Government College of Engineering, Karad

(An Autonomous Institute of Government of Maharashtra)

Programme: Civil Engineering

Curriculum for

Final year of B. Tech

POs:

Students in the UG Civil Engineering programme at the time of their graduation are expected to have:

a) An ability to identify and understand civil engineering problems.

b) An ability to analyse real life civil engineering problems.

c) An ability to apply civil engineering knowledge for design, construction, operation and maintenance of constructed facilities within realistic constraints such as technical, economic, environmental, political, social, safety and sustainability.

d) An ability to formulate, solve and simulate complex real life civil engineering problem using the imparted knowledge of mathematics, science, engineering, technology and optimization.

e) An ability to work on projects of societal concerns independently and in teams.

f) Demonstrate professional practice through participation in multidisciplinary activities.

g) Demonstrate high regards for engineering ethics and ethical responsibility.

h) An ability to apply the techniques, skills and modern engineering tools necessary for engineering practice.

i) An ability to understand contemporary issues.

j) Ability for effective communication and interaction.

k) An ability to engage in lifelong learning in relation with global, economic, environmental and societal context, through civil engineering projects.

PSOs:

l) The student will demonstrate ability to acquire in depth knowledge to practice in the field of civil engineering profession globally

m) The student will demonstrate the ability to apply the knowledge in desirous form in respective specialisation of civil engineering

n) The student will develop awareness towards environment and society for sustainable development while execution of civil engineering projects

Government College of Engineering, Karad
Final Year B. Tech.
CE701: Quantity Surveying & Valuation

Teaching Scheme			Examination Scheme	
Lectures	3 Hrs/week		**CT1**	15
Tutorial	-		**CT2**	15
Total Credits	03		**TA**	10
			ESE	60
			Duration of ESE	3Hrs**.**

Course Objectives

1	To provide students necessary knowledge and skills in estimation of civil works
2	To carry out rate analysis of various items
3	To understand procedure of tenders and contracts
4	To carry out valuation of civil engineering structures

Course Contents

		Hours
Unit I	**Introduction**: Purpose of quantity estimates, Types of estimates, Various items to be included in estimates, Modes of measurement and units of measurement as per Codal provision IS1200, Administrative approval and Technical sanction to estimates, Introduction to DSR (District Schedule Rate) and CSR(Common Schedule of Rates)	07
	Specifications: Purpose, basic principles, general and detailed specifications for various items related to building	
Unit II	**Measurement of Quantities**: Long wall- Short wall method and Center line method, measurement sheet and abstract sheet.	07
	Analysis of rates, Factors affecting cost of an item work, materials, sundries, labour, tools and plant, overheads and profit. Task work- Definition and factors affecting task work. Analysis of rates of items related to building.	
	Prime cost, Provisional sum and provisional quantities	
Unit III	**Detailed Estimation**: R.C.C works, Culverts, earthwork for canals. Roads including hill roads and other civil engineering works.	07
	Approximate estimates, purpose, Various methods used for buildings and other civil engineering works.	
	Preparation of schedule for steel reinforcement.	
Unit IV	**Tenders (Bids):** Meaning, Categories, Tender notice, Notification in press and media, e-procurement, National Building Code (NBC) Corrigendum, Preparation and Submission of tenders, Tenders form and information, EMD and SD, revocation of tenders, opening of tenders, qualification of contractors, Scrutiny of tenders, unbalanced tenders, acceptance of tenders,	07

		running bills and final bills, settlement of disputes, Arbitration	
Unit V		**Contracts:** General idea, Types of contracts viz: lump-sum, item rate, percentage rate ,cost plus, Engineering Procurement Construction (EPC). Conditions of contracts, Law of contract. Definition, objective and essentials of valid contract, Termination and breach of contracts, Negotiated contracts, Demolition contracts, Non-conventional contract: PPP, PWD&WRD organization.	06
Unit VI		**Valuation**: Purpose, Value and Cost, Price, Market value, Potential value, Sentimental value, Scrap value etc. Real estate, Rent fixation, Tenure of land, Free hold and lease hold property, Sinking fund, Depreciation, Capitalized value and Annualized value of an old building.	06

Course Outcomes (COs):	
At the end of this course, student will be able to	
1	take out of quantities for various construction projects
2	prepare estimates for various civil engineering works and calculate rates for various items of construction
3	draft specifications and tender notice
4	prepare valuation report for civil engineering structures
Text Books:	
1	S.C.Rangwala, "Elements of Estimating and Costing", Charotar Publishing house, 41th edition,2014.
2	B.N. Dutta, "Estimating and costing",DhanpatRai and sons, 28th edition, 2016.
3	P.L. Bhasin and S. Chand, "Quantity Surveying", 3rd Revised edition, 1987.
4	B.S Patil "Civil Engineering Contracts and Estimates", Universities Press Private Ltd, 4th edition, 2015.
5	G.S. Birdie, "Estimating and Costing",DhanpatRai& Sons, 6th edition, 2005.
References:	
1	Standard specifications volumes I & II (PWD Maharashtra) Govt. of Maharashtra
2	CPWD Specifications
3	CPWD schedules of rates
4	PWD Hand Book and Red Book
5	PWD Schedule of Rates – Latest
6	National Building Code of India – Guidelines for regulating the building construction activities
Useful Links:	
1	https://en.wikipedia.org/wiki/Estimation
2	https://www.youtube.com/watch?v=D04uxZpgp6M

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	A	b	c	D	e	f	G	h	i	j	k
1	√	√	√	√	√	√	√	√		√	√
2	√		√		√	√	√	√	√	√	
3	√		√		√				√	√	
4	√		√	√	√	√		√	√	√	√

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	03	03	02	05
Understand	05	05	05	20
Apply	05	05	03	20
Analyze	-	-	-	-
Evaluate	02	02	-	15
Create	-	-	-	-
Total	15	15	10	60

Government College of Engineering, Karad			
Final Year B. Tech.			
CE702 : Construction Planning and Management			
Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs/week	**CT1**	15
Tutorial	-	**CT2**	15
Total Credits	3	**TA**	10
		ESE	60
		Duration of ESE 2Hrs. 30 Min.	

Course Objectives	
1	To introduce the basic aspects of project management
2	To teach students about planning aspect of project management
3	To create awareness about fundamentals of engineering economics
4	To provide exposure to the knowledge of risk and safety management

Course Contents		
		Hours
Unit I	**Project Management:** objectives, agencies, phases, project planning, work breakdown structure. bar chart, mile stone chart, difference between project management and construction management	04
Unit II	**Development of critical path method (CPM) network:** time estimates, floats, critical path. network compression, resource allocation, network updating	10
Unit III	**Program Evaluation and Review Technique (PERT):** time estimates, slack, expected duration, probability of project completion Risk management : risk classification, risk reduction techniques, risk acceptance, risk avoidance, risk mitigation	06
Unit IV	**Engineering Economics:** relevance, time value of money, types of interest, equivalence, tangible and intangible factors, economic factors, compounding and discounting	08
Unit V	**Economic comparison methods:** payback period, present worth, annual cost, capitalized cost, IRR (Internal Rate of Return), benefit cost ratio, break even analysis	08
Unit VI	**Safety engineering** A. importance of safety, classification of accidents, causes of accidents, safety policy, safety plan, safety training, various safety equipment used on site, occupational hazards	04

	B. Introduction to Quality Control and Quality Assurance (QCQA), introduction to Building Information Modeling (BIM)	

Course Outcomes (CO):
At the end of this course, student will be able to

1	understand the basic aspects of project management
2	prepare project schedules
3	apply fundamentals of engineering economics
4	apply the knowledge of risk and safety management

Text Books:

1	K. K. Chitkara, "Construction Project Management", 3rd Edition, 2005
2	B. C. Punmia and K. K. Khandelwal, "Project Planning and Control with PERT and CPM", 2012

References:

1	L. S. Srinath, "PERT and CPM: Principles and Applications", 2006.
2	Kumar NeerajJha, 'Construction Project Management', 2011.
3	S. Seetharaman, "Construction Engineering and Management", 2nd edition, 2000.
4	RAMP – Risk Analysis and Management of Projects by Institution of Civil Engineers and the Faculty of Institute of Actuaries, Thomas Telford Publication, London.
5	Safety Management in Construction Industry – A Manual for Project Managers by NICMAR, Mumbai
6	Construction Safety Manual Published by National Safety Commission of India
7	Jagman Singh, "Heavy Construction – Planning, Equipment, Methods",2001.
8	R.L. Peurifoy, "Construction planning equipment and methods", 6th edition
9	Concerned ISI for Safety in Construction – Bureau of Indian Standard

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	b	c	d	e	f	G	h	I	j	k
1	√	√	√					√			√
2	√			√		√			√	√	
3	√	√	√	√	√		√		√		√
4	√	√	√		√		√	√		√	√
5	√		√			√			√		

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	4	4	2	15
Understand	4	4	2	15
Apply	4	4	2	15
Analyze	3	3	4	15
Total	15	15	10	60

Government College of Engineering, Karad				
Final Year B. Tech.				
CE703: Structural Dynamics and Earthquake Engineering				
Teaching Scheme			**Examination Scheme**	
Lectures	3 Hrs/week		**CT1**	15
Tutorial	-		**CT2**	15
Total Credits	3		**TA**	10
			ESE	60
			Duration of ESE	3 Hrs.

