Uttarakhand Technical University, Dehradun

Scheme of Examination as per AICTE Flexible Curricula

Evaluation Scheme & Syllabus for B. Tech Second Year

W.E.F. Academic Session 2019-20
II Year (III & IV SEMESTER)

Bachelor of Technology (B. Tech.)

[Civil Engineering]

Uttarakhand Technical University, Dehradun
As per AICTE model curriculum
[W.E.F. Academics Session: 2019-20]
B. Tech. II Year (Civil Engineering)

Uttarakhand Technical University, Dehradun
Scheme of Examination as per AICTE Flexible Curricula
Evaluation Scheme & Syllabus for B. Tech Second Year
W.E.F. Academic Session 2019-20
II Year (III SEMESTER) – Civil Engineering

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours / week			Total Credits
				Theory			Practical						
				End Sem	Mid Sem Exam.	Quiz/ Assignment	End Sem	Lab Work & Term work / Sessional		L	T	P	
1.	BAST 301	BSC-5	Mathematics-III	100	30	20	-	-	150	3	1	-	4
2.	BCET 302	DC-1	Construction Materials	100	30	20	-	-	150	4	-	-	4
3.	BCET 303 BCEP 303	DC-2	Surveying	100	30	20	30	20	200	3	1	2	5
4.	BCET 304 BCEP 304	DC-3	Building Planning & Architecture	100	30	20	30	20	200	3	-	2	4
5.	BCET 305 BCEP 305	DC-4	Strength of Materials	100	30	20	30	20	200	3	1	2	5
6.	BCEP 306	DLC-3	Study of Historical & Ancient Civil Engineering Practices	-	-	-	30	20	50	-	-	4	2
7.	BASP 107	DLC-1	Evaluation of Internship - I - completed at I year level	-	-	-	-	50	50			4	2
8.	BASP 307	DLC-4	90 hrs Internship based on using various softwares –Internship-II	completed anytime during Third / Fourth semester. Its evaluation/credit to be added in fifth semester.									
			Total	500	150	100	120	130	1000	16	3	14	25
		NSS/NCC											

1 Hr Lecture	1 Hr Tutorial	2 Hr Practical
1 Credit	**1 Credit**	**1 Credit**

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Evaluation Scheme & Syllabus for B. Tech Second Year
W.E.F. Academic Session 2019-20
II Year (III SEMESTER) – Civil Engineering

S. No	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Credits
				Theory			Practical			L	T	P	
				End Sem.	Mid Sem	Quiz/Assignment	End Sem.	Term work / Lab Work & Sessional					
1.	BCET 401	ESC	Energy & Environmental Engineering	100	30	20	-	-	150	3	1	-	4
2.	BCET 402 / BCEP 402	DC	Concrete Technology	100	30	20	30	20	200	3	1	2	5
3.	BCET 403 / BCEP 403	DC	Structural Analysis-I	100	30	20	30	20	200	3	1	2	5
4.	BCET 404 / BCEP 404	DC	Transportation Engineering-I	100	30	20	30	20	200	3	1	2	5
5.	BCET 405 / BCEP 405	DC	Engineering Geology & Remote Sensing	100	30	20	30	20	200	3	0	2	4
6.	BCEP 406	DLC*	Software Lab	-	-	-	30	20	50	-	-	4	2
7.	BCEP 407	DLC	90 hrs Internship based on using various software's – Internship –II	To be completed anytime during fourth semester. Its evaluation/credit to be added in fifth semester.									3
			Total	500	150	100	150	100	1000	14	4	12	25
8.	BCST 408	MC	Cyber Security	Non-credit course									
			NSS/NCC										

***A minimum of 2 hours per week should be allotted for the Virtual Lab along with the slot fixed for the conventional lab classes.**

MST: Minimum of two mid semester tests to be conducted.

1 Hr Lecture	1 Hr Tutorial	2 Hr Practical
1 Credit	**1 Credit**	**1 Credit**

BAST 301	Mathematics – III	3L-1T-0P	4 Credits

Students Should have the knowledge of Mathematics I and Mathematics II

Course Objective:

The objective of this course is to familiarize the students with Laplace Transform, Fourier Transform, techniques in numerical methods & some statistical techniques. It aims to present the students with standard concepts and tools at B.Tech first year to superior level that will provide them well towards undertaking a variety of problems in the concern discipline.

The students will learn:

- The idea of Laplace transform of functions and their applications.
- The idea of Fourier transform of functions and their applications.
- To evaluate roots of algebraic and transcendental equations.
- Interpolation, differentiation, integration and the solution of differential equations.
- The basic ideas of statistics including measures of central tendency, correlation, regression and their properties.

COURSE OUTCOMES(s):

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

1. Remember the concept of Laplace transform and apply in solving real life problems.
2. Understand the concept of Fourier transform to evaluate engineering problems
3. Understand to evaluate roots of algebraic and transcendental equations.
4. Understand interpolation, differentiation, integration and the solution of differential equations.
5. Understand the concept of correlation, regression, moments, skewness and kurtosis and curve fitting.

Module 1: Fourier Transforms: (8 hours)

Fourier integral, Fourier Transform, Complex Fourier transform, Inverse Transforms, Convolution Theorem, Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensional heat transfer equations.

Module 2: Laplace Transform: (8 hours)

Definition of Laplace transform, Existence theorem, Laplace transforms of derivatives and integrals, Initial and final value theorems, Unit step function, Dirac- delta function, Laplace transform of periodic function, Inverse Laplace transform, Convolution theorem, Application to solve linear differential equations.

Module 3: Solution of Algebraic and Transcendental equations & Interpolation (8 hours)

Number and their accuracy, Solution of algebraic and transcendental equations: Bisection method, Iteration method, Newton-Raphson method and Regula-Falsi method. Rate of convergence of these methods (without proof),

Interpolation: Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formula. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formula.

Module 4: Numerical differentiation, Integration & Solution of ODE (8 hours)

Numerical Differentiation, Numerical integration: Trapezoidal rule, Simpson's 1/3rd and 3/8 rule Runge-Kutta method of fourth order for solving first order linear differential equations. Milne's predicator-corrector method.

Module 5: Statistical Techniques (8 hours)

Introduction: Measures of central tendency, Moments, Moment generating function (MGF) , Skewness, Kurtosis, Curve Fitting : Method of least squares, Fitting of straight lines, Fitting of second degree parabola, Exponential curves. Correlation and Rank correlation, Regression Analysis: Regression lines of y on x and x on y, regression coefficients, properties of regressions coefficients and non-linear regression.

Reference Books:

1. E. Kreyszig: Advanced Engineering Mathematics; John Wiley & Sons
2. B.V. Ramana: Higher Engineering Mathematics; Tata McGraw- Hill Publishing Company Limited, New Delhi.
3. Peter V.O' Neil. Advanced Engineering Mathematics, Thomas (Cengage) Learning
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. T.Veerarajan : Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi.
6. R.K. Jain and S.R.K. Iyenger: Advance Engineering Mathematics; Narosa Publishing House, New Delhi.
7. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
8. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
9. N.P. Bali and Manish Goyal, Computer Based Numerical and Statistical Techniques , Laxmi Publications, Reprint, 2010.
10. J.N. Kapur: Mathematical Statistics; S. Chand & Sons Company Limited, New Delhi.
11. D.N.Elhance,V. Elhance & B.M. Aggarwal: Fundamentals of Statistics; Kitab Mahal Distributers, New Delhi.

BCET 302	Construction Materials	4L:0T:0P	4 credits

COURSE OBJECTIVE:

- To introduce students to various materials commonly used in civil engineering construction and their properties.

EXPECTED OUTCOMES:

On completion of this course the students will be able to

- Compare the properties of most common and advanced building materials.
- understand the typical and potential applications of these materials

- understand the relationship between material properties and structural form
- understand the importance of experimental verification of material properties

Detailed Syllabus:

Unit I: STONES – BRICKS – CONCRETE BLOCKS

Stone as building material – Criteria for selection – Tests on stones – Deterioration and Preservation of stone work – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – Compressive Strength – Water Absorption – Efflorescence – Bricks for special use – Refractory bricks – Concrete blocks – Lightweight concrete blocks.

Unit II: LIME – CEMENT – AGGREGATES – MORTAR

Lime – Preparation of lime mortar – Cement – Ingredients – Manufacturing process – Types and Grades – Properties of cement and Cement mortar – Hydration – Compressive strength – Tensile strength – Fineness– Soundness and consistency – Setting time – fine aggregates – river sand – crushed stone sand – properties – coarse Aggregates – Crushing strength – Impact strength – Flakiness Index – Elongation Index – Abrasion Resistance – Grading- sand bulking

Unit III: CONCRETE

Concrete – Ingredients – Manufacturing Process – Batching plants – RMC – Properties of fresh concrete – Slump – Flow and compaction Factor – Properties of hardened concrete – Compressive, Tensile and shear strength – Modulus of rupture – Tests – Mix specification – Mix proportioning – BIS method – High Strength Concrete and HPC – Self compacting Concrete – Other types of Concrete – Durability of Concrete.

Unit IV:TIMBER AND OTHER MATERIALS

Timber – Market forms – Industrial timber– Plywood – Veneer – Thermocol – Panels of laminates–

Steel – Aluminum and Other Metallic Materials – Composition – Aluminium composite panel – Market forms – Mechanical treatment – Paints – Varnishes – Distempers – Bitumens.

Unit V: MODERN MATERIALS

Glass – Ceramics – Sealants for joints – Fibre glass reinforced plastic – Clay products –Refractories Composite materials – Types – Applications of laminar composites – Fibre textiles– Geomembranes and Geotextiles for earth reinforcement.

TEXT/REFERENCE BOOKS:

1. Varghese.P.C, "Building Materials", PHI Learning Pvt. Ltd, New Delhi, 2012.
2. Rajput. R.K., "Engineering Materials", S. Chand and Company Ltd., 2008.
3. Shetty.M.S., "Concrete Technology (Theory and Practice)", S. Chand and Company Ltd.,2008.
4. Gambhir.M.L., "Concrete Technology", 3 rd Edition, Tata McGraw Hill Education, 2004
5. Duggal.S.K., "Building Materials", 4 th Edition, New Age International , 2008.
6. Jagadish.K.S, "Alternative Building Materials Technology", New Age International, 2007.
7. Gambhir. M.L., &NehaJamwal., "Building Materials, products, properties and systems", TMH.

BCET 303 & BCEP 303	Surveying	3L:1T:2P	5 credits

Course Objectives

With the successful completion of the course, the student should have the capability to:

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. Measure horizontal, vertical, and zenith angles with a transit, theodolite, total station.
8. Operate a total station to measure distance, angles, and to calculate differences in elevation.
9. Work as a team member on a surveying party to achieve a common goal of accurate and timely project completion,
10. Calculate, design and layout horizontal and vertical curves, 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

1. Learn tacheometry, curve fitting, hydrographic surveying
2. Use latest instruments like EDM, Total station

UNIT 1:

Introduction to Surveying: Principles, Linear, angular and graphical methods, Survey stations, Survey lines- ranging, Bearing of survey lines, Levelling: Plane table surveying, Principles of levelling- booking and reducing levels; differential, reciprocal leveling, profile levelling and cross sectioning. Digital and Auto Level, Errors in levelling; contouring: Characteristics, methods, uses; areas and volumes.

