DR. A.P.J ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW

EVALUATION SCHEME & SYLLABUS

FOR

B. TECH. THIRD YEAR

(CIVIL ENGINEERING)

(Effective from session 2020-21)

FIFTH SEMESTER CIVIL ENGINEERING SESSION 2020-21

S.No	Subject Code	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KCE 501	Geotechnical Engineering	3	1	0	30	20	50		100		150	4
2	KCE 502	Structural Analysis	3	1	0	30	20	50		100		150	4
3	KCE 503	Quantity Estimation and Construction Management	3	1	0	30	20	50		100		150	4
4		Departmental Elective-I	3	0	0	30	20	50		100		150	3
	KCE 051	Concrete Technology											
	KCE 052	Modern Construction Materials											
	KCE 053	Open Channel Flow											
	KCE 054	Engineering Geology											
5		Departmental Elective-II	3	0	0	30	20	50		100		150	3
	KCE-055	Engineering Hydrology											
	KCE-056	Sensor and Instrumentation Technologies for Civil Engineering Applications											
	KCE-057	Air and Noise Pollution Control											
	KCE-058	GIS and Advance Remote Sensing											
6	KCE-551	CAD Lab	0	0	2				25		25	50	1
7	KCE-552	Geotechnical Engineering Lab	0	0	2				25		25	50	1
8	KCE-553	Quantity Estimation and Management Lab	0	0	2				25		25	50	1
9	KCE-554	Mini Project or Internship Assessment*	0	0	2				50			50	1
10		Constitution of India/Essence of Indian Traditional Knowledge	2	0	0								
11		MOOCs (Essential for Hons. Degree)											
		Total	17	3	8							950	22

* The Mini Project or Internship (4 weeks) conducted during semester break after IV semester and will be assessed during V semester.

NOTE:

1. Regular classroom interaction with industry experts is to be ensured in all theory courses (minimum two expert talks from relevant Industry).
2. Working on experiments using virtual labs is to be ensured in lab courses.
3. Student's visit to Industry/Industry Expert's project site must be arranged as & when possible.

SIXTH SEMESTER CIVIL ENGINEERING SESSION 2020-21

S.No	Subject Code	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	Total	PS	TE	PE		
1	KCE 601	Design of Concrete Structures	3	1	0	30	20	50		100		150	4
2	KCE 602	Transportation Engineering	3	1	0	30	20	50		100		150	4
3	KCE 603	Environmental Engineering	3	1	0	30	20	50		100		150	4
4		Departmental Elective-III	3	0	0	30	20	50		100		150	3
	KCE 061	Advance Structural Analysis											
	KCE 062	River Engineering											
	KCE 063	Repair and Rehabilitation of Structures											
	KCE 064	Foundation Engineering											
5		Open Elective-I	3	0	0	30	20	50		100		150	3
6	KCE 651	Transportation Engineering Lab	0	0	2				25		25	50	1
7	KCE 652	Environmental Engineering Lab	0	0	2				25		25	50	1
8	KCE 653	Structural Detailing Lab	0	0	2				25		25	50	1
9	NC*	Essence of Indian Traditional Knowledge/Constitution of India	2	0	0	15	10	25		50			
10		MOOCs (Essential for Hons. Degree)											
		Total	17	3	6							900	21

NOTE:

1. Regular classroom interaction with industry experts is to be ensured in all theory courses (minimum two expert talks from relevant Industry).
2. Working on experiments using virtual labs is to be ensured in lab courses.
3. Student's visit to Industry/Industry Expert's project site must be arranged as & when possible.

KCE 501 GEOTECHNICAL ENGINEERING (L-T-P 3-1-0) Credit – 4

Course Outcomes: After completion of the course student will be able to:

CO-1 Classify the soil and determine its Index properties.
CO-2 Evaluate permeability and seepage properties of soil.
CO-3 Interpret the compaction and consolidation characteristics & effective stress concept of soil.
CO-4 Determine the vertical and shear stress under different loading conditions and explain the phenomenon of soil liquefaction.
CO-5 Interpret the earth pressure and related slope failures.

Unit 1

Origin and classification: Preview of Geotechnical field problems in Civil Engineering, Soil formation, transport and deposit, Soil composition, Basic definitions, Weight volume relationships, Clay minerals, Soil structure, Index properties, sensitivity and thixotropy,
Particle size analysis, Unified and Indian standard soil classification system. **[8]**

Unit 2

Soil Hydraulics: Stress conditions in soil- total, effective and neutral stresses and relationships. Permeability - Darcy's Law, hydraulic conductivity, equivalent hydraulic conductivity in stratified soil.

Seepage, flow nets, seepage calculation from a flow net, flow nets in anisotropic soils, seepage through earth dam, capillarity, critical hydraulic gradient and quick sand condition, uplift pressure, piping. **[8]**

Unit 3

Soil compaction, water content - dry unit weight relationships. Factors controlling compaction. Field compaction equipment; field compaction control; Proctor needle method.

Consolidation: Primary and secondary consolidation, Terzaghi's one dimensional theory of consolidation, Consolidation test, Normal and Over Consolidated soils, Over Consolidation Ratio, determination of coefficient of consolidation. **[8]**

Unit 4

Stress Distribution in soil: Elastic constants of soils and their determination, Boussinesq equation for vertical stress, The Westergaard equation, Stress distribution under loaded areas, Concept of pressure bulb, contact pressure.

Shear Strength: Mohr-Coulomb failure criterion, shear strength parameters and determination; direct and tri-axial shear test; unconfined compression test; pore pressure, Skempton's pore pressure coefficients, and Soil liquefaction. **[8]**

Unit 5

Earth pressure: Classical theories, Coulomb and Rankine's approaches for frictional and c-φ soils, inclined backfill, Graphical methods of earth pressure determination.
Stability of slopes - finite and infinite slopes, types of slope failure, Culmann's method & Method of slices, Stability number & chart, Bishop's method. **[8]**

Text & References Books

1. V.N.S. Murthy – Soil Mechanics and Foundation Engineering (Fifth Edition)
2. K.R. Arora – Soil Mechanics and Foundation Engineering
3. Narasinga Rao, B.N.D, "Soil Mechanics & Foundation Engineering", John Wiley &Sons, Wiley India Pvt. Ltd., Daryaganj, New Delhi – 110 002.
4. Alam Singh – Modern Geotechnical Engineering
5. Brij Mohan Das – Geotechnical Engineering , CENGAGE Learning
6. I.H. Khan – Text Book of Geotechnical Engineering
7. C. Venkataramaiah – Geotechnical Engineering
8. Gopal Ranjan and A.S.R. Rao – Basic and Applied Soil Mechanics
9. G.V. Rao & G.V.S.S. Raju – Engineering with Geosynthetics
10. P. Purushottam Raj- Soil Mechanics and Foundation Engineering, Pearson Education in South Asia, New Delhi.
11. Shenbaga R Kaniraj- Design Aids in Soil Mechanics and Foundation Engineering
12. Gulati, S.K., "Geotechnical Engineering" McGraw Hill Education (India), Pvt. Ltd., Noida.

KCE502 STRUCTURAL ANALYSIS (L-T-P 3-1-0) Credit – 4

Course Outcomes:

After completion of the course student will be able to:

CO-1 Explain type of structures and method for their analysis.
CO-2 Analyze different types of trusses for member forces.
CO-3 Compute slope and deflection in determinate structures using different methods.
CO-4 Apply the concept of influence lines and moving loads to compute bending moment and shear force at different sections.
CO-5 Analyze determinate arches for different loading conditions.