Course Objectives

1	To understand behavior of earth surface during earthquake.
2	To understand the dynamic behavior of structures.
3	To understand earthquake resistance design philosophy of structures.
4	To understand various vibration isolation techniques.

<div align="center">Course Contents</div>

		Hours
Unit I	**Elements of Seismology:** Terminology, structure of earth, causes of an earthquake, plate tectonic theory, continental drift theory, elastic rebound theory, seismic waves, magnitude and intensity, methods of measurement, energy released, seismograph, strong motion earthquakes, accelerogram, prominent earthquakes in India.	05
Unit II	**Fundamentals of Theory of Vibrations:** Free and forced vibrations of single degree of freedom systems (SDOF). Undamped and viscously damped vibrations, equations of motion and solutions. General dynamic loading, Duhamel Integral, earthquake response of SDOF system.	08
Unit III	**Response Spectrum Theory:** Earthquake response spectrum, tripartite spectrum, construction of design response spectrum, effect of foundation soil and structural damping on design spectrum, evaluation of lateral loads due to earthquake on multistory buildings as per IS 1893-2002 Part I.	07
Unit IV	**Conceptual Design:** Planning aspects, load path, stiffness and strength distribution, different structural system, liquefaction and settlement. Earthquake resistance design principles: Design philosophy,	10

	behaviour of RC building, ductility and ductile detailing of beam and columns using IS 13920.	
Unit V	**Masonry Structures:** Behavior of unreinforced masonry and reinforced masonry, RC bands, vertical reinforcement, openings, Provisions of IS 4326. Repair and strengthening of masonry and RC members.	**04**
Unit VI	**Introduction to Earthquake resistant modern techniques:** Base Isolation-Elastomeric, sliding, combined. Seismic dampers – Friction dampers, Tuned mass damper (TMD), Visco-elastic dampers.	**06**
Note:	Only IS 1893 Part I is allowed in examination.	

Course Outcome (CO):	
At the end of this course, student will be able to	
1	understand the structure and behavior of earth during earthquake.
2	design earthquake resistant structures.
3	know and understand the concept of vibration isolation and techniques.
Text Books:	
1	S. K. Duggal, 'Earthquake Resistance Design of Structures', Oxford University Press, New Delhi, 2013.
2	Manish Shrikhande and PankajAgarwal, 'Earthquake Engineering', Prentice Hall India Pvt. Ltd, New Delhi, 2009.
3	Mario Paz, 'Structural Dynamics', CBS Publication, New Delhi, 2nd Edition, 2004.
4	Vinod Hosur, 'Earthquake Resistance Design of Building Structures', Wiley India Pvt. Ltd. Publication, 1st Edition, 2013.
Reference Books:	
1	A. K. Chopra, Dynamics of Structures. Theory and Applications to Earthquake Engineering., Prentice Hall Publications, 2nd edition, 2001.
2	D. J. Dowrick, Earthquake Resistant Design and Risk Reduction., John Wiley Publication, 2nd edition, 2009.
3	IS 1893-2002 Part I, IS 13920, IS 4326 Bureau of Indian Standards, New Delhi.
Useful Links:	
1	www.*nicee*.org or www.bmtpc.org,

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
1	√	√	√	√			√			√	√
2		√	√		√		√				√
3	√	√	√		√	√		√	√		√

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	2	2	-	8
Understand	5	5	3	20
Apply	3	3	2	12
Analyze	3	3	3	12
Evaluate	2	2	2	8
Create	-	-	-	
Total	15	15	10	60

Government College of Engineering, Karad
Final Year B. Tech.
CE704:Limit State Design of Concrete Structures

Teaching Scheme			Examination Scheme	
Lectures	3 Hrs/week		**CT1**	15
Tutorial	1		**CT2**	15
Total Credits	4		**TA**	10
			ESE	60
			Duration of ESE	3 Hrs

Course Objectives		
	1	To understand behavior of structural members under various loadings
	2	To understand concept of RCC structural design
	3	To conceive elementary deign of different structural elements

	Course Contents	
		Hours
Unit I	**Introduction:** Stress-Strain behavior of concrete and steel, behavior of RCC, permissible stresses in steel and concrete, different design philosophies, various limit states, characteristic strength and characteristic load, load factor, partial safety factors, stress block parameters	07
Unit II	**Limit state of collapse (flexure):** analysis and design of singly and doubly reinforced rectangular sections, singly reinforced T and L beams	07
Unit III	a) **Limit state of collapse (shear and bond):** shear failure, design of shear reinforcement, bond-types, factors affecting bond resistance, check for development length b) **Limit state of serviceability:** deflection criteria, cracking-classification and types of cracks, causes, mechanism, and IS recommendations	06
Unit IV	a) **Design of slabs:** cantilever slab, simply supported one way slab, two way slab with different support conditions b) **Design of staircase:** simply supported single flight staircase and dog legged staircase	06
Unit V	Analysis and design of axially and eccentrically loaded circular and rectangular columns, interaction diagrams, circular column with helical reinforcement	07

Unit VI	Design of isolated rectangular column footing with constant depth subjected to axial load and moment, design of combined rectangular footing, Introduction to eccentric footing (numerical are not expected)	07

Course Outcomes (COs):	
At the end of this course, students will be able to	
1	analyze behavior of structural members under various loadings
2	implement concepts of structural design by Limit- state method
3	analyze and design the individual members and hence building as a whole
Text Books:	
1	N.C. Sinha and S.K. Roy, "Fundamentals of Reinforced Concrete", S.Chand publications, 4th edition, 2013
2	B. C. Punmia, A.K. Jain and A.K. Jain, "Comprehensive Design of R.C. Structures", Laxmi Publications,10th edition, 2015
3	V. L. Shah and S.R. Karve, "Limit State Theory and Design", Structures *publications,*8th*edition*, 2014.
4	A. K. Jain, "Reinforced Concrete: Limit State Design",7th edition, 2012.
References:	
1	IS 456-2000: code of practice for Plain and reinforced concrete, Bureau of Indian Standard, New Delhi.
2	IS 875 (part 1): code of practice for design loads (other than earthquake) for buildings and structures. part 1: dead loads-unit weights of building materials and stored materials (second revision)
3	IS 875 (part 2): code of practice for design loads (other than earthquake) for buildings and structures. part 2: imposed loads (second revision)
4	P.C. Varghese, "Limit State Design of reinforced concrete", Prentice-hall of India Pvt.Ltd , 2nd*Edition*, 2004.
5	M. L. Gambhir and McMillan, "Reinforced Concrete Design", PHI learning Pvt. ltd 4th*Edition,2006*
Useful Links:	
1	http://nptel.ac.in/downloads/105105104/
2	https://en.wikipedia.org/wiki/Reinforced_concrete

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	B	c	d	e	F	g	h	i	j	k
1	√		√			√	√	√			√
2	√	√			√			√	√		
3	√		√			√	√	√			√

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	1	1	2	5
Understand	5	5	5	20
Apply	5	5	3	20
Analyze	2	2		
Evaluate	2	2		15
Create				
Total	15	15	10	60

Elective-I

Government College of Engineering, Karad				
Final Year B. Tech.				
CE715: Advanced Structural Analysis				
Teaching Scheme			**Examination Scheme**	
Lectures	4Hrs/week		**CT1**	15
Tutorial	1 Hr/week		**CT2**	15
Total Credits	4		**TA**	10
			ESE	60
			Duration of ESE	3 Hrs.

