

Academic Hand Book
for
Bachelor of Technology Programme
in
Civil Engineering



National Institute of Technology Goa

Farmagudi, Ponda, Goa- 403 401

Programme Structure Summary

Institute-wide Categories of the Courses

The Bachelor of Technology (B.Tech.) program at National Institute of Technology Goa (NIT Goa) will have 170 credits as the lower limit for the award of degree. These courses are grouped in a number of categories as shown below:

S.N.	Category	Credits	Remarks
1.	Basic Sciences (BS)	27	Mathematics -14 Credits Physics -8 Credits Chemistry -5 Credits
2.	Basic Engineering Sciences (ES)	14	Engineering Mechanics -3 Credits Mechanical Engineering -2 Credits Basic Electrical Science -5 Credits Computer Programming -4 Credits
3.	Humanities and Languages (HL)	9	Professional Communication -3 Credits Economics -3 Credits Management -3 Credits
4.	Technical Arts (TA)	5	Engineering Drawing -3 Credits Workshop -2 Credits
5.	Professional Theory and Practice (PT)	110	
6.	Others (*Not counted for final CGPA)	6*	Environmental Studies -1 Credits Professional Communication -II and Language Lab -3 Credits Physical Education -1 Credits Value Education -1 Credits
Total Credits		171	165 credits are counted for CGPA

Semester-Wise Credit Distribution

Semester	Total Credits
I	22
II	21+1
III	21+1
IV	24
V	19+4
VI	24
VII	19
VIII	15
Total Credits	165+6

Semester-wise Distribution of the Courses

I Semester

Sl. No	Sub. Code	Subjects	L-T-P	Credits
1	MA100	Mathematics-I	3-1-0	4
2	PH100	Physics	3-0-0	3
3	ME100	Engineering Mechanics	3-0-0	3
4	CS100	Computer Programming and Problem Solving	2-0-3	4
5	HU100	Professional Communication	2-0-2	3
6	ME101	Engineering Drawing	1-0-3	3
7	PH101	Physics Laboratory	0-0-3	2
		Total Credits		22

II Semester

Sl. No	Sub. Code	Subjects	L-T-P	Credits
1	MA150	Mathematics-II	3-1-0	4
2	PH150	Material Science	3-0-0	3
3	CY150	Chemistry	3-0-0	3
4	ME150	Elements of Mechanical Engineering	2-0-0	2
5	EE151	Basic Electrical Science	3-0-0	3
6	ME151	Workshop Practices	0-0-3	2
7	CY151	Chemistry Laboratory	0-0-3	2
8	EE152	Basic Electrical Science Lab	0-0-3	2
9	PE150	Physical Education	1-0-0	1
		Total Credits		22

III Semester

Sl No	Course Code	Course Name	L-T-P	Credits
1	CV200	Mechanics of Solids	3-0-0	3
2	CV201	Mechanics of Fluids	3-0-0	3
3	CV202	Earth Sciences	3-0-0	3
4	CV203	Planning and Functional Design of Buildings	3-0-0	3
5	MA200	Mathematics III	3-0-0	3
6	CV204	Fluid Mechanics Lab	0-0-3	2
7	CV205	Material Testing I Lab	0-0-3	2
8	CV206	Geology Lab	0-0-3	2
9	VE200	Value Education	1-0-0	1
Total Credits				21+1

IV Semester

Sl No	Course Code	Course Name	L-T-P	Credits
1	CV250	Structural Analysis I	3-0-0	3
2	CV251	Surveying	3-0-0	3
3	CV252	Building Material and Construction Technology	3-0-0	3
4	CV253	Environmental Engineering I	3-0-0	3
5	CV254	Geotechnical Engineering I	3-0-0	3
6	MA250	Mathematics-IV (Computational Methods for Civil Engineering)	3-0-0	3
7	CV255	Surveying	0-0-3	2
8	CV256	Material Testing II Lab	0-0-3	2
9	CV257	Geotechnical Engineering Lab	0-0-3	2
Total Credits				24

V Semester

Sl No	Course Code	Course Name	L-T-P	Credits
1	CV300	Structural Design I (RCC)	3-0-0	3
2	CV301	Structural Analysis II	3-0-0	3
3	CV302	Transportation Engineering I	3-0-0	3
4	CV303	Geotechnical Engineering II	3-0-0	3
5	ES300	Environmental Studies	1-0-0	1
6	HU 300	Professional Communication-II and Language Lab	2-0-3	3
7	HS300	Economics	3-0-0	3
8	CV304	Transportation Engineering Lab	0-0-3	2
9	CV305	Building Design & Drawing	0-0-3	2
Total Credits				19+3

VI Semester

Sl No	Course Code	Course Name	L-T-P	Credits
1	CV350	Structural Design II (Steel)	3-0-0	3
2	CV351	Water Resource Engineering	3-0-0	3
3	CV352	Transportation Engineering II	3-0-0	3
4	CV353	Environmental Engineering II	3-0-0	3
5	CV5**	Elective-I	3-0-0	3
6	HS350	Management	3-0-0	3
7	CV354	Minor Project	0-0-3	2
8	CV355	Structural Design and Drawing	0-0-3	2
9	CV356	Environmental Engineering Lab	0-0-3	2
Total Credits				24

VII Semester

Sl. No	Sub. Code	Subjects	L-T-P	Credits
1	CV400	Profession Practice (Construction Planning and Management)	3-0-0	3
2	CV401	Estimation, Costing & Specifications	3-0-0	3
3	CV5**	Elective-II	3-0-0	3
4	CV5**	Elective-III	3-0-0	3
5	CV402	Mini Project/Industrial training	0-0-3	1
6	CV449	Major Project-I	0-0-4	4
7	CV450	Seminar	0-0-3	2
		Total Credits		19

