Koneru Lakshmaiah Education Foundation
(Category -1, Deemed to be University estd. u/s. 3 of the UGC Act, 1956)
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DEPARTMENT OF CIVIL ENGINEERING

PROGRAM ARTICULATION MATRIX

Articulation Matrix- B. Tech Civil Engineering

Academic year 2021-22

Sl No	Course Code	Course Title	CO	Description	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	20UC1101	Integrated Professional English	CO 1	Understand the concepts of grammar to improve communication, reading, and writing skills										1				
			CO 2	Demonstrate required knowledge over Dos and Don'ts of speaking in the corporate context. Demonstrate ability to face formal situations / interactions.									1					
			CO 3	Understand the varieties of reading and comprehend the tone and style of the author. Skim and scan effectively and appreciate rhetorical devices									1					
			CO 4	Apply the concepts of writing to draft corporate letters, emails, and memos										1				
2	20UC1202	English Proficiency	CO 1	Demonstrating different interpersonal skills for employability								1						
			CO 2	Distinguishing business essential skills									1					
			CO 3	Classifying social media and corporate communication skills												1		
			CO 4	Applying analytical thinking skills												2		
			CO 1	Developing critical and analytical reading skills												1		
			CO 2	Discovering different interpersonal skills to develop people skills												1		

3	21UC2103	Essential Skills for Employability	CO 3	To enhance the problem-solving skills of the students through the concepts of Simple Equations, Ratio, Proportion &Variation, Percentages, Profit & Loss, Averages, Allegations, Simple & Compound Interest					1									
			CO 4	Apply diagrammatic representation of the given data to find the possible outcomes in the topics of Deductions, Cubes, Venn Diagrams and Arrangements		1												
			CO 5	To apply deductive logic to solve questions in Connectives, Blood relations, Ranking and time sequence, Symbols and notations. Apply principles of reflection and rotation to solve picture puzzles.		1												
4	21UC2204	Corporate Readiness Skills	CO 1	To distinguish product and process and quote them in speaking and writing activities												1		
			CO 2	To apply interpersonal skills												1		
			CO 3	To enhance the problem-solving skills of the students through the concepts of Numbers, Time & Work, Time & Distance, Permutations & Combinations, Probability which will enable them to improve their problem solving abilities which in turn improve their programming skills.					1									
			CO 4	To apply known facts to find the unknowns in the topics Clocks, Calendars, Binary Logic. Identify the rule set by analyzing the given observations in the topics Series, Analogy, Odd Man, Coding-Decoding			1											
5	21UC0010	Universal Human Values & Professional Ethics	CO 1	Realize and Understand the basic aspiration, harmony in the human being.				2										
			CO 2	Envisage the roadmap to fulfill the basic aspiration of human beings.				2										
			CO 3	Understanding the society and nature with the view of human values				2										
			CO 4	Understand the profession and his role in this existence.								2						
6	21CE4102	Construction Planning & Project	CO 1	Apply the fundamentals of construction management to plan and control the progress of the project.	1										3	1		
			CO 2	Analyse the project progress through scheduling and identifying critical activities.				2							3	1		

		Management	CO 3	Analyse the resource allocation for the construction projects at optimal levels.				2							3	1		1
			CO 4	Apply the management techniques to provide quality and safety at construction sites.	1					2					3	1		2
7	20UC0007	Indian Heritage and Culture	CO 1	To familiarize with various aspects of the culture and heritage of India through ages	1													
			CO 2	To acquaint with the contributions of Indians in the areas of languages and literature, religion and philosophy	1													
			CO 3	To understand the Social structure and the spread of Indian culture abroad	1													
			CO 4	To know the development of Science and Technology in India through ages and to appreciate the contributions of some of the great Indian scientists	1													
8	20UC0008	Indian Constitution	CO 1	To understand Constitutional development after Independence												1		
			CO 2	To learn the fundamental features of the Indian Constitution												1		
			CO 3	To get a brief idea of the powers and functions of Union and State Governments												1		
			CO 4	To understand the basics of working of Indian Judiciary and the Election Commission												1		
9	20UC0009	Ecology & Environment	CO 1	Understand the importance of Environmental education and conservation of natural resources						1								
			CO 2	Understand the importance of ecosystems and biodiversity												1		
			CO 3	Apply the environmental science knowledge on solid waste management, disaster management and EIA process						2								
			CO 4	Understand the importance of Environmental education and conservation of natural resources						1								
11	20MT1101	Mathematics for Computing	CO 1	Model a system of equations for real world applications in engineering, physical and biological sciences, computer Science, finance, economics and solve them through matrix algebra	2													