Course Objectives

	1	Student should learn analysis of curved members
	2	Student should understand approximate methods of analysis
	3	Student should study Unsymmetrical Bending and Shear Center, analysis of space trusses
	4	Student should understand basics of theory of elasticity

Course Contents

		Hours
Unit I	**Influence line diagrams for indeterminate structure**: Muller Breslau principle, I.L.D. for propped cantilever, two span continuous beam	08
Unit II	**Fixed arches**: analysis of fixed arches by elastic center method beams curved in plan: determinate and indeterminate beams curved in plan.	08
Unit III	**Approximate method of analysis of multi-storey frames**: analysis of portal frames subjected to lateral loads – portal method, cantilever method	08
Unit IV	**Asymmetrical Bending:** shear center for thin walled beam section symmetrical about one axis	08
Unit V	**Analysis of space trusses** by tension coefficient method analysis of secondary stresses in plane frames	08
Unit VI	**Introduction to theory of elasticity–** (Treatment in Cartesian coordinates), state of stress at point, stress equilibrium equations, strain components, stress-strain relation, generalized Hooke's law, plane stress and plane strain conditions, stress and strain compatibility for 2 D	08

Course Outcomes (COs):	
At the end of this course, students will be able to	
1	perform analysis of curved members
2	do multistory frames using approximate methods
3	analyze members subjected to unsymmetrical bending, locate shear center and analyze space trusses
4	understand basics of theory of elasticity

Text Books:	
1	C.S.Reddy ,"Basic structural Analysis", Tata McGraw Hill, Delhi, 2nd edition
2	S. B. Junnarkar& H.J. Shah "Mechanics of Structures" Vol. II & III, Charotar Publishing House, Anand

References:	
1	Norris and Wilbur, "Elementary Structural Analysis", McGraw Hill Inc., 4th Edition
2	Negi and Jangid, "Structural Analysis", Tata McGraw Hill Pub. Co. Ltd.
3	Timoshenko, "Strength of Materials Vol.-II", East-West Press ltd. Delhi
4	Vazirani and Ratwani, "Analysis of Structures Vol.-II", Khanna Publishers, Delhi
5	B.C. Punmia and A.K. Jain, "Design of Steel Structures", Laxmi Publication Ltd. Delhi
6	S.P. Timoshenko and J.N. Goodier, "Theory of Elasticity", Tata McGraw-Hill Publishing Co. Ltd., 3rd edition

Useful Links:	
1	http://nptel.ac.in/courses/105105109/pdf/m6l36.pdf
2	https://www.youtube.com/watch?v=7ZR1p2K-gdI

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	b	c	D	E	F	G	h	i	j	K
1	√	√	√	√		√	√	√	√		√
2	√	√	√	√		√			√		√
3	√	√	√	√		√	√	√	√	√	√
4	√	√	√	√		√		√			√

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	02	02	01	08
Understand	03	03	01	12
Apply	02	02	02	08
Analyze	03	03	01	12
Evaluate	05	05	05	20
Total	15	15	10	60

Elective-I

Government College of Engineering, Karad			
Final Year B. Tech.			
CE 725:Hydraulic Structures			
Teaching Scheme		**Examination Scheme**	
Lectures	4 Hrs/week	**CT1**	15
Tutorial	1 Hrs/week	**CT2**	15
Total Credits	04	**TA**	10
		ESE	60
		Duration of ESE	2Hr 30Min.

Course Objectives:	
1	To understand basic components of hydraulic structures
2	To carry out reservoir storage calculations
3	To understand design criteria of hydraulic structures
4	To understand river engineering and river training work

Course Contents		
		Hours
Unit I	**Dams and Reservoirs:** Types of dams, selection of site for dams, selection of type of dam, Storage Calculations using mass curves, Area elevation curve & Elevation capacity curve, Control levels, Silting of reservoirs, Control of Losses in reservoirs	06
Unit II	**Earthen Dams:** Types of earthen dams, Components and their functions, methods of construction of earthen dam, Design criterion, plotting of phreatic line, Modes of failure, seepage control measures-Drainage & filters, stability of slopes for sudden drawdown & steady seepage, Rock fill dams	07
Unit III	**Gravity Dams:** Forces acting on dam, Design Criterion-theoretical and practical profile, high and low dam, fixing section of dam, stability analysis, and methods of construction, galleries and joints in dams. Arch dams-Introduction & types only. Introduction to instrumentation in dams. **Spillway:** Necessity and function components of spillway, different types, factors affecting choice of type of spillway. Elementary hydraulic design, types of energy dissipation	10

	arrangements, gates for spillway. **Outlets in Dams:** Outlets through concrete and earth dams, different types.	
Unit IV	**Diversion Head Works:** Component parts & their functions, types of weir and barrages, K T Weir, Causes of failure and remedies, Introduction to Theory of seepage-Bligh's creep theory, critical exit gradient, Khosla's theory	08
Unit V	**Canals:** Types, alignment, typical sections of canals, balancing depth Kennedy's and Lacey's silt theories, canal lining-purpose, types, selection and economics. **C.D. Works:** Necessity, Types. Canal Regulatory Works: head regulator, cross regulator, canal fall, canal escape, standing wave flume.	08
Unit VI	**River Engineering:** Classification and types of river, meandering phenomenon **River Training Works:** Classification-Marginal bunds, Guide banks and Groynes. River navigation. Interlinking of rivers, National perspective plan **Elements of Hydro-power:** Hydro-power & its importance, typical layout & functions of components parts-Intakes, conveyance system, surge tanks, Power house, Tail race, Types of hydro-power plants.	09

Course Outcome (CO):		
At the end of this course, student will be able to		
	1	develop the ability to study types of hydraulic structures
	2	develop the ability to determine storage capacity of reservoirs
	3	develop the ability to design sections of hydraulic structures
	4	develop the ability to study various components of river training work
Text Books:		
	1	S.K.Garg, "Irrigation Engineering and Hydraulic Structures", Khanna Publications, 2006
	2	P. N. Modi, "Irrigation water resources and water power Engineering", 9th edition, 2014
	3	B. C. Punmia, B. B. Lal, Ashok Kumar Jain and Arunkumar Jain,"Irrigation and water power Engineering", 16th edition,2009
References:		
	1	Grishin M.M, "Hydraulic Structures Vol. 1. & Vol. 2",Mir Publishers Moscow, 1982

2	Design Textbook in Civil Engineering: Volume Six: Dams- Leliavsky, Serge – Oxford and IBH Publishing Co. Pvt. Ltd., 1981.	
3	Design of Small Dams- United States Department of the Interior, Bureau of Reclamation revised reprint 1974, Oxford and IBH Publishing Co.	
4	P.Novak, A. I. B. Moffat, C. Nalluri and R.Narayanan, "Hydraulic Structures", Taylor and Francis, U. K.	
5	River Behavior Management and Training ,CBIP publication.	
Useful Links:		
1	http://nptel.ac.in/courses/105105110/	

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	b	c	D	E	f	G	h	i	j	k
1	√	√	√	√		√		√	√		√
2	√	√	√	√		√	√	√	√		√
3	√	√	√	√	√	√		√	√		√
4	√	√	√	√			√		√		√

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	12
Understand	3	3	2	12
Apply	3	3	2	12
Analyze	3	3	2	12
Evaluate	3	3	2	12
Create	-	-	-	-
Total	15	15	10	60

Elective-I

Government College of Engineering, Karad			
Final Year B. Tech.			
CE 735: Advanced Foundation Design			
Teaching Scheme		**Examination Scheme**	
Lectures	4 Hrs/week	**CT1**	15
Tutorial	1 Hrs/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60
		Duration of ESE	2 Hr 30Min

Course Objectives:

1	To understand basics of geotechnical design of shallow and deep foundations
2	To carry out geotechnical design of shallow and deep foundations
3	To understand Sheet Pile walls and Cofferdams
4	To understand foundations in difficult soils and soil stabilization

Course Contents

		Hours
Unit I	**Shallow Foundations:** Types, depth of foundation, calculation of bearing capacity by various approaches (Terzaghiis code method), proportioning of footing (isolated, combined rectangular and combined trapezoidal), eccentrically loaded footing, calculation of foundation settlement (immediate and consolidation settlement)	08
Unit II	**Raft Foundations:** Types of rafts, bearing capacity and settlements of raft, design considerations and IS code method of analysis	08
Unit III	**Deep Foundation:** Classification of piles, calculations of load capacity of single pile by static and dynamic formulae, group action of piles, negative skin friction and its estimation, under reamed piles, settlement of piles, cyclic pile load test	08
Unit IV	**Design of Machine Foundations:** Static and dynamic design criteria-permissible amplitude of vibrations for different types of machines, foundations for reciprocating machines- design criteria- calculation of induced forces and moments- multi cylinder engines	09

Unit V	**Sheet Pile walls and Cofferdams:** Types and uses of sheet piles, design of cantilever sheet pile walls in granular and cohesive soils, anchored bulkhead, free earth support and fixed earth support method, coffer dams, types, uses of cofferdams	07
Unit VI	**Foundations in difficult soils and soil stabilization**: foundation in expansive soil, soft and compressible soils, problems associated with foundation installation- ground water lowering and drainage, shoring and underpinning, different methods, damage and vibrations due to constructional operations soil stabilization: mechanical stabilization, cement stabilization, lime stabilization, bituminous stabilization, chemical stabilization, stabilization by grouting	08