Unit 1

Classification of Structures, Types of structural frameworks and Load transfer Mechanisms, stress resultants, degrees of freedom, Static and Kinematic Indeterminacy for beams, trusses and building frames. Analysis of cables with concentrated and continuous loadings, Effect of Temperature upon length of cable. **[8]**

Unit 2

Classification of Pin jointed determinate trusses, Analysis of determinate plane trusses (compound and complex). Method of Substitution, Method of tension coefficient for analysis of plane trusses. **[8]**

Unit 3

Strain Energy of deformable systems, Maxwell's reciprocal & Betti's theorem, Castigliano's theorems, Calculations of deflections: Strain Energy Method and unit load method for statically determinate beams, frames and trusses. Deflection of determinate beams by Conjugate beam method. **[8]**

Unit 4

Rolling loads and influence line diagrams for determinate beams and trusses, Absolute maximum bending moment and shear force. Muller-Breslau's principal & its applications for determinate structures. **[8]**

Unit 5

Arches, Types of Arches, Analysis of three hinged parabolic and circular Arches. Linear arch, Eddy's theorem, spandrel braced arch, moving load & influence lines for three hinged parabolic arch. **[8]**

References

1. Hibbler, "Structural Analysis", Pearson Education
2. Mau, "Introduction to Structural Analysis" CRC Press Taylor & Francis Group.
3. Ghali, " Structural Analysis: A Unified Classical and Matrix Approach" 5/e, CRC Press Taylor & Francis Group.
4. T S Thandavmorthy, "Analysis of Structures", Oxford University Press 5.Wilbur and Norris, "Elementary Structural Analysis", Tata McGraw Hill.
5. Temoshenko & Young "Theory of Structure" Tata Mc Grew Hill.
6. Reddy, CS, "Basic Structural Analysis", Tata McGraw Hill.
7. Jain, OP and Jain, BK, "Theory & Analysis of Structures ". Vol.I & II Nem Chand.
8. Vazirani & Ratwani et al , "Analysis of Structures", Khanna Publishers

9. Coates, RC, Coutie, M.G. & Kong, F.K., “Structural Analysis”, English Language Book Society & Nelson, 1980.
10. SP Gupta & Gupta “Theory of Structure Vol.1 & 2” TMH
11. DS Prakash Rao “Structural Analysis: A Unified Approach” Universities Press.
12. S Ramamurtham “Theory of Structure” Dhanpat Rai.
13. Devdas Menon “Advanced Structural Analysis” Narosa
14. Wang, CK, “Intermediate Structural Analysis”, Tata Mc-Graw Hill.
15. Hsieh, “Elementary Theory of Structures” 4/e, Pearson Education, Noida.
16. Mckenzie, “Examples in Structural Analysis” 2/e, CRC Press Taylor & Francis Group.
17. Bibek Kumar Mukherjee, “Theory and Analysis of Structures” Satya Prakashan, New Delhi.
18. Jacques Heyman, “Structural Analysis” Cambridge University Press.

KCE 503 QUANTITY ESTIMATION AND CONSTRUCTION MANAGEMENT

(L-T-P 3-1-0) Credit – 4

Course Outcomes:

After completion of the course student will be able to:

CO-1 Understand the importance of units of measurement and preliminary estimate for administrative approval of projects.

CO-2 Understand the contracts and tender documents in construction projects.

CO-3 Analyze and assess the quantity of materials required for civil engineering works as per specifications.

CO 4 Evaluate and estimate the cost of expenditure and prepare a detailed rate analysis report.

CO-5 Analyze and choose cost effective approach for civil engineering projects.

Unit 1

Quantity Estimation for Buildings Measurement units for various building materials, Centreline method, Long and short wall method of estimates, Types of estimates, PWD schedule of rate. **[8]**

Unit 2

Rate Analysis, Specification and Tenders Analysis of rates knowing cost of material, labour, equipment, overheads, profit, taxes etc, Specifications – Preparation of detailed and general specifications, Legal aspects of contracts, laws related to contracts, land acquisition, labour safety and welfare. Different types of contracts, their relative advantages and disadvantages. Elements of tender preparation, process of tendering, pre-qualification of contracts, Evaluation of tenders, contract negotiation and award of work, monitoring of contract extra items. **[8]**

Unit 3

Elements of Management & Network Techniques Project cycle, Organization, planning, scheduling**,** monitoring, updating and management system in construction, Bar charts, milestone charts, work break down structure and preparation of networks. Network Techniques like PERT & CPM in construction management. Project monitoring and resource allocation through network techniques. **[8]**

Unit 4

Equipment Management Productivity, operational cost, owning and hiring cost and the work motion study. Simulation techniques for resource scheduling. Construction Equipment for earth moving, earth compaction, Hauling Equipment, Hoisting Equipment, Conveying Equipment, Concrete Production Equipment, Tunnelling Equipment **[8]**

Unit 5

Project Cost Management Budgeting, Cost planning, Direct Cost, Indirect cost, Total Cost Curve, Cost Slope. Time value of money, Present economy studies, Equivalence concept,

financing of projects, economic comparison, present worthmethod Equivalent annual cost method, discounted cash flow method, Depreciation and its type, depletion, Arbitration, and break even cost analysis. **[8]**

References:

1.Dutta, B.N., "Estimating and Costing in Civil Engineering", UBS Publishers & Distributors Pvt. Ltd., 2003

2.Srinath, L.S., "PERT and CPM Principals and applications" Affiliated East-West Press Pvt. Ltd., New Delhi.

3.Patil, B.S., "Civil Engineering Contracts and Estimates" University Press India, Pvt. Ltd. Hyderabad –500 004

4.Construction Management by Ojha

5.Srivastava, U.K., "Construction Planning and Management", Galgotia Publications Pvt. Ltd., New Delhi.

6.Construction Technology by Sarkar, Oxford

7.Delhi Schedule of Rates (latest version)

KCE-551 CAD LAB **(L-T-P 0-0-2) Credit- 1**

1. Working on latest version of geotechnical engineering software (Open source/commercial software)

2. Working on latest version of surveying software (Open source/commercial software)

NOTE:-

For open source software the following link of FOSSEE may be used apart from other available resources:

https://fossee.in

FOSSEE: (Free/Libre and Open Source Software for Education), National mission on education through ICT, MHRD, Govt. of India.

KCE-552 GEOTECHNICAL ENGINEERING LAB **(L-T-P 0-0-2) Credit- 1**

PART -A (To be performed in lab)

1. Determination of water content of a given moist soil sample by (i) oven drying method, (ii) pycnometer method.
2. Determination of specific gravity of a given soil sample by (i) density bottle, (ii) pycnometer method.
3. Determination of in situ dry density of soil mass by (i) core-cutter method, (ii) sand replacement method.
4. Determination of relative density of a given soil sample.
5. Determination of complete grain size distribution of a given soil sample by sieve analysis and sedimentation (hydrometer) analysis.
6. Determination of consistency limits (liquid, plastic and shrinkage limits) of the soil sample used in experiment no. 5 (grain-size analysis).
7. Determination of shear strength of soil by Direct shear test.
8. Determination of compaction characteristics (OMC & MDD) of a given soil sample.
9. Determination of permeability of a remoulded soil sample by constant head &/or falling head method.
10. Determination of consolidation characteristics of a remoulded soil sample by an odometer test.
11. Determination of shear strength characteristics of a given soil sample by U/U test from Triaxial Compression Machine.
12. Retrieving soil samples and conducting SPT tests by advancing boreholes through hand-held auger.

Note: Any 8 experiments are to be performed from the list of experiments.

PART B

It is mandatory to perform experiments using virtual lab where ever applicable.

References:

1. Bowles, Joseph E., "Engineering Properties of Soil and Their Measurement" Fourth Edition, Indian Edition, McGraw Hill Education (India) Pvt. Ltd, New Delhi-110032.

KCE - 553: QUANTITY ESTIMATION AND MANAGEMENT LAB

(L-T-P 0-0-2) Credit- 1

1. Study of DSR, CPWD specifications and NBC.
2. Estimation of quantities for any one of the following: Building/ Septic tank/Water supply pipe line/road/bridge.
3. Preparation of Bill of Quantities (BOQ) for above project.
4. Practice on open source project management software / MS Project/Primavera software for same problem.
5. Study of any full set of tender documents (Institute shall provide the set from ongoing/ completed tenders).

NOTE:-

1. Suitable software must be used to complete above exercises in 8-10 hours.
2. For open source software the following link of FOSSEE may be used apart from other available resources:

https://fossee.in

References:

1. FOSSEE: (Free/Libre and Open Source Software for Education), National mission on education through ICT, MHRD, Govt. of India
2. Dutta, B.N., "Estimating and Costing in Civil Engineering", UBS Publishers & Distributors Pvt. Ltd., 2003
3. Srinath, L.S., "PERT and CPM Principals and applications" Affiliated East-West Press Pvt. Ltd., New Delhi.
4. Patil, B.S., "Civil Engineering Contracts and Estimates" University Press India, Pvt. Ltd. Hyderabad –500 004
5. Construction Management by Ojha
6. Srivastava, U.K., "Construction Planning and Management", Galgotia Publications Pvt. Ltd., New Delhi.
7. Construction Technology by Sarkar, Oxford

8. S V Deodhar and SC Sharma, "Construction engineering and Management", Khanna Publishing House.
9. Delhi Schedule of Rates (latest version)

KCE 051 CONCRETE TECHNOLOGY (L-T-P 3-0-0) Credit – 3

Course Outcomes:

After completion of the course student will be able to:

CO-1 Understand the properties of constituent material of concrete.
CO-2 Apply admixtures to enhance the properties of concrete.
CO-3 Evaluate the strength and durability parameters of concrete.
CO-4 Design the concrete mix for various strengths using difference methods.
CO-5 Use advanced concrete types in construction industry.