			CO 2	Model basic and computational techniques on discrete structures like relations, orders, functions & FSM, Lattices, and propositional &predicate logic Model real world structures and their related	2													
			CO 3	Applications using advanced discrete structures like graphs and trees. Model the given Statistical data for real world	2													
			CO 4	Applications in Engineering science, Economics and Management.	2													
12	21MT2102	Mathematics for Engineers	CO 1	Apply differential and integral calculus to find maxima & minima of functions, evaluate the integrals and solve the differential equations.	2													
			CO 2	Demonstrate the Fourier series and Laplace transforms.	1													
			CO 3	Describe probability, Random Variables	1													
			CO 4	Explain complex variables, analytic functions and introduction to stochastic process and Algebraic structures.	1													
13	21MT2007	Probability, Statistics and Numerical Methods	CO 1	Identify the basic concept of probability theory and types of random variables and also their applications in probability distributions.	2				1							3		3
			CO 2	Apply discrete and Continuous probability distributions to analyse the various real-world situations.	2							1			1			
			CO 3	Illustrate the bivariate data using correlation and regression analysis and formulate the given phenomena as a linear programming problem and solve it by graphical method. and simplex methods.	2										3		3	
			CO 4	Demonstrate the Big- M method, dual simplex method and obtain the solutions of non-linear programming problems using Pivot, Wolfe's algorithms and separable programming technique	2								1					
14	21PH1010	Mechanics (SE 1)	CO 1	Apply the concept of forces, governing static equations and analyze planer system of forces.	2													

			CO 2	Use analytical techniques for analyzing forces in statically determinate structures.				3											
			CO 3	Understanding the concepts of planar and non- planar system of parallel forces and analyzing them. Estimate moment of inertia of lamina and material bodies	2													3	
			CO 4	Apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems														3	
15	21UC1203	Design Thinking and Innovation	CO 1	Understand the importance of Design thinking process for contextualized problems		1				1									
			CO 2	Analyse, define, and ideate for solutions			1				1								
			CO 3	Develop and test the prototype made					2		2								
			CO 4	Explore the fundamentals of entrepreneurship skills for transforming the challenge into an opportunity					1			1							
16	21PH1002	Engineering Physics	CO 1	Understands the deformation of materials in response to action of load, for identification of materials having specific engineering applications.	1														
			CO 2	Understands the motion of electrons in microscopic	2														
			CO 3	level	3														
			CO 4	Understand the properties of light and engineering applications of lasers	2														
			CO 5	Apply the knowledge on structure and properties of materials while executing related experiments and develop some inter disciplinary projects	3														
17	21CY1001	Engineering Chemistry (SE-2)	CO 1	Describe some important design considerations in choosing a battery for a specific application.	1		2				3								
			CO 2	Predict potential complications from combining various chemicals or metals in an engineering setting	2		3												
			CO 3	Examine water quality and select appropriate purification technique for intended problem	3						2								
			CO 4	Explain the role of chemical kinetics in the formation and destruction of ozone in the atmosphere and predict the connection between molecular behavior and observable physical properties	3						2								