VIII Semester

Sl. No	Sub. Code	Subjects	L-T-P	Credits
1	CV5**	Elective-IV	3-0-0	3
2	CV5**	Elective-V	3-0-0	3
3	CV5**	Elective-VI	3-0-0	3
4	CV499	Major Project-II	0-0-6	6
		Total Credits		15

List of Electives

Sl. No	Course. Code	Course Name	L-T-P	Credits
1	CV500	Structural Dynamics	3-0-0	3
2	CV501	Finite Elements Methods	3-0-0	3
3	CV502	Advanced RCC Structures	3-0-0	3
4	CV503	Advanced Steel Structures	3-0-0	3
5	CV504	Concrete Technology	3-0-0	3
6	CV505	Composite Materials	3-0-0	3
7	CV506	Earth Retaining Structures	3-0-0	3
8	CV507	Advanced Solid Mechanics	3-0-0	3
9	CV508	Advanced Fluid Mechanics	3-0-0	3
10	CV509	Structural Design of Foundations	3-0-0	3
11	CV510	Advanced Pre-Stressed Composite Materials	3-0-0	3
12	CV511	Design of Bridges	3-0-0	3
13	CV512	Earthquake Resistant Structures	3-0-0	3
14	CV513	Wind Resistant Designs	3-0-0	3
15	CV514	Multi-Hazard Resistant Designs	3-0-0	3
16	CV515	Non-Destructive Testing and Evaluation	3-0-0	3
17	CV516	Experimental Stress Analysis	3-0-0	3
18	CV517	Rapid Transport System and Smart Cities	3-0-0	3
19	CV518	Disaster Management and Mitigation	3-0-0	3
20	CV519	Repair and Rehabilitation of Structures	3-0-0	3
21	CV520	City and Urban Planning	3-0-0	3
22	CV521	Engineering Optimization	3-0-0	3
23	CV522	Structural Stability	3-0-0	3
24	CV523	Structural Optimization	3-0-0	3
25	CV524	Structural Reliability	3-0-0	3
26	CV525	Applied Engineering Geology	3-0-0	3
27	CV526	Rock Mechanics and Engineering	3-0-0	3
28	CV527	Remote Sensing and GIS	3-0-0	3
29	CV528	Advanced Surveying	3-0-0	3
30	CV529	Occupational Safety and Health Act	3-0-0	3
31	CV530	Failure Forensics	3-0-0	3

32	CV531	Structural Health Monitoring	3-0-0	3
33	CV532	Environmental Pollution and Control	3-0-0	3
34	CV533	Tunnel and Underground Structures	3-0-0	3
35	CV534	Offshore Structures	3-0-0	3
36	CV535	Industrial Waste Management	3-0-0	3
37	CV536	Advanced Highway Engineering	3-0-0	3
38	CV537	Geo-environmental Engineering	3-0-0	3
39	CV538	Oil and Natural Gas Exploration	3-0-0	3
40	CV539	Hazardous Waste Management	3-0-0	3
41	CV540	Advanced Geo-environmental Engineering	3-0-0	3
42	CV541	Hazardous e-Waste Management	3-0-0	3
43	CV542	Computational Fluid Dynamics	3-0-0	3
44	CV543	Computer Aided Design	3-0-0	3
45	CV544	Smart Materials and Structures	3-0-0	3
46	CV545	Advanced Irrigation Engineering	3-0-0	3
47	CV546	Non-conventional and Renewable Energy	3-0-0	3
48	CV547	Green Building Design	3-0-0	3
49	CV548	Ground Improvement Techniques	3-0-0	3
50	CV549	Pavement Design	3-0-0	3

Detailed Syllabus of Courses

Subject Code CV200	Mechanics of Solids	Credits: 3 (3-0-0) Total hours: 42
<p>Stress: Types of forces, Definition of stress, Stress tensor, plane stress, differential equations of stress equilibrium, Principal stresses, maximum shear stress, Mohr's Circle, stress invariants, Stresses due to impact.</p> <p>Strain: Definition of strain, strain tensor, Plane strain, Saint Venant's equation of compatibility, Principal strains, strain invariants, Poisson's ratio, volumetric strain, thermal strain and deformation, strain rosettes.</p> <p>Stress-Strain Relationships: Hooke's Law, constitutive relations, deformation of axially loaded bars, elastic constants, generalised Hook's law for isotropic materials, Navier's Equations, Elastic strain energy, introduction to Tresca and Von-Mises theory of failure, Octahedral shear stress.</p> <p>Torsion: Torsion of circular elastic bars, torsion equation, introduction to warping of non-circular bars, power transmitted by shaft and hollow circular sections.</p> <p>Bending Moment and Shear force: Beams and support conditions, Types of supports and loads, shear force and bending moment, their diagrams for simply supported beams, cantilevers and overhanging beams.</p> <p>Bending Stress and Shear Stress: Theory of simple bending–Stress distribution at a cross section due to Bending Moment and Shear Force, Curved bars, Unsymmetrical bending, Product moment of inertia, shear centre, thin and introduction to thick walled cylinder.</p> <p>Deflection of beams: Moment curvature relation of beam, differential equation of beam. Slope and deflection for determinate structures using integration, moment area and conjugate beam method.</p> <p>Elastic Stability of Columns: Short and Long Column, stability of a long column, Euler's Theory of Columns, differential equations of beam- columns, Derivation of Buckling Load for different end conditions, Rankine's Formula.</p>		
Reference books	<ol style="list-style-type: none"> 1) Timosenko, S.P., and Young, D.H., " Elements of Strength of Materials", Affiliated East-West Press Pvt. Ltd. 2) Srinath, L.S, Desai. P., " Strength of Materials", Tata McGraw-Hill. 3) Popov, E.P., "Engineering Mechanics of Solids", PHI. 4) Kazimi, S. M.A, "Solid Mechanics", Tata McGraw-Hill. 5) Shames, H, "Introduction to Solid Mechanics", PHI. 6) Shaneloy, F.R, "Strength of Materials", McGraw Hill. 7) Timoshenko, S, "Strength of Materials Vol. I", McGraw Hill. 8) Srinath, L.S., "Advanced Mechanics of Solids", Tata McGraw-Hill. 9) R C Hibbeler, "Mechanics of Materials", Pearson. 10) Singer, F.L. <i>Strength of Materials</i>, 3rd Edition, Harper and Row Publishers, New York, 1980. 11) Hearn, E.J., <i>Mechanics of Materials</i>, Pergaman Press, England, 1972. 12) Beer and Johnston E. R. <i>Mechanics of Materials</i>, 3rd Edition, Tata McGraw Hill, New-Delhi, 2007. 13) Timoshenko and Gere, <i>Mechanics of Materials</i>, CBS Publishers, New Delhi, 1996. 14) S.B.Junarkar, <i>Mechanics of Structures</i>, Charotar Publishers, Anand, 1998. 	

Subject Code CV201	Mechanics of Fluids	Credits: 3 (3-0-0) Total hours: 42
<p>Properties of Fluid: Surface tension, viscosity–Ideal and real fluids, Newtonian and non-Newtonian fluids, Incompressible and compressible fluids.</p> <p>Fluid pressure and Hydrostatics: Pressure at a point, Pascal’s law etc., Introduction to Pressure measuring devices (Manometers & Mechanical Gauge), Total pressure and centre of pressure on plane and curved submerged bodies.</p> <p>Buoyancy: Centre of buoyancy, Meta centric height, Equilibrium analysis.</p> <p>Kinematics of fluid flow: Lagrangian and Eulerian approaches, Types of fluid flow, Continuity equation, Velocity potential function and Stream Function.</p> <p>Dynamics of fluid flow: Euler’s Equation of motion, momentum equation, Bernoulli’s equation, Applications of Bernoulli’s equation, Flow through Orifice, Mouth piece, Notches and weirs.</p> <p>Dimensional Analysis and Hydraulic Similitude: Dimensional Analysis, Buckingham’s theorem, important dimensionless numbers and their significance. Flow through pipes, friction and losses.</p> <p>Introduction of open channel flow: Critical depth, Concepts of specific energy and specific force, application of specific energy.</p> <p>Uniform Flow: Chezy’s and Manning’s equations for uniform flow in open channel, Velocity distribution, most efficient channel section.</p> <p>Hydraulic Jump: Classical hydraulic jump, Evaluation of the jump elements in rectangular and non-rectangular channels on horizontal and sloping beds.</p>		
Reference books	<ol style="list-style-type: none"> 1. Modi, P.N and Seth, S.M., Hydraulics and Fluid Mechanics, Standard Book House, Delhi, 2010. 2. Streete. V.L and Wylie. E.B., Fluid Mechanics, McGraw Hill Book Company, New York,1997. 3. VenTe Chow, Open Channel Hydraulics, McGraw Hill, New York 1959. 4. Nagaratnam, S., Fluid Mechanics, Khanna Publishers, 1995. 5. Natarajan, M.K. Principles of Fluid Mechanics, Oxford & IBH Publishing Co,1994. 6. JagdishLal, Hydraulics and Fluid Mechanics, Tata McGraw Hill, 2001. 7. Streeter V.L., Fluid mechanics, Tata McGraw Hill, 1998. 8. Garde, R. J. and A G Mirajgoaker, "Engineering Fluid Mechanics", Nem Chand & Bros Roorkee,1983. 9. Garde, R.J. , "Fluid Mechanics through Problems", Wiley Eastern Limited New Delhi,1989. 10. Hunter Rouse, " Elementary Mechanics of Fluids", JohnWiley & Sons,Inc.,1946. 11. L.H. Shames, "Mechanics of Fluids", Mc Graw Hill, Int. 12. Vijay Gupta and S.K.Gupta, " Fluid Mechanics and its Applications", Wiley Eastern Ltd. 13. Streeter, V.L and Wylie, E.B, " Fluid Mechanics ", Mc GrawHill, New York, 8th Ed.,1985 14. Asawa, G.L, " Experimental Fluid Mechanics", Vol 1, Nem Chand and Bros., 1992 15. R.K.Bansal, " Fluid Mechanics and Hydraulic Machines", Laxmi Publication Pvt. Ltd., 2005 	