Unit 1
Cement : types and cement chemistry. Aggregates: mineralogy, properties, test and standards. Quality of water for use in concrete. **[8]**

Unit 2
Introduction & study of accelerators, retarders, water reducers, air entrainers, water proofers, super plasticizers. Study of supplementary cementing materials like fly ash, silica fume , ground granulated blast furnace slag, metakaoline and pozzolana; their production, properties and effect on concrete properties . **[8]**

Unit 3
Concert production: batching, mixing and transportation of concrete. Workability test: slump test, compacting factor test and Vee Bee test. Segregation, bleeding and Laitance in concrete, curing of concrete and its methods. Determination of compressive and flexural strength as per BIS. Mechanical properties of concrete: elastic modules, poisson's ratio, creep, shrinkage and durability of concrete. **[8]**

Unit 4
Principle of mix proportioning, properties related to mix design, Mix design method (IS method and ACI method). Mix design of concrete, Rheology, mix design examples **[8]**

Unit 5
Study and uses of high strength concrete, self-compacting concrete, fibre reinforced concrete, ferro cement, ready Mix Concrete, recycled aggregate concrete and status in India. **[8]**

References

1. Neville, A.M. and Brooks, J.J.," CONCRETE TECHNOLOGY", ELBS .1990.
2. Shetty, M.S, "Concrete Technology, Theory and Practice", S. Chand and Company Ltd, New Delhi, 2008.
3. Gambhir, M.L, "Concrete Technology", Tata McGraw Hill Publishing Company Ltd, New Delhi, 2004.
4. Santhakumar, A.R; "Concrete Technology" , Oxford University Press, New Delhi, 2007.
5. Gupta B.L., Amit Gupta, "Concrete Technology", Jain Book Agency, 2010.
6. Newman, K., "CONCRETE SYSTEMS in COMPOSITE MATERIALS".EDT BY L. Holliday. Elsevier Publishing Company. 1966.
7. Popovics. S., "FUNDAMENTALS OF PORTLAND CEMENT CONCRETE: A Quantitative Approach VOL 1 FRESH CONCRETE" JOHN WILEY & SONS.1982.
8. P.K. Mehta and Paulo J.M. Monteiro, "Concrete: microstructure, properties and materials", The Mc GrawHill Companies.
9. Jayant D. Bapat (2013),Mineral admixtures in cement and concrete, Taylor and Francis group.
10. Concrete mix proportioning as per IS 10262:2009 – Comparison with IS 10262:1982 and ACI 211.1-91 M.C. Nataraja and Lelin Das
11. IS10262-1982 Recommended Guidelines for Concrete Mix Design, Bureau of Indian Standards, New Delhi, 1998.
12. IS456-2000 Plain and Reinforced Concrete- Code of Practice, Bureau of Indian Standards, New Delhi, 2000.

KCE 052 MODERN CONSTRUCTION MATERIALS (L-T-P 3-0-0) Credit – 3

Course Outcomes:

After completion of the course student will be able to:

CO-1 Understand the use of modern construction materials.
CO-2 Use geosynthetics and bituminous materials in constructions.
CO-3 Apply knowledge of modern materials in production of variety of concrete.
CO-4 Apply knowledge of composites and chemicals in production of modern concrete.
CO-5 Use modern water proofing and insulating materials in constructions.

Unit 1

Introduction, properties and uses of modern building materials: fly ash bricks, soil – cement blocks, calcium silicate bricks, red mud jute fibre polymer composite (RFPC) , glass reinforced gypsum. **[8]**

Unit 2

Introduction , properties and use of: geosynthetics, bituminous material, fire resistant materials (chemicals ,paints ,tiles ,bricks, glass),metals, light - weight concrete, mass concrete, waste material based concrete. **[8]**

Unit 3

Introduction , properties and use of: Ferro cement &fibre reinforced concrete, different types of fibres, high density concrete, Nuclear concrete, heat resisting & refractory concretes, prefabricated systems. **[8]**

Unit 4

Introduction , properties and use of: Polymers, fibre reinforced polymers, polymer concrete composites (PCCs), sulphur concrete and sulphur - infiltrated concrete. **[8]**

Unit 5

Introduction , properties and use of: Conventional and modern water proofing materials, Conventional and modern insulating materials(thermal, sound and electrical insulating materials).Concept of polymer floor finishes. **[8]**

Reference Book:

1) GhambhirM.L."Concrete Technology" Tata McGraw Hill education private Limited.

2) A.R. Santhakumar, Concrete Technology, Oxford University Press.
3) Building Materials, P.C. Varghese, Prentice-Hall India.
4) Shetty, M. S., "Concrete Technology" S. Chand Publication.
5) Krishnaraju .N., Advanced Concrete Technology, CBS Published.
6) Materials Science and Engineering: An introduction, W.D. Callister, John Wiley.
7) Nevile. A.M., Concrete Technology, Prentice Hall, Newyork.
8) Dr. U. K. Shrivastava, Building Materials Technology, Galgotia Publication pvt.ltd.
9) Materials Science and Engineering, V. Raghavan, Prentice Hall.
10) Properties of Engineering Materials, R.A. Higgins, Industrial Press.
11) Construction materials: Their nature and behaviour, Eds. J.M. Illston and P.L.J. Domone, 3rd ed., Spon Press.
12) The Science and Technology of Civil Engineering Materials, J.F. Young, S. Mindess,R.J. Gray & A. Bentur, Prentice Hall.
13) Engineering Materials 1: An introduction to their properties & applications, M.F. Ashby and D.R.H. Jones, Butterworth Heinemann.
14) The Science and Design of Engineering Materials, J.P. Schaffer, A. Saxena, S.D. Antolovich, T.H. Sanders and S.B. Warner, Irwin.
15) Concrete: Microstructure, properties and materials, P.K. Mehta and P.J.M. Monteiro, McGraw Hill.
16) S K Sharma, "Civil Engineering and construction material," Khanna Publishing House.
17) Properties of concrete, A.M. Neville, Pearson.

KCE-053 : OPEN CHANNEL FLOW (L-T-P 3-0-0) Credit – 3

Course Outcomes:

After completion of the course student will be able to:

CO-1 Apply knowledge of fluid flow for designing of channel sections.
CO-2 Analyze the gradually varied flow in channel section.
\CO-3 Analyze the rapidly varied flow in channel sections.
CO-4 Apply numerical methods for profile computation in channels.
CO-5 Design channels for sub critical and super critical flows.

Unit 1

Introduction: Basic concepts of free surface flows, velocity and pressure distribution, Mass, energy and momentum principle for prismatic and non-prismatic channels, Review of Uniform flow: Standard equations, hydraulically efficient channel sections, compound sections **[8]**

Unit 2

Gradually Varied Flow (GVF): Equation of gradually varied flow and its limitations, flow classification and surface profiles, Control sections, Computation methods and analysis: Integration of varied flow equation by analytical, graphical and advanced numerical methods, Transitions of subcritical and supercritical flow, flow in curved channels. **[8]**

Unit 3

Rapidly Varied Flow (RVF): Characteristics of rapidly varied flow, Classical hydraulic jump, Evaluation of the jump elements in rectangular and non-rectangular channels on horizontal and sloping beds, Hydraulic jump in gradually and suddenly expanding channels, submerged hydraulic jump, rolling and sky jump, use of jump as an energy dissipater, **[8]**

Flow measurement: by sharp crested and broad crested weirs, critical depth flumes, sluice gate, Free over fall.

Rapidly varied unsteady flow: Equation of motion for unsteady flow, "Celerity" of the gravity wave, deep and shallow water waves, open channel positive and negative surge, **[8]**

Unit 4

Spatially Varied Flow (SVF): Basic principles, Differential SVF equations for increasing and decreasing discharge, Classifications and solutions, Numerical methods for profile computation, low over side-weir and Bottom-rack. **[8]**

Unit 5

Flow in channel of non-linear alignment and non-prismatic channel sections, Design considerations for sub critical and super critical flows, Design of culvert.