Triangulation and Trilateration**:** Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Horizontal and vertical control - 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.

UNIT 2: **Curves**

Elements of simple and compound curves – Method of setting out–Elements of Reverse curve - Transition curve – length of curve – Elements of transition curve -Vertical curves

UNIT 3:

***Modern Field Survey Systems*:** 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.

UNIT 4:

Errors - Treatment of random errors, Normal law of errors, Most Probable Value, Weight of observations, Propagation of errors and variances, Principle of Least Squares Observations and correlative Normal Equations, Adjustment of triangulation figures

Unit 5:

Field Astronomy - Astronomical terms, co-ordinate systems, Spherical trigonometry, Astronomical triangle, Relationship between coordinates.

Experiments

1. Chain Surveying
2. Plane Table Surveying
3. Theodolite Traverse Surveying
4. Leveling / Route Surveying
5. House Setting
6. Setting out a Simple Circular Curve on Field
7. Height Measurement
8. Tacheometry
9. Contouring
10. Global Positioning System
11. Total Station

Reference Books:

1. S K Duggal : Surveying Vol 1 & 2 , TMH
2. Surveying, 5th Edition, Mc Cormac, Wiley India
3. R Subramanian : Surveying & Leveling , Oxford University Press
4. B C Punamia : Surveying & Leveling
5. C Venkatramaih : Text Book of Surveying , University Press
6. H . Kanitkar : Surveying & Levelling
7. Arora, K.R., ―Surveying‖, Vol. I & II, Standard Book House, Delhi

BCET 304 & BCEP 304	Building Planning & Architecture	L-3:T-0:P-2	4 Credits

OBJECTIVES

1. To understand the concept of building planning and architecture.
2. To understand the various building codes to be followed while planning a building.
3. To have the knowledge of various building components.

OUTCOMES

1. Understanding of building planning, orientation, drawing and architectural aspects.
2. Representation of a building on Paper.

Unit 1

Drawing of Building Elements- Drawing of various elements of buildings like various types of footing, open foundation, raft, grillage, pile and well foundation, Drawing of frames of doors, window, various types of door, window and ventilator, lintels and arches, stairs and staircases

Unit 2

Building Planning- Classification of buildings, Provisions of National Building Codes and Rules, Building bye-laws, open area, Setbacks, FAR terminology, Design and drawing of Building, Design concepts and philosophies, Preparing sketch plans and working drawings of various types of buildings like residential building, institutional buildings and commercial buildings, site plans, presentation techniques, pictorial drawings, perspective and rendering, model making, introduction to computer aided design and drafting, Applying of principle of architectural composition (i.e. unity, contrast, etc.), Principles of planning, orientation in detailed drawings.

Unit 3

Building Services- Introduction of Building Services like water supply, sewerage and drainage systems, sanitary fittings and fixtures, plumbing systems, principles of internal & external drainage systems, principles of electrification of buildings, intelligent buildings, elevators & escalators their standards and uses, air-conditioning systems, fire fighting systems, building safety and security systems, ventilation and lightening and staircases, fire safety, thermal insulation acoustics of buildings,

Unit 4

Principles of architectural design – Definition of architecture, factors influencing architectural development, characteristics features of style, historic examples, creative principles. **Principles of architectural composition –** Unity, balance, proportion, scale, rhythm, harmony, Accentuation and contrast. Organizing principles in architecture - Symmetry, hierarchy, axis linear, concentric, radial, and asymmetric grouping, primary and secondary masses, Role of color, texture, shapes/forms in architecture. Architectural space and mass, visual and emotional effects of geometric forms, space activity and tolerance space. Forms related to materials and structural systems. **Elements of architecture: Functions** – Pragmatic utility, circulatory function , symbolic function, physiological function. Structure – Physical structure, Perceptual structures. Space in architecture – Positive and negative space. Aesthetics: Visual perception. Protective: Protection from climate and other elements, architecture a part of the environment. Comfort factors.

Unit 5

Perspective Drawing and Town Planning- Elements of perspective drawing involving simple

problems, one point and two point perspectives, energy efficient buildings. Concepts of master plan, structure plan, detailed town planning scheme and action plan, estimating future needs planning standards for different land use, allocation for commerce, industries, public amenities, open areas etc., planning standards for density distributions, density zones, planning standards for traffic network, standard of roads and paths, provision for urban growth, growth models, plan implementation, town planning legislation and municipal acts, panning of control development schemes, urban financing, land acquisition, slum clearance schemes, pollution control aspects.

LIST OF EXPERIMENTS

1. Sketches of various building components.
2. Drawing of various building components containing doors, windows ventilators, lintels and arches stairs foundations etc.
3. Drawings for services and interiors of buildings.
4. Drawings containing detailed planning of one/two bed room residential building (common to all students)
5. Drawing of residential and institutional building (Each student performs a different drawing).

REFERENCES

1. Shah, Kale &Patki; Building Design and Drawing; TMH
2. Malik &Meo; Building Design and Drawing
3. W B Mckay,Orient Blackswan Building Construction Vol 1 -4, Pearson
4. Gurucharan Singh & Jagdish Singh, Building Planning, Designing and Scheduling, Standard Publishers Distributors.
5. Layal JS, Dongre A, Building Design and Drawing, Satya Prakashan
6. Ghose D.N., Civil Engineering Design and Drawing, CBS publisher
7. Das B M, Principles of Foundation Engineering, Cengage Learning.
8. Agrawal S. C., Architecture and Town Planning, Dhanpat Rai & Co.
9. S.C. Rangwala, Town Planning, Charotar Publishing House.
10. Lewis Keeble, Principles and Practice of Town and Country Planning.
11. Rame Gouda, Principles & Practices of Town Planning, University of Mysore, Manasa Gangotri.

