purification, Wastewater treatment & Recycling, Hazardous waste treatment; Flood control (Dams, Canals, River interlinking), Multi-purpose water projects, Atmospheric pollution; Global warming phenomena and Pollution Mitigation measures, Stationarity and non-stationarity; Environmental Metrics & Monitoring; Other Sustainability measures; Innovations and methodologies for ensuring Sustainability.	06
6	Built environment: Facilities management, Climate control; Energy efficient built environments and LEED ratings, Recycling, Temperature/ Sound control in built environment, Security systems; Intelligent/ Smart Buildings; Aesthetics of built environment, Role of Urban Arts Commissions; Conservation, Repairs & Rehabilitation of Structures & Heritage structures; Innovations and methodologies for ensuring Sustainability.	05
7	Civil Engineering Projects: Environmental Impact Analysis procedures; Waste (materials, manpower, equipment) avoidance/ Efficiency increase; Advanced construction techniques for better sustainability; Techniques for reduction of Green House Gas emissions in various aspects of Civil Engineering Projects; New Project Management paradigms & Systems (Ex. Lean Construction), contribution of Civil Engineering to GDP, Contribution to employment(projects, facilities management), Quality of products, Health & Safety aspects for stakeholders; Innovations and methodologies for ensuring Sustainability during Project development.	06

Text Books

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| 1. Žiga Turk (2014), Global Challenges and the Role of Civil Engineering, Chapter 3 in: Fischinger M. (eds) Performance-Based Seismic Engineering: Vision for an Earthquake |
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- Resilient Society. Geotechnical, Geological and Earthquake Engineering, Vol. 32. Springer, Dordrecht.
2. Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, Economical and Working Environment, 120th ASEE Annual Conference and Exposition
 3. NAE Grand Challenges for Engineering (2006), Engineering for the Developing World, The Bridge, Vol 34, No.2, Summer 2004.
 4. Allen M. (2008) Cleansing the city. Ohio University Press. Athens Ohio.
 5. Ashley R., Stovin V., Moore S., Hurley L., Lewis L., Saul A. (2010). London Tideway Tunnels Programme – Thames Tunnel Project Needs Report – Potential source control and SUDS applications: Land use and retrofit options
 6. <http://www.thamestunnelconsultation.co.uk/consultation-documents.aspx>.
 7. Ashley R M., Nowell R., Gersonius B., Walker L. (2011). Surface Water Management and Urban Green Infrastructure. Review of Current Knowledge Foundation for Water Research FR/R0014.
 8. Barry M. (2003) Corporate social responsibility – unworkable paradox or sustainable paradigm? Proc ICE Engineering Sustainability 156. Sept Issue ES3 paper 13550. p 129-130.
 9. Blackmore J M., Plant R A J. (2008). Risk and resilience to enhance sustainability with application to urban water systems. J. Water Resources Planning and Management. ASCE. Vol. 134, No. 3, May.
 10. Bogle D. (2010) UK's engineering Council guidance on sustainability. Proc ICE Engineering Sustainability 163. June Issue ES2 p61-63
 11. Brown R R., Ashley R M., Farrelly M. (2011). Political and Professional Agency Entrapment: An Agenda for Urban Water Research. Water Resources Management. Vol. 23, No.4. European Water Resources Association (EWRA) ISSN 0920-4741.

Development Engineering

Course Code	Course Name
VA-BTC 473	Development Engineering

Course pre-requisites	
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Course Outcomes

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

1. Develop multi scaled perspective about decisions in the built environment, urban development, rural development and sustainable development.
2. Analyse and evaluate real world problems and provide technological solutions.

Course Content

<i>Module No.</i>	<i>Details</i>	<i>Hrs.</i>
1	Introduction to Development Engineering Introduction to development engineering; need of development engineering; core disciplines and concept; major issues in development; urban development; rural development; socioeconomic development; Introduction to existing guidelines, standards, codes, policies and regulations, Census and other data sources, its elements and importance.	02
2	Research Formulation Scientific social research, formulation of research problem; field work and data collection, report drafting, logistics and planning, QoS assessment, third party audit, pre-feasibility studies – assessment - design, Cost effectiveness, assessment of outcomes.	03
3	Rural Development District administration, District Planning, Introduction to various sectors of rural areas and issues or challenges associated; drinking water, waste water treatment, electricity, public transport, irrigation, sanitation and cooking energy, providing Various schemes and policies floated by state and central government, phases in the schemes; life cycle costing of these schemes, use of engineering and technological solutions for the real world issues, People's participation and role in development of rural areas Importance of use of renewable energy in rural development.	05
4	Urban Development Sustainable Community Development; concept and development of sustainable communities; Sustainable design principles, building regulations, codes and standards, Rating systems Town Planning; history of town planning in India, characteristics of city/town, town planning at national, regional and local levels, planning standards, master plan, site layout and development, zoning and density control, green belt, slum	08

	redevelopment – Sanitation and health issues; Smart city planning-introduction to city planning, infrastructure elements of smart city planning, dimensions of smart cities – global standards and performance benchmark; smart solutions- e governance, waste management, water management, energy management – renewable energy RE100, urban mobility, citizen services, other services such as tele medication and education, trade facilitation, skill development.	
5	Geoinformatics for Planning and Development Introduction to Geoinformatics, Advantages, benefits and limitations; Real world applications; Data extraction; Spatial risk identification, Spatial analysis, thematic mapping, forecasting, decision making, identification of trends based on temporal data.	06

Text Books

1. Chand, M. and Puri, U.K.(1983), 'Regional Planning in India', Allied Publishers, New Delhi.
2. Kaiser, E. J., et.al. (1995), 'Urban Landuse Planning', 4th (ed) Urbana, University of Illinois Press.
3. Desai, V. (2005), 'Rural Development of India', Himalaya publishing house, Mumbai.

Reference Books

1. Sundaram, K.V. 1985 'Geography & Planning', Concept Publishing Co., New Delhi.
2. Ayyar, C.P.V. (1987), 'Town Planning in Early South India', Mittal Publications, Delhi.
3. Reeder, L. Hoboken, NJ, (2010), 'Guide to green building rating systems', John Wiley & Sons, Inc., 2010.
4. Longley, P. A., Michael F. Goodchild, Maguire, D.J., Rhind, D. W. (2005), 'Geographic Information Systems and Science', Second Edition 2005: John Wiley & Sons, New York.
5. Rau, S.K. (2001), 'Global Search for Rural Development', NIRD, Hyderabad.
6. Miles R. Simon, 1970, 'Metropolitan Problems' Methuen Publications, Canada
7. B.I.S., 1980, "National Building Code of India", ISI, New Delhi.
8. ANSI/ASHRAE/USGBC/IES Standard 189.1, Standard for the Design of High Performance Green Buildings Except Low-Rise Residential Buildings.
9. ASHRAE Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings