T.Y. B.Tech. In Civil Engineering

Sem. V & VI

Course Content

Year 2019-20

PC-BTC 501 Structural Engineering

(AY 2019-20)

Prerequisites: ES-BTC 302, ES-BTC 351, PC-BTC 402

Course Objectives:

1. To introduce the students to the method of analysis of three hinged arches, cables and suspension bridges.
2. To introduce the students to the concept of Influence line diagrams.
3. To introduce the students to the methods of finding absolute and relative deflections caused by loads, temperature changes and settlement of supports.
4. To introduce the students to the methods of analysis of indeterminate structures.
5. To prepare the base for the students to study other advanced structural engineering courses at a later stage.

Course Outcome:

At the end of the course the students shall be able to develop collaborative skills to work in a team/group and analytical skills to

1. Analyze three hinged arches and cables and suspension bridges.
2. Draw influence line diagrams for determinate beams and pin jointed frames.
3. Find absolute and relative deflections caused by loads, temperature changes and settlement of supports and to identify and determine the type and degree of indeterminacy in structures.
4. Analyze indeterminate beams using flexibility method and slope deflection method.

Module No	Details	Hrs
1	**Three hinged arch:** Determination of normal thrust, radial shear force and bending moment for three hinged parabolic arch. **Self Learning:** Determination of normal thrust, radial shear force and bending moment for segmental arch.	03
2	**Cables and suspension bridges:** Simple suspension cable, minimum and maximum tensions in the cable supported at same and at different levels, anchor cable, cable supports, suspension cable with three hinged stiffening girder, shear force and bending moment at any section of the three hinged stiffening girder.	05

3	**Influence lines for statically determinate structures:** Influence lines for simply supported beam and pin jointed truss. Criteria for maximum shear force and bending moment at a section, absolute maximum shear force and bending moment under moving loads (udl and series of point loads) for simply supported beams. **Self Learning:** Influence lines for cantilever and overhanging beams.	07
4	**Deflection of statically determinate structures:** Absolute and relative deflections caused by loads, temperature changes and settlement of supports, application to beams, pin jointed frames and rigid jointed frames. **Self Learning:** Absolute and relative deflections caused by lack of fit in pin jointed frames. **Degree of indeterminacy of structures:** Types of structures occurring in practice and their classification. Stable and unstable structure, degree of static and kinematic indeterminacy of structures.	05 03
5	**Introduction to analysis of indeterminate structures by force method:** Flexibility coefficients and their use in formulation of compatibility equations. Application of the flexibility method to analyze indeterminate beams. **Introduction to analysis of indeterminate structures by displacement method:** Slope deflection method- application to indeterminate beams.	04 03

Term work:-

At least 20 (twenty) solved problems based on the above syllabus as per the module weightage shall be submitted as term work.

Text Books:

1. Reddy C.S.(1999), "Basic Structural Analysis", Tata McGraw hill, ISBN 0070702764, 779 pages.
2. Junnarkar S.B. (2013), "Structural Analysis, Vol. II" Charotar Publishers ISBN 9380358703, 986 pages.
3. Pandit and Gupta (1999), "Structural Analysis Vol. I", Tata McGraw Hill, ISBN 0074634933, 679 pages.
4. L. S. Negi, and R. S. Jangid (1997), "Theory and Problems in Structural Analysis ",Tata McGraw Hill, ISBN 0074623044, 828 pages.

5. D.S. Prakash Rao (1996),"Structural Analysis: A Unified Approach", Orient Blackswan ISBN 8173710279, 672 pages.

Reference Books:-

1. John Benson Wilbur , SenolUtku, Charles H. Norris (1990), "Elementary Structural Analysis", Tata McGraw Hill, ISBN 9780070659339, 829 pages.
2. Harold I. Laursen (2007), "Structural Analysis", Tata McGraw Hill Higher Education, ISBN 0070366438, 468 pages.
3. Dr. B.N. Thadani And Dr. J. P.Desai (1964), "Modern Methods in Structural Analysis", Asia Publishing House,
4. C. K. Wang (2010), "Intermediate Structural Analysis", Tata McGraw hill. ISBN 0070702497
5. Russell C. Hibbeler (2012), "Structural Analysis", Prentice Hall, IBN 013257053X, 695 pages.
6. Alexander Chajes (1982), "Structural Analysis", Longman Higher Education, ISBN 0138534080, 352 pages.
7. Aslam Kassimali (2014), "Structural Analysis", Cengage Learning, ISBN 1133943896, 613 pages.

PC-BTC502–Hydrology and Water Resources Engineering

(AY 2019-20)

Prerequisites:

Course Objectives:
The main objectives of the course are

1. To acquire the knowledge of hydrological parameters for the discharge calculations.
2. To summarize the fundamentals of water resources systems and to compute the various parameters required for the design of hydraulic structures
3. Describe different types of dams, spillways and other irrigation structures.
4. To appraise the various parameters for the design of hydraulic structure, cross drainage work, groundwater and well water system.
5. To discuss different methods of irrigation, water distribution systems and their suitability.

Course Outcomes:
At the end of the course the students shall be able to develop collaborative skills to work in a team/group and analytical skills to:

1. Measure and analyze rainfall, runoff and water losses
2. Estimate the water requirements of crops
3. To compute groundwater flow.
4. Design various hydraulic structures and irrigation systems.

Module No	Details	Hrs.
1	**Introduction**: Hydrologic cycle, water-budget equation, applications in engineering, sources of data, *Precipitation* - forms of precipitation, characteristics of precipitation in India, measurement of precipitation, rain gauge network, mean precipitation over an area, depth area-duration relationships, maximum intensity/depth-duration-frequency relationship, Probable Maximum Precipitation (PMP), rainfall data in India.	**6**
2	**Abstractions from precipitation:** evaporation process, evaporimeters, analytical methods of evaporation estimation, reservoir evaporation and methods for its reduction, evapotranspiration, measurement of evapotranspiration, evapotranspiration equations, potential evapotranspiration over India, actual evapotranspiration, interception, depression storage, infiltration, infiltration capacity, measurement of infiltration, modelling infiltration capacity, classification of infiltration capacities, infiltration indices.	**6**

3	**Runoff:** runoff volume, flow duration curve, flow-mass curve, hydrograph, factors affecting runoff hydrograph, components of hydrograph, base flow separation, effective rainfall, unit hydrograph surface water resources of India.	**4**
4	**Ground water and well hydrology:** forms of subsurface water, saturated formation, aquifer properties, geologic formations of aquifers, well hydraulics: steady state flow in wells, equilibrium equations for confined and unconfined aquifers, aquifer tests.	**4**
5	**Water withdrawals and uses:**Water for energy production, water for agriculture, water for hydroelectric generation; flood control. Analysis of surface water supply, Water requirement of crops-Crops and crop seasons in India, cropping pattern, duty and delta; canal systems, alignment of canals, canal losses, estimation of design discharge. Design of channels- rigid boundary channels, alluvial channels, Kennedy's and Lacey's theory of regime channels. Introduction to Canal outlets	**6**
6	**Hydraulic Structures:** embankment dams: Classification, design considerations, Estimation and control of seepage, slope protection. Gravity dams: forces on gravity dams, causes of failure, stress analysis, elementary and practical profile. Arch and buttress dams, economic height of dam, and selection of suitable site.	**6**
7	**Spillways:** components of spillways, types of gates for spillway crests; Reservoirs- Types, capacity of reservoirs, yield of reservoir, reservoir regulation, sedimentation, Design of Ogee spillway and energy dissipater.	**4**

Term work:-
At least 10 assignments covering the entire syllabus shall be submitted as term work.

Recommended Books:-

1. Dr. B.C. Punmia and Dr. PandeB.B.Lal (2009); "Irrigation and Water Power Engineering", Laxmi Publications Pvt. Ltd. New Delhi. ISBN-13 –9788131807637. 964p.
2. Dr. P.N. Modi (2008); "Irrigation Water Resources and Water Power Engineering" Standard Book House. Delhi. ISBN-13 –9788189401290. 1070p.
3. S. K. Garg (2009); "Irrigation Engineering and Hydraulics Structures", Khanna Publishers. Delhi. ISBN-13 –9788174090478. 1594p
4. Challa Satya Murthy (2002); "Water Resources Engineering: Principles and Practice" ISBN-13 –9788122413823. 306p.
5. S. K. Sharma; "Design of Irrigation Structures", S. Chand and Co. ISBN-13 –9788121903295
6. G.L.Asawa (2006); "Irrigation and Water Resources Engineering", New Age International Publishers. ISBN-13 9788122416732. 624p
7. K N Muthreja, Applied Hydrology, Tata Mc-Graw Hill.
8. K Subramanya, Water Resources Engineering through Objective Questions, Tata Mc-Graw Hill.
9. L W Mays, Water Resources Engineering, Wiley.
10. J D Zimmerman, Irrigation, John Wiley & Sonsgy, Oxfor

PC-BTC 503 - Design of RCC Elements (Limit State Method)

(AY 2019-20)

Prerequisites: ES-BTC302, PC-BTC402

Course Objectives:

1. To develop Civil Engineering graduates having clear understanding of concepts of reinforced concrete design using Limit state approach.
2. Application of LSM to design different RCC members.
3. To familiarize students to use of IS 456 and relevant IS codes, its importance in RCC design.
4. To deal with environmental and economic issues.

Course Outcomes:

At the end of the course the students shall be able to develop collaborative skills to work in a team/group and design skills to:

1. Deign RCC members like beam, slab, column, footings using LSM method for safety ,stability and economy.
2. Use IS 456 for design of RCC members.

Module No	Details	Hrs
1	Limit State Method: Introduction to limit state method of design as per IS 456 (latest edition): concepts of probability and reliability, characteristic loads, characteristic strength, partial safety factors for loads and materials, introduction to various limit states.	02
2	Limit State of Collapse - Flexure: Limit state of collapse in flexure, shear and Limit state of serviceability in deflection and cracking, design of singly reinforced rectangular sections. Design and analysis of doubly reinforced rectangular sections, T sections for flexure, design of members in shear and bond, design of beam subjected to bending and torsion. Requirements governing reinforcement detailing.	08
3	Design of Slabs: Design of one way slab and two way slab	04
4	Limit State of Collapse - Compression: Limit state of collapse compression for short and slender column. Column Members subjected to combined axial and uni-axial as well as biaxial	07

	bending. Development of interactive curves and their use in column design.	
5	Design of Foundations: Isolated square and rectangular footings subjected to axial load and moments. Design of combined rectangular pad footings, slab beam type footing .	07

Term work:-

Assignments consisting of minimum twenty problems covering entire syllabus shall be submitted as term work.

Text Books:-

1. P. Dayaratnam,(2011), "Design of Reinforced Concrete Structures", Oxford &Ibh-Pubs Company-New Delhi, ISBN 8120414195
2. Ashok K. Jain(1993), "Reinforced Concrete: Limit State Design" , Nem Chand & Brothers, ISBN 8185240531, 844 pages
3. Dr. S.R. Karve& Dr. V.L. Shah (1994), "Limit State Theory and Design of Reinforced Concrete", Structures Publishers, ASIN B007I29ARC, 1140 pages
4. V. Ramakrishnan&P.D. Arthur (1969), "Ultimate Strength Design for Structural Concrete",Pitman, ISBN 0273403230, 264 pages
5. Dr. H. J .Shah,(2008),"Reinforced Concrete, Volume 2", Charotar Publishing House Pvt. Limited, ISBN 8185594732, 536 pages
6. S N Sinha, (2002),"Reinforced Concrete Design, Second Revised Edition", Tata McGraw-Hill Education, ISBN 0070473323, 708 pages
7. Karve& Shah, (2011), "Illustrated Design of Reinforced concrete Buildings", mihail-koprivchin-3758, 319 pages
8. P.C. Varghese (2009), Limit state design of Reinforved concrete, PHI Learning.
9. B.C. Punmia, Ashokkumar Jain and Arunkumarjain (2007), Limit State Design of Reinforced Conctrete.

Reference Book

1. Wang, C.K., Salmon, C.G., and Pincheira, (2007),"J.A. Reinforced Concrete Design", 7th Ed, John Wiley and Sons, ISBN 0471262862, 948 pages
2. Phil Moss Ferguson, Henry Jacob Cowan, (1981),"Reinforced Concrete Fundamentals, S I Version", John Wiley & Sons Canada, Limited, ISBN 0471051535, 694 pages.
3. B.P. Hughes (1976),"Limit State Theory for Reinforced Concrete Design", Pitman, ISBN 0273010239

PC-BTC504- Highway Engineering

(AY 2019-20)

Prerequisites: PC-BTC307, PC-BTC354 ,PC-BTC403

Course Objectives:

1. To Summarize brief History of roads in India, and classification of roads as per different 20 years Road Development Plan, to discuss Highway planning and geometric design of Roads,
2. Design and construction of Flexible as well as Rigid Pavements.

Course Outcomes:

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

1. To analyze and Design of Geometric elements of different road types.
2. To implement the knowledge gained for Design & Construction of Flexible Pavements, Rigid Pavements.
3. To execute construction and maintenance of Flexible and Rigid Pavements.

01	**Highway Planing** i Classification of roads, brief history of road developments in India, present status of roads in India. ii Highway alignment, basic requirement of ideal alignment, factors governing highway alignment iii Highway location survey, map study, reconnaissance, topographic surveys, highway alignment in hilly area, drawing and report preparation	04
02	**1. Geometric Design of Highway** i.Terrain classification, vehicular characteristics, highway cross section elements, salient dimensions, clearances, width of carriage way, shoulders, medians, width of road way, right of way, camber and its profile. ii.Design speed, sight distance, perception time, break reaction time, analysis of safe sight distance, analysis of overtaking sight distance, intersection sight distance. iii. Horizontal curves: design of superelevation and its provisions, minimum radius of horizontal curves, widening of pavement, transition curves. iv. Gradients: different types, maximum, minimum, ruling and exceptional, grade compensation in curves, vertical curves: design factors, comfort and	09

	sight distance. Summit curve, valley curve.	
03	**Traffic Engineering** Traffic volume study, spot speed study, traffic sign, traffic signals, intersection at grade, grade separate intersection.	03
04	**Pavement Design** i Types of pavements, different method of pavement design, comparison of flexible and rigid pavements, design wheel load, equivalent single wheel load, equivalent wheel load factor. ii Flexible pavement design: IRC approach, Burmister's layers theory, Triaxial method. iii Stress in Rigid Pavements, critical load position, wheel load stress, temperature stress, combine wheel load and temperature stress.	06
05	**Highway Construction:** i Construction of different types of roads: water bound macadam (WBM) road, different types of bituminous pavements, cement concrete pavement. ii Pavement failure: flexible pavement failure, rigid pavement failure, maintenance of different types of pavements. iii Strengthening of existing pavement: objective of strengthening, design of overlay using Benkelman beam method. iv Highway drainage, necessity, surface drainage, subsurface drainage.	05

Recommended Books:

1. Yoder, E. J., John (1975); **"Principles of Pavement Design"** Wiley & Sons, Inc., New York. ISBN -13: 9780471977803.
2. S. K. Khanna, C. E. G. Justo & A. Veeraragavan (2014); **"Highway Engineering",** X^{th}Edition New Chand & Brothers, Roorkee.
3. Dr. L. R. Kadiyali and Dr. N. B. Lal (2005); **"Principles and Practices of Highway Engineering",** Khanna Publication, New Delhi. ISBN-13: 9788174091659. 835p.
4. **Guide lines for the Design of Flexible Pavements**, IRC:37 -2001, IRC:37-2012,
5. **Guide lines for the Design of Rigid Pavements**, IRC:58:2002.
6. **Guide lines for Strengthening of Flexible Road Pavements using Benkelman Beam Deflection Technique.** IRC:81:1997.
7. Concrete Roads: HMSO, Road Research Laboratory, London

PC-BTC505- Foundation Engineering
(AY 2019-20)

Prerequisites: Soil Mechanics

Course Objectives:

1. Description of various earth pressure theories, design and analysis of stability of various types of earth retaining structures
2. Estimation of bearing capacity of shallow foundations by various theories.
3. Assessment of the need for pile foundations and determination of their load carrying capacity.
4. Explanation of basic design principles of flexible retaining system, underground conduits and introduction to reinforced soil.

Course Outcomes:

At the end of the course the students shall be able to develop collaborative skills to work in a team/group and analytical skills to:

1. Based on the understanding of soil properties and characteristics and interpretation of borelogs studied in Geotechnical Engineering, the students will be able to predict soil behaviour under the application of loads and come up with appropriate solutions to foundation design queries.
2. The students will be able to design a suitable retaining structure.

Module No	**Details**	**Hours**
1	**Lateral earth pressure theories:** Applications of earth pressure theories. Rankine's earth pressure theory, active earth pressure and passive earth pressure for horizontal and inclined backfill for cohesionless and cohesive soils. Coulomb's wedge theory. Coulomb's active pressure in cohesionless soils, expression for active pressure, Coulomb's passive earth pressure. Self Study: Rebhann's construction for active pressure, Culmann's graphical solutions for active pressure.	07
2	**Rigid retaining structures:** Stability analysis of retaining walls, cantilever retaining walls, construction details, drainage and wall joints **Flexible Retaining Structures:** Introduction to sheet pile walls, earth pressure diagrams for cantilever sheet pile walls in granular and cohesive soils. Introduction to gabion walls and diaphram walls	07

	Reinforced earth walls: The mechanism of reinforced earth. Types of reinforcement. Applications.	
3	**Bearing capacity of shallow foundations:** Ultimate bearing capacity, gross, net and safe pressures, allowable bearing pressure. Modes of failure. Bearing capacity theory – Terzaghi and Meyerhof . General bearing capacity equation. Corrections for square and circular footings. Ultimate bearing capacity in case of local shear failure. IS 6403 recommendations. Plate load test in detail with reference to IS 1888 and its applications and estimation of settlements. **Self Study: Bearing capacity under eccentric loads**	10
4	**Axially loaded pile foundations:** Introduction. Necessity of pile foundations. Classification of piles. Pile capacity based on static analysis. Dynamic methods and their limitations. Pile load test as per IS 2911 specifications, negative skin friction. Pile groups, ultimate capacity of groups, settlement of pile groups in sand and in clays as per IS 2911 and critical depth method.	08
5	**Underground conduits:** Classes of underground conduits, load on a ditch conduit, settlement ratio, ditch condition and projection condition, imperfect ditch conduit. **Open cuts:** Apparent earth pressure diagrams, average earth pressure diagrams in cohesive and cohesionless soils, estimation of strut loads in braced cuts	03
6	**Other foundation systems:** Introduction to caissons, raft foundations and piled-raft foundations	01

Recommended Books:

1. Alam Singh (2012); “Soil Engineering in Theory and Practice (Vol. -1)”, CBS Publishers & Distributors, New Delhi. ISBN-13: 979-8123902769. 325p.
2. V. N. S. Murthy (2002) “Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering”, CRC Press. ISBN13: 9780824708733. 1056p.
3. Winterkorn and Fang (1975) “Foundation Engineering Handbook” Van Nostrand Reinhold, ISBN: 9780442295646 751 p.
4. Tomlinson and Woodward (2014) “Pile Design and Construction Practice” CRC Press ISBN: 9781466592636. 608p.
5. Relevant Indian Standard Specifications & Codes, BIS Publications, New Delhi
6. BS:8006 – 2010 - Code of practice for strengthened/reinforced soils and other fills

PC-BTC506– Environmental Engineering-II

(AY 2019-20)

Prerequisites: PC-BTC407

Course Objectives:

The students will learn to –

1. Understant the physical, chemical and biological properties of sewage
2. Develop a flow Content for sewage treatment and design its units
3. Develop a flow Content for wastewater treatment including primary, secondary and tertiary unit

Course Outcomes:

The students will be able to

1. Analyze wastewater quality with respect to its pollution parameters
2. Design hydraulic elements of a sewerage system
3. Understand role of biology in wastewater treatment
4. Design wastewater treatment plant including preliminary, primary, secondary and Tertiary treatment.

Course Content

Module No.	Topics	No of Lectures
1	Sewage: Conveyance and pumping i. Conveyance of Sewage: Sewers- shapes and materials of sewers, sanitary, storm and combined sewers, capacities and designs, appurtenances, maintenance of sewers. ii. Sewage pumping: Consideration of the selection of pump and location of pumping stations. iii. Wastewater generation per person iv. Exposure to EPANET, the piping network free software.	05
2	Sewage: Characterization and disposal i. Characteristics of sewage: Composition, chemistry of sanitary sewage including all parameters including types of nitrogen, aerobic and anaerobic decomposition. ii. Sewage Disposal: discharge of raw and treated sewage on land and water, standards for disposal, raw and treated sewage on land and water, limits of dilution, Standards for disposal and reuse; MoEF standards iii. Self purification of streams: oxygen economy, sewage farming.	02
3	Sewage treatment: Basic flow sheets and Unit Operations	02

	Aims, methods of treatments and various flow-sheets for preliminary, primary, secondary and, tertiary treatment, screens, grit chambers, primary and secondary clarifiers, disposal of screenings and grit.	
4	Biological treatment methods, principles, trickling filter operation, recirculation, activated sludge process and its modifications, hydraulic design of trickling filter and activated sludge process, sludge volume index, operational problems in activated sludge process , trickling filters, stabilization ponds, Aerated lagoons, rotating biological contactors Sludge digestion: Principles of aerobic and anaerobic digestion, quantity and characterization of sludge, thickening, stabilization, dewatering, disposal Rural and Low cost sanitation: Septic tanks and Imhoff tanks – principles, operation and suitability, design values, disposal of treated effluent New technologies such as UASB, MBR, MBBR, SBR, FMBR, Natural Wetland system, microbial fuel cell, energy recovery, Advanced Oxidation Processes Selection of technology depending on area, technology, investment cost, maintenance	13
5	Wastewater Reuse Advanced wastewater technology, Potable and non potable reuse (Flushing, irrigation, construction, industry) Case studies in India and outside India related to wastewater reuse	02

Theory Examination:-

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

Recommended Books:-

1. E.W.Steel (1947); “Water Supply & Sewage”, McGraw Hill, New York. ASIN: B001SL037A
2. T.J.McGhee (1991); “Water Supply & Sewage” McGraw Hill, New York. ISBN-13-9780071008235. 602p.
3. Dr. P.N.Modi (2008); “Sewage Treatment & Disposal & waste water engineering” Standard Book House. ISBN 13 9788190089326. 988p.
4. Garg S. K (2008); “Sewage Disposal & Air Pollution Engineering”. Khanna Publication. ISBN 13 978-8174092304. 200p

5. Nathanson J.A (2014) "Basic Environmental Technology: Water Supply, Waste Management and Pollution Control". Prentice Hall. ISBN-13: 978-0132840149. 456p.
6. J.W. Clark, W.Veisman, M.J.Hammer (2008); "Water Supply and Pollution Control" Prentice Hall. ISBN-13: 978-0132337175. 864p.
7. Gilbert Masters (2013); "Introduction to Environmental Engineering and Science" Pearson Education. ISBN 13 9781292025759. 700p.
8. Manual on Water Supply and Treatment, (latest Ed.): Ministry of & Housing. New Delhi
9. Relevant Indian Standard Specifications, BIS Publications
   CPHEEO Manual on Water Supply & Treatment

HSM-BTC507– Organizational Communication and Interpersonal Skills

(AY 2019-20)

Prerequisites: HSM-BT107

Course Objectives:

1. To enhance effective corporate communication through professional writing
2. To prepare students for successful career that meets the corporate, industrial and global requirement.
3. To enable students to communicate in professional environment and social context with knowledge of professional etiquette, and understand social responsibilities with multi- disciplinary approach, in all tasks of life.
4. To discern and develop effective organizational writing.
5. To inculcate in students professional and ethical attitude at the workplace and develop an ability to imbibe effective interpersonal skills.

Course Outcome statements and Module –wise mapping

1. Develop professional communication using precise language and formats and apply the traits of a suitable candidate for a job/ higher education, through training and participation in group discussions, facing interviews and writing resume/ SOP
2. Demonstrate awareness of corporate etiquette and knowledge of professional responsibilities
3. Design technical documents using precise and objective language, apt for organizational communication
4. Deliver formal presentations effectively and develop life skills/ interpersonal skills to progress professionally by building stronger relationships in the society

Real Life Application Mapping with the Course

1. Communication Skills are critical career skills as well as life skills. A student can learn to be a responsible communicator, especially in the professional context.
2. The student will inculcate effective Reading and Writing skills, Speaking and Listening Skills. He or she will be equipped to express ideas in an effective manner and will learn interpersonal skills.
3. The student can use (fiction and non-fiction), magazines, videos, online articles to gain exposure to current affairs and corporate communication
4. Knowledge of good writing skills can help in the verbal section in aptitude tests, GRE, GMAT, CAT, TOEFL
5. In real life situations, students can learn to effectively communicate in various social and professional situations, and develop new perspectives. He or she can learn to participate and contribute to technical and non-technical discussions

Course Content:

Module No.	Details	Hrs.
01	**Business writing:** • Types of meetings, Notice, Agenda, Minutes of the meetings, Strategies for conducting effective meetings. • Email writing: (Netiquette)	04
02	**Employment Skills:** • Group Discussion • SWOT Analysis • Resume Writing / Curriculum Vitae • Interview Skills • Statement of Purpose	09
03	**Introduction to Corporate Etiquette and Core Values:** • Etiquettes and rules of behavior • Professional Conduct, • Etiquette in Meetings • Dining Etiquettes. • Core Values of an organization	03
04	**Report writing:** • Objectives of report writing, • Language and style in a report, • Types of reports. • **Formats of reports:** Memo, Letter, and Project report Survey based. ***(A Computer- aided presentation of the Project report)*** **Proposal Writing:** • Format and style. Technical Proposals: • Objectives of technical proposals, • Parts of proposals.	08
05	**Interpersonal Communication and Soft Skills:** • Creating and delivering effective presentations • Working and communication in teams • Leadership skills • Time management • Conflict resolution and negotiation skills	06

Text Books :

1. Lesiker and Petit, " Report Writing for Business" , Report Writing for Business, Edition10, Module Nos.1
2. Huckin and Olsen, "Technical Writing for Professional Communication",Mc Graw Hill,

Edition 2 , Module Nos.1, 2
3. Wallace and Masters," Personal development for Life and Work", Thomson Learning, Edition 12, Modules Nos. 3,4,5,6.
4. Herta Murphy," Effective Business Communication", Mc Graw Hill,Edition 7, ModuleNos.1,2,3,4,6.
5. Fred Luthans," Organizational Behaviour", Mc Graw Hill,Edition 12, Module Nos. 3,5.
6. R.C. Sharma and Krishna Mohan," Business Correspondence and Report Writing", Tata McGraw Hill, Edition 2, Module Nos.1,2,4,6.
7. Dr. K.Alex," Soft skills", S. Chand and company, Editon 3, Module Nos.3,5,6.
8. R.Subramaniam," Professional Ethics", OUP , module nos.5.
9. Robbins Stephens," Organizational Behaviour", Pearson Education, Eiditon 12, Module Nos.3.

Sr. No	Text Book Titles	Author/s	Publisher	Edition	Module Nos.
1	Report Writing for Business	Lesiker and Petit	Mc Graw Hill	10	1
2	Technical Writing for Professional Communication	Huckin and Olsen	Mc Graw Hill	2	1, 2
3	Personal development for Life and Work	Wallace and Masters	Thomson Learning	12	3,4,5,6
4	Effective Business Communication	Herta Murphy	Mc Graw Hill	7	1,2,3, 4,6
5	Organizational Behaviour	Fred Luthans	Mc Graw Hill	12	3,5
6					
7	Business Correspondence and Report Writing	R.C. Sharma and Krishna Mohan	Tata McGraw Hill	2	1,2,4,6
8	Soft skills	Dr. K.Alex	S. Chand and company	3	3,5,6
9	Professional Ethics	R.Subramaniam	OUP		5
10	Organizational Behaviour	Robbins Stephens	Pearson Education	12	3

- **List of Reference Books (R – Symbol for Reference Books) to be Referred by Students**

Sr. No	Reference Book Titles	Author/s	Publisher	Edition	Module Nos.
1	How to Speak Fluently	Jones	Indian Publishing House	1st	6
2	Speaking English Effectively	Krishna Mohan N.P. Singh	Macmillan	2nd	6
3	"Business Communication - Concepts Cases and Applications"	Chaturvedi and Chaturdevi	Pearson	2nd	5
4	"Communication Skills for Engineers"	Sunita Mishra and C. Murlikrishna	Pearson	1st	6
5	Business Communication- "Building Critical Skills"	Kitty O Locker	McGraw Hill	3rd	3, 4
6	"Body Language",	Alan Pease	Manjul Publications	18th	3, 4,6
7	"The Craft of Business Letter Writing"	Monipally	Tata McGraw Hill	1st	6
8	Soft Skills and Professional Communication	Francis Peter	Tata McGraw Hill	1st	3, 6
9	50 ways to improve your Business English	Ken Taylor	Summertown Publishing	1st	1, 5
10	50 ways to improve your Presentation Skills in English	Bob Dignen	Summertown Publishing	1st	6

- **List of E - Books (E – Symbol for E-Books) to be Referred by Students**

Sr. No	E- Book Titles	Author/s	Publisher	Edition	Module Nos.
1	Business Communication Today	Courtland L Bovee	Pretince Hall	--	3, 5, 6
2	Excellence in Business Communication	John Thill	Pretince Hall	6	4,
3	Business Communication: Building Critical Skills	Kitty O Locker	Mc Graw Hill	--	3

PC-BTC551– Highway Engineering (Lab)

(AY 2019-20)

Prerequisites: PC-BTC504

Course Objectives:

1. To understand theLaboratory procedure for computing various properties pavement layer materials.

Course Outcomes:

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

1. Understand the suitability of aggregate to be used for construction of Different layers of Pavements.

2. Understand the suitability of binding material to be used for construction of BM and BC layer of flexible Pavements

List of Experiments: - (At least six to be performed)

1. Impact test on aggregates
2. Abrasion test on aggregates
3. Crushing test on aggregates
4. Shape test on aggregates
5. Penetration test on bitumen
6. Ductility test on bitumen
7. Softening point test on bitumen
8. Viscosity test on bitumen

Recommended Books:

1. Yoder, E. J., John (1975); "Principles of Pavement Design" Wiley & Sons, Inc., New York. ISBN -13: 9780471977803. 711p.

2. Khanna & Justo (1971); "Highway Engineering", New Chand & Brothers, Roorkee.678p.

3. Dr. L. R. Kadiyali and Dr. N. B. Lal (2005); "Principles and Practices of Highway Engineering", Khanna Publication, New Delhi. ISBN-13: 9788174091659. 835p.

4. Guide lines for the Design of Flexible Pavements, IRC:37 -2001, IRC:37-2012

VAC –BTC 572– Introduction to Offshore Engineering

(AY 2019-20)

Prerequisites:

Course Objectives:

The objective of this course to make Civil and Mechanical Engineering students familiar with Offshore constructions.

Course Outcomes:

At the end of this course the students will be able to understand **introduction of Offshore Engineering**

Course Content:

1. Offshore environment
2. Types of offshore structures
3. Wave theories - linear and nonlinear
4. Wave induced forces - on fixed and floating structures; □
   Stability of floating structures;
5. Submarine pipelines;
6. Offshore construction - installation, repairs, maintenance and operation.

References:

1. C.A. Brebbla and S. Walker, Dynamic analysis of Offshore Structures, Newnes Butterworth, London, 1979.
2. T. Sarapkaya and M. Isaacson, Mechanics of Wave Forces on Offshore Structures, Van Nostrand Reinhold, New York, 1981.
3. B.C. Gerwick, Offshore Construction, Buttersworth, 2000. S. Narasimhan, S Kathiroli and T Nagendrakumar, Harbor and Coastal Engineering, National Institute of Ocean Technology, Chennai, 2001.
4. Prof. M.C. Deo: Waves and Structures: https://www.civil.iitb.ac.in/~mcdeo/waves.html
5. SUBRATA K. CHAKRABARTI http://dl.kashti.ir/ENBOOKS/offshore%20engineering-2.pdf

VAC –BTC 573– Legal Aspects in Projects

(AY 2019-20)

Prerequisites:

Course Objective:

1. To describe fundamentals of common law
2. To discuss the concept of bid cycle
3. To explain Indian contract act
4. To identify the concept contract administration
5. To summarize students with Laws applicable to construction activity
6. To interpret various acts in connection with construction activities
7. To summarize FIDIC contracts

Course Outcome:

Students will be able to

1. Use of law in general
2. Practice tendering process
3. Utilize Indian contract act and its provision with respect to construction
4. Implement contract administration
5. Use labor laws on construction site
6. Relate acts applicable to construction
7. Use International contract provisions

Course content

Module	Topics	No.of Lectures
1	Law and common man	04
2	Construction through contracts ;Types, critical comparison, bid cycle, tender and contract documents, contract conditions, study of contract documents of State PWD and CPWD	06
3	Indian Contract Act; Need, provisions, scope for modifications /	06
4	Contract administration Deviations and extras, claims and their management, disputes and dispute resolution methods, Arbitration and Conciliation Act.	06
5	Laws applicable to construction activity need and broad provisions of : Industrial Disputes Act, Workmen's Compensation Act ,	06
6	Employer's Liability Act, Payment of wages Act, Contract Labour Act,	06

	Minimum Wages Act, Inter-state Migrant workmen act, BOCW Act and other acts introduced from time to time	
7	FIDIC contracts; Contract administration;	06

Term work:-

Assignments consisting of minimum twenty problems covering entire syllabus shall be submitted as term work.