BCET 305 & BCEP 305	Strength of Materials	3L:1T:2P	5 credits

COURSE OBJECTIVE:

1. This subject is useful for a detailed study of forces and their effects.
2. To study the rigid and deformable solids.
3. To give an ability to calculate stresses and deformations of objects under external forces.
4. To give an ability to apply the knowledge of strength of materials on engineering applications and design problems

EXPECTED OUTCOMES:

1. Describe the concepts and principles, understand the theory of elasticity including strain/displacement and Hooke's law relationships; and perform calculations, relative to the strength and stability of structures and mechanical components;

2. Define the characteristics and calculate the magnitude of combined stresses in individual members and complete structures; analyze solid mechanics problems using classical methods and energy methods;

3. Analyze various situations involving structural members subjected to combined stresses by application of Mohr's circle of stress; locate the shear centre of thin wall beams;

4. Calculate the deflection at any point on a beam subjected to a combination of loads; solve for stresses and deflections of beams under unsymmetrical loading; apply various failure criteria for general stress states at points; solve torsion problems in bars and thin walled members;

Detailed Content

UNIT 1:

Simple Stresses and Strains- Concept of stress and strain, St. Venant's principle, stress and strain diagram, Elasticity and plasticity – Types of stresses and strains, Hooke's law– stress – strain diagram for mild steel – Working stress – Factor of safety – Lateral strain, Poisson's ratio and volumetric strain – Elastic modules and the relationship between them –Bars of varying section – composite bars – Temperature stresses. Strain Energy – Resilience– Gradual, sudden, impact and shock loadings – simple applications

Compound Stresses and Strains- Two-dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr circle of stress, ellipse of stress and their applications. Two-dimensional stress-strain system, principal strains and principal axis of strain, circle of strain and ellipse of strain, relationships between elastic constants.

UNIT 2:

Bending moment and Shear Force Diagrams- Bending moment (BM) and shear force (SF) diagrams.BM and SF diagrams for cantilevers simply supported and fixed beams with or without overhangs. Calculation of maximum BM and SF and the point of contra-flexure under concentrated loads, uniformly distributed loads over the whole span or part of span, combination of concentrated

loads (two or three) and uniformly distributed loads, uniformly varying loads, application of moments.

UNIT 3:

Flexural Stresses-Theory of simple bending – Assumptions – Derivation of bending equation: M/I = f/y = E/R - Neutral axis – Determination of bending stresses – Section modulus of rectangular and circular sections (Solid and Hollow), I,T, Angle and Channel sections – Design of simple beam sections.

Shear Stresses- Derivation of formula – Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections

UNIT 4:

Slope and deflection- Relationship between moment, slope and deflection, Moment area method, Macaulay's method, Use of these methods to calculate slope and deflection for determinant beams.

UNIT 5:

Torsion- Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion. Analysis of close coiled helical springs.

Thin Cylinders and Spheres- Derivation of formulae and calculations of hoop stress, longitudinal stress in a cylinder, and sphere subjected to internal pressures.

List of Experiments:

1. Tension test
2. Bending tests on simply supported beam and Cantilever beam.
3. Compression test on concrete
4. Impact test
5. Shear test
6. Investigation of Hook's law that is the proportional relation between force and stretching in elastic deformation,
7. Determination of torsion and deflection,
8. Measurement of forces on supports in statically determinate beam,
9. Determination of shear forces in beams,
10. Determination of bending moments in beams,
11. Measurement of deflections in statically determinate beam,
12. Measurement of strain in a bar
13. Bend test steel bar;

TEXT/REFERENCE BOOKS:

1. S S Rattan, ―Strength of Materials‖, McGraw Hill Education.
2. M L Gambhir, ―Fundamentals of Solid Mechanics‖, Prentice Hall India Learning Private Limited.

3. James M. Gere, Barry J. Goodno, ―Mechanics of Materials‖, 8th edition, Cenage Learning.
4. Timoshenko, S. and Young, D. H., ―Elements of Strength of Materials‖, DVNC, New York,USA.
5. Kazmi, S. M. A., ―Solid Mechanics‖ TMH, Delhi, India.
6. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: PearsonPrentice Hall, 2004
7. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics ofSolids. 2nd ed. New York, NY: McGraw Hill, 1979
8. Mechanics of Materials - Ferdinand P. Beer, E. Russel Jhonston Jr., John T. DEwolf– TMH 2002.
9. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi.

BCET 306	Study of Historical & Ancient Civil Engineering practices	0L-0-T-4P	2 Credits

OBJECTIVES:

1. The objective of this course is to explain historical and ancient civil engineering practices.
2. It will help to co-relate modern civil engineering practices to ancient civil engineering practices.
3. By studying ancient techniques student can easily understand different facts of science and chronological evolution and impacts of geographic, climatic, geological, religious, political and socio-cultural backgrounds of Indian ancient and medieval architecture – in relationship to materials and techniques of construction.
4. The course aims at to generate interest in Civil Engineering practices, enjoy and appreciate historic structures, changing the way Civil Engineering history is viewed and studied.

Course Outcomes

1. It encourages educators to think explicitly about the aims of world history education and about the knowledge and understandings that they expect their students to achieve
2. It is conceived on the premise that students will achieve will greater competence in world history and more successfully meet content and performance standards, if they are guided to relate particular subject matter to larger patterns of historical meaning and significance.
3. Classify nature of pre historic societies

Modules 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

Modules 2. 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

Modules 3. 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 work

Modules 4. Repairs & Rehabilitation of Structures: 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

Modules 5. Industrial lectures: Case studies of large civil engineering projects by industry Professionals, covering comprehensive planning to commission.