Course Outcome (CO):	
At the end of this course, student will be able to	
1	study basics of geotechnical design of shallow and deep foundations
2	determine proportioning of footing and settlement
3	study Sheet Pile walls and Cofferdams
4	study foundations in difficult soils and soil stabilization
Text Books:	
1	B.C. Punmia, "Soil Mechanics and Foundation Engineering", LaxmiPublications Pvt. Ltd., New Delhi,17th edition
2	GopalRanjan and A S Rao, "Basic and Applied Soil Mechanics", New Age International Publishers, 1st Edition
3	V. N. S. Murthy, "Soil Mechanics and Foundation Engineering", CBS, 1st edition
References:	
1	J.E. Bowles, "Foundation Analysis and Design", McGraw Hill Publishing Company,5[th]edition
2	N.P.Kurian, "Modern foundations", Tata McGraw Hill Publishing company
3	P Srinivasulu and Vaidyanathan C.V, Handbook of Machine foundations 2004 by
4	Swami Saran, "Soil Dynamics and machine foundation",Galgotia Publications Pvt. Ltd., New Delhi,2[nd]edition
5	W. C. Teng, "Foundation Design", Prentice by Hall of India Pvt. Ltd., New Delhi
6	Ronald F. Scott , "Foundation Analysis" ,Prentice Hall Inc.,1981
Useful Links:	
1	http://nptel.iitm.ac.in by Prof. B. V. S. Viswanadham and Prof. G. Venkatachalam

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	b	c	D	e	F	G	h	i	j	k
1	√	√	√	√		√		√	√		√
2	√	√	√	√		√	√	√	√		√
3	√	√	√	√	√	√		√	√		√
s4	√	√	√	√			√		√		√

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	12
Understand	3	3	2	12
Apply	3	3	2	12
Analyze	3	3	2	12
Evaluate	3	3	2	12
Create	-	-	-	-
Total	15	15	10	60

Elective-I

Government College of Engineering, Karad			
Final Year B. Tech.			
CE745: Remote Sensing			
Teaching Scheme		**Examination Scheme**	
Lectures	4 Hrs/week	**CT1**	15
Tutorial	1 Hrs/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60
		Duration of ESE	2Hrs 30 min..

Course Objectives

1	To get a basic and advanced level insight into the approach of latest remote sensing techniques
2	To understand the subject of Geographical information system as an extension of application software in civil engineering
3	To understand various applications of remote sensing in Civil Engineering

Course Contents

		Hours
Unit I	**Introduction and Basic Concepts** Introduction, basic concepts of remote sensing, airborne and space born sensors, passive and active remote sensing emr spectrum, energy sources and radiation principles energy interactions in the atmosphere energy interactions with earth surface features, spectral reflectance curves	06
Unit II	**Remote Sensing Systems** Satellites and orbits, polar orbiting satellites spectral, radiometric and spatial resolutions, temporal resolution of satellites multispectral, thermal and hyperspectral sensing. Indian remote sensing satellites and their features	06
Unit III	**Digital Image Processing - Image Restoration and Image Enhancement** Geometric corrections co-registration of data, ground control points (GCP) atmospheric corrections, solar illumination corrections concept of color, color composites contrast stretching – linear and non-linear stretching filtering techniques, edge enhancement density slicing, thresholding,	09

	Intensity Hue saturation (IHS) images, time composite images, synergetic images.		
Unit IV	**Digital Image Processing - Information Extraction and Digital Image Processing Software** Introduction to Multispectral classification, Ground truth correction, Supervised and unsupervised classification Change detection analysis, Principal component analysis Ratio images, Vegetation indices Image processing software, Multispectral classification algorithms Image processing using software	10	
Unit V	**Digital Elevation Modeling** Introduction, Sources of digital elevation data, Types of DEM Radar interferometry, Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) data, DEM for Slope, Aspect, Flow direction, Flow pathways, Flow accumulation, Streams, Catchment area delineation, Counter and draining extraction. Developing stereopairs and anaglyphs.	08	
Unit VI	**Remote Sensing Applications** Remote Sensing Applications in: Watershed management, Rainfall-runoff modeling, Irrigation management, Flood mapping, Drought assessment, Environmental monitoring Geomorphology, landuse and land cover, soil mapping, site selection, route alignment, cartography, highway engineering, reservoir siltation	08	

Course Outcome (CO):	
At the end of this course, student will be able to	
1	get a basic and advanced level insight into the approach of latest remote sensing techniques
2	understand the subject of Geographical information system as an extension of application software in civil engineering
3	understand various applications of remote sensing in Civil Engineering
Text Books:	
1	T.M. Lillesand and R.W. Kiefer, 'Remote Sensing and Image Interpretation', John Wiley & Sons, New York. 6th edition, 2008
2	J.B. Campbell, 'Introduction to Remote Sensing', Taylor & Francis, London, 1996
3	T. J. M. Kennie and M. C. Mathews, 'Remote sensing in Civil Engineering', Surry University press, London, 1985

References:	
1	F.F. Sabins, 'Remote Sensing: Principles and Interpretation', W.H. Freeman and Company, New York, 1997.
2	Paul Longley, M.F. Goodchild, 'Geographical Information System, Volume I and II', John Wiley and Sons, Inc. 1999.
Useful Links:	
1	http://nptel.ac.in/courses/105108077/Dr. D. Nagesh KumarIISc Bangalore
2	http://nptel.ac.in/courses/121107009/Dr.Arun K.Saraf,IIT Roorkee

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	b	c	D	e	F	g	h	i	j	k
1	√	√		√		√		√			√
2	√			√		√		√			√
3		√	√	√	√	√		√			√

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	01	01	-	04
Understand	03	03	02	12
Apply	03	03	03	12
Analyze	03	03	02	12
Evaluate	02	02	01	08
Create	03	03	02	12
Total	15	15	10	60

Elective-I

Government College of Engineering, Karad			
Final Year B. Tech.			
CE755: Traffic Engineering			
Teaching Scheme		**Examination Scheme**	
Lectures	4Hrs/week	**CT1**	15
Tutorial	1Hrs/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60
		Duration of ESE	2 Hrs 30 min.

Course Objectives:		
	1	To provide an insight on traffic and its components, factors affecting road traffic.
	2	To provide an insight on traffic movements and speed studies.
	3	To provides clear understanding on conducting various types of traffic surveys, data collection, analysis, inference and presentation
	4	To identify the role of various modes of Mass Transportation like Bus and Rail and its Planning and Management.

Course Contents		
		Hours
Unit I	**Introduction** Infrastructure &its role in developing society; Transport sector in India –policy framework; Development plans –Airports, Highways –National highway development program (NHDP); JNNURM, Asian highways network (AH).	07
Unit II	**Traffic Characteristics** Traffic characteristics –Road user characteristics, General human characteristics, Physical characteristics. Vision eye –Movement peripheral vision, Visual attention, Visual sensitivity to light and colour, glare vision and recovery perception of space. Hearing, Stability sensation, Time factor in response, Theory of PIEV modifying factors, conditional responses; Vehicular Characteristics –types, dimensions, resistance, power requirement for different resistance, change in direction –minimum turning radius, off tracking, slip angle.	09
Unit III	**Traffic Engineering & Speed Analysis** Introduction, Speed studies, journey time and delay studies, Sampling in traffic studies & application, Traffic surveys-types of volume count Planning, Problems on PCU, moving observer	09

		method and spot speed. Traffic operation and management. Traffic systems management and Travel demand management –Congestion Management Cost effective management measures, Traffic control aids, Street furniture, Road Arboriculture–Traffic Regulation, Traffic Sign and Road Markings.	
Unit IV	**Trip Generation and Distribution:** Factors governing trip generation and attraction –Application of Regression Analysis-Methods of trip distribution; Growth and Synthetic Models Calibration and Application of gravity model.-Category analysis	07
Unit V	**Introduction to Intelligent Transportation Systems (ITS)** Definition, Objectives, Historical Background, Benefits of ITS -ITS Data collection techniques –Detectors, Automatic vehicle location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), Video data collection. Advanced traffic management systems (ATMS), Advanced traveller information Systems (ATIS), Commercial vehicle operations (CVO), Advanced vehicle control systems (AVCS), Advanced Public transportation systems (APTS), and Advanced rural transportation systems (ARTS).	09
Unit VI	**Public Transport System** History and role of Transit, Transit system and transit mode characteristics, Transportation technology Vision–2020, Role of various modes of Mass Transport and their Impact, Indian condition Bus Rapid Transit Systems (BRTS)-Rapid transit rail-Metro & Mono rails.	07

Course Outcomes (COs):	
At the end of this course, student will be able to	
1	acquire and apply knowledge of traffic, its components, factors affecting road traffic.
2	analysis traffic speed study data and its presentation.
3	apply the knowledge of sampling data in conducting various surveys and analysis.
4	able to understand various modes of mass transit system and intelligent transport system
Text Books:	
1	L.R. Kadiyali and N.B. Lal, "Principles and Practice of Highway Engineering (Including Expressways and Airport Engineering)", Khanna Publishers, New Delhi, 2004
2	Kadiyali, "Traffic Engineering and Transport Planning", Khanna Publishers,

	New Delhi,1994
3	Partha Chakroborty and Animesh Das, "Principles of Transportation Engineering", Prentice-Hall India, New Delhi, 2003