			CO 5	An ability to analyze & generate experimental skills	1														
18	21UC3105	Problem Solving Skills-I	CO 1	To discuss and interpret English language skills necessary for placements												1		
			CO 2	To demonstrate skills to get selected in interviews and retain job												1		
			CO 3	To enhance the problem-solving skills of the students through the concepts of Menstruation, Quadratic Equations & Inequalities, Progressions, Logarithms, Data Interpretation, Data Sufficiency which will enable them to improve their problem- solving abilities which in turn improve their programming skills.					1									
			CO 4	To apply deductive logic to solve questions in Connectives, Blood relations, Ranking and time sequence, Symbols and notations. Apply principles of reflection and rotation to solve picture puzzles		1												
19	21UC3206	Problem Solving Skills-II	CO 1	Analyze the business environment in order to identify business opportunities,											2			
			CO 2	Identify the elements of success of entrepreneurial ventures											1			
			CO 3	Consider the legal and financial conditions for starting a business venture											1			
			CO 4	Evaluate the effectiveness of different entrepreneurial strategies											2			
20	21SC1101	Computational Thinking for Structured Design	CO 1	Design Basic and Complex Building Blocks for real world problems using structured programming paradigm.	2	2												
			CO 2	Translate computational thinking into Logic Design for Solving real world problems.	2	2												
			CO 3	Apply and Analyse CRUD operations on Basic Data Structures using Asymptotic Notations.	2	2												
			CO 4	Apply and Analyse CRUD operations on Linear Data Structures using Asymptotic Notations.				2										

				Apply the structured programming paradigm with logic building skills on Basic and Linear Data Structures for solving real world problems.	2	2		2											
21	20ME1103	Design Tools Workshop – I	CO 1	Practice design thinking by developing artistic skills, Visualize and complete his/her innovative design by final drafting using 3D modeling			2												
			CO 2	Understand the concept of web page, web browser, web server, and able to create Static webpages					**2**										
			CO 3	Understand the concept of report writing using a markup language Latex					2										
			CO 4	Understand the concept of data visualization and creating data visualization dashboards, Understand the basic concept of VR/AR.					2										
22	21SC1209	Design Tools Workshop – II	CO 1	Practice the design ideology by artistic skill			1												
			CO 2	Visualize the design ideology by using VR technology				2											
			CO 3	Visualize the design ideology by incorporating VR technique					2										
			CO 4	Visualize and present his design idea by applying AR technique				2											
23	21SC1202	Design of Data Structures	CO 1	Apply measures of efficiency to algorithms and Compare various linear data structures like Stack ADT, Queue ADT, Linked lists.	2		2												
			CO 2	Analyze and compare linear data structures and analyze different searching and hashing techniques	2		2												
			CO 3	Analyze and compare various non – linear data structures like Trees and Graphs	2		2												
			CO 4	Analyze and compare various sorting algorithms, to select from a range of possible options, to provide justification for that selection, and to implement the algorithm in a particular context.	2		2												
			CO 5	Execute lab experiments and develop a small project along with his/her team members.	2		2												

24	21CE1002	Engineering Graphics	CO 1	Understand the principles of drawing and use of drafting instruments and AutoCADD and Draw engineering curves, Geometrical Constructions	2						2		2			1		
			CO 2	Draw orthographic views for the given objects	2						2		2					
			CO 3	Draw Isometric views for the given orthographic views	2						2		2					
			CO 4	Draw the projections of points, lines, planes and solids	2				1		2		2					
			CO 5	Draw the total surface of solids by development of surfaces and the sections of Solids	2						2		2					
25	21CE2205	Geology	CO 1	Understand the significance of engineering geology, geological processes that modify the surface of the earth	1							2						
			CO 2	Understand the basics of minerals and rocks, geological structures exhibited by rocks and their influence	1							2						
			CO 3	Analyse the geological conditions to identify suitable site for civil engineering projects.	1							2						
			CO 4	Analyse the geological conditions to identify potential sites for groundwater, sites for dam and reservoir and tunnels	1				3			2						
			CO 5	Apply and analyse the geological conditions for suitability of the site for a major civil engineering project		2									3			
26	21CE2101	Solid Mechanics	CO 1	Associate with the stress-strain diagrams and the relationship between the elastic constants, estimate temperature stresses in compound bars and find the stresses in thin walled pressure vessels	2	2										3	1	1
			CO 2	Draw Shear force and Bending moment diagrams for statistically determinate beams	3	3											1	1
			CO 3	Calculate the Bending and shear stresses and draw the distribution diagrams for various cross sections.	3	3											1	1