Subject Code CV202	Earth Sciences	Credits: 3 (3-0-0) Total hours: 42
<p>Introduction to Geology: Relevance of geology in Civil Engineering, Introduction to formation of Rocks, Exploration and testing of Rock, Rock Quality Designation (RQD), Borehole problems. Elementary concepts of mineralogy, petrology, structural geology with special emphasis on structures in igneous, metamorphic and sedimentary rocks.</p> <p>Engineering Geological/ geotechnical problems and particular relevance of geology to civil engineering projects, Geotechnical properties of rock. Geotechnical considerations of ground water, environment, natural resources and Energy.</p> <p>Hydrogeology: Aquifers, geophysical exploration, selection of dam sites, tunnels, land slide control measures, environmental geology. Geology of Dam and reservoir sites, tunnels, hill slope. Weathering and erosion of rocks including rapid mass wasting movements.</p> <p>Fundamentals of Geophysical Prospecting, Importance of Seismic method and electrical resistivity method to civil engineering projects, Brief description of Seismic and Electrical resistivity prospecting for civil engineering purposes.</p> <p>Engineering seismology: Causes of earthquakes; seismic waves; magnitude, intensity and energy release; characteristics of strong earthquake ground motions, Earthquake occurrence in the world, Plate tectonics, Faults, Related Hazards, Volcanoes, Landslides.</p> <p>Structural geology: Discontinuities and Defects in rock mass, Strike and Dip, Study of folds, faults, Joints, unconformities.</p>		
Reference books	<ol style="list-style-type: none"> 1. Parbin Singh, Engineering and General Geology, Katson Pub., Delhi, Sixth edition 2001. 2. Blyth. F.G.H & De Freitas M. H., Engineering Geology, ELBS, 7th edition, 1984 3. D.V.Reddy, Engineering Geology for Civil Engineers, Oxford IBH Publishers, 1995, 1997. 4. N. Chennakesavulu, A text book of Engg. Geology. 5. A.E.Kehew., General Geology For Engineers. 6. Perry H. Rahu. "Engineering Geology An Environmental Approach", 7. P.K.Mukherjee, "A text Book of Geology", 8. Blyth. F.G.H & De Freitas M. H, "Engineering Geology", ELBS 9. D.V.Reddy, "Engineering Geology for Civil Engineering", Oxford IBH Publishers 10. N. Chennakesavulu, "A text book of Engg. Geology", 11. A.E.Kehew, "General Geology For Engineers", 11. William D. Thornbury, "Principles of Geomorphology", WILEY EASTERN 	

Subject Code CV203	PLANNING AND FUNCTIONAL DESIGN OF BUILDINGS	Credits: 3 (3-0-0) Total hours: 42
<p>Introduction: Building planning and by-laws, conceptual and functional planning, Introduction to Energy efficient buildings</p> <p>Acoustics: Physics of sound- Behavior of sound- Sound insulation and reverberation control</p> <p>Lighting: Principles- Day lighting and artificial lighting – design methods</p> <p>Thermal design of buildings: Climatic elements – classification- thermal comfort and indices-solar radiation calculations and design of shading devices.</p> <p>Thermo physical properties of building materials and thermal control- passive and active building design- Steady and periodic heat flow through building envelope. Concept of green building.</p>		
Reference books	<ol style="list-style-type: none"> 1. National Building Code 2016, Bureau of Indian Standards 2. AjithaSimha.D, <i>Building Environment</i>, Tata McGraw Hill Publishing Co., New Delhi, 1985 3. Bureau of Indian standards, <i>Handbook on Functional Requirement of Buildings – SP:41(S and T) – 1987</i> 4. Givoni. B Man., <i>Climate and Architecture</i>, Applied Science Publication, 1976 5. Knudsen V.O. and Harris C.M., <i>Acoustical Design in Architecture</i>, John Wiley, 1980 6. Koenigseberger, <i>Manual of tropical Housing and Building Part I – Climatic design</i>, Orient Longman, 2011 7. Krishnan, <i>Climate responsive architecture</i>, Tata McGraw Hill, 1999 8. M David Egan, <i>Architectural Acoustics</i>, J.Ross Publishing, 2007 9. Olgay Victor, <i>Design with climate-A bioclimatic approach to architectural regionalism-</i> Princeton University press-1963 10. Human Factors Design Handbook, Wesley Woodson, Barry Tillman, Peggy Tillman, McGraw-Hill 11. M.G. Shah, C.M. Kale and S.Y. Patki; <i>Building Drawing</i>; Tata McGraw Hill Publication 	

Subject Code MA200	MATHEMATICS III	Credits: 3 (3-0-0) Total hours: 42
Course Prerequisites	Mathematics-I & II	
Course Objectives	This Mathematics course provides requisite and relevant background necessary to understand the other important engineering mathematics courses offered for Engineers and Scientists. Important topics of applied mathematics, namely complex analysis, power series solutions, Fourier series and transforms and partial differential equations	
Module 1	Complex Analysis	18 hours
Complex Numbers, geometric representation, powers and roots of complex numbers, Functions of a complex variable, Analytic functions, Cauchy-Riemann equations; elementary functions, Conformal mapping (for linear transformation); Contours and contour integration, Cauchy's theorem, Cauchy integral formula; Power Series and properties, Taylor series, Laurent series, Zeros, singularities, poles, essential singularities, Residue theorem, Evaluation of real integrals and improper integrals.		
Module 2	Power Series Solutions	9 hours
Differential Equations Power Series Method - application to Legendre equation, Legendre Polynomials, Frobenius Method, Bessel equation, Properties of Bessel functions, Sturm- Liouville BVPs, Orthogonal functions.		
Module 3	Partial Differential Equations	15 hours
Introduction to PDE, basic concepts, second order PDE and classification, D'Alemberts formula and Duhamel's principle for one dimensional wave equation, Laplace's and Poisson's equations, Laplace, Wave, and Heat equations using separation of variables. Vibration of a circular membrane. Heat equation in the half space.		
Reference books	1. E. Kreyszig, Advanced engineering mathematics (8th Edition), John Wiley (1999). 2. W. E. Boyce and R. DiPrima, Elementary Differential Equations (8th Edition), John Wiley (2005). 3. R. V. Churchill and J. W. Brown, Complex variables and applications (7th Edition), McGraw-Hill (2003).	