Recommended Books:-

1. Bajirao Shankarrao Patil (1986); "Legal Aspects of Building & Engineering Contracts" S.B. Patil. 471p.
2. G. T. Gajria, Kishore Gajria (2000); "Law Relating To Building & Engineering Contracts In India", Lexisnexis Butterworths India. ISBN 13: 9788187162162. 538p.
3. P. C. Markanda, Naresh Markanda (2013); "Law Related To Arbitration and Conciliation" Lexisnexis Butterworths India. ISBN 13: 9788180388132. 1570p.
4. Edward R. Fisk, Wayne D. Reynolds (2013); "Construction Project Administration" Pearson Education. ISBN 13: 9780133149258. 432p.
5. Indian Contract Act 1872
6. Arbitration Conciliation Act 1996.4. All Referred Bare Acts
7. CPWD Manual Volume I & II, A Handbook For Government Officials And Contractors

VAC –BTC 574– Computational Techniques

(AY 2019-20)

Prerequisites:

Course Objectives:

1. To Describe Different methods of statistics.
2. To explain the knowledge of probability theory and application in construction Industry.
3. To identify about different methods of data collections and its analysis.
4. To outline the importance of Hypothesis testing and its application in Civil Engineering.
5. To Discuss Application of ANOVA.
6. To explain the application of linear programming problem and transportation problem in construction industry.

Course Outcome:

Students will be able to:

1. Practice different methods of statistics and its applications, different methods of data collection and presentation.
2. Carry out application of Binomial Distribution, Poissons distribution in civil engineering projects.
3. Implement the concept of linear Programming Problem and Transportation Problem in getting the optimum solution for civil engineering problem.
4. Test hypothesis, significance level, type – I and type – II error in hypothesis.

Course content:

Sr.No.	Description	Hrs
1	**Review of basic statistics and probability**	**06**
2	**Probability Distributions:** Theoretical, binomial, poisson, normal, exponential, hypergeometric, uniform	**06**
3	**Sampling and Sampling Distributions:** Probability and non-probability samples, sampling and non-sampling errors, sample size, sampling distributions : t, F and χ^2 distributions	**06**
4	**Hypothesis Testing:** Type I and II error, testing of mean, proportion, tests for equality of mean and variances of two populations, confidence interval, χ^2 test for goodness of fit, ANOVA (one way classification), Non parametric tests : sign test, U test	**06**
5	**Correlation and Regression:** Karl Pearson's and Rank Correlation coefficient, simple linear regression: least squares method. **Simulation:** Random number generation. Monte Carlo Applications	**06**
6	**Management Decision Making:** System approach, decision making under uncertainty and risk: decision tables and decision tree	**06**
7	**Linear Programming:** Graphical solution, simplex method, dual, sensitivity analysis, transportation and assignment problems	**06**

Recommended Books:

1. Shrivastava, Shenoy& Sharma (1989); "Quantitative Techniques for Managerial Decisions" New Age International. ISBN-13: 9788122401899. 941p.
2. Kothari C R (2004); "Research Methodology: Methods and Techniques", New Age International. ISBN-13: 978-8122415223. 401p.
3. Goode W J &Hatt P K (2006) "Methods in Social Research" Surjeet Publication.

SEM -VI

AY-19-20

PC-BTC601– Construction Engineering & Management

(AY 2019-20)

Prerequisites:

Course Objectives:

The main objectives of the course are

1.To describe the unique features of constructions
2. To understand basics of construction Equipment and methods
3. To summarize the students about various techniques of construction planning, resource scheduling, project monitoring quality control and safety of personnel involved

Course Outcomes:

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

1. An idea of how structures are built and projects are developed on the field as well as modern construction practices.
2. A basic ability to plan, control and monitor construction projects with respect to time and cost
3.An idea of how to optimise construction projects based on costs
4. An idea how construction projects are administered with respect to contract structures and issues.

Course Content

Module No	Details	Hrs
1	*Basics of* Construction- Unique features of construction, construction projects types and features, phases of a project, agencies involved and their methods of execution; Construction Equipment basics*:* Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities	4
2	Construction project planning- Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data;	4

	Techniques of planning- Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion.	
3	Planning and organizing construction site and resources- Site: site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing, motivation; Materials: concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing; Funds: cash flow, sources of funds; Histograms and S-Curves. Earned Value; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and leveling. Common Good Practices in Construction	4
4	*Project Monitoring & Control*- Supervision, record keeping, periodic progress reports, periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost overruns and corrective measures. Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modelling (BIM) in project management; Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health.	4
5	*Contracts Management basics:* Importance of contracts; Types of Contracts, parties to a contract; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price. Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Dispute Resolution methods.	4
6	*Construction Costs: Make-up of construction costs;* Classification of costs, time cost trade-off in construction projects, compression and decompression.	4

Recommended Books:-

1.Varghese, P.C., "*Building Construction"*, Prentice Hall India, 2007.
2. *National Building Code*, Bureau of Indian Standards, New Delhi, 2017.
3. Chudley, R., *Construction Technology*, ELBS Publishers, 2007.
4. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011
5. Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006
6. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015
7. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016.
8. Barrie D.S. & Paulson B C (2013); "Professional Construction Management" McGraw Hill Education (India) Private Limited. ISBN-13: 978-1259098420. 672p.
9. Chitkara K K (2010); "Construction Project Management" McGraw Hill Education (India) Private Limited. ISBN-13: 978-0070680753. 772p.
10. P K Joy (1991); "Handbook of Construction Management", Macmillan, India. ISBN-13- 9780333926932. 484p
11.. King & Hudson (1985); "Construction Hazard and Safety Handbook", Butterworths. ISBN-13: 978-0408013475. 477p.
12. Antill J M & Woodhead R W, (1990); "Critical Path Methods in Construction Practice:" John Wiley & Sons. ISBN-13: 978-0471620570. 448p
13. S.Seetaraman (2000); "Construction Engineering and Management". Umesh pub. ISBN-13 9788188114061. 487p
14. L.S.Shreenath (2001); "CPM and PERT" Affiliated East-West Press (Pvt.) Ltd. ISBN-13: 978-8185336206
15. Dr.B.C.Punmia (2010); "CPM and PERT" Motilal UK Books of India. ISBN-13: 978-8131806982. 250p.
16. Indian Contract act.
17 Various labour laws

Term work:-

At least 10 assignments covering the entire syllabus shall be submitted as term work.

PC-BTC602- Design of Steel Structures

(AY 2019-20)

Prerequisites: PC-BTC402,ES-BTC302 ,PC-BTC501

Course Objectives:

1. To introduce behavior and design of simple steel structures according to limit state design concept.
2. To have the basic knowledge about the design and failure mode of steel structural members.

Course Outcome:

At the end of the course the students shall be able to develop collaborative skills to work in a team/group and design skills to:

1. Design simple structural elements using IS-800-2007:Tension members,Compression members,Flexural members,Slab base ,Bolted and Welded connections
2. Design simple structural systems using IS-800-2007 & IS-875-2015:Truss (subjected to wind load) & G+3 steel building

Module No	Details	Hrs
1	Introduction to types of steel, mechanical properties of steel, advantages of steel as structural material, design philosophies of Working Stress Method (WSM) and Limit State Method (LSM) Limit state method, limit state of strength and serviceability (deflection, vibration, durability, fatigue, fire), characteristics and design loads, Classification of cross section- plastic, compact, semi-compact and slender, limiting width to thickness ratio. Introduction to bolted and welded connections by LSM,	06
2	Design of tension members with welded / bolted end connections using single and double angle sections by LSM, design strength due to- yielding of gross section, rupture of critical section and block shear.	07
3	Design of compression members with welded / bolted end connections using single and double angle by LSM, design strength, effective length of compression members. Design of columns with single sections, bolted and welded connections using LSM, column buckling curves, effective length, slenderness ratio, limiting values of effective slenderness ratio, buckling class of various cross sections.	07

4	Design of slab base using bolted and welded connection by LSM, Effective area of a base plate.	03
5	Design of members subjected to bending by LSM, design strength in bending, of laterally supported beams. Design for shear, web buckling and web crippling & serviceability check	05

Text Books:-

1. DrRamachandra (2010), "Design Of Steel Structures Vol. II", Scientific Publishers-Jodhpur, ISBN 8172336446
2. N. Subramanian (2008), "Design Of Steel Structures", Oxford, ISBN 0195676815, 864 pages
3. PasalaDayaratnam (2014), "Design Of Steel Structures",S. Chand Publishing, ISBN 8121923204, 868 pages
4. S. S. Bhavikatti (2009), " Design of Steel Structures by Limit state mrthod as per IS 800:2007", I K International Pvt. Ltd, 414 pages
5. Duggal S K (2010), "Limit State Design of Steel Structures", Tata McGrwaHill
6. Shiyekar M R (2010), "Limit State Design of Steel Structures", PHI Learning
7. SaiRam K S (2010), " Design of Steel Structures", PHI Learning

Reference Books:-

1. Anand S. Arya, J.L. Ajmani (1977), "Design of Steel Structures", Nem Chand & Bros., India, ISBN 0861861671, 888 pages
2. B. C. Punmia, Ashok Kumar Jain (2006), "Comprehensive Design of Steel Structures", Laxmi Publications, ISBN 8170080932, 1156 pages
3. Edwin H. Gaylord, Charles N. Gaylord, James E. Stallmeyer (1991), "Design Of Steel Structures", Tata McGraw-Hill, ISBN 0070230544, 792 pages
4. T. J. Mac Ginley (1998), "Design Of Steel Structures", Spon Press ISBN 0419179305, 496 pages
5. William T. Segui (1996), "LRFD Steel Design", PWS Pub Co., ISBN 0534954782, 563 pages
6. James K. Nelson Jr.,Jack C. McCormac (2002), "Structural Steel Design: LRFD Method", Prentice Hall, ISBN 0130479594, 713 pages
7. Charles G. Salmon, John E. Johnson, Faris A. Malhas (2008), "Steel Structures: Design and Behavior", Prentice Hall, ISBN 0131885561, 888 pages
8. Satinder Singh, IcSyal (2007), "Design Of Steel Structures", Standard Publishers Distributors, ISBN 8186308646, 780 page

PE-BTC 621 –Analysis of Indeterminate Structures

(AY 2019-20)

Prerequisites: ES-BTC 302, ES-BTC 351, PC-BTC 402, PC-BTC 501

Course Objectives:

The main objectives of the course are

1. To introduce the students to the methods of analysis of indeterminate structures.
2. To introduce the students to the plastic analysis of steel structures.
3. To prepare the base for the students to study other advanced structural engineering courses at a later stage.

Course Outcomes:

At the end of the course the students shall be able to develop collaborative skills to work in a team/group and analytical skills to

1. Analyze indeterminate structures using force methods.
2. Analyze indeterminate structures using displacement methods.
3. Find shape factor, determine collapse load for beams using plastic analysis.

Module No	Details	Hrs
1	**Analysis of indeterminate structures by force method:** Application of flexibility method to simple pin jointed frames (including effect of lack of fit for members) with static indeterminacy up to 3, application to simple rigid jointed frames with static indeterminacy up to 3.	06
2	**Analysis of indeterminate structures by force method:** Theorem of three moments and its applications to indeterminate beams. Application of flexibility method to two hinged parabolic arches.	04
3	**Analysis of indeterminate structures by force method:** Analysis of indeterminate structures by the theorem of least work. Application of the theorem to indeterminate beams, simple rigid jointed frames with static indeterminacy up to 3 and pin jointed frames with static indeterminacy up to 3.	04
4	**Slope deflection method:** Application of the method to simple rigid jointed frames.	05

	Application to simple rigid jointed frames with inclined member but having only one translational degree of freedom in addition to rotational degree of freedom.	
5	**Moment distribution method:** Application of the method to indeterminate beams including the effect of settlement of supports and simple rigid jointed frames without and with sway.	07
6	**Analysis of indeterminate structures by stiffness method:** Stiffness coefficients for prismatic members and their use for formulation of equilibrium equations, direct stiffness method, Application of the above methods to indeterminate beams including the effect of settlement of supports and simple rigid jointed frames with kinematic indeterminacy up to 3.	07
7	**Introduction to plastic analysis of steel structures:** Behavior of ductile material. Idealized stress strain diagram for plastic analysis. Concept of plastic theory of bending, plastic hinge and plastic moment carrying capacity, shape factor, lower bound, upper bound and uniqueness theorems. Determination of collapse load for single and multiple span beams.	05

Term work:-

At least 20 (twenty) solved problems based on the above syllabus as per the module weightage shall be submitted as term work.

Text Books:

1. Reddy C.S.(1999), "Basic Structural Analysis", Tata McGraw hill, ISBN 0070702764, 779 pages.
2. Junnarkar S.B. (2013), "Structural Analysis, Vol. II" Charotar Publishers ISBN 9380358703, 986 pages.
3. Pandit and Gupta (1999), "Structural Analysis Vol. I", Tata McGraw Hill, ISBN 0074634933, 679 pages.
4. L. S. Negi, and R. S. Jangid (1997), "Theory and Problems in Structural Analysis ",Tata McGraw - Hill Education, ISBN 0074623044, 828 pages.
5. ISBN 0138534080, 352 pages.
6. Baker &Heyman (1980), "Plastic Design of Steel frames", Cambridge University Press, ISBN 0521297788, 238 pages.

Reference Books:

1. G. Pandit and S. Gupta (2008), "Matrix Method in Structural Analysis", Tata McGraw hill, ISBN 0070667358, 612 pages.
2. Dr. B.N. Thadani And Dr. J. P.Desai (1964), "Modern Methods in Structural Analysis", Asia Publishing House.
3. C. K. Wang (2014), "Intermediate Structural Analysis", Tata McGraw Hill, ISBN 0070702497, 805 pages.
4. James M. Gere, William Weaver (1990), "Matrix Analysis of Framed Structures", Springer US, ISBN 0442234856, 547 pages.
5. D.S. Prakash Rao (1996),"Structural Analysis: A Unified Approach", Orient Blackswan ISBN 8173710279, 672 pages.
6. Dr. A. S. Meghre, and S. K. Deshmukh (2003), "Matrix Methods of Structural Analysis", Charotar Publishing House, ISBN 8185594088, 552 pages.