References:

1. Chow, V.T., Open channel Hydraulics, McGraw Hill International
2. Henderson, F.M., Open Channel Flow, McGraw Hill International

3. Subramanya, K., Flow in Open Channels, Tata McGraw Hill
4. Ranga Raju, K.G., Flow through open channels, T.M.H.
5. M. Hanif Chaudhry, Open Channel Flow, PHI
6. French, R.H., Open channel Hydraulics, McGraw Hill International
7. Srivastava, Flow through Open Channels, Oxford University Press.
8. Open Channel Flow by Madan Mohan Das

KCE 054 ENGINEERING GEOLOGY **(L-T-P 3-0-0) Credit – 3**

Course Outcomes:

After completion of the course student will be able to:

CO-1 Understand the scope of geological studies.
CO-2 Understand the rocks and its engineering properties.
CO-3 Understand the minerals and constituents of rocks.
CO-4 Understand the rock deformations, their causes effects and preventive measures.
CO-5 Understand the ground water reserves, Geophysical exploration methods and site selection for mega projects.

Unit 1

Introduction-Branches of geology useful to civil engineering, scope of geological studies in various civil engineering projects. Department dealing with this subject in India and their scope of work- GSI, Granite Dimension Stone Cell, NIRM. Mineralogy-Mineral, Origin and composition. Physical properties of minerals, susceptibility of minerals to alteration, basic of optical mineralogy, SEM, XRD., Rock forming minerals, mega scopic identification of common primary & secondary minerals. **[8]**

Unit 2

Study of Rocks: Introduction and importance of Geological knowledge. Rocks: their origin, structure and texture. Classification of igneous, sedimentary and metamorphic rocks and their suitability as engineering materials, Weathering and erosion of rocks, Stratification, Lamination bedding.Outcrop-its relation to topography. Dip and Strike of bed. Overlap, outlier and Inlier. Building stones and their engineering properties. **[8]**

Unit3

Study of Minerals: Physical properties of minerals. Detailed study of certain rock forming minerals. Alkaliaggregate reaction. Grouting. Pozzolonic materials. **[8]**

Unit4

Rock Deformation & Earthquake Folds, Faults, Joints and unconformities: Their classification, causes and relation to engineering behavior of rock masses. Landslides, its causes and preventive measures. Earthquake, its causes, classification, seismic zones of India and its geological consideration. **[8]**

Unit5

Geophysical Exploration and Geological Investigation: Geophysical exploration methods for sub-surface structure. Underground water and its origin. Aquifer & Aquiclude. Artesian wells. Underground provinces and its role as geological hazard. Site selection for dam, reservoir, tunnel, bridge and highway. **[8]**

References:

1. D Venkat Reddy: Engg. Geology, Vikas Publication
2. Tony Waltham: Foundations of Engg. Geology, Spon Press
3. Tony Waltham: Foundations of Engineering Geology, SPON Press.
4. D Venkat Reddy: Engineering Geology, Vikas Publishing House Pvt. Ltd.
5. J M Treteth: Geology of Engineers, Princeton, Von. Nostrand.
6. K V G K Gokhale: Text book of Engineering Geology, B S Publication.
7. Prabin Singh: Engg. and General Geology, Katson Publishing House.
8. D S Arora: Geology for Engineers, Mohindra Capital Publishers, Chandigarh.
9. F G Bell: Fundamental of Engineering Geology, B S Publication.
10. Leggot R F: Geology and Engineering, McGraw Hill, New York.
11. P K Mukerjee: A Text book of Geology, Calcuta Word Publishers.
12. B S Sathya Narayanswami: Engineering Geology, Dhanpat Rai & Co.
13. Prakash Rao : Engineering Geology, Nirali Prakashan, Pune.

KCE055 ENGINEERING HYDROLOGY (L-T-P 3-0-0) Credit – 3

Course Outcomes:

After completion of the course student will be able to:

CO-1 Understand the basic concept of hydrological cycle and its various phases.

CO-2 Understand the concept of runoff and apply the knowledge to construct the hydrograph.

CO-3 Apply the various methods to assess the flood.

CO-4 Assess the quality of various forms of water and their aquifer properties.

CO-5 Understand the well hydraulics and apply ground water modelling techniques.

Unit 1

Introduction: hydrologic cycle, water budget equations, world water balance, Precipitation: Forms of precipitation, measurement. Introduction to characteristics of storm. Abstraction from Precipitation: Evaporation – process, measurement and estimation; Evapotranspiration-measurement and estimation; Initial Losses- Interception & Depression storage; Infiltration-process, capacities indices, measurement & estimation. **[8]**

Unit 2

Runoff and Hydrographs: Runoff characteristics of stream, mass curve. Hydrograph, Factors affecting flood hydrographs, unit hydrograph and its analysis, s-curve hydrograph, synthetic and instantaneous unit hydrographs. **[8]**

Unit 3

Flood: Rational method, empirical formulae, flood frequency studies, statistical analysis, regional flood frequency analysis, design storm & design flood, risk/reliability and safety factor; Flood Routing: Basic equation, hydrologic storage routing & attenuation, hydrologic channel routing, flood forecasting & control, hydraulic method of flood routing. **[8]**

Unit 4

Groundwater: Introduction, forms of subsurface water, aquifers & its properties, Occurrence of ground water, hydro-geology& aquifers, Ground water movement.

Steady and unsteady flow through confined and unconfined aquifers. Well Hydraulics: Single& Multiple well system, partially penetrating wells, Image wells, Mutual interference of wells, well losses, specific capacity. **[8]**

Unit 5

Water Wells: Introduction to Well construction, completion and Development. Pumping equipment for water wells, maintenance of wells.
Ground Water quality, Contamination of groundwater and its Control, Ground Water Modelling Techniques and exploration, artificial discharge and Recharge of Ground Water, Roof-top rainwater harvesting and recharge. **[8]**

Text Books:

• 'Groundwater Hydrology' by Todd D. K., Wiley
• 'Groundwater Resource Evaluation' by Walton W. C., McGraw Hill
• 'Groundwater' by Raghunath H. M., New Age Publisher
• 'Engineering Hydrology' by K. Subramanya, Mc Graw Hill Education
• 'Hydrology: Principles. Analysis. Design' by Raghunath H. M., New Age Publisher
• 'Handbook of Applied Hydrology' by Chow V. T., Mc Graw Hill Education

Reference:

• 'Irrigation: Theory & Practice' by Michael A. M., Vikas Publication House
• 'Groundwater' by S.Ramakrishnan, Scitech Publications
• 'Irrigation: Theory & Practice' by Michael A. M., Vikas Publication House
• 'Engineering Hydrology' by Ojha, Oxford University Press.
• 'Introduction to Hydrology' by Viessman& Lewis by Pearson Publication.
• 'Applied Hydrology' by Fetter, by Pearson Publication

KCE 056 SENSOR AND INSTRUMENTATION TECHNOLOGIES FOR CIVIL ENGINEERING APPLICATIONS (L-T-P 3-0-0) Credit – 3

Course Outcomes:

After completion of the course student will be able to:

CO-1 Analyze the errors during measurements
CO-2 Describe the measurement of electrical variables
CO-3 Describe the requirements during the transmission of measured signals
CO-4 Construct Instrumentation/Computer Networks
CO-5 Suggest proper sensor technologies for specific applications
CO-6 Design and set up measurement systems and do the studies

Unit 1

Fundamentals of Measurement, Sensing and Instrumentation covering definition of measurement and instrumentation, physical variables, common types of sensors; Describe the function of these sensors; Use appropriate terminology to discuss sensor applications; and qualitatively interpret signals from a known sensor type, types of instrumentation, Sensor Specifics, Permanent installations, Temporary installations;

Unit 2

Sensor Installation and Operation covering to: i) Predict the response of sensors to various inputs; ii) Construct a conceptual instrumentation and monitoring program; iii) Describe the order and methodology for sensor installation; and iv) Differentiate between types of sensors and their modes of operation and measurement and v) Approach to Planning Monitoring Programs, Define target, Sensor selection, Sensor siting, Sensor Installation & Configuration, Advanced topic, Sensor design, Measurement uncertainty

Unit 3

Data Analysis and Interpretation covering a) Fundamental statistical concepts, b) Data reduction and interpretation, c) Piezometer, Inclinometer, Strain gauge, etc. d) Time domain signal processing, e) Discrete signals, Signals and noise and f) a few examples of statistical information to calculate are: Average value (mean), On average, how much each measurement deviates from the mean (standard deviation), Midpoint between the lowest and highest value of the set (median), Most frequently occurring value (mode), Span of values over which your data set occurs (range)

Unit 4

Frequency Domain Signal Processing and Analysis covering Explain the need for frequency domain analysis and its principles; Draw conclusions about physical processes based on analysis of sensor data; Combine signals in a meaningful way to gain deeper insight into physical phenomena, Basic concepts in frequency domain signal processing and analysis,

Fourier Transform, FFT (Fast Fourier Transform), Example problems: Noise reduction with filters, Leakage, Frequency resolution

Text/Reference Books:

Alan S Morris (2001), Measurement and Instrumentation Principles, 3rd/e, Butterworth Hienemann

David A. Bell (2007), Electronic Instrumentation and Measurements 2nd/e, Oxford Press

S. Tumanski (2006), Principle of Electrical Measurement, Taylor & Francis

Ilya Gertsbakh (2010), Measurement Theory for Engineers, Springer

KCE 057 AIR & NOISE POLLUTION CONTROL (L-T-P 3-0-0) Credit – 3

Course Outcomes:

After completion of the course student will be able to:

CO-1 Understand air pollutants and their impacts.
CO-2 Explain air pollution chemistry and meteorological aspects of air pollutants.
CO-3 Demonstrate methods for controlling particulate air pollutants.
CO-4 Demonstrate methods for controlling gaseous air pollutants.
CO-5 Understand automotive emission standards.
CO-6 Apply methods for controlling noise pollution.