			CO 4	Estimate the transformation of stress in a plane and draw Mohr's circle, estimate stresses due to torsion for circular shafts and find buckling load for centric and eccentric columns	3	3					1						1	1
27	21CE2102	Fluid Mechanics & Hydraulics	CO 1	Apply fluid properties to solve engineering problems	**2**	**2**												
			CO 2	Analyze static, kinematic and dynamic states of fluids	**3**	**2**												
			CO 3	Analyze the flow through pipes and head losses	**3**	**2**												
			CO 4	Perform dimensional analysis for model simulation	**2**	**3**												
				Demonstrate the flow through Notches, pipes and open channels	**3**	**3**												
28	21CE2103	Surveying	CO 1	Understand basic concepts of surveying	2			2									1	1
			CO 2	Understand how to operate instruments required for surveying	2	2											1	1
			CO 3	Applying the surveying equipments required based on the functionality and nature of work		3					3		3				1	1
			CO 4	Apply field data to prepare a plan required for a given civil engineering project		3					3	1	3		3		1	1
29	21CE2201	Structural Analysis	CO 1	Find the deformation using energy theorems i.e. Castigliano's theorems, Betti's theorem and Maxwell's reciprocal theorem.	3	3										3	1	1
			CO 2	Students will be able to estimate the deflection of beams by various methods such as deflection curves, moment area method, conjugate beam method and unit load method	3	3											1	1
			CO 3	Able to analysis proper cantilevers and fixed beams for any type of landing using consistent deformation method and can analysis conjugate beam by Clapereyon's theorem of Three moments	3	3					1						1	1
			CO 4	Student will be able to analyze beams and frames for any type of loading using slope deflection method and moment deflection methods	3	3						3		1			1	1

30	21CE2203	Construction Materials & Concrete Technology	CO 1	Compare the properties of most common and advanced building materials	2	2			1								2	2
			CO 2	Understand the typical and potential applications of these materials such as concrete and its mix proportioning	2	2					1						2	2
			CO 3	Understand the relationship between material properties and structural form	2	2											2	2
			CO 4	Understand the importance of experimental verification of material properties.	2	2			2	1							2	2
31	21CE2204	Environmental Engineering	CO 1	To apply the concept of forecast population and design of water treatment units	1					2	2							
			CO 2	To apply the concept of Water distribution system by using Equivalent pipe method	1					2	2							
			CO 3	To apply concept of sewage quantity and design of sewerage system and septic tank design.	1					2	2							
			CO 4	To Understand the concept of Solid Waste Management methods and Noise pollution effects	1					2	2							
			CO 5	To apply the testing of water & wastewater, design of water, wastewater treatment plant.	1					3	3							
32	21CE2202	Building Planning, Drawing & Construction Management	CO 1	Understand different types of buildings, building components along with materials used for the construction of buildings.			2											
			CO 2	Understand building bye-laws for planning and construction of buildings						2								
			CO 3	Understand different types of equipment used in construction projects and management of construction projects.						2					1			
			CO 4	Apply the techniques required for construction project management.	2													
			CO 5	Apply the principles and guidelines proposed by building regulatory bodies to develop the plan of a building.														

33	21CE2206	Geotechnical Engineering	CO 1	Describe soils and determine their physical characteristics such as grain size, water content, and void ratio, and their inter-relations, classify soils, determine compaction of soils, soil permeability and seepage analysis.	1	2											3	
			CO 2	Understand & Apply the concept of effective stress principle, and porewater pressures and their distribution within a soil mass, determine the consolidation settlement , and determine soil strength parameters from soil tests for “drained” and “undrained” conditions.	3	3											3	
			CO 3	Determine the lateral earth pressure, stability of slopes and retaining walls, Understand the importance and methods of soil investigations and be able to plan a soil investigation	3	3											3	
			CO 4	Understand Terzaghi’s shear failure criteria for soils and their limitations and determine the bearing capacity and settlement of structures founded on soils using shallow and pile foundations.	3	3											3	
				Analyze the index and engineering properties of soils from various laboratory tests and prepare the soil investigation report.			3	1	1				3	1			3	3
34	21CE3101	Design Of Reinforced Concrete Structures	CO 1	Design RC beams subjected to bending using Working Stress Method.	3	3	3							1		3	1	1
			CO 2	Explain the concept of Limit State Design and apply it to beams	3	3	3					2					1	1
			CO 3	Apply Limit state design for flanged sections subjected to shear, torsion and concept of bond	3	3	3								1		1	1
			CO 4	Design one-way, two-way and continuous slabs, Design columns and isolated footings subjected to axial load, Uni-axial and bi-axial bending	3	3	3										1	1
			CO 5	Analysis and Design of Structures using software such as ETABS/Staad Pro/CYPE CADD etc.	3													