References:	
1	Black John ,"Urban Transportation Planning", Croom Helm Ltd. London, 1981
2	BPR, "Urban Transportation Planning: General Information and Introduction to System 360", Bureau of Public Roads, Washington D.C ,1970
3	Bruton M.J. and Hutchinson, "Introduction to Transportation Planning", 2nd edition, London, 1975
4	Drew D.R., "Traffic Flow Theory and Control", McGraw-Hill, New York, 1968
5	Hutchinson B.G., " Principles of Urban Transport Systems Planning", McGraw-Hill Book Co., New York, 1974
6	McShane W.R. and Roess R.P. , "Traffic Engineering" Prentice-Hall Inc., New Jersey, 1990
7	Pignataro L.J. , "Traffic Engineering: Theory and Practice", Prentice-Hall Inc., New Jersey, 1973
8	Putman S.H , "Integrated Urban Models", Pion Ltd., London, 1983
9	Wilson A.G. , "Entropy in Urban and Regional Modelling", Pion Ltd., London, 1970

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	B	c	D	e	F	g	h	i	j	k
1	√	√	√		√			√			√
2	√	√	√	√				√		√	√
3	√	√	√			√	√	√	√	√	√
4				√	√	√		√	√	√	√

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	2	2		8
Understand	5	5	3	20
Apply	3	3	2	12
Analyze	3	3	3	12
Evaluate	2	2	2	8
Create	-	-	-	-
Total	15	15	10	60

Elective-I

Government College of Engineering, Karad			
Final Year B. Tech.			
CE765: Advanced Water Treatment			
Teaching Scheme		**Examination Scheme**	
Lectures	04 Hrs/week	**CT1**	15
Tutorial	01Hrs/week	**CT2**	15
Total Credits	04	**TA**	10
		ESE	60
		Duration of ESE	2Hrs 30 min.

Course Objectives		
	1	To understand the basic concepts of Water Treatment process
	2	To design the various units of Water treatment
	3	To understand the principles of tertiary treatments

Course Contents		
		Hours
Unit I	**Introduction:** Standards for raw and treated water. Water quality and standards, Thermal stratification. Seasonal Change, lake overturns, Limnology, Algae, Control measures, quality of underground Waters. Nature and source of impurities. Characterization of water. Unit operations and unit processes.	08
Unit II	**Aeration and Sedimentation:** Principles of Aeration, System parameters and mathematical model. Methods of aeration. Principles of sedimentation, General equations for settling or discrete particulates. Hindered settling, effect of Temperature, viscosity efficiency of an ideal basin, short-circuiting. Specific gravity relationship.	08
Unit III	**Coagulation and Flocculation**: Theory, Nature of colloids. Zeta potential. Coagulant and their specificity. Sedimentation with coagulation. Design of mechanical flocculators. Mean velocity gradient "G", "Gt" effect of temperature and other variables. Power consumption. Mathematical Modeling. Rapid mixing	08
Unit IV	**Filtration.** System Parameter and mathematical modeling, size and shape characteristics of granular filtering materials. Preparations of filter sand, Hydraulics of filtration through homogeneous and stratified beds.	09

	Performance of slow, rapid, high-rate multilayer and composite filters. Up flow, two-way filter, dual media filter. **Pressure Filters**: Diatomaceous earth filters. Micro-strainers. Filterability Index.	
Unit V	**Disinfection and Softening**: Factors affecting disinfection. Halogens, Chlorine, Iodine and Bromine. Hardness and softening: Different methods of removal of hardness, Boiling, Ion-exchange Zeolite, Lime soda ash etc. **Adsorption:** Theory and different methods of adsorption, Activated carbon, adsorption isotherm,	08
Unit VI	**Advanced Treatment**: Advance Technologies: Reverse osmosis, Ultra-filtration, Nano-filtration, UV radiation treatment, etc. Water quality requirements of industry.	07

Course Outcomes (COs):	
At the end of this course, student will be able to	
1	understand the concept of various units of water treatment process
2	design of various units of water treatment process
3	design of advanced treatment for water treatment process
Text Books:	
1	Fair Geyer and Okun, "Water and Waste Water Engineering", John Willy and Sons, 1968
2	Mark J. Hammer , "Water and Waste Water Technology", John Willy and Sons, 6th edition, 2007,
References:	
1	E.W.Steel and McGhee, "Water Supply and Sewerage", McGraw Hill Company, 6th edition, 1991
2	Manual on "Water Supply & Treatment", CPHEEO, New Delhi, 1999
3	Weber , "Physico-Chemical Processes for Water Quality Control", John Wiley & Sons, 1972
Useful Links:	
1	nptel.ac.in/courses/105104102/5
2	nptel.ac.in/courses/105106119/33

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	b	c	D	E	F	g	h	i	j	k
1	√	√	√				√		√		√
2	√	√	√	√	√	√	√	√	√	√	√

| | 3 | √ | √ | √ | √ | √ | √ | | √ | √ | √ | √ |

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	02	02	02	08
Understand	03	03	03	12
Apply	05	05	05	20
Analyze				
Evaluate	05	05	05	20
Create				
Total	15	15	10	60

Elective-I

Government College of Engineering, Karad				
Final Year B. Tech.				
CE775 : Finite Element Method				
Teaching Scheme			**Examination Scheme**	
Lectures	4 Hrs/week		**CT1**	15
Tutorial	1 Hrs/week		**CT2**	15
Total Credits	4		**TA**	10
			ESE	60
			Duration of ESE	3 Hrs**.**

Course Objectives

1	To understand fundamentals of finite element method (FEM) of analysis.
2	To understand the power of FEM in areas other than classical methods.
3	To understand modelling of systems using FEM.
4	To understand the use of FEM software in analysis of real life structures.

Course Contents

		Hours
Unit I	**Introduction to Finite Element Method:** Variational principles in solid mechanics, Principle of Virtual work, Principle of minimum potential energy., Rayleigh-Ritz method, finite element procedure.	**05**
Unit II	**General Description and Analysis Procedure**; Basic equations in elasticity, Linear constitutive Laws; Concept of element and node, Element aspect ratio, Nodal degree of freedom, Coordinate systems, Generalized co-ordinate form of displacement, displacement functions or fields, Convergence requirements and compatibility conditions, Pascal's triangle.	**08**
Unit III	**Shape Functions:** Definition, Polynomial shape functions, Shape functions in Cartesian co-ordinates and Natural co-ordinates, Shape functions using Lagrange polynomials, Shape functions for 1-D, 2-D finite elements, serendipity family elements.	**07**
Unit IV	**1D problems:** Discretization, nodes, displacement model, shape functions, selection of order of polynomials, application to bars with constant and variable cross sections subjected to axial forces. Development of element stiffness matrix and nodal load vector for truss, beam and plane frame elements. Transformation of	**10**

Unit		
	matrices, relevant structural engineering applications.	
Unit V	**2D Problems:** elements of triangular and quadrilateral shapes for plane stress and plane strain problems. Plate bending problems, axisymmetric problems such as chimney, cooling towers etc.	**04**
Unit VI	**Isoparametric Elements:** Natural coordinate systems, Shape functions. Classification of isoparametric elements: isoparametric, subparametric, superparametric elements, 1D and 2D isoparametric elements, Gauss quadrature and numerical integration.	**06**

Course Outcomes (COs):	
At the end of this course, students will be able to	
1	Learn the fundamentals of the finite element method.
2	Model the structural behavior through FE Analysis leading to design of structures.
3	Enhance the knowledge in numerical analysis with FE softwares and FE Programs.
Text Books:	
1	J. N. Reddy , "An introduction to the finite element method ", Tata McGraw hill publication co. ltd, 3 rd edition, 2006
2	T. R. Chandrupatla and A. D. Belegundu, "Introduction to Finite Elements in Engineering", Pearson higher education, inc.,4th edition, 2011
3	C.S. Desai, "Introduction to finite element method", CBS Publication & Distributors, 5th edition, 2000
Reference Books:	
1	O. C. Zienkiewicz, R. L. Taylor and Butterworth-Heinemann, "The Finite Element Method: Its Basis and Fundamentals ", 7th edition, 2013
2	George R. Bachanan,"Schaum's Outline of Finite Element Analysis", McGraw-Hill Education, 1994.
3	R. D. Cook , "Concepts and Applications of Finite Element Analysis ", John Wiley & Sons ltd
Useful Links:	
1	http://nptel.ac.in/courses/112104115/
2	http://nptel.ac.in/courses/105108141/

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	B	c	D	e	F	g	h	i	j	k
1	√	√	√	√			√			√	√
2		√	√		√		√				√
3	√	√	√		√	√		√	√		√

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	2	2	-	8
Understand	5	5	3	20
Apply	3	3	2	12
Analyze	3	3	3	12
Evaluate	2	2	2	8
Create	-	-	-	-
Total	15	15	10	60

Elective-I

Government College of Engineering, Karad			
Final Year B. Tech.			
CE785:Hydropower Engineering			
Teaching Scheme		**Examination Scheme**	
Lectures	4 Hrs/week	**CT1**	15
Tutorial	1 Hrs/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60
		Duration of ESE	2.30 Hrs.

Course Objectives	
1	To enable students to study and understand construction and functioning of hydroelectric power station.
2	To enable students to design water conductor system.
3	To enable students to select appropriate type of turbine.
4	To acquaint students with laws and regulatory aspects of electricity.