Subject Code VE200	Value Education		Credits: 1 (1-0-0) Total hours: 14
Course Prerequisite	General Awareness of the Society/ Environment we live in		
Course Objectives	It aims at Holistic Development		
Course Outcome	At the end, the students should be a complete human being in every respect		
Module 1	Ethics in Engineering	4 hours	
Concepts of Values and Ethics, History and Purposes, Utilitarianism, Duties, Rights, Responsibility, Virtue, Honesty, Moral Autonomy, Obligations of Engineering Profession and moral Propriety			
Module 2	Engineer's Moral responsibility	3 hours	
Engineer's Moral responsibility for Safety and Human Rights, Risk Assessment and Communication, Product Liability, Engineers-Employers Liaison, Whistle-Blowing and Its Moral Justification.			
Module 3	Computer Ethics	3 hours	
Social Impact of Computer, Gender-Issues and Privacy, Cyber Crime, Ethical use of Software			
Module 4	Intellectual property	4 hours	
Definition, Types, Rights and Functions, Patents, Trademark, Grant of Patent in India, Surrender and Revocation of Patents, Compulsory Licensing, Acquisition of Inventions by the Government, Contents of draft application of Patents, WTO			
Reference books	<ol style="list-style-type: none"> 1. Vinod V. Sople, <i>Managing Intellectual Property: The Strategic Imperative</i>, PHI, 2006 2. Govindarajan, Natarajan & Senthil Kumar, <i>Engineering Ethics</i>, PHI 3. Robin Attfield, <i>A Theory of Value and Obligation</i>, London: Croomhelm, 1987 4. Jones and barlett, "Cyber Ethics: Morality and Law in Cyber Space" <p>Case Studies from Newspapers</p>		

Subject Code CV204	FLUID MECHANICS LAB	Credits: 2 (0-0-3) Total hours: 42
Calibration of V notch, Venturimeter, Orifice meter, Water meter. Friction factor of pipes. Impact of jet on vanes. Bernoulli's theorem, losses in pipes, metacentric height.		
Reference books	Modi, P.N and Seth, S.M., <i>Hydraulics and Fluid Mechanics</i> , Standard Book House	

Subject Code CV205	MATERIAL TESTING LAB - I	Credits: 2 (0-0-3) Total hours: 42
<ul style="list-style-type: none"> • Stress-strain characteristics of (a) Mild Steel and (b) Tor steel (c) Copper (d) Aluminium (e) G.I. wire and sheet • Compressive strength tests on building materials like (a) wood (b) brick (c) rocks (d) concrete • Hardness tests of metals (a) Steel (b) Brass (c) Aluminium (d) Copper • Modulus of rigidity and Torsion test on (a) Solid shafts (b) Hollow shaft. • Determination of Young's modulus on material by conducting deflection tests on (a) Simply supported beam. (b) Propped Cantilever beam. (c) Continuous beam • Ductility test for steel. • Shear test on steel. 		
Reference books	Timoshenko and Gere, <i>Mechanics of Materials</i> , CBS Publishers, New Delhi, 1996	

Subject Code CV206	GEOLOGY LAB	Credits: 2 (0-0-3) Total hours: 42
<ul style="list-style-type: none"> • RQD, study of bore-log data, • Petrology: Identification and description of Igneous, Sedimentary, Metamorphic rocks. • Structural Geology: Interpretation of geological and Structural geological maps, Solving Dip and strike problems. 		
Reference books	<ol style="list-style-type: none"> 1. K.M. Gurappa, <i>Structural geology Manual</i> 2. B.S. SathyaNarayanaswamy <i>Engineering Geology Laboratory Manual</i>, Eurasia pub. 	

Subject Code CV250	STRUCTURAL ANALYSIS I	Credits: 3 (3-0-0) Total hours: 42
Introduction: General introduction on concept of analysis, Concept of Force, Method of Analysis Classification of Structures, Stress resultants, Degrees of freedom per node, Static and Kinematic Indeterminacy.		
Analysis of Plane Truss: Classification of Pin jointed Determinate Trusses, Analysis of determinate plane Trusses by Method of Joints and Sections and Method of tension coefficient.		
Strain Energy: Strain energy due to axial load, bending and shear, theorem of minimum potential energy, principle of virtual work, law of conservation of energy, Castiglino's Theorems, Betti's & Maxwell's reciprocal theorem, Deflection of Beams, pin jointed truss and frames using Strain Energy Method and Unit load method		
Rolling Load and Influence Lines: Rolling loads, influence lines for beams and trusses, Absolute maximum bending moment.		
Analysis of Arches and Cables and suspension bridges: Analysis of Arches, Linear Arch, Eddy's theorem, three hinged parabolic arch, moving loads & influence lines, Analysis of Cables under point loads and UDL, Analysis of Suspension bridges.		
Indeterminate structure-Compatibility Methods: Analysis of Fixed beam, Continuous beam and simple frames with and without translation of joints by Method of Consistent Deformation and Three moments Theorem. Analysis of Propped Cantilever beam, Two-hinged Arches, ILD for Continuous beam.		
Curved Beams: Introduction, Bending of Curved bars in plane of bending, stresses in bars of small and large initial curvatures, combined bending and torsion.		
Reference books	<ol style="list-style-type: none"> 1. Bhavikatti S.S., "<i>Basic Structural Analysis (Vol. I & II)</i>", Vikas Publishing 2. B.C. Punmia, "<i>Theory of Structures</i>", Laxmi Publication 3. Jain, O.P. and Jain B.K. , "<i>Theory & Analysis of Structures (Vol. – I & II)</i>", Nem Chand 4. R.C. Hibber, "<i>Structural Analysis</i>", Pearson Publication 5. Ghali, A. & Neville, M., "<i>Structural Analysis</i>", Chapman & Hall Publication. 1974 6. Willbur and Norris, "<i>Elementary Structural Analysis</i>", Tata McGraw Hill 7. Negi L.S. & Jangid R.S., "<i>Structural Analysis</i>", Tata McGraw Hill 8. Ramamurtham S. & Narayan R, "<i>Theory of Structures</i>", Dhanpat Rai Publications 9. Norris and Wilbur, "<i>Elementary Structural Analysis</i>", Tata McGraw Hill 10. Reddy, C. S. Basic Structural Analysis Tata McGraw Hill 11. Wang, C. K Indeterminate Structural Analysis McGraw Hill 12. Kinney, J.S. Indeterminate Structural Analysis McGraw Hill 	