PE-BTC 631 – Hydraulic Structures & Irrigation Engineering

(AY 2019-20)

Prerequisites:

Course Objectives:

The main objectives of the course are

1. To understand design principles of hydraulic structures for irrigation purpose.
2. To Know about the basics of design of canals, weir, barrage and appurtenance works
3. To provide knowledge on various hydraulic structures such as energy dissipaters, head and cross regulators, canal falls and structures involved in cross drainage works

Course Outcomes:

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

1. Estimate the crop water requirement, design of unlined and lined canals, falls and regulators.
2. To design barrage, cross drainage works

Module No	Details	Hrs.
1	Design principles for gravity and earthen dams. Key issues in designing irrigation channels and hydraulic structures used in irrigation systems	4
2	Estimation of crop water requirement; Design of lined and unlined channels; Analysis for surface and sub-surface flow at hydraulic structures;	4
3	Site selection and investigations for diversion works; Hydraulics of flow over weirs/under sluices; Components of barrage- waterway, under sluice/weir, glacis, stilling basin and appurtenance works, cutoff, u/s and d/s protection works, Bligh's creep theory, Khosla's Theory,	6
4	Design of canal falls, regulators.	6
5	Cross drainage works: Types of cross drainage works. Design aspects of aqueducts, siphon aqueducts, super-passage, siphon.	6
6	Instrumentation and maintenance aspects in earth and gravity dams: Measurements of deformations, pore pressures; Quality control; Foundation preparation and treatment; Quality control of materials and control of moisture, laying and compaction; Tests for quality control; Diversion during construction Deterioration of concrete in dams and remedial measures.	6
7	Discussion on various case studies in Hydraulic structures and Irrigation engineering	4

Term work:-

At least 10 assignments covering the entire syllabus shall be submitted as term work

Recommended Books:-

1. S. R. Sahasrabudhe (2011); "Irrigation Engineering and Hydraulic Structures" S. K.Kataria& Sons
2. S. K. Sharma; "Design of Irrigation Structures", S. Chand and Co. ISBN-13 –9788121903295
3. R. S. Varshney and R. C. Gupta (1988); "Theory and Design of Irrigation Structures: Canal and storage works" Nem Chand & Bros. ISBN-13 – 9788185240022

4. G.L.Asawa (2006); “Irrigation and Water Resources Engineering”, New Age International Publishers. ISBN-13 9788122416732. 624p
5. A. M.Michael,(2014); “Irrigation Theory and Practice” 2nd Edition, Vikas Publishing Pvt. Ltd

PE-BTC 632 – Introduction to Offshore Engineering

(AY 2019-20)

Prerequisites:

Course Objectives:
The objectives of this course are:

1. to understand the complexities in offshore construction and obtaining resources from the ocean.
2. to addresses the general engineering concepts that are fundamental to offshore engineering.
3. to understand types of sites and platform structures, key engineering systems and ocean environmental monitoring.

Course Outcomes:
At the end of this course students will be able:

1. to know various offshore construction methodologies
2. to addresses the general engineering concepts during construction stages.
3. to handle complexities and key engineering systems in ocean environment

Module No.	Content
1	**Introduction:** History and current state of the art of offshore structures, Definition of Offshore Structures, Met ocean Engineering: wind, wave and current loads on offshore structures
2	**Environment & Construction:** Offshore environment, Construction and launching, offshore project management,
3	**Ocean construction:** Types of Platforms: Jackets, TLPs, Semisubmersibles, Jack-ups, Concrete Gravity, deep water construction in ocean, offshore site investigations
4	**Offshore Pipelines:** Hydrostatic, hydrodynamic analysis and structural design
5	**Buoys and Mooring systems**: mooring configurations, advantages and disadvantages
6	**Design criteria:** Introduction to probabilistic design, extreme load & strength & fatigue, basics of anchoring and mooring system, riser system, Scaling laws & Model testing, **Challenges in Deepwater testing:** deepwater installations, constructions challenges.

Reference:

1. Subrata K. Chakrabarti (2005): Handbook of offshore engineering Volume–I & II, Elsevier, The Boulevard Langford Lane, Kidlington, Oxford OX5 l GB, UK.
2. Deo M C (2013): Waves and Structures, http://www.civil.iitb.ac.in/~mcdeo/waves.html
3. American Petroleum Institute, Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms - Load and Resistance Factor Design, 1st Edition, 1993. (TP690.A642 RP2A-LRFD)
4. American Petroleum Institute, Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms - Working Stress Design, 21st ed., 2000. (TP690.A642 RP2A-WSD).

PE-BTC 641 –:- Special Construction Materials & Methods

(AY 2019-20)

Prerequisites:

Course Objectives:

The main objectives of the course are

1. 1.To describe the unique materials used in constructions
2. To understand the need and basics of constructions chemicals.
3. To summarize the students about various techniques of sub structure and super structure construction

Course Outcomes:

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

1. An idea of how structures are built with Eco friendly Construction Materials/ Green Construction materials/ unique materials
2. An idea about sub structure and super structure construction in special situations

Course Content

Module No	Details	Hrs
1	Design, production, application, specification, and quality control of construction materials unique to civil engineering. Eco friendly Construction Materials/ Green Construction materials	3
2	**Materials used in construction Especially for masonry work and concrete work**, such as Lightweight Autoclaved Aerated Concrete Blocks, Geopolymer bricks, slag sand, Rebaring materials, Predefined Concrete solutions such as Concrete Cover/spacers blocks.	4
3	**Construction Chemicals**: in Concrete, water proofing, tiling:Admixtures & Surface Treatments,Grouts and anchors,Industrial Flooring,Concrete repairs and crack filling,Protective Coating,Joint sealants,Water proofing and adhesives,Cement additives	4

4	Reflective coating materials, thermal Insulation materials, Fire proof insulation materials, Earthquake resistant Materials and materials used in special requirements of construction, Ferro cement Plumbing material Precast concrete construction methods/Pre Engineered Building: Recycling of Construction and Demolition wastes, Use of plastics in Construction 3D printing	6
5	Basics of construction methods for Bridges; Identification of cutting edge sustainable construction materials, technologies, and project management strategies for use in the construction industry and evaluation of their potential to reduce the negative environmental impacts of construction activity.	5
6	Sub Structure Construction- Techniques of Box jacking – Pipe Jacking -under water construction of diaphragm walls and basement-Tunnelling techniques – Piling techniques - well and caisson - sinking cofferdam - cable anchoring and grouting-driving diaphragm walls, sheet piles - shoring for deep cutting - well points -Dewatering and stand by Plant equipment for underground open excavation;	7
7	Super Structure Construction- Launching girders, bridge decks, off shore platforms – special forms for shells - techniques for heavy decks – in-situ pre-stressing in high rise structures, Material handling - erecting light weight components on tall structures - Support structure for heavy Equipment and conveyors - Erection of articulated structures, braced domes and space decks;	7

Recommended Books:

1. Dr. B.C. Punamia(2008); "Building Construction" Laxmi Publications (P) Ltd.ISBN-13: 978-8131804285. 666p.
2. S. S. Bhavekatti (2012); "Building Construction" VikasPulishing House Pvt Ltd. ISBN-13: 978-9325960794. 356p.
3. S. P. Arora and S. P. Bindra (2010); "Textbook of Building Construction", Dhanpat Rai & Sons publication, ISBN-13: 978-8189928803. 688p
4. Sushil Kumar (2010); "Building Construction" Standard Publishes-Distributors.ISBN-13: 978-8180141683. 796p.
5. Construction Technology: Analysis,and Choice, 2ed,Bryan, Wiley India
6. Construction Planning, Equipment and methods – Peurifoy-Tata McGraw Hill Publication
7. Construction Equipment Planning and Applications – Dr. Mahesh Varma
8. Brochures Published by various agencies associated with construction..
9. Journals such as CE & CR. Construction world, International Construction.
10. Document Reports of actual major works executed.
11. Construction Technology by Roy Chudley and Roger Greeno, Prentice Hall, 2005

PE-BTC 651 –: Solid and Hazardous Waste Management

(AY 2019-20)

Prerequisites:

Course Objectives:

The students will learn to –

1. Explain the various units in integrated solid waste management
2. Quantify and characterize the solid waste
3. Utilize solid waste as renewable energy
4. Deliberate and propose the kind of collection system to be used
5. Develop flowsheets based on various characterization of waste

Course Outcomes:

The students will be able to -

1. Develop flowsheets based on type of solid waste management
2. Evaluate Quantities of waste generated
3. Analyse the type of waste generated and its end use
4. Understand laws related solid waste management

Course Content

Module No	Topics	No of Lectures
1	Introduction- History, notifications related to Solid Waste; Hazardous Waste, Plastic Waste, E Waste, Construction and Demolition Waste Definition of solid waste Domestic: garbage, ashes, rubbish, dust, debris. Biodegradable, non biodegradable and inert (ruminant) waste. Commercial: wastes from offices, shops and markets etc. Hazardous waste: household, industrial. Biomedical waste Segregation at source	04

2	Sources, Quality and Quantity of solid wastes : Household wastes. Waste from commercial establishments, offices, markets Solid waste from construction activities. Hospital wastes, dead animals. Quantity, composition and properties of solid wastes : Per capita municipal solid waste(city wise – as per CPHEEO manual). Quantity of industrial solid waste per unit produced. Compositions: physical, chemical and biological constituents. Sampling and characterization of solid wastes.	08
3	Collection, segregation, storage and transportation of solid waste : How to do segregation at source: Household level, society level, community level House to house collection, collection centers: location, sizes, types and maintenance. Transportation methods: manual, mechanical, methods with or without compaction, economy in transportation of waste, optimization of transportation routes, Application of GIS	05
4	Disposal of solid waste : Segregation, reduction at source, recovery and recycle Disposal methods : pen dumping, sanitary land filling, composting- anaerobic and aerobic, windrow composting, in vessel composting, incineration, sea disposal, vermin-composting Scientific closure of open dumping site with case study Modern trends : Thermal, biological and chemical conversion technologies.; Disposal of other waste: Construction and demolition, E- Waste, biomedical, sanitary waste Case studies (Household level, society level, municipal level) Site visit to SWDF , (Ramky Taloja)	12
5	Management of specific types of waste Plastic waste, E Waste, Biomedical waste and construction and demolition waste Waste as resource Case studies	05
6	Introduction to hazardous waste: generation, minimization at source, treatment and disposal.	04
7	Effect of solid waste on environment: effects on air, soil, water surface and ground, health hazards Municipal solid waste in Indian conditions, legal aspects of solid waste disposal. Qualitative exposure: waste to energy	07

Term work:-

Each student shall prepare a report on any industrial / hazardous / municipal solid waste comprising source, characterization, transportation, recycles, treatment and disposal.

The report mentioned above, assignments shall be submitted as term work.

Recommended Books:-

1. Integrated Solid Waste Management: Techobanglous, Thisen and Vigil, McGraw Hill International.
2. Hazardous Waste Management: Lagrega, Buckingham and Evans, McGraw Hill International.
3. Solid Waste Management in Developing Countries: A.D. Bhide, Nagpur publications
4. Environmental Pollution Control Engineering: C.S. Rao, Wiley Eastern,
5. Manual of solid waste of management, CPHEEO

PE-BTC 652– Elective II: Air and Noise Pollution Control

(AY 2019-20)

Prerequisites:

Course Objectives:

The students will learn to –

1. Quantify Composition of air and quantification of gases and particulates
2. Understand effects of air and noise pollution
3. Design of control devices such as fabric filters, cyclones, electrostatic precipitators for air pollution
4. Mitigation measures for control of noise pollution

Course Outcomes:

The students will be able to

1. Understand nature and characteristics of air pollutants, noise pollution and basic concepts of air quality management
2. Identify, formulate and solve air and noise pollution problems
3. Design stacks and particulate air pollution control devices to meet applicable laws

Course Content

Module No	Topics	No. of Lectures
1	Air Pollution, Definition, Air Pollution and Global Climate, Units of measurements of pollutant, Air quality criteria, emission standards, National ambient air quality standards – Air pollution indices, Air quality management in India.	02
2	Sources and classification of air pollutants, Man made, Natural sources, Type of air pollutants, Pollution due to automobiles , Analysis of air pollutants , Chemical, Instrumental and biological methods. Principle and methods for analysis (online assessment of air pollutants) Air pollution and its effects on human beings, plants and animals, Economic effects of air pollution.	03
3	Meteorological aspects of air pollution Large scale wind circulation geotropic wind, gradient wind, cyclone, anticyclone, planetary boundary layer. Lapse rate, stability conditions, wind velocity profile, maximum mixing depth, topographic effects.	04
4	Plume patterns, plume dispersion, Gaussian model for predicting concentration, downwind from a single source, diffusion	05

	coefficients,.Methods and instruments for sampling and analysis of air for stack and ambient air monitoring. Assessment models such as AERMOD, CALINE, ISC Emission factors for different pollutants and its sources for doing Emission modeling; Emission from vehicular sources	
5	Control Devices Principles, operations and types, simple hoods and ducts. Settling chambers, cyclones, electrostatic precipitators (ESP), Filters, scrubbers, absorption towers and incinerators. Collection efficiencies for laminar and turbulent flows for settling chambers, particle cut size for cyclone, ESP Concept of frictional and overall efficiencies. Design criteria for filters, scrubbers, absorption towers and incinerators, Control of SOx, NOx New techniques to control particulate matters like filters, thermal oxidation; use of catalyst like $TiO_2$to control NOx, CO, VOCs; Design of household air purifiers	09
6	Sources of noise, Units and Measurements of Noise, Characterization of Noise from Construction, Mining, Transportation and Industrial Activities, Airport Noise, General Control Measures, Effects of noise pollution , auditory effects, non-auditory effects. Noise Menace, Prevention and Control of Noise Pollution, Control of noise at source, control of transmission, protection of exposed person, Control of other types of Noise Sound Absorbent Introduction to noise modeling software like SoundPlan, Caustik	07
7	Government of India: air and noise pollution laws. Indian standards-emission and air quality standards, noise standards Indian and International. Continuous Emission Monitoring Requirement Discussion of occupational hazard and Safety	04

Text Books:-

1. C. S. Rao, "Environmental Pollution Control Engineering", Wiley Eastern Limited, 2000.
2. M. N. Rao, H. V. N. Rao, Air pollution, Tata McGraw Hill Pvt Ltd, New Delhi, 1993
3. Dr. Y. Anjaneyulu, "Air Pollution and Control Technologies", Allied publishers Pvt. Ltd., 2002.

REFERENCES:

1. Noel De Nevers, "Air pollution control Engineering", McGraw Hill International Edition, McGraw Hill Inc, New Delhi, 2000.
2. Air Pollution act, India, 1981
3. Peterson and E.Gross Jr., "Hand Book of Noise Measurement", 5 th Edition, 1963
4. Mukherjee, "Environmental Pollution and Health Hazards", causes and effects, 1986
5. Antony Milne, "Noise Pollution: Impact and Counter Measures", David & Charles PLC, 1979.
6. Kenneth wark, Cecil F.Warner, "Air Pollution its Origin and Control", Harper and Row Publishers, New York, 1981.

PE-BTC 661 –: Pavement Subgrade and Materials

(AY 2019-20)

Prerequisites: PC-BTC307 ,PC-BTC403,Soil Mechanics

Course Objectives:

1. To describe the different layers of flexible and rigid pavement.
2. To explain the function of subgrade, properties of subgrade material and its determination.
3. To discuss the importance of drainage system, its design and ground improvement techniques.

Course Outcomes:

At the end of course students will be able

1. Identify the quality of material to be used in subgrades and other pavement layers and demonstrate laboratory and field test.
2. Utilize the knowledge gained for the analysis and design of surface and subsurface drainage system.
3. Appraise different ground improvement technique, use of different stabilizer like, lime, fly ash, fibres in highway subgrade.

Course Content

Module No.	Topics	No. of Lectures
1	Subgrade: Functions, Importance of subgrade soil properties on pavement performance, subgrade soil classification for highway engineering purpose soils as per PRA system, revised PRA system, Burmister system,Compaction system.	4
2	Grading requirements for aggregate, selection of bases and subbase material (including stabilized materials), selection of different grade of bitumen, types of bituminous surfaces, skid qualities, bituminous mix design, Marshall stability test, design aspect of paving concrete. Experimental characteristics of road aggregate.	6

3	Soil Survey: Soil Survey Procedure for Highway and Ground Water Investigation. Identification and Significance of soil Characteristics, effect of water in soil Swelling/shrinkage, cohesion, plasticity in soil. Soil Moisture movement-ground water, gravitational water, held water, soil suction.	4
4	Storm water Drainage: General principles subsoil Drainage. Compaction of soils, field and laboratory method of soil compaction, equipment's used in field compaction. Design of surface and subsurface drainage system, pumping system, water body, holding ponds.	6
5	Stress in soil: Theories of elastic and plastic behaviour of soils, Methods of reducing settlement, estimation of rate of settlement due to consolidation in foundation of road embankment,	4
6	Test on subgrade soils: Static and cyclic triaxial test on subgrade soils, resilient deformation, Resilient strain, resilient modulus. CBR test, effect of lateral confinement on CBR and E – value of Subgrade soil. Static and cyclic plate load test, estimation of modulus of subgrade reaction, correction for plate size, correction for worst moisture content.	6
7	Ground Improvement Technique: Different method of soil stabilization, use of geo-textile, geogrid and fibres, lime, fly ash in highway subgrade. Vertical sand drain: design criteria, construction and uses	6

Term work: -

At least 10 assignments covering entire syllabus shall be submitted as term work.

Text Books: -

1. Principles of Pavement Design, Second edition, 1975: Yoder, E. J., John Wiley & Sons, Inc., New York
2. Concrete Roads: HMSO, Road Research Laboratory, London.
3. Highway Engineering: Khanna & Justo, New Chand & Brothers, Roorkee.
4. Principles and Practices of Highway Engineering: Dr. L. R. Kadiyali and Dr. N. B. Lal, Khanna Publication, New Delhi.