Course Contents		
		Hours
Unit I	**Energy Resources – Planning and Potential :** Sources of energy,Power resources – Conventional and Nonconventional, need and advantages, Overview of World Energy Scenario, energy and development linkage ,hydropower development in India,, types of power station, estimation of hydro power available, gross head, net head, storage and pondage, plant capacity factor, plant use factor	08
Unit II	**Hydropower Plants :** Classification of hydropower plants - Run of river plants, Storage or Valley dam plants, Components of hydropower plants **Power station** : General arrangements of power station, power house, substructure and super structure **Underground power station**: – Necessity, types, development and economics, advantages and disadvantages	07
Unit III	**Water Conductor System:** Alignment, Intake Structures-Location and Types, Trash Rack. Penstock and pressure shaft, **Pen-stock :** Types , hydraulic design and economic diameter pipe, supports, anchor blocks	08

		Tunnels: Classification, location and hydraulic design, tunnel linings	
Unit IV		Turbines : Classification, Principles and design of impulse and reaction turbines, Selection of Turbine, characteristics of different types, specific speed, Governing of turbines, Water hammer, Draft tubes, , turbine setting and cavitation, Tail Race ,draft tubes, function and types	07
Unit V		**Economics of Hydroelectric Power:** Hydropower - Economic Value and Cost and Total Annual Cost. Economic considerations – pricing of electricity, laws and regulatory aspects, Policies, Electricity act – 2003, Investment in the power sector, Carbon credits, Participation of private sector. **Pumped storage plants**: purpose and general layout of pumped storage schemes, types, economics of pumped storage plants.	07
Unit VI		**Load Assessment:** Estimation of electrical load on turbines. Load factor, Plant factor, peak demand, Prediction of load, Tariffs.	05

Course Outcomes (COs):	
At the end of this course, students will be able to	
1	study and understand construction and functioning of hydroelectric power station
2	design water conductor system
3	to select appropriate type of turbine
4	understand laws and regulatory aspects of electricity
Text Books:	
1	M. M. Dandekar, "Water Power Engineering", Vikas Publication house Pvt. Ltd., 2nd edition, 2013
2	Charles Simeons, "Hydro-Power The Use of Water as an Alternative Source of Energy"
3	P. K. Bhattacharya , "Water Power Engineering", Khanna Publication, Delhi, 3th edition ,1984,
4	J.R. McDonald and X. Wang, "Modern Power System Planning" ,McGraw-Hill publication.,1994
5	P S Nigam ,"Handbook of Hydro Electric Engineering"
Useful Links:	
1	http://nptel.ac.in/courses/105105110/pdf/m5l01.pdf
2	http://nptel.ac.in/courses/105105110/pdf/m5l02.pdf

| 3 | http://nptel.ac.in/courses/105105110/pdf/m5l03.pdf |

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
1	√	√	√	√	√	√	√	√	√	√	√
2	√	√		√	√	√		√	√	√	
3	√	√	√	√	√	√	√	√	√		√
4		√		√	√	√	√			√	√
5	√	√	√	√	√		√	√	√	√	

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	1	1	1	11
Understand	2	3	2	11
Apply	4	4	2	13
Analyze	5	5	2	13
Evaluate	3	2	3	12
Total	15	15	10	60

Government College of Engineering Karad				
Final Year B.Tech				
CE:706 Quantity Surveying & Valuation Lab				
Laboratory Scheme			**Examination Scheme**	
Practical	2Hrs/week		**CA**	25
Total Credit	01		**ESE**	25

Course Objectives:

1	To provide students necessary knowledge and skills in estimation of civil works
2	To make students aware of professional practices.

Course Contents

Experiment 1.	Writing detailed specifications for items of work from various civil engineering works. (each from Building, Roads, Irrigation works, Water supply & sanitation & sewer from buildings)
Experiment 2.	Detailed rate analysis for items of work from various civil engineering works. (at least 10 items) Schedule of reinforcement for the following: Beams, Slab, Staircase, Column & footing
Experiment 3.	Preparing detailed estimate for G + 1 building with framed structure
Experiment 4.	Preparing detailed estimate for civil structures other than building such as Culvert, road, embankment, drainage system (any one)
Experiment 5.	Preparing tender notice and schedule 'B' (BOQ)for G + 1 building for which the detailed estimate is prepared Preparing tender document for G + 1 building for which the detailed estimate is prepared
Experiment 6.	Preparing detailed valuation report for residential/commercial/ industrial building using standard format

Course Outcomes(COs): Student will be able to

1	take out quantities for various items of construction
2	draft specifications and tender notice
3	prepare estimates for various civil engineering works
4	carry out the valuation of immovable properties using appropriate methods

Mapping of CO and PO

	A	b	c	D	E	f	g	h	i	j	k
1	√		√		√	√	√	√	√		
2	√		√			√			√	√	
3	√	√	√	√	√	√	√	√		√	√
4	√		√	√	√	√		√	√	√	

Assessment Pattern

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Avg.
Task I	15	15	15	15	15	15	
Task II	05	05	05	05	05	05	
Task III	05	05	05	05	05	05	
CA							

Government College of Engineering, Karad
Final Year B. Tech
CE707: Limit State Design of Concrete Structures Lab

Laboratory Scheme			Examination Scheme	
Practical	2Hrs/week		**TA/CA**	25
Total Credits	1		**ESE**	25

Course Objectives:		
	1	To prepare detailing of reinforcement of members under various loading conditions
	2	To prepare schedule of the reinforcement
	3	To practice the elementary design of different structural elements

Course Contents	
Experiment 1	Stress strain behavior of concrete and steel, behavior of RCC, permissible stresses in steel and concrete
Experiment 2	Different design philosophies, characteristic strength and characteristic load, load factor, partial safety factors
Experiment 3	Analysis and design of singly and doubly reinforced rectangular sections
Experiment 4	Design of singly reinforced T and L beams
Experiment 5	Types of shear reinforcement and design of shear reinforcement with at least 3 examples
Experiment 6	Cracking : classification and types of cracks, causes, mechanism
Experiment 7	Simply supported one way slab, two way slab with different support conditions as per IS:456-2000
Experiment 8	Design of cantilever slab and simply supported single flight and dog legged staircase
Experiment 9	Analysis and design of axially and eccentrically (Uni-axial) loaded rectangular columns
Experiment 10	Analysis and design of axially and eccentrically (Uni-axial) loaded circular columns with helical reinforcement
Experiment 11	Design of isolated rectangular column footing

Experiment 12	Design of combined rectangular footing
PROJECT -1	Site visit to residential building in progress, reinforcement detailing and formwork

List of Submission

1	Total number of experiments-12
2	Site visit report

Course Outcomes (COs):
Students will be able to

1	implement the concepts of structural design procedure
2	design the individual members and hence building as a whole.

Mapping of CO and PO

	a	b	c	d	e	f	g	h	i	j	k
1	√		√			√	√	√			√
2	√	√			√			√	√		

Assessment Pattern

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	Project1	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15	15	15	
Task II	05	05	05	05	05	05	05	05	05	05	05	05	05	
Task III	05	05	05	05	05	05	05	05	05	05	05	05	05	
CA														

Government College of Engineering Karad
Final Year B. Tech
CE708: Seminar

Laboratory Scheme				Examination Scheme	
Lecture	1Hrs/week			**TA**	50
Total Credits	1				

Course Objectives:	
1	To able students to represent knowledge that they gain from curriculum
2	To introduce students with recent trends in respective subjects.

Course Contents

The topic for the Seminar may be related to Civil Engineering area and interdisciplinary area related to Civil Engineering such as –
1. Structural Engineering
2. Concrete Technology
3. Environmental Engineering
4. Geotechnical Engineering
5. Transportation Engineering
6. Infrastructural Engineering
7. Water Resources Engineering
8. Town & Country Planning
9. Construction Engineering
10. Surveying & Remote Sensing Techniques
11. Project Management
12. Legal Aspects in Civil Engineering
13. Earthquake Engineering
14. Disaster Management
15. Repairs and Rehabilitation of buildings
16. Any other relevant subject to recent development and advances in civil engineering

Course Outcomes (COs): Student will be able to
1	represent knowledge that they gain from curriculum
2	acquire recent trends in civil engineering

Mapping of CO and PO

	a	b	c	d	e	f	g	h	i	j	k
1	√					√	√		√	√	√
2	√	√	√	√	√	√		√	√		√
3	√			√				√		√	
4	√	√	√		√	√	√	√	√	√	√

Assessment Pattern

Skill Level	Seminar Report
TA	50

Government College of Engineering, Karad				
Final Year B. Tech.				
CE709:Project Phase – I				
			Examination Scheme	
Practical	2Hrs/week		**CA**	50
Total Credits	4		**ESE**	50
Course Objectives				
	1	To carry out extensive literature survey on the research topic		
	2	To identify the problem statement for the research work.		
	3	To decide methodology for the research work.		
	4	To carry out initial mathematical modeling or experimental set up.		
Course Contents				
	The project work will be a design project, experimental project, field surveying or computer oriented on any of the topics of civil engineering interest. Project group consists of a minimum THREE and maximum FIVE students. The group is required to do literature survey, formulate the problem and form a methodology of arriving at the solution of the problem. The assessment of the project will be done at the end of the semester by a committee consisting of three faculty members from the department along with Project Guide. The students will present their project work before the committee. A minimum ten page typed report excluding photographs based on the work done will have to be submitted in prescribed format to the assessing committee. The project guide will award the marks to the individual students depending on the group average awarded by the committee. One Project Guide shall be allotted maximum TWO groups for guidance. For work load calculation minimum load is 1 Hr/week, for one groups of FOUR to FIVE students. (As per AICTE Guide Lines).				