Subject Code CV251	SURVEYING	Credits: 3 (3-0-0) Total hours: 42
<p>Introduction and Principles of surveying: Introduction, classification of surveying, Principles, some basic terms, Scale, Precision, Accuracy and errors, Tape corrections, Ranging out Survey lines.</p> <p>Compass Surveying: Principle, Prismatic compass, Bearings, Magnetic declination, Local attraction, Error in compass surveying, Precautions.</p> <p>Levelling: Introduction, definition basic terms, instruments, Method of Levelling, Reciprocal Levelling, Correction for Curvature and refraction, Contouring.</p> <p>Plane Table Surveying: Principle, instruments, Methods, Two and Three point problems.</p> <p>Areas and Volumes: Area from field measurements, Area from plans, Planimeter. Area of cross-section, Measurement of volumes, Mass diagram.</p> <p>Theodolite Surveying – Introduction, Types of Theodolite, Definitions of Terms, Temporary adjustments, Measurement of various angles, Fundamental lines and their relations, Sources of Error in theodolite work. Tachometric surveying, Traversing, Balancing of traverse, Calculation of traverse area.</p> <p>Introduction to Advanced Surveying equipment - Total station - Remote Sensing- GPS.</p> <p>Application of surveying – Setting out of buildings, culverts, tunnels, road and bridges, Curve setting Types.</p>		
Reference books	<ol style="list-style-type: none"> 1. Duggal, S.K. <i>Surveying Vol. I and II</i>, Tata McGraw Hill, 2004. 2. Punmia, B.C. <i>Surveying Vol. I and II</i>, Standard Publishers, 1994. 3. Arora, K. R. <i>Surveying Vol. I and II</i>, Standard Book House, 1996. 4. Satheesh Gopi. <i>Advanced Surveying</i>, Pearson Education, 2007. 5. Satheesh Gopi. <i>The Global Positioning System and Surveying using GPS</i>, Tata McGraw, 2005 6. Agor, R. <i>Surveying Vol. I & II</i> Khanna publications 7. Bannister, <i>Solving Problems in Surveying</i> Longman Scientific Technical 8. A. and Baker, "R Engineering Surveying Technology", Khanna publications 9. Kanetkar, T.P., " Surveying I, II, Pune Vidyarthi Griha Prakashan 	

Subject Code CV252	BUILDING MATERIALS AND CONSTRUCTION TECHNOLOGY	Credits: 3 (3-0-0) Total hours: 42
<p>Building Materials: Bricks, Stone, Timber, Plywood, Steel: Classification, Properties and selection criteria. Cement, Aggregate, Admixture: Types, Properties and selection criteria and tests. Concrete: Preparation and properties, concrete mix design. Mortar: Types, classification and strength, I.S. specifications.</p>		
<p>Foundations: Brief study of different types of foundations, nature of soil (expansive or non-expansive, alluvial or residual, sandy or clayey for settlement etc.), approximate values of bearing capacities, breadth and depth of foundation, typical cross sections for foundations under walls and R.C.C. Columns. Foundations in black cotton soils, under reamed pile foundations, foundation failures and remedial measures.</p>		
<p>Masonry: Technical terms in masonry, classification and brief specifications of stone masonry, bonds in brick masonry, general principles to be observed in stone and Brick Masonry Construction.</p>		
<p>Walls: Different types (load bearing, cavity-walls and partition walls), thickness considerations. Doors, Windows And Lintels : Different types based on materials and methods of construction, technical terms, size and locations.</p>		
<p>Floors: Ground and upper floors, various types, their suitability, construction details of concrete and terrazzo floors, Floor tiles. Roofs: Technical terms and different types of pitched and flat roofs. Various roof coverings for pitched and flat roofs.</p>		
<p>Formwork: Different types of formwork, stripping times.</p>		
<p>Damp Proofing: Causes and effect of Dampness, parts of a building likely to be affected most, methods of damp proofing in different locations including roofs. Plastering And</p>		
<p>Plastering and Pointing: Types and considerations during plastering and pointing.</p>		
<p>Stairs: Types based on geometry and material, suitability, proportioning of stairs, lifts and escalators.</p>		
<p>Sound Proofing: Materials and Methods of sound proof construction.</p>		
Reference books	<ol style="list-style-type: none"> 1. <i>Building Construction</i> – B.C. Punmia (Laxmi Publication Pvt. Ltd.) 2. <i>Building Construction</i> – Sushil Kumar (Standard Publication Distributors) 3. <i>Building Construction</i> – S. C. Rangwala (Charotar Publishing House, Anand, Gujarat) 4. <i>Building Construction</i> – Gurucharan Singh (Standard Publication Distributors) 5. Arora, S.P. A text book of Building Construction, Dhanpat Rai and Sons 6. Jha, J and Sinha, S.K. Building Construction. Khanna Publishers, Delhi 7. Kulkarni, C.J. A text Book of Engineering Materials. Ahmedabad Book Depot 8. Kulkarni, C.J. A text Book of Engineering Construction. Ahmedabad Book Depot 9. Kumar Sushil, "Engineering Materials", Standard Publishers. 10. Kumar Sushil, "Building Construction", Distributors Delhi Standard Publishers 11. McKay W.B. Building Construction Distributors, Delhi Vol. 1 to 4, Orient Longman Ltd., Hyderabad 	