Unit 1
Air pollution: composition and structure of atmosphere, global implications of air pollution, classification of air pollutants: particulates, hydrocarbon, carbon monoxide, oxides of sulphur, oxides of nitrogen and photochemical oxidants. Indoor air pollution. Effects of air pollutants on humans, animals, property and plants. **[8]**

Unit 2
Air pollution chemistry, meteorological aspects of air pollution dispersion; temperature lapse rate and stability, wind velocity and turbulence, plume behaviour, dispersion of air pollutants, the Gaussian Plume Model, stack height and dispersion. **[8]**

Unit 3
Ambient air quality and standards, air sampling and measurements. Control of particulate air pollutants using gravitational settling chambers, cyclone separators, wet collectors, fabric filters (Bag-house filter), electrostatic precipitators (ESP). **[8]**

Unit 4
Control of gaseous contaminants: Absorption, Adsorption, Condensation and Combustion, Control of sulphur oxides, nitrogen oxides, carbon monoxide, and hydrocarbons. Automotive emission
control, catalytic convertor, Euro-I, Euro-II and Euro-III specifications, Indian specifications. **[8]**

Unit 5
Noise pollution: Basics of acoustics and specification of sound; sound power, sound
intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation; psychoacoustics and noise criteria, effects of noise on health, annoyance rating schemes; special noise environments: Infrasound, ultrasound, impulsive sound and sonic boom; noise standards and limit values; noise instrumentation and monitoring procedure. Noise indices. Noise control methods. **[8]**

References:

1. Peavy, Rowe and Tchobanoglous: Environmental Engineering.
2. Martin Crawford: Air Pollution Control Theory.
3. Wark and Warner: Air Pollution: Its Origin and Control.
4. Rao and Rao: Air Pollution Control Engineering.
5. Nevers: Air Pollution Control Engineering.
6. Mycock, McKenna and Theodore: Handbook of Air Pollution Control Engineering and Technology.Suess and Craxford: W.H.O. Manual on Urban Air Quality Management
7. C.S. Rao, Air pollution and control
8. Advanced Air and Noise Pollution Control by Lawrence K. Wang, Norman C. Pereira & Yung IseHung.
9. Noise Pollution and Control by S. P.Singhal , Narosa Pub House
10. Textbook of Noise Pollution and Its Control by S. C. Bhatia, Atlantic; Edition

KCE 058 GIS AND ADVANCE REMOTE SENSING (L-T-P 3-0-0) Credit – 3

Course Outcomes:

After completion of the course student will be able to:

CO-1 Understand the concepts of Photogrametry and compute the heights of objects
CO-2 Understand the principles of aerial and satellite remote sensing, Able to comprehend the energy interactions with earth surface features, spectral properties of water bodies .
CO-3 Understand the basic concept of GIS and its applications, know different types of data representation in GIS
CO-4 Understand and Develop models for GIS spatial Analysis and will be able to know what the questions that GIS can answer are
CO-5 Illustrate spatial and non-spatial data features in GIS and understand the map projections and coordinates systems
CO-6 Apply knowledge of GIS and understand the integration of Remote Sensing and GIS

Unit 1

Introduction to photogrammetry Principles and types of aerial photographs, geometry of vertical and aerial photograph, Scale and Height measurement on single and vertical aerial photograph, Height measurement based on relief displacement, Fundamentals of Stereoscopy, fiducial points, parallax measurement using fiducial line. **[8]**

Unit 2

Remote sensing Basic concepts and foundation of Remote Sensing elements, Data information, Remote sensing data collection, Remote sensing advantages and Limitations,

Remote sensing process. Electromagnetic spectrum, Energy interaction with atmosphere and with earth surface features (soil, water, and vegetation) Indian Satellites and Sensors characteristics, Map and Image false color composite, introduction to digital data, elements of visual interpretations techniques. **[8]**

Unit 3

Geographic Information Systems Introduction to GIS, Components of GIS, Geospatial data: Spatial Data – Attribute Data- Joining Spatial and Attribute Data, GIS Operations: Spatial Data input- Attribute Data Management-Data Display-Data Exploration-Data Analysis. COORDINATE SYSTEMS: Geographic Coordinate system; Approximation of Earth, Datum: Map Projections; Types of Map Projections-Map Projection Parameters-Commonly used Map Projections – Projected Coordinate Systems. **[8]**

Unit 4

Vector data model Representation of simple features- Topology and its importance: coverage and its data structure, shape file:, data models for composite features Object Based Vector

Data Model; Classes and their Relationships: The geobased data model: Geometric representation of Spatial feature and data structure: Topology rules. **[8]**

Unit 5

Raster data model Elements of Raster data model: Types of Raster data: Raster data structure: Data conversion, Integration of Raster and Vector data. Data Input: Metadata: Conversion of Existing data, Creating new data, Remote sensing data, Field data, Digitizing, Scanning, on screen digitizing, importance of source map, Data Editing. **[8]**

TEXT BOOKS:

1. Remote Sensing of the environment- An earth resource perspective- 2nd edition- by John R. Jensen, Pearson Education.
2. Introduction to geographic information system- kang – Tsung Chang, Tata McGraw- Hill Education Private Limited.

REFERENCES:

1. Concepts & Techniques of GIS by C.P.Lo Albert, K.W. Yonng, Prentice Hall (India) Publications.
2. Remote Sensing and Geographical Information systems by M.Anji Reddy JNTU Hyderabad 2001, B.S. Publications.
3. Principals of Geo physical Information System- Peter A Burragh and Rachael A. Mc Donnell, Oxford Publishers 2004
4. Basics of Remote Sensing and GIS by S. Kumar, laxmi Publications.

KCE 601 DESIGN OF CONCRETE STRUCTURE (L-T-P 3-1-0) Credit – 4

Course Outcomes:

After completion of the course student will be able to:

CO-1 Analyse and Design RCC beams for flexure by IS methods.
CO-2 Analyse and Design RCC beams for shear by IS methods.
CO-3 Analyse and Design RCC slabs and staircase by IS methods.
CO-4 Design the RCC compression members by IS methods.
CO-5 Design various types of footings and cantilever retaining wall

Unit 1

Introduction to Various Design Philosophies, Design of Rectangular Singly and Doubly Reinforced Sections by Working Stress Method. Assumptions in Limit State Design Method, Design of Rectangular Singly and Doubly Reinforced beams, T-beams, L-beams by Limit State Design Method**.** **[8]**

Unit 2

Behaviour of RC beam in Shear, Shear Strength of beams with and without shear reinforcement, Minimum and Maximum shear reinforcement, design of beam in shear.

Introduction to development length, Anchorage bond, flexural bond. (Detailed Examples by Limit State Design Method), Failure of beam under shear, Concept of Equivalent Shear and Moments. **[8]**

Unit 3

Design of one way, One way continuous and cantilever solid slabs by Limit State Design Method, Design of Dog-legged staircases.

Design of two way slabs by limit state method, Serviceability Limit States, Control of deflection, cracking and vibrations. **[8]**

Unit 4

Design of Columns by Limit State Design Method- Effective height of columns, Assumptions, Minimum eccentricity, Short column under axial compression, requirements for reinforcement, Column with helical reinforcement, Short column under axial load and uni-axial bending, Design of columns under bi-axial loading by Design Charts. **[8]**

Unit 5

Structural behaviour of footings, Design of isolated footings, combined rectangular and trapezoidal footings by Limit State Method, Design of strap footings.