Course Outcomes (COs):	
At the end of this course, student will be able to	
1	perform extensive literature survey and identify research topic of work
2	identify the problem statement for the research work
3	decide methodology for the research work.
4	carry out mathematical modeling or experimental program for the proposed work

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
1	√	√	√	√	√		√	√	√	√	√
2	√	√	√	√	√	√	√	√	√	√	
3	√	√	√	√	√	√	√	√	√	√	√
4	√	√	√	√		√	√	√	√	√	

Assessment Pattern

Knowledge Level	TA	ESE
Remember	9	9
Understand	8	8
Apply	8	8
Analyze	9	9
Evaluate	8	8
Create	8	8
Total	50	50

Government College of Engineering Karad
Final Year B. Tech
CE:710 Industrial Training Presentation

Laboratory Scheme			Examination Scheme	
Practical	1 Hrs/week		**CA**	50
Total Credits	2		**ESE**	-

Course Objectives:		
	1	To expose the students to actual working environment.
	2	To enhance their knowledge and skill from what they have learned in the academic.
	3	To instill the good qualities of integrity, responsibility and self-confidence.

	Course Contents
	ASSESSMENT ON VACATION FIELD TRAINING (4 WEEKS) The students are required to undergo rigorous field training for summer vacation for minimum of 4 weeks in any of the Civil engineering firms to have an exposure to practical aspects. Student shall submit a report on field training and give presentation based on training. **The Report Should Consist:** 1. Introduction and Brief History of the Organization 2. Technical and Practical information gained during the summer training period 3. Daily Material Consumption Report 4. Daily Work Progress Report 5. Daily Muster of Labours on Site 6. Safety Measures 7. Site Layout 8. Site Details (Includes Plan) 9. Bar Chart of Work 10. Necessary certificate from the organization where such training is undertaken 11. Conclusion and Recommendations, Photo gallery, References, Appendices. Note: The faculty in charge shall personally visit the site at least once during the training period. Evaluation of Report by External should be done at the end of 7th semester.

List of Submission	
1	Industrial Training Report

Course Outcomes (COs): Students will be able to	

	1	Relate engineering knowledge and understand field practices in civil engineering.
	2	correlate theoretical concepts with practical implementation.
	3	acquire report preparation skill and work as an individual and team.

Mapping of CO and PO

	A	B	c	d	e	F	G	h	i	j	K
1	√	√	√	√	√	√		√	√		√
2		√	√	√	√	√	√	√			√
3	√		√		√	√	√	√		√	

Assessment Pattern

Knowledge Level	CA
Remember	-
Understand	10
Apply	20
Analyze	05
Evaluate	05
Create	10
Total	50

Government College of Engineering, Karad
Final Year B. Tech.
CE801:Design of Concrete Structures

Teaching Scheme			Examination Scheme	
Lectures	4 Hrs/week		**CT1**	15
Tutorial	-		**CT2**	15
Total Credits	4		**TA**	10
			ESE	60
			Duration of ESE	3 Hrs

Course Objectives	
1	To study the concept of torsion, design for torsion, design of continuous beams
2	To understand working stress philosophy and design of water tanks
3	To study concept of pre-stressed concrete, methods of pre-stressing along with its advantages
4.	To study concept of analysis & design of Pre-stressed concrete sections.

Course Contents		
		Hours
Unit I	**Limit State of Collapse:** torsion behavior of R.C. rectangular sections subjected to torsion, design of sections subjected to combined bending and torsion, combined shear and torsion	07
Unit II	Limit state design of two span continuous beams and three span continuous beams using is coefficient, concept of moment redistribution	08
Unit III	**Design of water tank:** Introduction to working stress method for water tank design, design criteria, permissible stresses, design of water tank resting on ground using IS code method – (i) circular water tanks with flexible and rigid joint between wall and floor, (ii) rectangular water tanks, introduction to limit state method (LSM), IS 3370 (2009)	09
Unit IV	Basic concepts of pre-stressing, historical development, types and systems of pre-stressing, losses of pre-stress in pre tensioned and post tensioned member, flexural strength of pre-stressed concrete sections, introduction to end blocks	08
Unit V	Analysis of pre-stressed rectangular and symmetrical I sections, different cable profiles	06

Unit VI	**Design of pre-stressed concrete:** rectangular and Symmetrical I sections for following criteria: (i) Design of section for flexure (ii) Design of section for the limit state of collapse in flexure.	08

Course Outcomes (COs):	
At the end of this course, student will be able to	
1	analyse sections subjected to torsion
2	analyse and design water tanks resting on ground
3	understand pre-stressed concrete and method of pre-stressing along with its advantages
4	analyse& design Pre-stressed concrete sections
Text Books:	
1	B. C. Punmia and A.K. Jain , "Comprehensive Design of R.C. Structures'', Laxmi publications ,10th edition, 2015
2	V. L. Shah and S.R. Karve, "Limit State Theory and Design", Structures *publication,*8th*edition*, 2014
3	N.C. Sinha and S.K. Roy, "Fundamentals of Reinforced Concrete", S.Chandpublications , 4th edition,2013
4	A. K. Jain, "Reinforced Concrete: Limit State Design'',Nem Chand & brother's publication,7th edition, 2012
5	N Krishna Raju, "Prestressed Concrete'', Tata McGraw-Hill publication company ltd., 4th*edition*,2012
References:	
1	IS 456-2000:Plain and reinforced concrete – code of practice
2	IS 875 (part 1): code of practice for design loads (other than earthquake) for buildings and structures. part 1: dead loads-unit weights of building materials and stored materials (second revision)
3	IS 875 (part 2): code of practice for design loads (other than earthquake) for buildings and structures. part 2: imposed loads (second revision)
4	IS 1343: 1980,code of practice for pre-stressed concrete
5	IS 3370: code of practice concrete structures for the storage of liquids
6	P.C. Varghese, "Limit State Design of reinforced concrete", Prentice-hall of India Pvt. Ltd ,2nd*edition*,2004
7	SP34: 1987,handbook on concrete reinforcement and detailing
8	T.Y. Lin John, "Prestressed Concrete",*Wiley* and sons *publication*,3rd revised edition,*1981*
9	Sinha& Roy, "Prestressed Concrete",S. Chand & company New Delhi ,3rd*edition,1985*
Useful Links:	
1	http://nptel.ac.in/courses/105105104/
2	https://en.wikipedia.org/wiki/Reinforced_concrete

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	A	b	c	D	E	F	g	h	i	j	k
1	√		√			√	√	√			√
2	√	√			√			√	√		
3	√		√			√	√	√			√
4	√		√			√	√	√			√

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	1	1	2	5
Understand	5	5	5	20
Apply	5	5	3	20
Analyze	2	2		
Evaluate	2	2		15
Create				
Total	15	15	10	60

Elective-II

Government College of Engineering, Karad			
Final Year B. Tech.			
CE812: Advanced Design of Concrete Structures			
Teaching Scheme		**Examination Scheme**	
Lectures	4hrs/week	**CT1**	15
Tutorial	--	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60
		Duration of ESE	3 Hrs.