Text/Reference Books:

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. Avina

IV Semester

BCET 401	**Energy and Environmental Engineering**	**3L:1T:0P**	**4 Credits**

Course Objectives:

The objective of this course is to apply knowledge of mathematics, science, technology and engineering appropriate to energy science and engineering degree discipline and to enhance the understanding of conventional and non-conventional energy sources and its relationship with the ecology and environment. More precisely the objectives are:

1. Use mathematical or experimental tools and techniques relevant to the energy and energy-related environmental disciplines along with an understanding of their processes and limitations.
2. Equip the students with knowledge and understanding of various possible mechanisms about renewable energy projects
3. To produce graduates strong in understanding on energy resources, technologies and systems, energy management fundamentals, and capable in innovative technological intervention towards the present and potential future energy.
4. To identify, formulate and solve energy and energy-related environmental problems by pursuing development of innovative technologies that can generate clean and sustainable energy to address energy scarcity and combat pollution and climate change.

Course Outcomes

1. Apply advanced level knowledge, techniques, skills and modern tools in the field of Energy and Environmental Engineering.
2. Distinguish the different energy generation systems and their environmental impacts.
3. Respond to global policy initiatives and meet the emerging challenges with sustainable technological solutions in the field of energy and environment.

Detailed Content

Module I:
Introduction to Energy Science - Introduction to energy systems and resources; Introduction to Energy, sustainability & the environment, Global Energy Scenario: Role of energy in economic development. Indian Energy Scenario: Introduction to Energy resources & Consumption in India. Common terminologies

Module II
Energy Sources - Overview of energy systems, sources, transformations, efficiency, 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; Sun as Source of Energy, Availability of Solar Energy, Nature of Solar Energy, Solar Energy & Environment. Various Methods of using solar energy.

Commercial and noncommercial forms of energy, Fossil fuels, Renewable sources including: Nuclear Energy, Hydel Energy, Storage of Hydrogen, Hydrogen Production, Hydrogen Energy Geothermal, Tide and Wave Energy, Bio-fuels in India.

Module III

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.

Module IV

Energy & Environment - Environment**:** Introduction, Multidisciplinary nature of environmental studies- Definition, scope and importance, Need for public awareness. Ecosystem: Concept, Energy flow, Structure and function of an ecosystem. Food chains, food webs and ecological pyramids, Forest ecosystem, Grassland ecosystem, Desert ecosystem and Aquatic ecosystems, Ecological succession. Environmental Pollution: Definition, Cause, effects and control measures of - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution and Nuclear hazards , solid waste Management.

Module V

Environmental Protection and Ethics - Environmental Protection- Role of Government Initiatives by Non-governmental Organizations (NGO) Environmental Education. Ethics and moral values Objectives of ethics, Professional and Non- professional ethics Sustainable Development of the ecology and environment Codes of ethics and their limitations

Suggested reading material:

1. Schaeffer, John. 2007. Real Goods Solar Living Sourcebook: The Complete Guide to Renewable Energy Technologies and Sustainable Living (30th anniversary edition). Gaiam.
2. Boyle, Godfrey, Bob Everett, and Janet Ramage (eds.) 2004. Energy Systems and Sustainability: Power for a Sustainable Future. Oxford University Press, 619 pages (ISBN: 0-19-926179-2)
3. Energy Management Principles: C.B.Smith (Pergamon Press)
4. Renewable Sources of Energy and Conversion Systems: N.K.Bansal and M.K.Kleeman.
5. EnergyManagement: W.R.Murphy, G.Mckay (Butterworths)
6. Ristinen, Robert A. Kraushaar, Jack J. AKraushaar, Jack P. Ristinen, Robert A. (2006) Energy and the Environment, 2nd Edition, John Wiley
7. Ravindranath, N. H., & Hall, D. O. (1995). Biomass, energy and environment: a developing country perspective from India. Oxford University Press.
8. Popp, D., Newell, R. G., & Jaffe, A. B. (2010). Energy, the environment, and technological change. In Handbook of the Economics of Innovation (Vol. 2, pp. 873-937). North-Holland.

BCET 402	Concrete Technology	3L:0T:2P	4 Credits

OBJECTIVE:

1. To study the behavior of various materials used in Concrete.
2. To study physical and mechanical properties of fresh and hardened concrete
3. To study the different codes of practices for the preparation of concrete
4. To study the preparation and properties of special type of concrete

OUTCOMES:

1. Identify Quality Control tests on concrete making materials
2. Understand the behavior of fresh and hardened concrete
3. Design concrete mixes as per IS and ACI codes
4. Understand the durability requirements of concrete
5. Understand the need for special concretes

Detailed Content

Module-I: Concrete as a Building Material and its gradients:

(i) Cement: Manufacture of Portland Cement, its composition, Hydration of cement, physical and chemical properties, concept of strength development. Gel space Ratio, Powers Law. Gel structure.

(ii) Testing of Cement for general physical and chemical properties as per BIS specifications.

(iii)Different types of cement such as Slag Cement, Portland Pozzolona Cement and high Alumina cement, their characteristics, composition, use and properties.

Module-II: Aggregates and Testing of Aggregates:

Classification, source, physical and mechanical properties. Testing of Aggregates for physical and mechanical properties.

Module-III: Production of Fresh Concrete:

(i) Proportioning of concrete, operations involved in concrete production, Workability, Factors Affecting workability, Measurement of workability. Problem of Segregation and bleading and Laittance.

(ii) Properties of Hardened Concrete.