Structural behaviour of retaining wall, stability of retaining wall against overturning and sliding, Design of cantilever retaining wall by Limit State Method. **[8]**

References

1. IS: 456 – 2000.
2. Reinforced Concrete Design by S. U. Pillai& D. Menon, Tata Mc.-Graw, New Delhi
3. Reinforced Concrete – Limit State Design by A. K. Jain, Nem Chand & Bros., Roorkee.
4. Reinforced Concrete Vol. - II by H.J. Shah, Charotar Publisher, Gujarat.
5. RCC Designs (Reinforced Concrete Structures) by B.C. Punmia, Ashoka Kumar Jain and Arun Kumar Jain, Laxmi Publishers, New Delhi.
6. Reinforced Concrete Structures by R. Park and Pauley.
7. Reinforced Concrete Design by P. Dayaratnam.
8. Reinforced Concrete Design by M.L. Gambhir
9. Reinforced Concrete Design by S.N. Sinha , TMH
10. Plain and Reinforced Concrete Vol. I & II by O.P. Jain & Jai Krishna, Nem Chand & Bros.
11. SP-16: Design Aid to IS- 456.

KCE 062 TRANSPORTATION ENGINEERING (L-T-P 3-1-0) Credit – 4

Course Outcomes:

After completion of the course student will be able to:

CO-1 Understand the history of road development , their alignment & Survey.
CO-2 Design the various geometric parameters of road.
CO-3 Study the traffic characteristics & design of road intersections & signals.
CO-4 Examine the properties of highway materials & their implementation in design of pavements.
CO-5 Learn methods to construct various types of roads.

Unit 1

Introduction: Role of Transportation, Modes of Transportation History of road development, Road types and pattern, Nagpur road plan, Bombay road plan & 3rd 20 Year Road Plan, Highway Alignment & Location Survey: Horizontal Profile, Vertical Profile, Factors Controlling the alignment, Survey for route location, **[8]**

Unit 2

Geometric Design(IRC:73-Latest revision): Cross sectional elements, camber, shoulder, sight distance, horizontal curves, super elevation, extra widening, transition curves and gradient, vertical curves, summit and valley curves. **[8]**

Unit 3

Traffic Engineering: Traffic Characteristics, Traffic studies on flow, speed, travel time - delay and O-D study, PCU, peak hour factor, accident study , traffic capacity, density, traffic control devices: signs, Island, signal design by Webster's and IRC method . Intersection at grade and grade separated intersections, design of roundabouts as per IRC:65-2017.Highway capacity and level of service of rural highways and urban roads as per latest IRC recommendation **[8]**

Unit 4

Highway Materials: Properties of Subgrade, Aggregates & Binding materials, Various tests and specifications, Design of Highway Pavement : Types of Pavements, Design factors,Design of bituminous paving mixes; Design of Flexible Pavement by CBR method (IRC : 37- Latest revision), Design of rigid pavement, Westergaard theory, load and temperature stresses, joints, IRC method of rigid pavement design (IRC:58-2015) **[8]**

Unit 5

Highway Construction: Construction of Subgrade, Water Bound Macadam (WBM), Wet mix macadam (WMM), Granular Sub Base (GSB),Tack Coat, Prime Coat, Seal Coat, Surface

Dressing, Bituminous Macadam (BM), Semi dense bituminous concrete (SDBC) and Bituminous concrete, Dry lean concrete (DLC), Cement Concrete (CC) road construction, **[8]**

Note: All designs and procedure are to be done with reference to latest revision of IRC as given below in reference section

Text Book:

1. Khanna S. K., Justo C.E.G, & Veeraragavan, A. "Highway Engineering", Nem Chand and Bros., Roorkee- 247 667.
2. Khanna S. K., Justo C.E.G, & Veeraragavan A., "Highway Materials and Pavement Testing", Nem Chand and Bros., Roorkee- 247 667.

References:

1. Kadiyali L. R., & Lal, N.B. "Principles and Practices of Highway Engineering (including Expressways and Airport Engineering)", Khanna Publications, Delhi – 110 006
2. Saxena, Subhash C, A Textbook of Highway and Traffic Engineering, CBS Publishers & Distributers, New Delhi
3. Kumar, R Srinivasa, "A Text book of Highway Engineering", Universities Press, Hyderabad.
4. Kumar, R Srinivasa, "Pavement Design", Universities Press, Hyderabad.
5. Chakraborty Partha & Das Animesh., "Principles of Transportation Engineering", Prentice Hall (India), New Delhi,
6. IRC : 37- Latest revision, "Tentative Guidelines for the design of Flexible Pavements" Indian Roads Congress, New Delhi
7. IRC:58-2015 Guidelines for the Design of Plain Jointed Rigid Pavements for Highways (Fourth Revision) (with CD)
8. IRC:65-2017 Guidelines for Planning and Design of Roundabouts (First Revision)
9. IRC:73-1980 Geometric Design Standards for Rural (Non-Urban) Highways
10. IRC:106-1990 Guidelines for Capacity of Urban Roads in Plain Areas
11. IRC:93-1985 Guidelines on Design and Installation of Road Traffic Signals.
12. IRC:92-2017 Guidelines for Design of Interchanges in Urban Areas (First Revision)
13. IRC: SP: 68-2005, "Guidelines for Construction of Roller Compacted Concrete Pavements", Indian Roads Congress, New Delhi.
14. IRC: 15-2002, "Standard Specifications and Code of Practice for construction of Concrete Roads" Indian Roads Congress, New Delhi.
15. MORTH, "Specifications for Road and Bridge Works", Ministry of Shipping, Road Transport & Highways, Published by Indian Roads Congress, New Delhi.

KCE 603 ENVIRONMENTAL ENGINEERING (L-T-P 3-1-0) Credit – 4

Course Outcomes:

After completion of the course student will be able to:

CO-1 Assess water demand and optimal size of water mains.
CO-2 Layout the distribution system & assess the capacity of reservoir.
CO-3 Investigate physical, chemical & biological parameter of water.
CO-4 Design treatment units for water and waste water.
CO-5 Apply emerging technologies for treatment of waste water.

Unit 1

Fresh water, water demands, variation in demands, population forecasting by various methods, basic needs and factors affecting consumption, design period.

Transmission of water: Various types of conduits, capacity and sizes including economical sizes of rising main, structural requirements; laying and testing of water supply pipelines; pipe materials, joints, appurtenances and valves; leakages and control. **[8]**

Unit 2

Storage and distribution of water: Methods of distribution, pressure and gravity distribution systems, Concept of service and balancing reservoirs.

Capacity of distribution reservoirs: general design guidelines for distribution system. **[8]**

Unit 3

Physical, chemical and bacteriological examination of water and wastewater: Temperature, pH, colour and odour, solids, nitrogen and phosphorus, chlorides, toxic metals and compounds, BOD, COD etc. quality requirements, standards of water and waste water, disposal of wastewater on land and water bodies. **[8]**

Unit 4

Objectives of water treatment: unit operations, processes, and flow sheets.

Water treatment: screening, sedimentation, determination of settling velocity, efficiency of ideal sedimentation tank, design of settling tanks, grit chamber.

Primary sedimentation and coagulation, filtration: theory of filtration; hydraulics of filtration; slow sand, rapid sand and pressure filters, backwashing; design of slow and rapid sand filters.

Disinfection: requirements of an ideal disinfectant; various disinfectants, chlorination and practices of chlorination, water softening and ion-exchange process **[8]**

Unit 5

Objectives of waste water treatment: unit operations, processes, and flow sheets.

Secondary and tertiary treatment: secondary sedimentation and theory of organic matter removal. Working of activated sludge process, trickling filters; aerated lagoons, waste stabilization ponds, oxidation ditches, rotating biological contactors (RBC).

Anaerobic digestion of sludge: design of low and high rate anaerobic digesters and septic tank. Working of up flow anaerobic sludge blanket (UASB) reactor and other emerging technologies for wastewater treatment **[8]**

Text Books:

1. Peavy, Howard S., Rowe, Donald R and Tchobanoglous, George, "Environmental Engineering" McGraw Hill Education (India) Pvt. Ltd., New Delhi.
2. Metcalf & Eddy "Wastewater Engineering: Treatment & Reuse", Tata Mc-Graw Hill.
3. Garg, S.K.: Water Supply Engineering (Environmental Engineering Vol. – I)
4. Garg, S.K.: Sewage Disposal and Air Pollution Engineering (Environmental Engineering Vol.–II).
4. Garg: Sewage Disposal and Air Pollution Engineering (Environmental Engineering Vol. – II).
5. Davis, M.L. & Cornwell, D.A.: Introduction to Environmental Engineering, Mc-Graw Hill.