35	21CE3103	Transportation Engineering	CO 1	Know Versatile with history - current trends of transportation and Carry engineering surveys and can decide the alignment						2	2						2	2
			CO 2	Analyze and design highway geometric elements		2	2										2	2
			CO 3	Analyze and design of flexible, rigid pavements, Pavement Drainage		2	2							1			2	2
			CO 4	Handle pavement construction activities and also conduct quality control at site and Evaluate pavement condition and can identify and suggest remedial measures**,** understand traffic Rules, Analyze and design of traffic infrastructure			2		2	2	2	3					2	2
36	21CE3102	Water Resources Engineering	CO 1	Evaluate the different components of hydrological cycle	3			2			1							2
			CO 2	Estimate the ground water yield and requirement of water for the crops	3	2					1							2
			CO 3	Desgin the canal irrigation system based on discharge	3			3			1							2
			CO 4	Analyze stability and forces acting on Gravity dams and life of reservoir	3			2			1							2
37	21CE3201	Design Of Steel Structures	CO 1	Analyse and design bolted and welded connections	2	2	2										1	1
			CO 2	Design single and compound beams as per IS code	2	2	2										1	1
			CO 3	Design simple and built-up columns as per IS code	2	2	2										1	1
			CO 4	Design column base systems as per IS code, Calculate wind forces and design roof trusses	2	2	2					2					1	1
38	21CE3202	Quantity Surveying and Estimation	CO 1	Applying the methods of approximate estimate and detailed estimate to the buildings.	1	2									2			
			CO 2	Applying the methods of detailed estimates to R.C.C works, Roads and Canals	1	2									2			
			CO 3	Applying the specifications concept to for different items of work and performing rate analysis.	1	2									2			
			CO 4	Applying tenders and contracts concept to a project and carry out building valuation.	1	2									2			
			CO 5	Applying estimation concept to buildings, road works, canal works by using a software package (M.S Excel)	1										3			

39	21CE3211	Advanced Structural Aanalysis	CO 1	Analysis of Determinate Structures For Various Loads And Load Combinations	2	2			2									
			CO 2	Analysis of Indeterminate Structures Using Matrix Methods	2	2			2									
			CO 3	Analysis of Hinged Arches	2	2			2									
			CO 4	Analysis of Indeterminate Beams Using Plastic Analysis Method	2	2			2									
40	21CE4101	Comprehensive Exam	CO 1	Apply the concepts of structural engineering		2						2						1
			CO 2	Apply the concepts of Geotechnical and Transportation Engineering		2						2						1
			CO 3	Apply the concepts of Water and Environmental Engineering		2						2						1
			CO 4	Apply the concepts of surveying and Traffic Engineering		2						2						1
41	21IE2040	Social Internship	CO 1	Remember the fundamentals of the science of water cycle along with powerful tools that students can use to diagnose the health of the local water cycle as well as develop targeted action plans to restore the local natural water cycle and bring water prosperity	1		1						1				1	
			CO 2	Remember the water sustainability and water resilience of village, city, residential facilities and households using multi-level water scorecards		1		1	1									
			CO 3	Apply the design thinking positive action plan for a village, campus, residential facility and community neighbourhood.					1		1		1					
			CO 4	Applying the water positive solutions within an urban watershed, a rural watershed, residential institutional and corporate community	2							2					1	
42	21CE3221	Advanced Design of Reinforced	CO 1	Design different types of stair cases.	2	2	2										1	1
			CO 2	Select appropriate foundation system.	2	2	2								1		1	1
			CO 3	Apply the design principles of retaining walls.	2	2	2										1	1