PE-BTC 622 -Repairs and Rehabilitation of Structures

(AY 2018-19)

Prerequisites: ES-BTC302, PC-BTC402,PC-BTC501,PC-BTC503

Course Objective:

1. To understand need for repair and rehabilitation.
2. To develop clear understanding of concepts, and practical knowledge of modern Civil Engineering techniques.
3. To encourage students and faculty to interact with industry, alumni and other reputed institutes for purpose of better understanding of industry requirements and different materials used.
4. To deal with social, environmental and economic issues when applying various techniques..

Course Outcomes:

At the end of the course the student shall be able to develop collaborative skills to work in a team/group and technical skills to

1. Select and apply various repair techniques and appropriate materials as per the requirement of the problem.
2. Select and apply various structural strengthening techniques and appropriate materials.
3. Select and apply appropriate materials for repair and restoration of heritage structures.
4. Prepare protection & maintenance schedule against environmental distress.

Course Content:

Module No	Topics	No. of Lectures
1	Introduction: Need for strengthening due to various reasons such as ageing, natural calamities, increase of load, change of function and design, construction errors. Structural Audits- Proforma 'B'-MCGM.	03
2	Structural Strengthening: Strengthening and retrofitting of columns, beams, walls, footings and slabs, piers of concrete structures by jacketing, external post-tensioning, replacing or adding reinforcement, plate bonding, textile reinforced concrete	08
3	Specialized Repairs: Basics of Corrosion, Electro chemical repair using cathodic protection, impressed current cathodic protection (ICCP), re-alkalization and chloride extraction techniques, Specialized repairs for chemical disruption, fire, marine exposure etc, Repair of damaged structures of water retaining structures, hydraulic structures, Pavements and Runways, Tunnels, Bridges,	08

	Piers and Flyovers, Parking Garages, Underwater repair, Masonary Repair.	
4	Seismic Retrofitting: Seismic strengthening of existing RC structures, Use of FRP for retrofitting of damaged structures	05
5	Retrofitting by composite materials: Fiber reinforced concrete, Ultra-high performance fibre reinforced concrete (UHPFRC), Fiber reinforced composites, Carbon fibre reinforced polymer (CFRP), Fibre wrapping (Carbon, Aramide, Glass)	07
6	Post-Repair Maintenance of Structures: Protection & Maintenance schedule against environmental distress to all those structures	03
7	Repair and Restoration of Heritage Structures Study of Construction chemicals required for repair i.e. reinforcement coating, band coat, polymer modified mortar, microconcrete, protective coating.	02

Recommended Books:-

1. Concrete Repair and Maintenance: Peter H .Emmons and Gajanan M. Sabnis, Galgotia Publication.
2. Repairs and Rehabilitation-Compilation from Indian Concrete Journal-ACC Publication.
3. Guide to Concrete Repair and Protection, HB84-2006, A joint publication of Australia Concrete Repair Association, CSIRO and Standards Australia.
4. CPWD hand book on Repairs and Rehabilitation of RCC buildings published by DG(Works), CPWD, Government of India (NirmanBhawan), http://www.cpwd.gov.in/handbook.pdf
5. Guide to Concrete Repair, Glenn Smoak, US Department of the Interior Bureau of Reclamation, Technical Service Center , http://books.google.co.in
6. Management of Deteriorating Concrete Structures: George Somerville, Taylor and Francis Publication
7. Concrete Building Pathology: Susan Macdonald, Blackwell Publishing.
8. Testing of Concrete in Structures: John H. Bungey, Stephen G. Millard & Michael G. Grantham, Taylor & Francis Publication.
9. Durability of concrete and cement composites: C.L.Page& M.M. Page,Woodhead Publishing
10. Concrete Repair, Rehabilitation and Retrofitting: M. Alexander, H. D. Beushausen, F. Dehn& P. Moyo, Taylor & Francis Publication
11. Concrete Repair Manual, Volume I & II, Published jointly by ACI, BRE, Concrete Society, ICRI
12. ACI 440 – Guideline for use of composite for repair
    CPWD hand book on Seismic retrofit of buildings published by DG(Works), CPWD, Government of India, IBC & IIT-Madras. http://cpwd.gov.in/units/finaldrafthandbook_apr2007.pdf

PE-BTC 633 – Open Channel Flow

(AY 2019-20)

Prerequisites:

Course Objectives:
The objectives of this course is

1. to introduce Open Channel Flow to students, explaining the types of open channel and their behaviours, the causes and principles of such behaviours, and applications open channels, enabling the students to identify the open channels, and to analyse, design and manage channels.
2. to understand a mathematical study of one dimensional flow in open channels, including uniform, gradually varied flow and sediment transport in channel

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

1. understand and analyse uniform flow in channels
2. analyse gradually varied and sediment transport in channel flow
3. Differentiate between prismatic and non prismatic channels and its applications in the field

Module No.	Content
1	**Uniform flow: U**niform flow formulas, Hydraulically most efficient channels, Design of channels
2	Specific Energy and Specific Force: Specific Energy, force concept, Channel Transition, Classical hydraulic jump, jump types, Energy dissipation, Control of hydraulic jump and its importance, Types of Hydraulic Jump, Energy loss.
3	**Gradually Varied Steady Flow:** Gradually varied steady flow and rapidly varied steady flow in open channels, surface profiles in GVF-analysis
4	**Computation of Gradually Varied Steady Flow:** Different method of computations, Chow'-s methods, Direct step methods, standard step method, introduction to professional software's.
5	**Spatially Varied Flow** Differential Equation of spatially varied flow (increasing and decreasing), applications
6	**Sediment Transport:** incipient motion, mechanism of sediment transport, sediment load, design of alluvial channels.

Reference Books:
1. Open Channel Hydraulics – Ven Te Chow, Mc-Graw Hill, 1959.
2. Flow in Open Channel – K. Subramanya, Tata Mc-Graw Hill, 1986.

3. Flow through Open Channel-K.G.Ranga Raju, Tata Mc-Graw Hill, 1993.
4. Open Channel Hydraulics- Richard H. French, Mc-Graw Hill, 1986.
5. Open Channel Flow- F. M. Henderson, Macmillan Publishing Co. Inc., 1966.

General Reading Suggested:

Codes: 1) I.S. 4997 (1968). "Criteria for design of hydraulic jump type stilling basins with horizontal and sloping apron". Bureau of Indian Standards, New Delhi.

Hand books: 1) Peterka, A.J. (1984). "Hydraulic design of stilling basins and energy dissipators". Eng. monograph no. 25, U.S. Bureau of Reclamation.

2) Water measurement manual. (2001). "Chapter 7-weirs". A water resources technical publication, U.S. Bureau of Reclamation.

e-Resourses: Research Publications in

1) ASCE Journal of Hydraulic Engineering
2) ASCE Journal of Hydrologlic Engineering
3) ASCE Journal of Irrigation and Drainage
4) ASCE Journal of Water Resources Planning and Managament
5) IAHR Journals

PE-BTC 634 –: Ground Water Development and Management

(AY 2019-20)

Prerequisites:

Course Objectives:

The main objectives of the course are

1. To understand the problems of groundwater in India.
2. To study the elements of groundwater hydrology as well as well hydraulics
3. To summarize the various methods of groundwater exploration
4. To evaluate sources groundwater pollution in detail and devise methods for controlling them

Course Outcomes:

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

1. Design, construction and development of shallow and deep wells.
2. Able to choose suitable type of method for groundwater exploration
3. develop a mitigation plan for ground water pollution.

Module No	Details	Hrs.
1	**Introduction:** Problems and perspectives regarding groundwater in India; Use of groundwater and its impact on irrigation water management;	**2**
2	Hydrologic properties of water bearing formation, occurrence, storage and distribution of groundwater;Use of groundwater zone maps; Groundwater resource assessment and budget	5
3	**Elements of Groundwater Hydrology:** Ground water recharge, ground water balance, aquifer properties Surface investigations of groundwater; Well hydraulics- steady and unsteady flows; Water wells- test holes and well logs; Design, construction and development of shallow and deep wells, design of screen and gravel packs	**6**
4	**Surface and Subsurface investigations** (Geologic methods; remote sensing; geophysical explorations; electrical resistivity and seismic refraction), Water Wells: Construction; completion, development, protection and rehabilitation of wells;	**6**
5	**Ground water conservation and artificial recharge:** sustained yield, water balance equation; Ground-water and surface-water interaction, interference of wells; Watershed conservation measures in irrigation commands	**6**
6	**Groundwater quality:** agricultural sources of pollution, causes and monitoring; Technical, socio-economic and organizational aspects of groundwater management	**6**

7	Case Studies: Discussion on case studies and field applications in Ground water development and management	**5**

Term work:- At least 10 assignments covering the entire syllabus shall be submitted as term work.

Reference:

• Bear, J., "Hydraulics of Groundwater", McGraw Hill.1979
• Karanth, K. R., "Groundwater Assessment, Development and Management", Tata McGraw Hill.1987
• Rastogi, A.K., "Numerical Groundwater Hydrology", Penram International.2007
• Raghunath, H.M., "Groundwater", New Age International.2007
• Sharma, H.D. and Chawla, A.S., "Manual on Ground Water and Tube Wells", Central Board of Irrigation and Power.1977
• Sterrett, R.J., "Groundwater and Wells", Smyth Companies. 2008
Todd, D. K and Mays, L.W. "Groundwater Hydrology", John Wiley.2005

PE-BTC 642 –DISASTER RISK PREPAREDNESS, PLANNING AND MANAGEMENT

(AY 2019-20)

Prerequisites:

Course Outcome:

On completion of the course, the student will develop competencies in

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

Proposed Syllabus

Module	Topic	Lectures (hours)
1	**Introduction** Concepts and definitions: UNISDR; disaster, hazard, vulnerability, risk, severity, frequency and details, capacity, impact, prevention, mitigation	**03**
2	**Disasters –** Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.	**05**
3	**Disaster Impacts –** Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.	**05**
4	**Disaster Risk Reduction (DRR) –** Disaster management cycle – its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.	**10**

5	**Disasters, Environment and Development –** Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land use changes, urbanization etc.), sustainable and environmental friendly recovery; reconstruction and development methods.	**08**
6	**Hazard, Vulnerability Risk Assessment (HVRA)** Definitions; risk, hazard, vulnerability, severity, exposure, Rating scale or classification of levels of exposure, vulnerability, threat, hazard, Hazard probability, Risk calculation, Hazard mapping, Risk mapping	**05**

Textbooks:

1. Singh B.K. (2008); "Handbook of Disaster Management: Techniques & Guidelines" Rajat Publication; **ISBN-10:** 9788178803555; 312p.
2. Asthana P. and Asthana N.C. (2014); "Disaster Management" Aavishkar Publishers; ISBN-10: 8179104605;
3. Baas S., Ramasamy S., Dey de Pryck J., Battista F. (2008); "Disaster risk management systems analysis A guide book" FAO, Electronic Publishing Policy and support branch Communications Division, FAO, Italy; ISBN 978-92-5-10605-8; 78p.

References Books

1. Ghosh G.K. (2006); Disaster Management", APH Publishing Corporation; ISBN-10: 813130017X; 863p.
2. Sahni P. (2004); "Disaster Risk Reduction in South Asia", Prentice Hall; ISBN-10: 9788120322004; 388p.

Other References:

1. http://ndma.gov.in/ (Home page of National Disaster Management Authority)
2. http://www.ndmindia.nic.in/ (National Disaster management in India, Ministry of Home Affairs).

PE-BTC 643 –:- Infrastructure Planning and Management

(AY 2019-20)

Prerequisites:

Course Objectives:

The main objectives of the course are
1. To describe the role of Infrastructure in the development of nation.
2. To understand basics of infrastructure planning and management.
3. To summarize the students about emerging trends in infrastructure

Course Outcomes:

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

1. To plan and manage the Infrastructure project.
2. To use the various policies for effective implementation of Infrastructure projects.

Course Content

Module No	Details	Hrs
1	Introduction: Definition of basic terminologies, role of infrastructure in economic development, types of infrastructure, measurement of infrastructure capacity, bases for quantification of demand and supply of various types of infrastructure, Indian scenario in respect of adequacy and quality.	4
2	Infrastructure Planning: Goals and objectives of infrastructure planning; Identification and quantification of the casual factors influencing the demand for infrastructure; review and application of techniques to estimate supply and demand for infrastructure;	5
3	Infrastructure Planning: use of econometric, social and land use indicators and models to forecast the demand and level of service of infrastructure and its impact on land use; critical review of the relevant forecasting techniques;	5
4	Infrastructure Planning: infrastructure planning to identify and prioritize preferred areas for development; Integration of strategic planning for infrastructure at urban, regional and national levels; case studies in infrastructure planning.	5
5	Infrastructure Management: Concepts, Common aspects of urban and rural infrastructure management systems; pavement and bridge management systems	5

6	Integrated infrastructure management, Case studies; Emerging trends in infrastructure, Overview of Public-Private Participation in infrastructure projects, Understanding stakeholders' concerns, regulatory framework, risk management in infrastructure projects,	6
7	Public policy for infrastructure: Sectoral Overview Highways, railways, waterways, airports, urban and rural infrastructure: roads, housing, water supply, sanitation – case study examples.	6

Recommended Books:-

1. Project Preparation, Appraisal, Budgeting, and Implementation: Prasanna Chandra, Tata McGraw Hill.
2. Project Management: K Nagrajan, New Age International Publishers.7th Edition, 2015.

Construction Engineering and Management of Projects (for Infrastructure and Civil works),S.C.Sharma, Khanna Publishers.2nd Edition 2011.

PE-BTC 653– Rural Water Supply and Sanitation

(AY 2019-20)

Prerequisites:

Course Objectives

The students will learn to –

1. Comprehend the global picture of water/sanitation/hygiene and health;
2. Know the major technologies and processes of water/sanitation infrastructure in developing countries;
3. Understand the social and cultural factors (e.g., gender issues, children's needs) that must be considered and incorporated into the planning and implementation of water supply and sanitation systems in developing countries;
4. Familiar with the patterns of domestic water use and waste disposal in developing countries, and to describe the modes of transmission of water-related diseases;
5. Understand the principles of operation of a range of appropriate water and sanitation technologies, and to be able to critically evaluate them with respect to multiple criteria;
6. Investigate the concept of community participation and its role in enabling project success and sustainability;

Course Outcomes

The students will be able to

1. Design the rural water supply system based on the characteristics of water and requirement of community
2. Provide solution to basic infrastructure and hygiene problems faced by the community
3. Design rural sanitation system in affordable and hygienic manner

Course Content

Module No	Topics	No. of Lectures
1	Introduction to water and sanitation development	01
2	Rural Water Supply: Issues of rural water supply –Various techniques for rural water supply- merits- National rural drinking water program- rural water quality monitoring and surveillance- operation and maintenance of rural water supplies. Network of water supply	10

	Low Cost water Treatment: Introduction – Epidemiological aspects of water quality methods for low cost water treatment - Specific contaminant removal systems; Pot chlorination	
3	Epidemiology : Communicable diseases, Micro-organisms, Methods of communication, Diseases communicated by discharges of intestines, nose and throat, other communicable diseases and their control	03
4	Rural Sanitation: Introduction to rural sanitation- Community and sanitary latrines - Planning of wastewater collection system (network) in rural areas- Treatment and Disposal of wastewater - Compact and simple wastewater treatment units and systems in rural areas stabilization ponds - septic tanks - Imhoff tank- soak pits- low cost excreta disposal systems Effluent disposal. Identify problems pertaining to rural water supply and sanitation. Design water supply and sanitation system for rural community Recycle and reuse using low cost technology like constructed wetlands, anerobic digestor, modification of septic tanks, grey water recycling technologies	10
5	Industrial Hygiene and Sanitation: Hygiene requirements for Schools- Public Buildings-Hospitals- Eating establishments- Swimming pools – Cleanliness and maintenance and comfort- Industrial plant sanitation.	04
6	Solid Waste Management: Disposal of Solid Wastes- Pit Composting- land filling incineration- Biogas plants - Rural health - Other specific issues and problems encountered in rural sanitation. In vessel composting, waste to energy	04
7	Case study – Utility pro poor approach to Bangalore slums Business model for providing affordable sanitation and water; Water and sanitation requirement for religious purposes	04

Theory Examination:-

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

TextBooks:-

1. 'Water Treatment and Sanitation – Simple Method for Rural Area' by Mann H.T. and Williamson D.
2. Operation and maintenance of rural water supply and sanitation systems by Brikké F
3. 'Water Supply for Rural Areas & Small Communities' by Wanger E.G. and Lanoix J.N.
4. WHO 'Water Supply and Sewerage', by E.W.Steel&T.J.Mcghee, McGraw Hill.
5. 'Manual on Water Supply and Treatment', CPHEEO, Ministry of Urban Development, Govt. of India.
6. 'Manual on Sewerage and Sewage Treatment', CPHEEO, Ministry of Urban Development, Govt. of India
7. 'Environmental Engineering' by D. Srinivasan, PHI Learning Pvt. Ltd. 2009.
8. Cairncross, Sandy, and Richard Feachem. *Environmental Health Engineering in the Tropics: An Introductory Text*. Chichester, UK: John Wiley & Sons, 1993, chapter 1 and appendix C. ISBN: 97804719388

PE-BTC-662– Elective-II : Low Cost Roads

(AY 2019-20)

Prerequisites: PC-BTC406,PC-BTC504,Soil Mechanics

Course Objectives:

1. To acquire the knowledge about the selection of materials for construction and maintenance of Rural Roads.
2. To discuss the Geometric standard of rural roads and utilize the knowledge for implementation.
3. To identify and Implement the suitable technique for construction of rural roads.