Strength and durability, Factors affecting strength and durability of concrete. Mechanics of setting and hardening of concrete

Module-IV: Concrete Mix Design:
Principle and Methods, Statistical Quality control. Concrete Rheology, Maturity concept.

Introduction to special concretes:
(a) Admixtures in concrete.

(b) Special concrete as lightweight concrete. High Density Concrete, Sulpher Impregmented concrete Polymer concrete, Lime concrete constituents and uses.

(c) High strength concrete (d) Fibre Reinforced Concrete (e) High performace concrete, Ready mix concrete and mass concrete

Module-V: Material testing and instrumentation:
Conventional vs. Non-Destructive Testing. Methods & Principles of NDT.

List of Experiments:

1. Fineness modulus and grain size distribution
2. Abrasion test on aggregate
3. Slump Test
4. Workability of concrete
5. Concrete mixed design as per Indian Standard recommendation guidelines.
6. Effect of water cement ratio on the strength of concrete

TEXT/REFERENCE BOOKS:

1. S S Rattan, "Strength of Materials", McGraw Hill Education.
2. M L Gambhir, "Fundamentals of Solid Mechanics", Prentice Hall India Learning Private Limited.
3. James M. Gere, Barry J. Goodno, "Mechanics of Materials", 8th edition, Cenage Learning.
4. Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, NewYork, USA.
5. Kazmi, S. M. A., "Solid Mechanics" TMH, Delhi, India.
6. Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: PearsonPrentice Hall, 2004
7. Crandall, S. H., N. C. Dahl, and T. J. Lardner. An Introduction to the Mechanics of Solids. 2nd ed. New York, NY: McGraw Hill, 1979
8. Mechanics of Materials - Ferdinand P. Beer, E. RusselJhonston Jr., John T. DEwolf– TMH 2002.
9. Strength of Materials by R. Subramanian, Oxford University Press, New Delhi.

BCET 403 & BCEP 403	Structural Analysis 1	3L:1T:2P	5 Credits

OBJECTIVE:

1. To equip the students with the comprehensive methods of structural analysis with emphasis on analysis of elementary structures.

OUTCOMES:

The students will be able to

1. analyse trusses and study displacement response of statically determinate structural systems using energy methods:
2. apply unit load method and strain energy method for determination of deflection of statically determinate beams, frames & pin jointed trusses
3. analyse statically indeterminate structures using strain energy method and method of consistent deformation
4. know about moving loads and influence lines
5. know about Statically determinate and indeterminate suspension bridges and arches

Detailed Content:

Module 1 - Truss Analysis:

Analysis of determinate truss- Methods of joints and sections. Degree of static and kinematic determinacies, Introduction to force and displacement methods

Module II - Moving loads and influence lines.

Introduction to moving loads - concept of influence lines - influence lines for reaction, shear force and bending moment in simply supported beams and over hanging beams - analysis for different types of moving loads - single concentrated load - several concentrated loads, uniformly distributed load on shorter and longer than the span.

Module III - Cables and Suspension Bridges (8)

Analysis of forces in cables under concentrated and uniformly distributed loads - Anchor Cables Un-stiffened suspension bridges, maximum tension in the suspension cable and backstays, pressure on towers.

Module IV - Arches

Theory of arches - Eddy‟s theorem - analysis of three hinged arches-Support reactions-normal thrust and Radial shear at any section of a parabolic and segmental arch due to simple cases of loading. Moving loads on three hinged arches **(8)**

Module V- Elastic theorems and energy principles

Strain energy due to axial load, bending moment, shear and torsion - strain energy method, Castigliano's method for deflection, Unit load method-Betti's theorem – Maxwell's law of

reciprocal deflections - principle of least work - application of unit load method and strain energy method for determination of deflection of statically determinate beams, frames - pin jointed trusses.

LIST OF EXPERIMENTS

1. Experiment on a 2 hinged arch for horizontal thrust and influence line for horizontal thrust.
2. Experimental and analytical study of a 3 bar pin jointed truss.
3. Experimental and analytical study of deflection and unsymmetrical bending of a cantilever beam.
    - Beggdefometer- verification of Muller Breslau principle.
    - Experimental and analytical study of an elastically coupled beam.
4. Sway in portal frames- demonstration.
5. To study the cable geometry and statics for different loading condition.
6. To plot stress –strain curve for concrete. Use of mechanical and electrical strain

Text Books:

1. Gere and Timoshenko, Mechanics of materials, CBS. Publishers
2. Kenneth Leet,Chia M Uang& Anne M Gilbert., Fundamentals of Structural Analysis, McGraw Hill
3. R.Vaidyanathan and P.Perumal, Comprehensive Structural Analysis Volume I & II, Laxmi Publications (P) Ltd
4. Wang C.K., Intermediate Structural Analysis, McGraw Hill

References:

1. AslamKassimali., Structural Analysis, Cenage Learning
2. Chandramouli P N, Structural Analysis I –Analysis of Statically Determinate Structures, Yes DeePublishingPvt Ltd.,Chennai,Tamil Nadu.
3. DevdasMenon, Structural Analysis, Narosa Publications
4. Hibbeler., Structural Analysis, Pearson Education
5. Kinney S., Indeterminate Structural Analysis, Oxford & IBH
6. M.L. Gambhir, Fundamentals of structural Mechanics and analysis, Printice Hall India
7. Reddy C.S., Indeterminate Structural Analysis, Tata McGraw Hill
8. Timoshenko S.P.& Young D.H., Theory of Structures, McGraw Hill

BCET 404	Transportation Engineering -I	3L-1T-2P	5 Credits

Course Objectives:

1. To enable the students to have a strong analytical and practical knowledge of Planning, Designing and solving the transportation problems.
2. To introduce the recent advancements in the field of Sustainable Urban Development, Traffic Engineering and Management, Systems Dynamics Approach to Transport
3. Planning, Highway Design and Construction, Economic and Environment Evaluation of Transport Projects.
4. To strength the students knowledge and technical knowhow to be efficient Transport Engineers.