		Concrete Structures	CO 4	Differentiate types of rectangular water tanks and analyse as per IS code methods, select types of circular water tanks and analyse as per IS code methods	2	2	2										1	1
43	21CE3231	Prestressed concrete	CO 1	To introduce prestressing methods, principles and concepts	2	2											1	1
			CO 2	To determine losses in prestress	2	2											1	1
			CO 3	To Analyse PSC Sections both at transfer of prestress and Service load conditions	2	2								1			1	1
			CO 4	To design prestressed concrete beams as per IS Code, to design end block of PSC beams.	2	2											1	1
44	21CE4141	Bridge engineering	CO 1	Explain about various types of Bridges and IRC Specifications for road bridges													1	
			CO 2	Design deck Slab bridge and T-Beam Bridge as per IRC guidelines	3		2										1	
			CO 3	Design Abutment and Elastomeric Pad Bearings for bridges as per IRC guidelines	3		2										1	
			CO 4	Design Piers and Well Foundations for bridges as per IRC guidelines	3		2										1	
45	21CE4151	Precast and Prefabricated structures	CO 1	Analyze the prefabricated load carrying members.		2											2	
			CO 2	Analyze Behaviour of structural components and production technology of prefabrication.		2											2	
			CO 3	Design joints in precast construction.			1										2	
			CO 4	Design and detail precast structures.			1										2	
46	21CE3216	Projects& Contract management	CO 1	Understand the concept of construction laws and regulations.						2		2						2
			CO 2	Study the current trend toward alternative project delivery systems via contractual arrangements such as design-build and construction management at risk											2		3	
			CO 3	Investigate how to avoid the possibilities of construction disputes via alternative dispute resolution (ADR)						3		3					3	
			CO 4	Understand the Labour regulations and applications on review construction contracts and specifications						3					3		3	

47	21CE3226	Quality and Safety Management	CO 1	Understand the basics systems of man power and materials management															
			CO 2	Analyse the basics systems of machinery management		2	3												
			CO 3	Understand and analyse the basics systems of safety management	1	2	3												
			CO 4	Understand and analyse the basics systems of quality management	1	2	3												
48	21CE3236	Form Work	CO 1	To understand theoretical knowledge of formwork and its materials	1						2								
			CO 2	To perceive the theoretical knowledge of formwork for walls,columns, slab, beam, and special structures	1						2								
			CO 3	To interpret the theoretical knowledge of formwork for bridge structures, flying deck, slip forms, shoring, and scaffolding.	1						2								
			CO 4	To interpret the theoretical knowledge of formwork for bridge structures, flying deck, slip forms, shoring, and scaffolding.	1						2								
49	21CE4146	Construction Economics	CO 1	Apply the fundamentals of financial management to prepare the cashflow statements.	1			2							3				
			CO 2	Evaluate potential major project financial issues using capital budgeting techniques.	1			2							3				1
			CO 3	Apply financial methodologies to efficiently evaluate and manage construction projects .	1			2							3				1
			CO 4	Apply the fundamentals of construction finances to enable decision making based on project type	1			2							3				1
50	21CE4156	Sustainable Construction Technology	CO 1	Understand the construction basics of a Common building construction methods conventional	1	1											1	1	
			CO 2	Understand the modern construction methods basics of construction Modular Construction Precast concrete.	2	2											1	1	
			CO 3	Understand the sustainable construction materials technologies and project management strategies	2	2											1	1	