Subject Code CV253	ENVIRONMENTAL ENGINEERING I	Credits: 3 (3-0-0) Total hours: 42
<p>Introduction: Necessity and importance of water supply schemes.</p> <p>Water demand : Classification of water demands, Estimation of quantity of water required by a town, per capita demand, factors affecting per capita demand, design period and population forecasting, variation in water demand.</p> <p>Sources of water supply: Surface sources and underground sources, Intake works, site selection, type of intake works.</p> <p>Quality of Water: Common impurities, physical, chemical and biological characteristics of water, water quality standards for municipal and domestic supplies.</p> <p>Water Processing: Object of water processing, flow diagrams of typical ground water system and surface water systems.</p> <p>Sedimentation: Theory of sedimentation, sedimentation tanks and its types, design parameters related with sedimentation tanks, sedimentation with coagulations, coagulants and coagulant aids, Jar test for determining coagulant dosage.</p> <p>Filtration: Theory of filtration, slow sand and rapid sand filters, Construction and operation.</p> <p>Disinfection: Methods of disinfection, Chlorination, Types of chlorination, Break Point chlorination.</p> <p>Softening: Methods of Softening, Iron Removal, Fluoridisation.</p> <p>Distribution System: Methods of distribution, layout of distribution system, methods of analysis, pressure in the distribution system, distribution reservoirs, functions and its types, storage capacity of distribution reservoir.</p> <p>Plumbing: Plumbing designs for a typical building.</p>		
Reference books	<ol style="list-style-type: none"> 1. <i>Water Supply Engineering</i> – S.K. Garg (Khanna Publication). 2. <i>Water Supply Engineering</i> – B.C. Punmia (Laxmi Publication, New Delhi) 3. <i>Environmental Engineering</i> – Peavy& Rowe (Tata McGraw Hill, New Delhi). 4. <i>C P H E E O Manual on Water Supply and Treatment Environmental Science and Engineering</i> – Henry and Heinke (Pearson Education) 	

Subject Code CV254	GEOTECHNICAL ENGINEERING I	Credits: 3 (3-0-0) Total hours: 42
<p>Introduction: Introduction to Geotechnical Engineering; Unique nature of soil; Soil formation and Soil types.</p> <p>Simple Soil Properties: Basic Definitions; Phase relations; Index properties of soil-soil grain and soil aggregate properties of coarse grained and fine grained soils.</p> <p>Soil Classification: Indian Standard Soil Classification System, AASHTO, Unified Soil Classification.</p> <p>Permeability: One dimensional flow; Permeability of soils-Darcy's law; Permeability as a function of soil type, void ratio, soil fabric, and effective stress; Two dimensional flow problems- steady flow, confined flow and unconfined flow; Flow nets and their characteristics; Uplift pressure; Exit gradient; Failure due to piping; Criteria for design of filters; Quick Sand; Liquefaction.</p> <p>Compaction Behavior: Clay minerals (basic concepts) and soil structure; Theory of compaction and compaction control.</p> <p>Compressibility and Consolidation behavior: Compressibility-Effects of soil type, stress history and effective stress on compressibility; Consolidation-Factors affecting consolidation and compressibility parameters; Different forms of primary consolidation equation; Transient flow condition; Terzaghi's theory of one-dimensional consolidation and time-rate of consolidation; Evaluation of compressibility and consolidation parameters from consolidation.</p> <p>Principle of Effective Stress and related Phenomena: Principle of effective stress; Capillarity; seepage force and quick sand condition; Total pressure and elevation heads.</p> <p>Stress Due to Applied Load: Introduction; Stress-Strain parameters; Geo-static Stresses; Vertical stress due to concentrated loads; Isobar diagram; Vertical Stress distribution on a horizontal plane; Influence Diagram; Vertical stress distribution due to line load, strip load, circular area, rectangular area; Nemark's Influence charts.</p> <p>Shear Strength Behavior</p> <p>Introduction; Stress at a point and Mohr's stress circle; Mohr-Coulomb failure criterion; Laboratory tests for shear strength determination; Effective stress and total stress shear strength parameters; UU, CU and CD tests and their relevance to field problems; Shear strength characteristics of normally consolidated and pre-consolidated clays; Shear strength characteristics of sands.</p>		
Reference books	<ol style="list-style-type: none"> 1. <i>Basic and Applied Soil Mechanics</i>, Gopal Ranjan and Rao, A.S.R New Age International, New Delhi 2. <i>Soil Mechanics in Engineering Practice</i>, Terzaghi, K, and Peck, R.B John Wiley, New York, 1968. 3. <i>Soil Mechanics and Foundation Engineering</i>, Arora, K.R., Standard Publishers Distributors, New Delhi-110006. 	