Course outcomes

1. Acquire in-depth knowledge of Transportation Engineering, including wider and global perspective, with an ability to discriminate, evaluate, analyse and synthesise existing and new knowledge, and integration of the same for enhancement of knowledge.
2. Able to learn geometric design of highways
3. Able to learn traffic engineering and pavement engineering

Module-I

Highway Development and Planning - Historical Development of Highway, road patterns, master plans, road development plans (20 year road plans), PMGSY. Cross Section elements, sight distances, horizontal and vertical alignment. Super Elevation, Vertical Curves, Transition Curves

Module-II

Material and Testing - Aggregates- requirements, properties and testing used in granular layers and bituminous layers, concept of size and gradation-design gradation, aggregate blending to meet specification Bitumen and Tar- origin, preparation, properties and chemical constitution of bituminous road binders. Bituminous emulsions and cutback - preparation, characteristics uses and tests, mechanism of stripping, adhesion failure.

Bituminous mixes: preparation, design and testing Subgrade Soil, Sub base and base course materials, bituminous materials, testing of soils, stone aggregates and bitumen

Module-III

Traffic Engineering: Traffic characteristics, road user & vehicular characteristics, traffic studies, accident studies, traffic operations, traffic control devices, intelligent transport systems, pollution due to traffic; Design of Traffic Signals,

Module-IV

Design of Highway Pavements - DESIGN OF FLEXIBLE PAVEMENTS Factors affecting design and performance - Stresses and deflection in homogenous masses, Burmister's 2 layer, 3 layer and multi-layer theories , wheel load stresses, ESWL, pavement behavior under transient traffic loads, problems on above. CBR method, principle, advantages and application

DESIGN OF RIGID PAVEMENTS Factors affecting design and performance, types of stresses, causes and factors affecting stresses, EWL, Westergaard's analysis, wheel load stresses, warping- frictional combined stresses, problems on above.

Module-V

Highway Construction and Maintenance - Construction of various layers, earthwork, WBM, GSB, WMM, various types of bituminous layers, joints in rigid pavements Highway: Various type of failures, evaluation and remedial measures

LIST OF EXPERIMENTS

1. Determination of aggregate crushing value.
2. Determination of Los Angeles abrasion value of aggregates.
3. Determination of aggregate impact value.
4. Determination of penetration value of bitumen.
5. Determination of softening point value of bitumen.
6. Determination of ductility value of bitumen.
7. Determination of flash and fire point of bitumen.
8. Determination of specific gravity of bitumen.
9. Determination of stripping value of aggregate
10. Determination of flakiness index and elongation index of coarse aggregate
11. Determination of specific gravity and water absorption of coarse aggregate.
12. CBR test for soil.

Suggested reading material:

1. Khanna, S.K. and Justo, C.E.G., "Highway Engineering", Nem Chand & Bros. 2004
2. Khanna, S.K. and Justo, C.E.G., "Highway Material Testing Manual", Nem Chand & Bros. 2004
3. Kadiyali, L.R., "Traffic Engineering and Transportation Planning", Khanna Publishers. 2002
4. Sharma, S.K., "Principles and Design of Highway Engineering", S.Chand& CO. 1995
5. Papacostas, C.S. and Prevedouros, P.D., "Transportation Engineering and Planning", Prentice Hall. 2002
6. JotinKhisty, C. and Kent Lall,B., "Transportation Engineering- An Introduction", Prentice Hall

BCET 405 **BCEP 405**	**Engineering Geology & Remote Sensing**	**3L:0T:2P**	**4 credits**

Objectives:

1. The objective of this Course is to focus on the core activities of engineering geologists site characterization and geologic hazard identification and mitigation.
2. Student will learn to couple geologic expertise with the engineering properties of rock and unconsolidated materials in the characterization of geologic sites for civil work projects and the quantification of processes such as rock slides, liquefaction etc.
3. Engineering Geology is useful for the safe development of civil works.
4. Engineering geology also includes the assessment and mitigation of geologic hazards such earthquakes, landslides, flooding; the assessment of timber harvesting impacts; and groundwater remediation and resource evaluation.

Course Outcomes

1. Identify the main and most common igneous, sedimentary and metamorphic rocks encountered by foundations and construction.
2. To identify and define the main morphological and geological characteristics as shown on maps,
3. Analyse geological parameters important in geotechnical studies.

Module 1:

Introduction to Geology & its Scope: Branches of geology useful to civil engineering, scope of geological studies in various civil engineering projects. Department dealing with this subject in India and their scope of work- GSI, Granite Dimension Stone Cell, NIRM. Mineralogy-Mineral,

Origin and composition. Physical properties of minerals, susceptibility of minerals to alteration, basic of optical mineralogy, SEM, XRD., Rock forming minerals, megascopic, identification of common primary & secondary minerals.