			CO 4	Understand the LEED for New Construction rating system	2	2								1			1	1
51	21CE3212	Foundation engineering	CO 1	Analyze Bearing capacity of soils	3	3											3	
			CO 2	Estimate the load carrying capacity of piles	3	3											3	
			CO 3	Analyze lateral stability of well foundation and settlement analysis	3	3											3	
			CO 4	Analyze stability of slopes and earth retaining structures in various civil engineering aspect	3	3											3	
52	21CE3222	Ground improvement techniques	CO 1	Analyze the ground modification by vibro replacement, stone columns, preloading and prefabricated drains	3	1											1	
			CO 2	Analyze the reinforced earth structures	3	1											2	
			CO 3	Analyze different properties of geotextiles, geogrids, geonets, geomembranes, geotubes.	3	2											3	
			CO 4	Analyze different grouting, deep mixing, PVDs, vacuum consolidation techniques.	2	1											2	
53	21CE3232	Design of earth retaining structures	CO 1	Knowledge about the different techniques of earth retaining structures and their suitability.	2	2											1	1
			CO 2	Understanding and design of retaining walls, braced cuts and sheet piles.	3	3											1	1
			CO 3	Knowledge of the grouts, their types, properties and application.	2	2											1	1
			CO 4	Introduction to reinforced earth and geo synthetics, their types, function and application, Ability to design and analyse the earth-reinforcements and coffer dams with their functions.	3	3											1	1
54	21CE4142	Geotechnical earthquake engineering	CO 1	Describe soils and determine their physical characteristics such as grain size, water content, and void ratio, and their inter-relations, classify soils, determine compaction of soils, soil permeability and seepage analysis.	1	2											3	

			CO 2	Understand & Apply the concept of effective stress principle, and porewater pressures and their distribution within a soil mass, determine the consolidation settlement , and determine soil strength parameters from soil tests for “drained” and “undrained” conditions.	3	3											3	
			CO 3	Determine the lateral earth pressure, stability of slopes and retaining walls, Understand the importance and methods of soil investigations and be able to plan a soil investigation	3	3											3	
			CO 4	Understand Terzaghi’s shear failure criteria for soils and their limitations and determine the bearing capacity and settlement of structures founded on soils using shallow and pile foundations.	3	3											3	
			CO 5	Analyze the index and engineering properties of soils from various laboratory tests and prepare the soil investigation report.			3	1	1				3	1			3	3
55	21CE4153	Forensics in Civil Engineering	CO 1	Apply forensic engineering to demonstrate structural and geotechnical failures	2	2	2								2			
			CO 2	Understand reinforced concrete Structures and steel structure failures through case studies	2	2	2								2			
			CO 3	Evaluate different geotechnical failures through case studies	2	2	2								2			
			CO 4	Analyze reasons for geo-environmental and fluid and hydraulic failures	2	2	2											
56	21CE3215	Intelligent transportation systems	CO 1	Understand the Objectives ITS		2	2			2							2	2
			CO 2	Understand the Importance of telecommunications in the ITS system		2	2			2				3		1	2	2
			CO 3	Understand Advanced Traffic Management Systems		2	2			2							2	2
			CO 4	Understand Integration of Automated Highway Systems			2			2					1		2	2
57	21CE3225	Pavement materials &design	CO 1	Characterize pavement materials and also carry the advance tests on bituminous mixtures	1			1									1	1
			CO 2	Thorough with stresses and strains of flexible and rigid pavements.	1	1										2	1	1

			CO 3	Thorough with analysis and design of flexible highway and airport pavements	1		1					2					1	1
			CO 4	Thorough with analysis and design of rigid highway and airport pavements	2		2										1	1
58	21CE3235	Traffic engineering and management	CO 1	Apply the Concepts of Probability in traffic Engineering	3							3		3	2	2	2	2
			CO 2	Know the Fundamental design concepts of Interchanges, Parking Facilities, Freeways			2										2	2
			CO 3	Design Traffic Facilities include Un signalized Intersections (Rotary), Signalized Intersection (signal design)			3										2	2
			CO 4	Know the Accident Situation in India, road safety measures, Understand Detrimental Effects of traffic on the environment						3	3						2	2
59	21CE4145	Urban transportation systems planning.	CO 1	Learn the concept of travel demand and supply and modes available for transportation						2	2			3	3		2	2
			CO 2	Understand the different types of Traffic Surveys used in planning					2							3	2	2
			CO 3	Identify and analyze trips as a part of transport planning				3	3								2	2
			CO 4	Plan Public Transport Systems, Utilize ITS in Transport Planning		2			2	2	2						2	2
60	21CE4155	Railway engineering airport planning and design	CO 1	Understand about the Classification of Railways, Permanent Way & its components, functions.						2		3					2	2
			CO 2	Analyze track alignment, geometric elements, Horizontal and Vertical curves, super elevation, and Negative Super elevation.				2						2	2		2	2
			CO 3	Understand about the various factors affecting Selection of site for Airport.						2						2	2	2
			CO 4	Geometric Design of Runway, Computation of Runway length, Correction for runway length, Understand the layout of port components and operation of navigational aids that involved in functions of ports.				2		2	2						2	2