Course Outcome:
At the end of course the students will be able

1. To produce the knowledge for deciding the geometric standards for rural roads.
2. To acquire the knowledge about the selection of materials for construction and maintenance of Rural Roads.
3. To identify and Implement the suitable technique for construction of rural roads.

Detailed Syllabus

Module No	Topics	No. of Lectures
1	**Rural Road Planning**: classification of low cost roads, reason of low connectivity, Road alignments survey, factor affecting alignments, collection of data, preparation of project reports and drawing, PMGSY Approach for priority of construction and upgradation of roads.	06
2	**Geometric Design standards:** Classification of rural roads, design speed, cross sectional elements, sight distance, horizontal and vertical curve, super elevation, extra widening, gradients,	05
3	**Pavement Materials** subgrade soil classification for highway engineering purpose soils as per PRA system, revised PRA system, Grading requirements for aggregate, Grading of aggregate for WBM type bases and subbase construction, material selection for Bituminous Course of Rural Roads. Suitability of aggregate and binding material for construction of rural roads. CBR test, triaxial test on subgrade soils, plate bearing test, modulus of	06

	subgrade reaction, E – Value of subgrase soils.	
4	**Design and construction of Rural Roads:** Flexible pavement, semi rigid pavements, roller compacted concrete pavements; equipment's used during construction of roads.	06
5	**Use of waste materials:** Different methods of stabilization, use of fly ash in embankment and subgrade, construction of lime – fly ash – soil, construction of Lime – Fly ash bound macadam, lime fly ash concrete, roller compacted concrete pavement, dry lean concrete for base course. Use of other waste materials like rise husk ash, recycled concrete, iron and steel slag, natural and synthetic fibers, geotextile and geogrids.	06
6	**Maintenance of Rural roads:** Distresses in flexible, rigid and semi-rigid pavements, routine maintenance, periodic maintenance, maintenance of earth road, gravel roads, WBM type roads, Bituminous macadam types roads etc.	04
7	**Quality Control:** Quality control test prior to construction and during construction on different pavement layer materials and pavement layers. frequency of tests,	04

Term work:-
At least 10 assignments shall be submitted as term work. Report based on site visit to road site.

Recommended Books:-
1. S. K. Khanna, C. E. G. Justo & A. Veeraragavan (2014); **"Highway Engineering",** X^{th} Edition New Chand & Brothers, Roorkee.
2. Dr. L. R. Kadiyali and Dr. N. B. Lal (2005); **"Principles and Practices of Highway Engineering",** Khanna Publication, New Delhi. ISBN-13: 9788174091659.
3. **Guide lines for the Design of Rigid Pavements**, IRC: 58:2002, IRC: 58:2011.
4. **Guide lines for the Design of Flexible Pavements**, IRC: SP: 20 2002.
5. **Specification for Rural Roads – 2014**, Ministry of Rural Development.

PE-BTC 623 -Prestressed Concrete

(AY 2019-20)

Prerequisites: ES-BTC302,PC-BTC402,PC-BTC501,PC-BTC503

Course Objective

1. To understand prestress force and its effect in structural members, prestressing systems and industrial applications.
2. To understand the materials which can be used for prestressed structure. 3. To understand the concept ofdeflections due to prestressing force along with other forces
3. To understand the concept ofcomposite structures and concordancy of cables.
4. To understand the design concept using prestressing force and familiarize with IS-1343.

Course Outcome

At the end of the course the students shall be able to develop collaborative skills to work in a team/group and analytical/technical skills to

1. Analysis of prestressed concrete structures
2. Design simple beams and bridge girder.

Module No	Details	Hrs
1	Introduction to basic concepts and general principles of pre-stressed concrete, materials used in prestressed concrete and methods and techniques of prestressing, prestressing systems.	02
2	Analysis of prestressed concrete sections for flexure considering loading stages, computational of sectional properties, critical sections under working loads for pretensioned and post tensioned members, load balancing method of analysis of prestressed concrete beams, losses in prestress, application to simply supported beams and slabs, concept of debonding of cables in pre tensioned units.	08
3	Design philosophy of prestressed concrete sections, permissible stresses in concrete and steel, design approaches using working stress method as per IS 1343 – 2012, limit state of collapse – flexure and shear as applied to prestressed concrete beams, kern points, choice and efficiency of sections, cable profile and layouts, cable zone, deflection of prestressed concrete sections.	08
4	End zone stresses in prestresses concrete members, pretension transfer bond, transmission length, end block of post tensioned members.	05
5	Design of simply supported pre-tensioned and post tensioned slabs and beams.	05

	Design of bridge girders subjected to IRC loadings.	
6	Analysis and design of composite prestressed concrete structures, concept and behavior of long term creep and relaxation of prestressed members.	04
7	Introduction to application of prestressing to continuous beams, linear transformation and concordancy of cables, deck continuity.	04

Recommended Books:

1. T. Y. Lin, "Design of Prestressed Concrete Structures", John Wiley Publishers
2. N. Krishna Raju, "Prestressed Concrete", Tata McGraw Hill
3. Y. Guyon, "Prestressed Concrete", Contractors Record Ltd.
4. R. H. Evans & E. W. Bennette, "Prestressed Concrete", McGraw Hill Book Co.

PE-BTC 635 – Urban Hydrology and Hydraulics

(AY 2019-20)

Prerequisites:

Course Objectives:
The objectives of this course are:

1. to give basic concepts of urban storm water collection systems
2. to give information about field practices in storm water collection system design,
3. to enable students to design a storm water collection system and design a storm water drainage system using real data
4. to enable students applications of GIS in urban hydrology

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

1. understand the basic concepts of urban storm water collection systems
2. understand the field practices in storm water collection system
3. design a storm water collection and design system using real data.
4. enable students applications of GIS in urban hydrology

Module No.	Content	Hrs.
1	**Introduction:** Scope, Design storm, IDF curve, SCS-CN, Estimation of urban floods, Hydraulic analysis and design of urban, highway, and small watershed drainage problems; discussion of overland and drainage.	**5**
2	**Storm Water Management Practices:** Storm Water Drainage System and appurtenance	**5**
3	**Storm Water Drainage Design**:channel flows; hydraulics of storm-drain systems and culverts; determination of design flow; Road Surface Drainage	**6**
4	**Sub Surface Drainage:** Different Types of Filter Material, Disposal of Acceptable Quality of Storm Water	**6**
5	**Storm Water Drainage of Special Locations:** Infiltration of Storm Water, Ground Water Recharging, Ponds and Rain Water Harvesting, Drainage Through Pumping **Maintenance of Drains:** Enforcement for Cleaning Drains,	**6**
6	**GIS**: Role of Geographical Information System and Master Plan, applications in flood plain mapping.	**4**
7	**Case studies:** Various applications in Urban hydrology	**4**

References:

1. Guidelines on Urban drainage: IRC: SP: 50-2013
2. Butler, D. & Davies, J.W. Urban Drainage, Spon Press, 2nd Edn., 2004.
3. Akan A.O and Hioughtalen R.J. Urban Hydrology, Hydraulics and Stormwater Quality â€“ Engineering Applications and Computer Modeling, John Wiley & Sons 2003
4. Hall, M.J. Urban Hydrology. Elsevier, 1984.
5. Shaw, E.M. Hydrology in Practice. 3rd Edn., Chapman & Hall, 1994

PE-BTC 644 –:- TQM and MIS in Construction

(AY 2019-20)

Prerequisites:

Course Objectives:

The main objectives of the course are to

1. To study the concept of quality in construction.
2. To describe the need of MIS in Construction.
3. To explain the need of TQM, ISO and SIX Sigma in Construction.

Course Outcomes:

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

1. To carry out quality control in construction.
2. To develop Total quality management system and Management Information System

Course Content

Module No	Details	Hrs
1	**Quality in Construction** a) Quality – Various definitions and interpretation. Importance of quality on a project in the context of global challenges. **b)** Factors affecting quality of construction, reasons for poor quality & measures to overcome.	4
2	**MIS** a) Introduction to Management Information systems (MIS) Overview, Definition. **b)** MIS and decision support systems, Information resources, Management subsystems of MIS.	5
3	**TQM in Construction** a) TQM – Necessity, advantages, Six sigma as a tool in TQM. **b)** Defects & it's classification in construction. Measures to prevent and rectify defects.	4
4	**TQM & ISO** a) Difference between, quality control, quality assurance, total quality control and total quality management (TQM). b) Process based approach for achieving TQM. Study of ISO 9001 principles. ISO implementation procedure in Construction Industry.	5
5	**Quality Manual** – Importance, contents, documentation. Importance of check-lists in achieving quality. Typical checklist for concreting activity, formwork activity, steel	6

	reinforcement activity. Importance of third party certification in Quality Control(ISO, Six Sigma, DUPONT certifications)	
6	**Management Control** a) Management information system structure based on management activity whether for Operational control, management control or strategic planning. b) Supply chain management as a tool in TQM, Benchmarking in TQM, Kaizen in TQM c) Categories of cost of Quality.	6
7	**Modern tools in TQM Implementation** a) Development of an MIS for a construction organization associated with building works, study and use of various modules of ERP software for construction. b) Introduction to smart phone technology & incorporating GIS, GPS, Android subsystems for documentation and monitoring of construction projects.	6

Recommended Books:-

1. Juran's Quality Handbook – Juran Publication

2. Management –Principal, process and practices by Bhat – Oxford University Press.

3. Financial management by Shrivastava- Oxford University Press

4. Management Information Systems – Gordon B. Davis, Margrethe H. Olson – Tata McGraw Hill Publ. Co.

5. Total Project Management – The Indian Context - P.K.Joy Macmillan India Ltd.

6.Total Quality Management-- Dr. Gunmala Suri and Dr. Puja Chhabra Sharma—Biztantra

7.Quality Control and Total Quality Management by P.L.Jain- Tata McGraw Hill Publ.Company

8.Total Quality Management - Dr. S.Rajaram and Dr. M. Sivakumar-- Biztantra

9. Total Engineering Quality Management – Sunil Sharma – Macmillan India Ltd.

10.E- Sources: www.nptel.ac.in ,www.mobile.enterpriseappstoday.com

PE-BTC 654– Physiochemical Processes

(AY 2019-20)

Prerequisites:

Course Objectives

The students will learn to –

1. Understand the basic concepts of physico chemical processes
2. Application of concepts in water, air and wastewater engineering

Course Outcomes

The students will be able to

1. Understand the basic concepts of physicochemical engineering processes
2. Incorporate the concepts studied for water, air and wastewater pollution control
3. Design units based on the concepts in water, air and wastewater engineering

Course Content

Module No	Topics	No. of Lectures
1	**Structure and properties of the water molecule:** • Aquatic chemistry of strong and weak acids/bases in water. • Inorganic carbon system. • Alkalinity and acidity. • Buffering capacity.	02
2	Contaminants in natural waters; coupling water quality with aquatic chemistry; water quality criteria and standards. **Transport of contaminants in natural aquatic systems:** • Advection. • Diffusion. • Dispersion. • Derivation of advection-dispersion equation. • Examples of contaminant transport and transformations in rivers, lakes and aquifers	05
3	**Gas-liquid mass transfer:** • Henry's constant, mass transfer between gaseous and aqueous phases.	10

	• Two film theory.	
4	**Solid-liquid mass transfer:** • Langmuir and Freundlich and other isotherms. • linear isotherms, i.e., partitioning coefficients. • Hydrophobicity and partitioning. • Adsorption rates and factors affecting the adsorption rates	06
5	Reactors and reactor efficiency; completely mixed, plug flow and mixed flow reactors.	05
6	**Engineered physico-chemical processes in water treatment:** • Neutralization. • Precipitation. • Oxidation-reduction. • Sedimentation. • Coagulation-flocculation. • Filtration. • Adsorption, gas stripping, etc.	08

Theory Examination:-

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

Text Books:-

1. Environmental Engineering Science. First Edition (2001). By: William W. Nazaroff and Lisa AlvarezCohen. John Wiley and Sons Inc.
2. Chemistry for Environmental Engineering. Fourth Edition (1994). By: Clair N. Sawyer, Perry L. McCarty and Parkins, G. F
3. Physicochemical processes (1972)By Walter J Weber.Interscience New York

PE-BTC 663 – Traffic Engineering and Control

(AY 2019-20)

Prerequisites: BS-BTC401 ,PC-BTC504

Course Objectives:

1. To discuss different types of traffic surveys with conventional and latest techniques for data collection and summaries the application of statistical techniques for the traffic related problems.
2. To develop skills for planning, design and operations of traffic regulatory and control devices with due application of statistical techniques.

Course Outcomes:

Graduate students will be able

1. To collect required traffic data independently and analyses to plan and design traffic regulatory and control devices with due consideration to road safety issues.
2. To design traffic regulatory and control devices with due application of statistical techniques.

Detailed Syllabus

Module No	Topics	No. of Lectures
1	**Traffic Engineering and control:** Importance of traffic engineering, power performance of vehicles, running speed, journey speed, spot speed studies, Various traffic surveys and traffic studies: vehicle volume counts classification and occupancy, Origin – Destination surveys, Trip generation and trip distribution.	07
2	**Statistical methods for traffic engineering and their applications:** probability and its application, std. deviation, Distributions, Sampling theory and Significance testing, Regression and Correlation, Hypothesis.	07
3	**Transportation and Assignment problems:** Balanced and Unbalanced Transportation Problem, N-W Corner Method, Least Cost Method, Vogel's Approximation method.	06
4	**Intersection Design:** at grade and grade separate intersection, rotary inter section its advantages and disadvantages, design rotary inter section, mini round about.	05

5	**Traffic signals**: types of traffic signals, advantages, determination of optimal cycle time and signal setting for an intersection with fixed time signals, co-ordination of signals, types, area traffic control, delay at signalized intersection.	05
6	**Economic Evaluation of Transportation Plan:** cost and benefits of transportation project, different methods available for economic evaluation.	04
7	**Traffic signs and Markings**: General principal of traffic signing, Types of traffic signs, Location and maintenance of signs, Different types of road markings, marking design, marking maintenance.	04

Term work:-

Project based on traffic studies - data collection and analysis, proposals for new facilities or improvement to existing facility / Application of traffic engineering software, at least 10 assignments covering entire syllabus shall be submitted as term work. Alternately a mini-project can be done involving data collection. Analysis and design.

Recommended Books:-

1. Traffic Engineering and Transport Planning: L.R. Kadiyali, Khanna publishers Delhi
2. Principles of Traffic Engineering: G.J. Pingnataro, Mc Graw-Hill, 1970.
3. Traffic System Analysis for Engineering and Planners: Wohl and Martin, Mc Graw Hill, 1983.
4. Principles of Transportation Engineering: ParthaChakroborty and Animesh Das, Prentice hall (India)
5. Traffic Flow Theory and Control: Drew D.R., McGraw – Hill , New York, 1964

Highway Capacity Manual, Transportation Research Board, National Research Council, Washington D.C.