Internal structure of the earth. Suitability of rocks as engineering materials. Building stones occurrences and characteristics. Petrology-Rock forming processes. Specific gravity of rocks. Ternary diagram. Detailed Classification of Different Types of Rocks; Igneous Rocks- their types; Sedimentary Rocks- their types; Metamorphic Rocks- their types

Rock forming Minerals- Their Engineering Aspects

Module 2:

Weathering. Erosion and Denudation. Factors affecting weathering and product of weathering. Engineering consideration. Superficial deposits and its geotechnical importance: Water fall and Gorges, River meandering, Alluvium, Glacial deposits, Laterite (engineering aspects), Desert Landform, Loess, Residual deposits of Clay with flints, Solifluction deposits, mudflows, Coastal deposits. Stress and Strain in rocks. Concept of Rock Deformation & Tectonics. Dip and Strike. Outcrop and width of outcrop. Inliers and Outliers

Module 3:

Main types of discontinuities according to size. Fold- Types and nomenclature, Criteria for their recognition in field. Faults: Classification, recognition in field, effects on outcrops. Joints & Unconformity; Types, Stresses responsible, geotechnical importance. Importance of structural elements in engineering operations. Consequences of failure as land sliding, Earthquake and Subsidence. Strength of Igneous rock structures Earthquake: Magnitude and intensity of earthquake. Seismic sea waves. Revelation from Seismic Records of structure of earth. Case Study on Elevation and Subsidence in Himalayan region in India. Seismic Zone in India.

Module 4:

Remote Sensing - 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.

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

Module 5

Introduction, Geographical concepts and terminology, difference between image processing system and GIS. Utility of GIS Raster and vector data, data storage,v erification and editing Rectification and registration, interpolation of data. Database Structure –Hierarchical data, network systems, relational database. Data manipulation and analysis, spatial and mathematical operations on data, area analysis, query-based analysis.

Experiments

1. Study of physical properties of minerals.
2. Study of different group of minerals.
3. Study of Crystal and Crystal system.
4. Identification of minerals: Silica group: Quartz, Amethyst, Opal; Feldspar group:
5. Orthoclase, Plagioclase; Cryptocrystalline group: Jasper; Carbonate group: Calcite;
6. Element group: Graphite; Pyroxene group: Talc; Mica group: Muscovite; Amphibole
7. group: Asbestos, Olivine, Hornblende, Magnetite, Hematite, Corundum, Kyanite, Garnet, Galena, Gypsum.
8. Identification of rocks (Igneous Petrology): Acidic Igneous rock: Granite and its varieties,
9. Syenite, Rhyolite, Pumice, Obsidian, Scoria, Pegmatite, Volcanic Tuff. Basic rock: Gabbro, Dolerite, Basalt and its varieties, Trachyte.

10. Identification of rocks (Sedimentary Petrology): Conglomerate, Breccia, Sandstone and its varieties , Laterite, Limestone and its varieties, Shales and its varieties.
11. Identification of rocks (Metamorphic Petrolody): Marble, slate, Gneiss and its varieties, Schist and its varieties. Quartzite, Phyllite.
12. Study of topographical features from Geological maps. Identification of symbols in maps.

Text/Reference Books:

1. Engineering and General Geology, Parbin Singh, 8th Edition (2010), S K Kataria& Sons.
2. Text Book of Engineering Geology, N. ChennaKesavulu, 2nd Edition (2009), Macmillan Publishers India.
3. Geology for Geotechnical Engineers, J.C.Harvey, Cambridge University Press (1982).
4. Geology and Engineering, R.F Legget., McGraw Hill, New York.
5. Manoj, K. Arora and Badjatia, Geomatics Engineering, Nem Chand & Bros, 2011
6. Chandra, A.M., Higher Surveying, Third Edition, New Age International (P) Limited, 2002.

BCST 408	Cyber Security	Non- Credit Course

Course Objectives:

1. Understand the basic concept of Cyber Security.
2. Understand the basic concept of Viruses.
3. Understand the basic concept of Digital Attacks.
4. Understand the basic concept of Phishing.
5. Understand the basic concept of Cyber Law.

Course Outcomes:

After the completion of this course the student will able to:

1. Know about various attacks and viruses in cyber systems
2. Know about how to prevent digital attacks
3. Know about how to prevent Phishing Attacks
4. Know about how to do secure transactions

MODULE-1

Introduction to information systems, Types of information Systems, Development of Information Systems, Introduction to information security, Need for Information security, Threats to Information Systems, Information Assurance, Cyber Security, and Security Risk Analysis.

MODULE-2

Application security (Database, E-mail and Internet), Data Security Considerations-Backups, Archival Storage and Disposal of Data, Security Technology-Firewall and VPNs, Intrusion Detection, Access Control.

Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail viruses, Macro viruses, Malicious Software, Network and Denial of Services Attack, Security Threats to E-Commerce- Electronic Payment System, e- Cash, Credit/Debit Cards. Digital Signature, public Key Cryptography.

MODULE-3

Developing Secure Information Systems, Application Development Security, Information Security

Governance & Risk Management, Security Architecture & Design Security Issues in Hardware, Data Storage & Downloadable Devices, Physical Security of IT Assets,

Access Control, CCTV and intrusion Detection Systems, Backup Security Measures.

MODULE-4

Security Policies, Why Policies should be developed, WWW policies, Email Security policies, Policy Review Process-Corporate Policies-Sample Security Policies, Publishing and Notification Requirement of the Policies.

Information Security Standards-ISO, IT Act, Copyright Act, Patent Law, IPR. Cyber Laws in India; IT Act 2000 Provisions, Intellectual Property Law: Copy Right Law, Software License, Semiconductor Law and Patent Law.

References:

1. Charles P. Pfleeger, Shari Lawerance Pfleeger, "Analysing Computer Security ", Pearson Education India.
2. V.K. Pachghare, "Cryptography and information Security", PHI Learning Private Limited, Delhi India.
3. 3.Dr. Surya Prakash Tripathi, Ritendra Goyal, Praveen kumar Shukla ,"Introduction to Information Security and Cyber Law" Willey Dreamtech Press.
4. Schou, Shoemaker, " Information Assurance for the Enterprise", Tata McGraw Hill. 5. CHANDER, HARISH," Cyber Laws And It Protection " , PHI Learning Private Limited ,Delhi ,India