61	21CE3213	Sustainable engineering & technology	CO 1	Understand the concept of sustainability, Challenges for Sustainable Development and Clean Development Mechanism			2												
			CO 2	Understand the sources, impacts of solid waste, Global environmental issues and Water Act, Air Act.			2												
			CO 3	Understand the Life Cycle Analysis, Procedures of EIA, green materials for building construction and Methods for increasing energy efficiency of buildings Sustainable cities			2												
			CO 4	Understand the Conventional and non-conventional of Energy sources and Sustainable Urbanization, industrialization and poverty reduction			2												
62	21CE3223	Environmental impact assessment and life cycle analyses	CO 1	Knowledge of Environmental Technology	1					2	2								
			CO 2	To attain assessment of Impacts of Development activities	1					2	2								
			CO 3	To attain Environmental Impact assessment on water and air	1					2	2								
			CO 4	To know the preparation of Environmental Audit Report	1					2	2								
63	21CE3233	Solid Waste Management and Landfills	CO 1	Identify the Hazardous solid waste	2						3								
			CO 2	Understand the Functional Elements of Solid Waste Management															
			CO 3	Applying a mathematical model of municipal solid waste Management	2				1		3								
			CO 4	Construct and operate sanitary landfill	2						3								
64	21CE3214	River engineering	CO 1	Understand the concept of river equilibrium															
			CO 2	Apply the concepts of sediment transport processes	3		1												
			CO 3	Apply the methods of river training works for river stabilization	3		1												
			CO 4	Application of physical river models and governing equations in river flow	3		1												
65	21CE3224	Urban water hydrology and hydraulics	CO 1	Analysis urban hydrological data for storm water management		3		2			2								2
			CO 2	Estimate the components of urban hydrological processes		2		2			2								2

			CO 3	Estimate runoff from highways, airports and urban areas		3		2			2							2
			CO 4	Plan and design of urban drainage systems for an urban area		3		2			2							2
66	21CE40A2	Environmental Pollution Control Methods	CO 1	Applying the modelling techniques used in Air Pollution	2				1		3							
			CO 2	Applying the Mathematical modelling techniques used for control of water Pollution	2				1		3							
			CO 3	Understanding the waste treatment unit processes														
			CO 4	Applying a mathematical model of municipal solid waste Management	2				1		3							
67	21CE40A3	Solid and Hazardous waste management	CO 1	Understand the importance types, sources and disposal methods of Solid waste.	2		2				2							
			CO 2	Summarize the importance of conversion and recycling of waste	2						2							
			CO 3	Associate about types, Sources of Hazardous waste	2						2							
			CO 4	Discuss the disposal and treatment methods of Hazardous waste	2		2				2							
68	21CE40A4	Remote Sensing and GIS	CO 1	Understanding the Basics concepts of Remote Sensing	1													
			CO 2	Understanding the Basic elements of image interpretation	1													
			CO 3	Understanding the concepts of GIS	1			2										
			CO 4	Understanding about the Land use /Land cover studies	1								3					
69	21CE40A5	Disaster Management	CO 1	Understand the types of disasters, related hazards and the causes for disasters		2	2											
			CO 2	The resilience and mitigation measures for various disasters by proper planning with respect to the kind of disaster that occurs		2	2											
			CO 3	Understand the disaster risk, reduction and the various organizations involved with related to disasters.		2						2						
			CO 4	Understand the disaster vulnerability with the help of case studies			2					2						