Subject Code MA250	Mathematics-IV(Computational Methods in Civil Engineering)	Credits:3 (3-0-0) Total hours:45
Course Objective	To get familiarized with the numerical solution of linear and non-linear systems, Numerical solution of ordinary differential equations and partial differential equations; probability and statistics.	
Module 1	Numerical solution of linear and nonlinear equations	Hours :10
Gauss elimination method and Gauss-Seidel iterative method, sufficient conditions for convergence, power method to find the dominant Eigen value and eigenvector. Bisection method, Fixed point method, Newton- Raphson method-order of convergence, interpolation and curve fitting, method of least squares.		
Module 2	Numerical solution of ordinary differential equations	Hours :10
Numerical differentiation and integration. Euler's method, Euler's modified method, Taylor's method and Runge-Kutta method for simultaneous equations and 2nd order equations, multistep methods, Milne's and Adams' methods.		
Module 3	Numerical solution of partial differential equations	Hours :10
Liebmann's method, solution of one dimensional heat flow equation, Bender- Schmidt recurrence relation, Crank-Nicolson method, solution of one dimensional wave equation		
Module 4	Probability and Statistics	Hours:15
Introduction to Probability: Conditional Probabilities; Independence; Bayes' Theorem and application. Concept of Random Variables; Distribution and Density Function; Joint Distributed Random of Variables; Conditional and Joint Density Distribution function; Function of Random Variables; Expected Value: Mean and Variance; conditional expectation; covariance and correlation; Some special distributions: Uniform, Gaussian, Binomial and Poisson distributions. Statistics: Elements of estimation theory: linear minimum mean-square error and Orthogonality principle in estimation; Parameter Estimation		
Reference Books	<ol style="list-style-type: none"> 1. M. K. Jain, S.R.K Iyengar and R.K.Jain, "Numerical Methods for Scientific and Engineering Computation," New Age Publishers, 6th Edition, 2012. 2. E.Kreyszig, "Advanced Engineering Mathematics", 8th Edition, Wiley India Pvt. Ltd., 2010. 3. R. L. Burden and J. D. Faires, "Numerical Analysis", 9th Edition, Brooks/Cole, 2012. 4. S. C. Gupta, and V.K. Kapoor, "Fundamentals of Mathematical Statistics", 7th Edition, Sultan Chand and Sons, 1980. 5. A. Papoulis, and P. Unnikrishnan, "Probability, Random Variable and Stochastic Process", 4th Edition, Tata McGraw-Hill, 2002 6. G.D Smith, "Numerical solution of Partial Differential Equations," Oxford University Press. 7. Peter V. O'Neil, "Advanced Engineering Mathematics," 5th Edition, Thomson, Book/Cole. (2003). 8. B.S.Grewal, "Higher Engineering Mathematics," 42nd Edition, Khanna Publications, 2013 	

Subject Code CV255	SURVEYING LAB	Credits: 2(0-0-3) Total hours: 42
<ul style="list-style-type: none"> • Compass surveying • Plane table surveying; Radiation, intersection- Traverse- Resection • Levelling: Fly levelling and contouring • Subtense Bar • Theodolite surveying: <ul style="list-style-type: none"> ○ Single and two plane observation of trigonometric levelling ○ Determination of Tacheometric Constants ○ Tangential Tacheometry • Total station 		
Reference books	1. <i>Surveying (Vol. I & II)</i> – Punmia, B.C. (Laxmi Publications, New Delhi, 1996) 2. <i>Surveying (Vol. I & II)</i> – Kanetkar T.P. (Pune Vidyarthi Griha Prakashan, Pune)	

Subject Code CV256	MATERIAL TESTING II LAB	Credits: 2(0-0-3) Total hours: 42
Course Prerequisites		
Course Objectives	<ul style="list-style-type: none"> • Studies on Cement- physical and chemical properties • Tests on Concrete and Concrete making materials: Green and hardened concrete • Mix Design • Tests on Tiles 	
Reference books	1. Timoshenko and Gere, <i>Mechanics of Materials</i> , CBS Publishers, New Delhi, 1996.	

Subject Code CV257	GEOTECHNICAL ENGINEERING LAB	Credits: 2(0-0-3) Total hours: 42
<p>Following 9 topics can be suitably combined in 6 experiments</p> <ol style="list-style-type: none"> 1. Grain Size analysis of Soil by Sieve. 2. Specific Gravity of Soil. 3. Grain size analysis of Soil by Hydrometer. 4. Field Density of Soil.(Two Methods) 5. Atterberg Limits of Soil (Two methods) 6. Permeability test of Soil. 7. Consolidation Test of Soil. 8. Determination of moisture content by rapid moisture metre. 9. Standard Proctor test of Soil. <p>Following 6 topics can be suitably combined in 4 experiments</p> <ol style="list-style-type: none"> 1. Direct Shear Test. 2. Triaxial Test for Different Drainage Condition. 3. Standard Penetration test of Soil and Static Cone Penetration Test. 4. Dynamic Cone Penetration test. 5. Plate load test. 6. Block vibration test. <p>•</p>		
Reference books	1. <i>Soil Testing and Instrumentation. Alam Singh, New Age International, New Delhi, 1998. (Revised Edition),</i>	