References:

1. Manual on Water Supply and Treatment, C. P. H. E. E. O.,Ministry of Urban Development, Government of India, New Delhi
2. Manual on Sewerage and Sewage Treatment, C. P. H. E. E. O.,Ministry of Urban Development, Government of India, New Delhi
3. Steel and McGhee: Water Supply and Sewerage
4. Fair and Geyer: Water Supply and Wastewater Disposal
5. Hammer and Hammer Jr.: Water and Wastewater Technology
6. Raju: Water Supply and Wastewater Engineering
7. Rao: Textbook of Environmental Engineering
8. Davis and Cornwell: Introduction to Environmental Engineering
9. Kshirsagar: Water Supply and Treatment and Sewage Treatment Vol. I and II
10. Punmia: Water Supply and Wastewater Engineering Vol. I and II
11. Birdie: Water Supply and Sanitary Engineering
12. Ramalho: Introduction to Wastewater Treatment Processes
13. Davis Mackenzie L., Cornwell, David A., "Introduction to Environmental Engineering" McGraw Hill Education (India) Pvt. Ltd., New Delhi.
14. Birdie: Water Supply and Sanitary Engineering
15. Ramalho: Introduction to Wastewater Treatment Processes
16. Parker: Wastewater Systems Engineering

KCE 651 TRANSPORTATION ENGINEERING LAB (L-T-P 0-0-2) Credit – 1

PART -A (To be performed in lab)

1. To Determine the Crushing Value of Coarse Aggregates.
2. To Determine the Impact Value of Coarse Aggregates.
3. To determine the Flakiness Index and Elongation Index of Coarse Aggregates.
4. To determine the Los Angeles Abrasion Value of Coarse Aggregates.
5. To determine the Stripping Value of Coarse Aggregates.
6. To determine the penetration Value of Bitumen.
7. To determine the Softening Point of Bituminous material.
8. To determine the Ductility Value of Bituminous material.
9. To determine the Flash and Fire Point of Bituminous material.
10. To determine the Stripping Value of Bituminous material.
11. Classified both directional Traffic Volume Study.
12. Traffic Speed Study. (Using Radar Speedometer or Enoscope).
13. Determination of CBR Value of soil sample in the Lab or in Field.

Note: A minimum of 8 experiments are to be performed from the list of Experiments.

PART B

1. It is mandatory to perform experiments using virtual lab where ever applicable.
2. Relevant IRC specifications and codes must be studied.

References:

1. Khanna S. K., Justo C.E.G, & Veeraragavan A., "Highway Materials and Pavement Testing", Nem Chand and Bros., Roorkee- 247 667.
2. Gambhir, M.L., Jamwal, Neha," Lab Manual: Building and Construction Materials, Testing and Quality Control" McGraw Hill Education (India), Pvt.Ltd., Noida.
3. Duggal, Ajay K., Puri, Vijay P.," Laboratory Manual in Highway Engineering" New Age International (P) Limited, Publishers, New Delhi.
4. Sood Hemant, Mittal, L.N., Kulkarni,P.D., " Laboratory Manual on Concrete Technology" CBS Publishers & Distribiters Pvt. Ltd. New Delhi.

KCE 652 ENVIRONMENTAL ENGINEERING LAB (L-T-P 0-0-2) Credit -1

PART -A (To be performed in lab)

1. Determination of turbidity and conductivity.
2. Determination of pH, alkalinity and acidity.
3. Determination of hardness and chlorides.
4. Determination of residual chlorine.
5. Determination of MPN (most probable number) of coliforms.
6. Measurement of SPM and PM10 with high volume sampler.
7. Measurement of sound level with sound level meter.
8. Determination of total , suspended and dissolved solids.
9. Determination of BOD.
10. Determination of COD.
11. Determination of kjeldahl nitrogen.
12. Determination of fluoride.
13. Determination of optimum dose of coagulants by Jar Test Apparatus.
14. Field Visit of Water/ Sewage Treatment Plant of a nearby area.

Note: 1. Experiment at S.NO. 14 is mandatory.
2. Any 8 Experiments out of the S.NO 1 to 13 are to be performed.

PART B

1. It is mandatory to perform experiments using virtual lab where ever applicable.
2. Relevant specifications and IS codes must be studied.

References:

1. A.P.H.A. “Standard Methods for the Examination of Water andWastewater”, American Public Health Association.
2. Sawyer, C.N., McCarty, P.L. & Parkin, G.F. “Chemistry for Environmental Engineering”, McGraw Hill.
3. Mathur, R.P. “Water & Wastewater Testing”, Lab Manual, Roorkee.
4. O P Gupta, Environmental Chemistry, " Khanna Publishing house.

KCE 653 STRUCTURAL DETAILING LAB (L-T-P 0-0-2) Credit – 1

PART -A (To be performed in lab)

1. To verify Maxwell's Reciprocal theorem.
2. To find horizontal thrust in a three-hinged arch and to draw influence line diagrams for Horizontal Thrust end Bending moment.
3. To find horizontal thrust in a two hinged arch and to draw influence line diagrams for horizontal Thrust and bending moment.
4. Study of SP34/IS13920/IS456:2000 for detailing of structural elements.
5. Preparation of working hand sketches and soft drawings using BIM software (Open source/Commercial) for the following-
    a) Simply supported, Continuous and Cantilever RCC Beams(T-beam and l-Beam)
    b) RCC Slabs – (Simply supported, Continuous, One way and two way).
    c) RCC Columns –(Tied columns and Spirally reinforced columns)
    d) Isolated and combined footings for RC Columns.
6. Preparation of bar bending schedule.
7. Detailing of buildings with respect to Earthquake Resistant Design
8. Study of full set of structural drawing of a building as made available by Institute.

PART B

It is mandatory to perform experiments using virtual lab where ever applicable.

NOTE:-

1. For open source software the following link of FOSSEE may be used apart from other available resources:

https://fossee.in

References:

1. FOSSEE: (Free/Libre and Open Source Software for Education), National mission on education through ICT, MHRD, Govt. of India

2. Krishna Raju N., "Structural Design and Drawing" University Press (India), Pvt.Ltd., Hyderabad.

KCE 061 ADVANCE STRUCTURAL ANALYSIS (L-T-P 3-0-0) Credit – 3

Course Outcomes:

After completion of the course student will be able to:

CO-1 Analyze indeterminate structure to calculate unknown forces, slope and deflections by different methods.
CO-2 Apply principle of influence lines to analyze indeterminate beams and arches.
CO-3 Analyze and design cable structure with their influence line diagram.
CO-4 Apply basics of force and stiffness methods of matrix analysis for beams, frames and trusses.
CO-5 Apply the basic of plastic analysis to analyze the structure by using different mechanism.

Unit 1
Analysis of fixed beams, Continuous beams and simple frames with and without translation of joint by Slope-Deflection method, Moment Distribution method and Strain Energy method. **[8]**

Unit 2
Muller-Breslau's Principle and its applications for drawing influence lines for indeterminate beams, Analysis of two hinged and fixed arches, Influence line diagrams for maximum bending moment, Shear force and thrust in two hinge arches. Analysis of two and three hinged stiffening girders. **[8]**

Unit 3
Introduction to Suspension Bridges, Analysis of two and three hinged stiffening girders, Influence line diagrams for maximum bending moment and shear force for stiffening girders. **[8]**

Unit 4
Basic Force and Displacement Matrix method for analysis of beams, frames and trusses. **[8]**

Unit 5
Basics of Plastic Analysis. Applications of Static and Kinematic theorem for Plastic Analysis of Beams and Single Storied Frames. **[8]**

References:
1. Jain, A. K., "Advanced Structural Analysis ", Nem Chand & Bros., Roorkee.
2. Hibbeler, R.C., "Structural Analysis", Pearson Prentice Hall, Sector - 62, Noida-201309
3. C. S. Reddy "Structural Analysis", Tata Mc Graw Hill Publishing Company Limited, New Delhi.
4. Timoshenko, S. P. and D. Young, " Theory of Structures" , Tata Mc-Graw Hill Book Publishing Company Ltd., New Delhi.
5. Dayaratnam, P. " Analysis of Statically Indeterminate Structures", Affiliated East-West

Press.
6. Wang, C. K. " Intermediate Structural Analysis", Mc Graw-Hill Book Publishing Company Ltd.
7. Thandavamoorthy, T.S., "Structural Analysis" Oxford University Press, New Delhi.
8. Martin, H. C." Introduction to Matrix Methods of Structural Analysis", Mc-Graw Hill Book Publishing Company Ltd, New Delhi.
9. Mau, "Introduction to Structural Analysis" CRC Press Taylor & Francis Group.
10. Ghali, " Structural Analysis: A Unified Classical and Matrix Approach" 5/e, CRC Press Taylor & Francis Group.
11. Wilbur and Norris, "Elementary Structural Analysis", Tata McGraw Hill.
12. Vazirani & Ratwani et al , "Analysis of Structures", Khanna Publishers
13. Coates, RC, Coutie, M.G. & Kong, F.K., "Structural Analysis", English Language Book Society & Nelson, 1980.
14. SP Gupta & Gupta "Theory of Structure Vol.1 & 2" TMH
15. DS Prakash Rao "Structural Analysis: A Unified Approach" Universities Press.
16. S Ramamurtham "Theory of Structure" Dhanpat Rai.
17. Devdas Menon "Advanced Structural Analysis" Narosa
18. Hsieh, "Elementary Theory of Structures" 4/e, Pearson Education, Noida.
19. Mckenzie, "Examples in Structural Analysis" 2/e, CRC Press Taylor & Francis Group.
20. R Agor, Structural Analysis, " Khanna Book Publishing.
21. Jacques Heyman, "Structural Analysis" Cambridge University Press.