OE-BTC 611 – Human Resources Development and Organizational Behavior

(AY 2019-20)

Prerequisites:

Course Objectives:

The learning objectives of this course are:

1. to develop a systematic and planned approach through which the efficiency of employees is improved.
2. development of the integrated use of training, organization, and career development efforts to improve individual, group, and organizational effectiveness.
3. To understand the key competencies that enable individuals in organizations to perform current and future jobs through planned learning

Course Outcomes:

At the end of this course students will be able:

1. to set the future goals and objectives for the entire organization and for self.
2. to apply integrated use of training, organization, and career development efforts
3. to understand the importance of key competencies that enable individuals in organizations to grow.

Module No.	Content	Hrs.
1	Introduction to Human Resource Development: Emergent of HRD, Critical roles, challenges, HRD Process Model: identification of needs and Design and development of HRD programmes, Process Model: Methods of Implantation, Evaluation of programmes.	5
2	HRD interventions: Mentoring for employee development: Role of mentoring in development, Employee counseling for HRD: Overview of counseling programmess, employee assistance programme, stress management, employee wellness and health promotion, Competency framework of HRD: steps in competency mapping.	6
3	Career Planning, management, and development: Career development stages and activities, role of individual and organization in career planning, Organizational Learning, and learning organizations.	5
4	The future of HRD and Ethics: Research, practice and education of HRD for innovation and talent development and management, Role of HRD in developing ethical attitude and behavior and development, Ethical problems with HRD roles.	5
5	Organizational Behavior: Introduction, What is organizational Behavior? Diversity in Organizations, Attitudes and Job Satisfaction, Emotions and Moods, Personality and Values, Perception and Individual Decision Making, Motivation Concepts.	5
6	Foundations of Group Behavior: Understanding Team work, Communication, Leadership, Power and Politics, Conflict and Negotiation, Foundations of Organization Structure, Organizational Culture, Human Resource Policies and Practices, Organizational Change and Stress Management.	5
7	Case Studies: Based on survey done with various industries	5

References:

1.Werner and DeSimone (2006). Human Resource Development. Thomson Press, Network.
2. David Mankin (2009). Human Resource Development, Oxford University Press: Delhi.
3. Rosemary Harison (2000). Employee Development. University Press: Hyderabad.
4. John P. Wilson (2005). Human Resource Development. Kogan Page.
5. Stephen P. Robbins and Timothy A. Judge (2013) Organizational behavior, Copyright © 2013, Pearson Education, Inc., publishing as Prentice Hall

OE-BTC 613–Watershed Development and Management
(AY 2019-20)

Prerequisites:

Course Objectives:

The main objectives of the course are

1. To explain the concept of watershed and its management.
2. To study watershed hydrology and its behavior.
3. To describe erosion process.
4. To summarize the engineering measures for soil and water conservation

Course Outcomes:

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

1. Apply the engineering measures for soil and water conservation
2. Develop watershed management plan

Module No	Details	Hrs.
1	Components of watershed and need of watershed management; Principal factors influencing watershed operations; Delineation of watersheds; Engineering surveys; Data requirement	**4**
2	Watershed hydrology, water resources assessment in watershed, hydrological cycle; Surface water assessment- rainfall-runoff analysis; Groundwater assessment, infiltration and its measurement	**4**
3	Watershed Behavior- Physical elements of watershed, effects of land use changes on hydrological cycle components, watershed experiments, Land capability classification; Erosion process- factors affecting erosion, types of erosion, soil erosion models	**6**
4	Engineering measures for soil and water conservation- Contour bunding, graded bunding, bench terracing, land leveling and grading; Small storage structures- Types and design data requirement, loose boulder dams, gabions, check dams and their design criteria	**6**
5	Rainwater harvesting, direct and indirect methods, filter design, planning and design; Layout and execution; Impact assessment, operation and maintenance issues	**6**
6	Watershed management plan- Methodology of planning a watershed, identification of watershed problems, socio-economic issues.	**6**
7	Case studies: Application of Remote sensing and GIS in watershed management	**4**

References:

1. Das, G., "Hydrology and Soil Conservation Engineering", Prentice Hall.(2002)
2. Debarry, P. A., "Watershed: Processes, Assessment and Management", John Wiley.(2004)
3. Lyon, J. G., "GIS for Water Resources and Watershed Management", Taylor and Francis.(2003)
4. Schwab, G.O., Fangmeier, D.D., Elliot, W. J., Frevert, R. K., "Soil and Water Conservation Engineering", John Wiley.(2002)
5. Suresh, R., "Soil and Water Conservation Engineering", Standard Publishers.(2006)

OE-BTC 614 – Artificial Intelligence Techniques

(AY 2019-20)

Prerequisites:
Course Objectives:
Course Outcomes:

Module No.	**Content**	**Hrs.**
1.	**Introduction to Soft computing techniques-** soft computing techniques, importance, types of soft computing techniques, advantages and limitations**.**	3
2	**Fuzzy logic**: Fuzzy sets- Fuzzy set operations- Fuzzy relations-Cardinality of Fuzzy relations-Operations on Fuzzy relations-Properties of Fuzzy relations- Membership Functions-Features of Membership functions- Fuzzification-Methods of Membership value Assignments- Fuzzy Rule Base-Defuzzification-Deffuzzification methods- Fuzzy logic controller, applications to water resources engineering	5
3	**Artificial Neural Networks**: Basic concepts- Biological foundations, ANN models, Types of activation function,Neural network Architectures-Single layer feed forward network-Multilayer feed forward network, Perceptron networks-Back Propagation networks-Radial base function network, applications to water resources engineering, applications to water resources engineering	6
4	**Fundamentals of genetic algorithms and Genetic programming:**Intuition behind Genetic Algorithms, Biological Inspiration, What is Genetic Algorithm?, Steps Involved in Genetic Algorithm, Initialization, Fitness Function, Selection, Crossover, Mutation, Application of Genetic Algorithm, Feature Selection, Difference between GA & GP, applications to water resources engineering	6
5	**Model Trees:** Introduction, model trees, CART, Building initial tree, Standard deviation reduction, Pruning the tree, Smoothing, M5 algorithm and M5P algorithms.	5
6	**Support Vector Machine:** Margins: Intuition, functional and geometric margins, the optimal margin classifier, Lagrange duality, Lagrange multipliers, Karush-Kuhn-Tucker (KKT) conditions, Kernals, applications to water resources engineering.	5
7	Case studies: case studies on FL, ANN, GA, GP ,MT, SVM	6

References:

1.S.Rajasekharan, G.A.VijayalakshmiPai, *Neural Network, Fuzzy Logic andGeneticAlgorithms Synthesis and Applications*, Prentice Hall India.
2. S.N.Sivanandam, S.N.Deepa, *Principles of Soft Computing*, Wiley India.
3. Timothy J Ross, *Fuzzy logic with Engineering Applications*, McGraw Hill, NewYork.
4. S.Haykins, *Neural Networks a Comprehensive foundation*, Pearson Education.
5. D.E.Goldberg, *Genetic Algorithms in Search Optimization and Machine Learning*,Pearson Education.
6. Breiman, L., Friedman, J.H., Olshen, R.A. & Stone, C.J. (1984). Classification and regression trees. Belmont CA: Wadsworth.
http://www.genetic-programming.org/

OE-BTC 615– NUMERICAL COMPUTATIONS

(AY 2019-20)

Prerequisites: Engineering Mathematics

Course Objectives:

With the development of powerful computer, now it has become easier to design and develop complex engineering system with its help. Numerical techniques are brain behind this capability. The objective of this course is to equip students with such techniques of computation so that they can understand and solve real life problems.

Course Outcomes:

1. Upon successful completion of the course, students should be able to
2. understand the basic concept of modeling, numerical computation and associated errors.
3. apply numerical techniques of common mathematical tools to solve real life problem.
4. analyze and compare different techniques with reference to errors, convergence and accuracy.
5. demonstrate potential to develop code which can be used with available programming resources.

Course Contents:

Module	Description	Hrs.
1.	**Exposure to Numerical Software** Introduction to MATLAB and numerical programming through it, Using EXCEL worksheet in numerical computation.	06
2	**Fundamentals of Modeling and Error**: Fundamentals of mathematical modeling - needs and limitations. Mathematic modeling of simple engineering systems Significance of analytical and numerical methods in engineering analysis. Error analysis; significant figures, accuracy and precision, Error definitions, Round-off and truncation error	04
3	**Numerical Solution of Systems of Linear Algebraic Equation:** Direct Methods: Matrix inversion, Gauss Elimination, LU Decomposition, TDMA Nature of iterative solution, Role of eigen values in convergence, Successive under relaxation, Iterative Methods - Jacobi, Gauss Siedel, Effect of rounding off on iteative solution and ill-conditioned system.	06
4	**Numerical Solution of Systems of Non-linear Equations:** Roots of equations: Bisection, False position, Secant, Newton- Raphson methods. Problems based on real-life application.	06
5	**Numerical Integration and Differentiation:** Newton-Cotes Integration Formulas - Trapezoidal rule, Simpson's rule,	06

	Finite Difference Methods - Forward difference, Backward difference and Central Difference	
6	**Numerical Solution of Ordinary Differential Equation:** Explicit and Implicit Marching Method, Modified Euler's Method, Runge- Kutta Methods - RK-II and RK-IV, ODE System: Initial value problem, Boundary value problem, Predictor-corrector methods - Adams Method, Adams-Bashforth-Moulton Method, Milne's Method, Adams- Moulton Method , Stiff ODE System	08
7	**Curve Fitting;** Regression - Least- square regression Interpolation - Newton's divided difference polynomials, Lagrange's polynomials, Spline interpolation;	06

Term Work:
The term work shall comprise of problems and case studies covering different topics taken from course studied in the semester. Assignment shall consist of progra`mmes written in pseudo code, any programming language or MATLAB.

Recommended Books:

Sastry, S S. Introductory methods of numerical analysis . PHI Learning Pvt. Ltd., 2012.
Chapra, Steven and Canale. Numerical methods for engineers . New York: McGraw – Hill, 7ed.
Applied numerical analysis : Curtis Gerald

OE-BTC 616 – Engineering System and Development

(AY 2019-20)

Course Objectives:

(i) to introduce the basic principles of engineering for a developing society,
(ii) to develop an ability to formulate problem, analyze, solve and report to the stakeholders, and
(iii) to practice the ability to design, conduct and report field-work in a particular discipline of engineering contributing to the development

Course Outcomes:

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

(i) understand the basic principles of engineering for a developing society,
(ii) formulate problem, analyze, solve and report to the stakeholders, and
(iii) design, conduct and report field-work in engineering contributing to the development of the society.

Course content:
Module 1. Engineer and Society: Basics of Engineering Profession, engineering services, understanding the values of equity, efficiency and sustainability.
Module 2. The Engineer as a change agent: Interdisciplinary, the need for design and synthesis
Module 3. Development Indices: Human Development Index (HDI) and Organization for Economic Co-operation and Development (OECD) indices, The data needed to compute these, Core values of equity, efficiency and sustainability, Paradigms of development.
Module 4: Role of Engineer as a change agent: Understanding Rural and Urban divide and its economy, Wholesale vs. Retail markets, the role of knowledge, practices, science and technology.
Module 5: A Sectoral Engineering System. Example: Drinking water, Irrigation, Electricity, Diesel pumps, non-conventional energy, solar system, community services, water pipe networking, education, health services, road networking, road development, drainage system, energy audit, telecommunication, small scale industries, agricultural sector, effect of seasonal variation on development, understanding service and manufacturing sector, understanding local and global scenario, any other as per engineering sector (Civil, Mechanical, Electrical, Computer, Agricultural, Health etc.)
Module 6: Project through case studies (Rural/Urban): Framing the project, Understanding the demand, needs analysis, Studying the options available, measurement of social and economic parameters as inputs, The activities and the analysis, picking case-study, analyzing, solving and reporting solutions to the stakeholders.

References:

https://unfoundation.org

http://www.undp.org

http://hdr.undp.org

http://www.oecd.org

http://unnatbharatabhiyan.gov.in

http://www.ctara.iitb.ac.in

https://sustainabledevelopment.un.org

Course Code: OE-BTE601 Course:- Project Management

(AY 2019-20)

Prerequisite:

Basics of Electrical Engineering, Basics of statistics and mathematics, general knowledge about working of organizations

Course Objectives:

1. Get familiarized with basics of project management, its organization and project management framework.
2. Learn five important project management process groups, namely: initiating, planning, executing, monitoring & control, closing and ten important project management knowledge areas.
3. Understand the relationship between project management process groups and knowledge areas.

Course Outcomes: Students will demonstrate the ability to

1. Explain basics of Project Management, its organization and project management framework.
2. Perform project management process group and knowledge area mapping.
3. Solve a case study using step-by-step process of managing projects and explain why each step is necessary.

Course Contents

Unit	Contents	Hrs.
1	**Introduction** • Basics of project management, operations management and organizational strategy, • Project management framework, organizational structures, • Project Management Processes – Initiating, Planning, Executing, Monitoring & Control, Closing.	03
2	**Project Integration Management** • Integrated change control, Developing project management plan and project	04

	charter, • Project selection, corrective action, preventive action, defect repair, change control board, • Cost benefit analysis, Net present value, internal rate of return, payback period, present value, economic value added, • Opportunity costs, sunk costs, law of diminishing returns, working capital, depreciation. **Project Scope Management** • Scope baseline, WBS, Project scope statement, WBS dictionary, benefits and uses of WBS • Requirement documentation, requirements traceability matrix, requirements management plan	
3	**Project Time Management** • Schedule baseline, schedule compression, Network diagram, • Precedence Diagramming Method (PDM), Three point estimating, analogous estimating, parametric estimating, • Schedule management plan, resource optimization, Critical path method, Program Evaluation Review Technique (PERT). **Project Cost Management** • Earned value measurement, Earned value monitoring, cost baseline, cost budget, Cost management plan, • Reserve analysis, contingency reserve, management reserves, cost risk, • Variable / fixed costs, direct / indirect costs, life cycle costing, value analysis, control thresholds, cost of quality, Return of Interest (RoI), and discounted cash flow. **Project Quality Management** • Seven basic quality improvement tools – control chart, Pareto diagram, Cause and effect diagram, flow chart, scatter diagram, histogram. Use of s-curve in project monitoring. • Quality assurance tools and techniques – Affinity diagram, tree diagrams, process decision program charts, matrix diagrams, prioritization matrices, network diagrams.	09
4	**Project Human Resource Management** • Role of PM, sponsor, stakeholders, functional manager, portfolio manager, program manager, • HR management plan, recognition and reward systems, team building, stages of team formation and development, team types. • Conflict Management, • Responsibility Assignment Matrix (RAM), RACI Chart, • Motivation theory, Management and Leadership styles,	04

	Project Communication Management • Communication models, channels, method, communication blockers.	
5	**Project Risk Management** • Risk management plan, risk response strategies, threats, opportunities, risk register, contingency plans, fallback plans, residual risks, secondary risks, • Risk types and categories, SWOT analysis, **Project Procurement Management** • Procurement management plan, types of agreements and contract types, advantages and disadvantages of each contract type, • PM's role in procurement, procurement documents : RFP, IFB, RFQ, RFI, • Types of procurement, procurement negotiations, centralized / decentralized contracting, contract interpretation, price, profit, cost, target price, sharing ratio, ceiling price	06
6	**Project Stakeholder Management** • Stakeholder analysis, stakeholder register, stakeholder expectations, stakeholder engagement, • Power and interest grid, stakeholders engagement assessment matrix	03
7	**Professional and Social Responsibility** • Project management traits in professional and social responsibility, • Code of Ethics and Professional conduct w. r. t. responsibility, respect, fairness, honesty. **Project Management Case Study / Activity**	05

Text/ Reference Books:

1. Gower Handbook of People in Project Management, Dennis Lock and Lindsay Scott, Routledge Publishers, NY, USA, 2016.
2. Project Management – Essentials You Always Wanted to Know, Kalpesh Ashar, Vibrant Publishers, 2012.
3. Projects: Planning, Analysis, Selection, Financing, Implementation and Review, Prasanna Chandra, McGraw Hill India, 2014.
4. A Guide to the Project Management Body of Knowledge (PMBOK Guide), 5th Ed., Project Management Institute, USA.
5. Project Management: Processes, Methodologies and Economics, 2nd Ed., Avraham Shtub, J. F. Bard, S, Globerson, PH Inc., USA.
6. Project Management Handbook,, 2nd Ed., David Cleland, Wiley, 1988.

Sr. No.	Examination	Modules
1	Test 1	1,2, Part of 3
2	Test 2	Part of 3,
3	End Semester	01-07

Course Code:OE-BTE602 Course:-Artificial Intelligence (AY 201920)

Course Outcome: Students will demonstrate the ability to

1. Develop a basic understanding of AI building blocks presented in intelligent agents
2. Choose an appropriate problem solving method and knowledge representation technique
3. analyze the strength and weaknesses of AI approaches to knowledge – intensive problem solving
4. Design models for reasoning with uncertainty as well as the use of unreliable information

Module	Details	Hours
1	Introduction to Artificial Intelligence (AI) History of Artificial Intelligence, Intelligent Systems: Categorization of Intelligent System, Components of AI Program, Foundations of AI, Sub-areas of AI, Applications of AI, Current trends in AI	04
2	Intelligent Agents Agents and Environments, The concept of rationality, The nature of environment, The structure of Agents, Types of Agents, Learning Age	04
3	Problem solving 1 Solving problem by Searching: Problem Solving Agent, Formulating Problems, Example Problems. Uninformed Search Methods: Breadth First Search (BFS), Depth First Search (DFS), Depth Limited Search, Depth First Iterative Deepening(DFID), Informed Search Methods: Greedy best first Search ,A* Search , Memory bound edheuristic Search.	07
4	Problem solving 2 Local Search Algorithms and Optimization Problems: Hill-climbing search Simulated annealing, Local beam search, Genetic algorithms. Adversarial Search: Games, Optimal strategies, The minimax algorithm, Alpha-Beta Pruning.	07
5	Knowledge based Agents, The Wumpus World, The Propositional logic, First Order Logic: Syntax and Semantic, Inference in FOL, Forward chaining, backward Chaining, Knowledge Engineering in First-Order Logic, Unification, Resolution, Introduction to logic programming (PROLOG), Uncertain Knowledge and Reasoning: Uncertainty, Representing knowledge in an uncertain domain, The semantics of belief network, Inference in belief network.	10
6	Planning and Learning The planning problem, Planning with state space search, Partial order planning, Hierarchical planning, Conditional Planning, Learning: Forms of Learning, Inductive Learning, Learning Decision Tree, Expert System: Introduction, Phases in building Expert Systems, ES Architecture, ES vs Traditional System.	06
7	Applications Natural Language Processing(NLP), Expert Systems.	04

Text/Reference Books:

1. Stuart J. Russell and Peter Norvig, "Artificial Intelligence A Modern Approach "Second Edition" Pearson Education.
2. SarojKaushik "Artificial Intelligence" ,Cengage Learning.
3. George F Luger "Artificial Intelligence" Low Price Edition , Pearson Education., Fourth edition.
4. Ivan Bratko "PROLOG Programming for Artificial Intelligence", Pearson Education, Third Edition.
5. Elaine Rich and Kevin Knight "Artificial Intelligence" Third Edition
6. Davis E.Goldberg, "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley, N.Y., 1989.
7. Hagan, Demuth, Beale, "Neural Network Design" CENGAGE Learning, India Edition.
8. Patrick Henry Winston , "Artificial Intelligence", Addison-Wesley, Third Edition.
9. Han Kamber, "Data Mining Concepts and Techniques", Morgann Kaufmann Publishers.
10. N.P.Padhy, "Artificial Intelligence and Intelligent Systems", Oxford University Press

Sr. No.	Examination	Modules
1	**Test 1**	**1,2, Part of 3**
2	**Test 2**	**Part of 3,4, Part of 5**
3	**End Semester**	**01-07**

OE-BTM611 Computational Methods

Course pre-requisites: Engineering Mathematics

Course Objectives:

With the development of powerful computer, now it has become easier to design and develop complex engineering system with its help. Numerical techniques are brain behind this capability. The objective of this course is to equip students with such techniques of computation so that they can understand and solve real life problems.

Course Outcomes:

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

1. understand the basic concept of modeling, numerical computation and associated errors.
2. apply numerical techniques of common mathematical tools to solve real life problem.
3. analyze and compare different techniques with reference to errors, convergence and accuracy.
4. demonstrate potential to develop code which can be used with available programming resources.

Course Contents:

Module	Description	Hrs.
1.	**Exposure to Numerical Software** Introduction to MATLAB and numerical programming through it, Using EXCEL worksheet in numerical computation.	04
2	**Fundamentals of Modeling and Error**: Fundamentals of mathematical modeling - needs and limitations. Mathematic modeling of simple engineering systems Significance of analytical and numerical methods in engineering analysis. Error analysis; significant figures, accuracy and precision, Error definitions, Round-off and truncation error	02
3	**Numerical Solution of Systems of Linear Algebraic Equation:** Direct Methods: Matrix inversion, Gauss Elimination, LU Decomposition, TDMA Nature of iterative solution, Role of eigen values in convergence, Successive under relaxation, Iterative Methods - Jacobi, Gauss Siedel, Effect of rounding off on iteative solution and ill-conditioned system.	04
4	**Numerical Solution of Systems of Non-linear Equations:** Roots of equations: Bisection, False position, Secant, Newton- Raphson methods. Problems based on real-life application.	04
5	**Numerical Integration and Differentiation:** Newton-Cotes Integration Formulas - Trapezoidal rule, Simpson's rule, Finite Difference Methods - Forward difference, Backward difference and Central Difference	04

6	**Numerical Solution of Ordinary Differential Equation:** Explicit and Implicit Marching Method, Modified Euler's Method, Runge- Kutta Methods - RK-II and RK-IV, ODE System: Initial value problem, Boundary value problem, Predictor-corrector methods -Adams Method, Adams-Bashforth-Moulton Method, Milne's Method, Adams- Moulton Method , Stiff ODE System	06
7	**Curve Fitting;** Regression - Least- square regression Interpolation - Newton's divided difference polynomials, Lagrange's polynomials, Spline interpolation;	04

Term Work:
The term work shall comprise of problems and case studies covering different topics taken from course studied in the semester. Assignment shall consist of programmes written in pseudo code, any programming language or MATLAB.

Recommended Books:

1. Sastry, S S. Introductory methods of numerical analysis . PHI Learning Pvt. Ltd., 2012.
2. Chapra, Steven and Canale. Numerical methods for engineers . New York: McGraw – Hill, 7ed.
3. Applied numerical analysis : Curtis Gerald

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

OE-BTM613 Entrepreneurship Development and Start Up

Course pre-requisites: General Engineering

Course Objectives:
In this Course Students will:

1. Know different aspects of Entrepreneurships, Business models.
2. Demonstrate the idea generation techniques, Planning of Marketing process, prototyping methods,
3. Apply engineering knowledge to develop prototype of their ideas and innovations.
4. Demonstrate different aspects of Techno-Economic Feasibility, Intellectual Property Rights and Institutional Support for Start-Ups

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

1. Know different aspects of Entrepreneurships, Business models.
2. Demonstrate the idea generation techniques, Planning of Marketing process, prototyping methods,
3. Apply engineering knowledge to develop prototype of their ideas and innovations.
4. Demonstrate different aspects of Techno-Economic Feasibility, Intellectual Property Rights and Institutional Support for Start-Ups

Module No.	Course Contents	Hrs
1	**Entrepreneurship:** Introduction to Entrepreneurship, Need for Entrepreneurship, Types of Entrepreneurs, Types of Leaders, Entrepreneurship Development.	4
2	**Idea generation & Creativity:** Invention and Innovation, Types of Innovations, Idea Generation techniques: Brain storming. SCAMPER Technique, Morphological Matrix; Evaluation Strategies.	4
3	**Market Research and Planning:** Purpose of market research, Techniques of Market Survey, Procedure of market research and research process, Limitations of Market Survey.	4
4	**Prototyping & Rapid Prototyping:** Roles of Prototyping, Phases of Prototyping**,** Fundamentals of Rapid Prototyping, Benefits of Rapid Prototyping, Classification of Rapid Prototyping,	4
5	**Intellectual Property Rights:** Fundamentals of IPR, Legislations on IPR in INDIA, International Organization and Treaties, Types of IPRs: Patents, Trademarks, Copyrights, Trade Secret	4
6	**Techno-Economic Feasibility Analysis:** Types of Analysis: Economic Feasibility, Marketing Feasibility, Financial Feasibility, Technical Feasibility.	4
7	**Institutional & Financial Support for Start-Ups:** Government Policies for small scale industries, Different financial institutions for small scale industries and Incentives by government schemes. International Schemes	4

Tutorial will consists of one Assignment on each module and Case Studies.
Reference Books:

1. "Entrepreneurship Development", S. Anil kumar, New Age International Publishers.
2. "Entrepreneurial Development", S. S. Khanka, S. Chand & Company Ltd.
3. "Entrepreneurship Development", A. Nirjar, Word-Press.
4. "Rapid Prototyping, Principles and Applications", Chua C. K., Leong K. F. and Lim C. S., World Scientific Publishing Company Ltd.
5. Intellectual Property Rights", Neeraj Pandey and Khushdeep Dharni, PHI Learning Pvt. LTd.
6. Intellectual Property Rights, Texts and Cases", Dr. R. Radhakrishnan and Dr. S. Balasubramanium, Excel Books.

Sr. No.	**Examination**	**Module**
1.	**Test – I**	Module 1, 2
2.	**Test – II**	Module 3, 4
3.	**Endsem**	Module 1 to 7

OE-BTM614 Introduction to Optimization Methods

Course pre-requisites: Engineering Mathematics

Course Objectives:

1. To introduce tools and techniques for optimization to engineering applications
2. To understand the formulation of design equations for engineering systems.
3. To understand algorithms and methods used for optimization

Course Outcomes:

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

1. Explain different approaches to optimize engineering systems.
2. Create programs based on different optimization algorithms using IT tools, such as Minitab, MATLAB, etc.
3. Calculate optimum solution to linear and non-linear problems.
4. Apply the numerical and optimization understanding for finalizing design of engineering systems.

Course content:

M. No	Description	Hrs
1	Need for optimization and historical development, classification and formulation of optimization problem, objective function and constraints	04
2	Calculus based methods, function of single, two and multiple variables, Hessian matrix formulation, Kuhn-Tucker condition	04
3	Linear programming (LP) based methods, standard form of LP problem, graphical method for two variables, simplex algorithm, examples for transportation and assignment problems	04
4	Enumerative schemes, Random search algorithms	04
5	Integer programming, integer linear programming, mixed integer programming	04
6	Evolutionary algorithms, Genetic algorithms, Nature inspired optimization methods	04
7	Use of software tools for solving linear optimization problems	04

Text Books:

1. Rao, Singiresu S., and S. S. Rao. *Engineering optimization: theory and practice*. John Wiley & Sons, 2009.
2. Deb, Kalyanmoy. *Optimization for engineering design: Algorithms and examples*. PHI Learning Pvt. Ltd., 2012.

Reference Books

1. Mital, K.V., 1996. *Optimization methods in operations research and systems analysis*. New Age International.
2. Taha, Hamdy A. *Operations Research: An Introduction (For VTU)*. Pearson Education India, 1982.

Term work: Assignments containing numerical problems based on each module.
Seminar based on recent advances in subject.
At least one case study based on any one optimization method.

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

OE-BTM615 Project Management

Course pre-requisites: Nil

Course Objectives:

1. To understand knowledge areas and tool – techniques for efficient Project Management.
2. Understand the role of Project Management in an organization.
3. Develop an insight as to how Project Management tool/techniques are used strategically for the betterment of organization.
4. To improve management skills

Course Outcomes:

Upon successful completion of the course, students should be able

1. To describe the basic concepts in Project Management.
2. To describe the various tools and Techniques in Project Management.
3. To apply the various concepts and Tools in & Project Management for Industrial cases
4. To investigate the factors for improving the process and Managing the Project successfully.

Course Content:

Module No	Details	Hrs
1	**Introduction:** Introduction to Project Management, the triple constraint, Stakeholders, Project Management Knowledge Area, tools and techniques, Role of a Project Manager, job description, Suggested Skills, Importance of people and leadership skills.	**04**
2	Project Management: Overview, Organizational Structure, Project vs Operational Work, Organizational influences on Project Management, Project Life Cycle, Phases and Nature of Mechanical Engineering projects, Trends affecting Mechanical Engineering Project Management, Globalization, Outsourcing, and Virtual Teams.	**04**
3	Project Time Management, Defining and Sequencing Project Activities and Dependencies, Developing Schedule, Gantt Chart, Critical Path Method, Project Uncertainty – PERT, Critical Chain Method, Resource loading and Resource Leveling, Schedule Controlling.	**04**
4	Project Cost Management, Estimating Techniques, Earned Value Management, Project Quality Management, Planning Quality, Performing Quality Assurance, Quality Control – Tools and Techniques	**04**
5	Project Resource Management, Development of Human Resource Plan,	**04**

	Project Organizational Chart and Responsibility Assignment, Multi project Scheduling and Resource Allocation	
6	Project Communication Management, Identifying Stakeholders, Planning Communication, Project Risk Management, Identifying Risks; Common Sources of Risk in Mechanical Engineering Projects, Qualitative Risk Analysis: Probability and Impact Matrix, Quantitative Risk Analysis: Decision Trees, Planning Risk Response	**04**
7	Project Procurement Management Plan Procurements, Conduct Procurements, Administer Procurements, SLA	**04**

Term work

1. Assignments based on above modules
2. Seminar based on recent advances in the course
3. At least one Case study conducted at industry
4. MCQ on each module

Teaching Methods:

1. The course will use the following pedagogical tools:
2. Discussion on concepts and issues of Project Management in an organization.
3. Case discussion covering a cross section of gaining strategic advantage by applying Project Management tools and techniques.
4. Projects/ Assignments/ Quizzes/ Class participation etc.

References:

1. Meredith, Jack R., and Samuel J. Mantel Jr. Project management: a managerial approach. John Wiley & Sons, 2011.
2. Lewis, James P. Project Planning, Scheduling & Control, 4E. McGraw-Hill Pub. Co., 2005.
3. Larson, Erik W., and Clifford F. Gray. "Project management: The managerial process." (2011).
4. Meredith, Jack R., and Samuel J. Mantel Jr. Project management: a managerial approach. John Wiley & Sons, 2011.

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

VA-BTC671– Geographical Information Systems (GIS) and Its Applications

(AY 2019-20)

Prerequisites:

Course Outcomes:

With the rapid development of industry and information technology, users / researchers/ in all fields begin to discuss some new ideas connected with Geographic Information Systems (GIS). This course will provide a valuable opportunity for the students of all the fields to learn the theories and technologies in Geoinformatics, their applications to their related fields.

Course Objectives:

The students will learn:

1. About various softwares and their utility for geographical information systems (GIS), Digital elevation modeling, etc.
2. Demonstrate and use state-of-the-art computer softwares in conjunction with the fundamentals of civil and site design.

Course Outcome:

At the end of this course he students will be able to

1. Demonstrate an appropriate mastery of fundamental knowledge and software of GIS, DEM, and other technological processes inherent to their specific field of study.
2. Apply fundamental knowledge along with GIS technology and skills to conduct small projects.

Course Content

Module No	Topics	No. of Lectures
1	Introduction to GIS: Definition, sources of data, types of data, concept of space and time in GIS, spatial information theory, history of GIS, elements of GIS, objectives of GIS, hardware and software requirements of GIS, application of GIS	4
2	Data models of spatial information:	4

	representation of spatial data models in computer: raster and vector models, comparative overview between raster and vector models	
3	Data models of non-spatial information: Database management systems, hierarchical structure, network structure, relational structure	4
4	Digitizing, Editing and Structuring of map data: Digitizing: manual, semi-automatic and automatic, editing: error detection and correction, tolerances, topology creation, attribute map generation	4
5	Digital Elevation Model: Need of DEM, Various structures of DEM: line, TIN, grid.	4
6	Integration of GIS, GPS & RS: Integrated systems, its advantages, development of integrated systems.	4
7	Applications: Forest resource management, agriculture and soil management, water resource management, land use and land suitability, disaster management	8

Text Books:-

1. Geographic Information Systems and Science, Second Edition 2005: Longley, Paul A., Michael F. Goodchild, David J. Maguire, David W. Rhind, John Wiley & Sons, New York.
2. Modeling Our World: The ESRI Guide to Geodatabase Design: Zeiler, M. 1999. ESRI Press, Redlands, California
3. GIS, Spatial Analysis and Modeling: Maguire, D., M. Batty, and M. Goodchild. 2005, ESRI Press.
4. Introduction to geographic Information Systems: Kang-tsung Chang, Tata McGraw Hill.
5. Advanced Surveying (Total Station, GIS and Remote Sensing) First Edition 2007: SatheeshGopi, R. Sathikumar, N. Madhu,