KCE062 RIVER ENGINEERING (L-T-P 3-0-0) Credit – 3

Course Outcomes:

After completion of the course student will be able to:

CO-1 Explain river morphology and its classification.
CO-2 Explain hydraulic geometry and behavior of river.
CO-3 Explain socio-cultural influences and ethics of stream restorations.
CO-4 Analyze flow and sediment transport in rivers and channels.
CO-5 Design guide band, embankments and flood protection systems.

Unit 1

Introduction, classification of Rivers, Mechanics of alluvial rivers including channel and flood plain features, Sediment transport and budgets, River morphology and various classification schemes. **[8]**

Unit 2

Behavior of Rivers: Introduction, River Channel patterns, Straight river channels, causes, characteristics and shapes of meanders and control, cutoff, Braided Rivers, Bed forms, Instability ofrivers, Hydraulic geometry, Delta formation and control. **[8]**

Unit 3

Mechanics of Alluvial Rivers, Rivers and restoration structures, Socio-cultural influences and ethics of stream restoration. **[8]**

Unit 4

Bio-engineering Techniques, Classification review, Natural Channel Design Analysis, Time Series, Analysis of flow, Sediment and channel geometry data. **[8]**

Unit 5

River Training and Protection Works: Introduction, Classification of River Training, Types of training works, Protection for Bridges with reduced waterway, Design of Guide Band, embankment and spurs/dampners and other river/ flood protection works. **[8]**

Text book:

1. River Behavior Management and Training (Vol. I & II), CBI&P, New Delhi.
2. Irrigation & Water Power Engineering- B. C. Punmia and Pande B. B. Lal.
3. River Engineering by Margeret Peterson
4. Principles of River Engineering by (the non tidel alluvial) PH Jameen

KCE063 REPAIR AND REHABILITATION OF STRUCTURES

(L-T-P 3-0-0) Credit – 3

Course Outcomes:

After completion of the course student will be able to:

CO-1 Understand the fundamentals of maintenance and repair strategies.

CO-2 Identify for serviceability and durability aspects of concrete.
CO-3 Know the materials and techniques used for repair of structures.
CO-4 Decide the appropriate repair and retrofitting techniques.
CO-5 Use appropriate health monitoring technique and demolition methods

Unit 1

Maintenance: Repair and rehabilitation, facts of maintenance, importance of maintenance various aspects of inspection, assessment procedure for evaluating damaged structure, causes of deterioration.

Repair Strategies: Causes of distress in concrete structures, construction and design failures, condition assessment and distress-diagnostic techniques, assessment procedure for inspection and evaluating a damaged structure. **[8]**

Unit 2

Serviceability and Durability of Concrete: Quality assurance for concrete construction, concrete properties – strength, permeability, thermal properties and cracking. effects due to climate, temperature, chemicals, corrosion. **[8]**

Unit 3

Materials and Techniques for Repair: Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, expansive cement, polymer concrete, sulphur infiltrated concrete, ferro cement, fibre reinforced concrete, bacterial concrete, rust eliminators and polymers coating for rebars during repair, foamed concrete, mortar and dry pack, vacuum concrete, gunite and shotcrete, epoxy injection, mortar repair for cracks, shoring and underpinning. **[8]**

Unit 4

Repair, Rehabilitation and Retrofitting Techniques: Repairs to overcome low member strength, deflection, cracking, chemical disruption, weathering corrosion, wear, fire, leakage and marine exposure.

Repair of structure: Common types of repairs, repair in concrete structures, repairs in under water structures. Strengthening of Structures: Strengthening Methods, retrofitting, jacketing. **[8]**

Unit 5

Health Monitoring and Demolition Techniques: Long term health monitoring techniques, engineered demolition techniques for dilapidated structures, use of sensors for building instrumentation. **[8]**

References

1. Concrete Technology by A.R. Santakumar, Oxford University press
2. Defects and Deterioration in Buildingts, E F & N Spon, London
3. Non-Destructive Evaluation of Concrete Structures by Bungey - Surrey University
4. Maintenance and Repair of Civil Structures, B.L. Gupta and Amit Gupta, Standard Publications.
5. Concrete Repair and Maintenance Illustrated, RS Means Company Inc W. H. Ranso, (1981)
6. Building Failures : Diagnosis and Avoidance, EF & N Spon, London, B .
7 .Mehta, P.K and Montevic. P.J., Concrete- Microstructure, Properties and Materials, ICI, 1997.,
8. Jackson, N., Civil Engineering Materials, ELBS, 1983.

KCE 064 FOUNDATION DESIGN (L-T-P 3-0-0) Credit – 3

Course Outcomes:

After completion of the course student will be able to:

CO-1 Understand various methods of Soil Exploration and its importance.
CO-2 Analyze bearing capacity and settlement of soil for shallow foundation.
CO-3 Design the various types of shallow foundation and understand the basics of deep foundation.
CO-4 Understand the characteristics of well foundations and retaining wall.
CO-5 Understand the concept of soil reinforcement.

Unit 1

Introduction to soil exploration, methods of boring and drilling, soil sampling and sampler, in-situ tests, SPT, CPT, DCPT, geophysical methods; soil resistivity methods seismic refraction methods. **[8]**

Unit 2

Bearing capacity of shallow foundation, design criteria, factors affecting bearing capacity, factors influencing selection of depth of foundation, modes of shear failures, types of shallow foundations, contact pressure under rigid and flexible footings, Terzaghi's, Meyerhof, Hansen's bearing capacity theories, IS code method

Settlement of shallow foundations: components of settlement & its estimation, immediate, consolidation, & differential settlements. **[8]**

Unit 3

Design of shallow foundation; principles of design of footing, design of isolated footings and strip footing.

Deep foundation; introduction, necessity of deep foundations, pile installation, pile groups, group action of piles in sand and clay, group efficiency of piles, settlement of piles, negative skin friction, single and double under reamed piles. **[8]**

Unit 4

Introduction, shapes and characteristics of wells, components of well foundation, forces acting on well foundation, sinking of wells, causes and remedies of tilts and shifts.
Retaining walls: introduction, types of retaining structures, support systems for flexible retaining walls (struts, anchoring), construction methods, introduction and uses of sheet piles. **[8]**

Unit 5

Geotechnical properties of reinforced soil, use of soil reinforcement, shallow foundation on soil with reinforcement, design considerations, idealized soil, foundation and interface behaviour, elastic models of soil behaviour. **[8]**

Reference Books:

1) Alamsingh; Soil Mechanics & Foundation Engineering; CBS Publishers & Distributors, Delhi
2) Taylor D.W.; Fundamentals of Soil Mechanics; Asia Publishing House, Mumbai
3) Das Braja M; Principles of Geotechnical Engineering; Thomson Asia Pvt. Ltd.
4) Joseph E. Bowles: Foundation analysis and design.McGraw-Hill Higher Education
5) Gopal Ranjan, Rao A.S.R.; Basic and applied soil mechanics; New age int. (p) ltd.
6) Arora K.R.; Soil Mechanics & Foundation Engineering; Standard Pub., Delhi
7) B.C. Punamia; Soil Mechanics & Foundation Engineering; Laxmi Pub. Pvt. Ltd., Delhi.
8) V. N. S. Murthy; Soil Mechanics & Foundation Engineering; Sai Kripa Technical Consultants, Banglore
9) P. Purushothama Raj; Soil Mechanics and Foundation Engineering; Pearson Education.
10) I.H. Khan – Text Book of Geotechnical Engineering
11) C. Venkataramaiah – Geotechnical Engineering
12) Shenbaga R Kaniraj- Design Aids in Soil Mechanics and Foundation Engineering
13) Gulati, S.K., "Geotechnical Engineering" McGraw Hill Education (India), Pvt. Ltd., Noida.