Course Objectives

1	To understand behavior of special RC structures under various loadings
2	To study analysis and design special RC structures
3	To study the detailing of reinforcement in special RC structures

Course Contents		
		Hours
Unit I	**Design of Flat Slabs:** analysis and design of flat slab, detailing of reinforcement as per Codal provisions	6
Unit II	**Analysis of Deep Beams:** design of simply supported and continuous deep beam as per Codal provisions	6
Unit III	**Design of Chimney:** analysis of stresses in concrete chimneys- uncracked and cracked sections, Codal provisions, design of chimney	6
Unit IV	**Design of Overhead Water Tanks:** rectangular and circular water tank with flat bottom, rectangular and circular base slab, flat and dome tank roof, design based on IS 3370	8
Unit V	**Design of retaining walls:** analysis and design of cantilever and counter fort retaining walls with horizontal and inclined surcharge	8
Unit VI	**Yield line analysis of slabs:** virtual work and equilibrium method of analysis, design of simply supported rectangular slabs	6
Note:	**Instruction to paper setter:** **The paper setter is expected to set questions on all topics precisely (mentioning the extent up to which the design and detailing is expected) so that the students can solve the same in stipulated time. (specially on topic retaining walls and elevated water tanks)**	

	Course Outcomes (COs):
	At the end of this course, students will be able to:
1	understand behavior of special RC structures under various loadings
2	analyze and design special RC structures
3	draft detailing of reinforcement in special RC structures as per IS provisions

	Text Books:
1	V. L. Shah and S.R. Karve, "Limit State Theory and Design",Structures *publications,*8th*edition*, 2014
2	N *Krishna Raju*, "Advanced Reinforced Concrete Design",CBS publishers and distributors, 2nd edition,2010
3	Ramamrutham, "*Design* of *Reinforced Concrete* Structures", Dhanpatrai& son's publication,9th *edition,*1981

	References:
1	P Purushothaman, "Reinforced Concrete Structural Elements", *Mc-Grawhill* publishing co.,3 rd. edition, 2004
2	G.S.Ramaswamy, " Design and Construction of Concrete Shell Roofs", McGraw-Hill publication,New York, 1968
3	A. K. Jain, "Reinforced Concrete: Limit State Design",Nem Chand & bros. publications, 7th edition, 2012
4	Jain & JaiKrishna, "Plain and Reinforced Concrete–Vol. I & II", Nem Chand Bros. Publication,Roorkee.
5	Taylor C Pere, "Reinforced Concrete Chimneys",Laxmi publications,7th edition, New Delhi
6	Jones LL&Thomas and Hudson, "Yield Line Analysis of Slabs", Chatto&windus Publisher, London, 1967
7	Design of deep girders, Concrete Association of India
8	Mallick& Gupta, "Reinforced Concrete", Oxford & IBHpublishing co. Pvt. Ltd.6th edition,1996
9	Code of practice IS 456-2000, Plain and reinforced concrete
10	IS 3370: code of practice concrete structures for the storage of liquids

	Useful Links:
1	http://nptel.ac.in/courses/105105104/
2	https://en.wikipedia.org/wiki/Reinforced_concrete

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	A	b	c	d	E	f	g	h	i	j	k
1	√		√			√	√	√			√
2	√	√			√			√	√		
3	√		√			√	√	√			√

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	1	1		5
Understand	2	2	5	10
Apply	5	5	3	10
Analyze	5	5	2	15
Evaluate	2	2		20
Create				
Total	15	15	10	60

Elective-II

Government College of Engineering, Karad				
Final Year B. Tech.				
CE822: Channel and River Hydraulics				
Teaching Scheme			**Examination Scheme**	
Lectures	4Hrs/week		**CT1**	15
			CT2	15
Total Credits	4		**TA**	10
			ESE	60
			Duration of ESE	2.30 Hrs**.**
Course Objectives				
	1	To study fluid flow concepts, uniform flow in open channel.		
	2	To study and analyze hydraulic jump and its effects.		
	3	To study different hydraulic models.		
	4	Student will be able to understand the Gradually and rapidly flow and its applications		
Course Contents				
				Hours
Unit I	Fluid Flow Concepts: Classification of open channels, basic equations (Continuity, Energy, Momentum) , Energy and Momentum coefficients, Specific energy and Critical depth ,Establishment of Uniform flow in open channels, Uniform flow formulae, Section factor and conveyance factor, First and Second hydraulic exponent , Depth Energy relationship			06
Unit II	Gradually Varied Steady Flow: Gradually varied steady flow and rapidly varied steady flow in open channels, surface profiles in GVF analysis, different method of computations, Chow's methods, standard step method, finite difference method			08
Unit III	Hydraulic Jump : Introduction to Jump, Momentum equation of jump, classification of jump, Characteristics of jump in a rectangular channel, Formations of jump in expanding channel, jump at an abrupt drop and rise, control of jump by baffle blocks, jump in sloping rectangular channels			07
Unit IV	Unsteady Flow in Open Channels: Gradually varied unsteady flow, waves and their classification, celerity of a wave, rapidly varied flow, surges, positive and negative			06

	surges, surges in power canals, dam-break problem		
Unit V	**Flood Routing:** Hydraulic and Hydrologic flood routing, Reservoir and channel routing, Differential form of Momentum Equation, Finite difference scheme, Method of characteristics	07	
Unit VI	**Hydraulic Models:** Fixed bed river models (Distorted and Undistorted), Moveable bed Models, Model materials and construction, Physical model calibration and verification, Special-Purpose models	06	

Course Outcomes (COs):	
At the end of this course, student will be able to	
1	study fluid flow concepts, uniform flow in open channel.
2	study and analyze hydraulic jump and its effects.
3	study different hydraulic models.
4	understand the Gradually and rapidly flow and its applications
Text Books:	
1	A.K. Jain, "Fluid Mechanics",Khanna Pub., Delhi, (Edition 2009)
2	Modi/Seth, "Hydraulic &Fluid Mechanics including Hydraulic Machines", Standard book House,Delhi, (Edition 2010)
3	S. Nagrathanam, "Fluid Mechanics", Khanna Pub., Delhi, (Edition 2012)
4	H. Rouse, "Elementary Fluid Mechanics", Toppan C. Ltd., Tokyo, (Edition2010)
5	Garde-Mirajgaonkar, "Fluid Mechanics", NemChand &Bros.Publishers, Roorkee, (Edition 2004)
6	Shames, "Fluid Mechanics", McGraw-Hill International Book Co., Auckland, (Edition 2000)
References:	
1	Streeter and Wylie, "Fluid Mechanics", McGraw-Hill International Book Co., Auckland, (Edition 2000)
2	John F. Douglas et.al, "Fluid mechanics", Pearson Education Co., Delhi (International Edition), 2002
3	V. T. Chaw, "Flow in open channel", McGraw-Hill International Book Co., Auckland, (Edition 1962)
4	K. Subramanyam, "Flow in open channel", Tata McGraw-Hill Pub. Co., Delhi, (Edition 2007)
Useful Links:	
1	http://www.nptel.iitm.ac.in/S.Mohan
2	www.ocw.mit.edu

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	B	c	d	E	f	g	h	i	j	k
1	√	√	√	√		√	√		√	√	√
2	√	√	√	√	√	√		√	√		
3	√	√	√	√	√		√	√		√	√
4	√	√	√	√				√	√	√	√

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	12
Understand	3	3	2	12
Apply	3	3	2	12
Analyze	3	3	2	12
Evaluate	3	3	2	12
Create	-	-	-	-
Total	15	15	10	60

Elective-II

Government College of Engineering, Karad		
Final Year B. Tech.		
CE832 : Pre-stressed Concrete Design		

Teaching Scheme			Examination Scheme	
Lectures	4Hrs/week		**CT1**	15
Tutorial	-		**CT2**	15
Total Credits	4		**TA**	10
			ESE	60
			Duration of ESE	3Hrs.

Course Objectives		
	1	To understand the behavior and design of pre-stressed members compare to R.C. members
	2	To conceive the elementary deign of different structural elements using Pre-stressed concrete
	3	To build confidence in practical implementation for pre-stressed concrete projects

Course Contents		
		Hours
Unit I	a) **Analysis and design of beams:** rectangular, flanged and I sections, for limit state of flexure, ultimate flexural strength, recommendations of I.S. codes b) **Analysis and design of end blocks in post tensional members :** primary and secondary distribution zones, bursting and spalling tensions	**08**
Unit II	**Shear strength of pre-stressed concrete beams** : mode of failure in beams, recommendations of I.S. code, ultimate shear strength of concrete, design of shear reinforcement, Bond in pre-stressed concrete	**08**
Unit III	Analysis and design of continuous (up to two spans) and fixed beams. elastic analysis, secondary moments, concordant cable, linear transformations, Pre-stressed concrete slabs	**04**
Unit IV	Analysis and design of pre-stressed concrete structures such as concrete pipes and sleepers	**04**
Unit V	Analysis and design of portal frames, single storey and limited to two bays (fixed and hinged)	**08**
Unit VI	Design of Pre-stressed concrete bridges (simply supported) for I.R.C. loadings or equivalent uniformly distributed loads	**08**

Course Outcomes (COs):	
At the end of this course, students will be able to :	
1	Carry out structural design of pre-stressed concrete members.
2	design the individual members using pre-stressed concrete.
3	execute pre-stressed concrete projects

Text Books:

1	N Krishna Raju, "Prestressed Concrete", Tata McGraw-Hill publication company ltd.,4th*edition*,2012,
2	T.Y. Lin John, "Prestressed Concrete",*Wiley* and Son's *publication*, 3rd revised edition,*1981*
3	Sinha& Roy, "Prestressed Concrete", S Chand & company, New Delhi, 3rd*edition,1985*

References:

1	IS 1343:2012 Code of Practice for Pre-Stressed Concrete by Bureau of Indian Standards.
2	Guyon Y, "Prestressed Concrete-Vol. I & II", John Wiley and Sons, New York.

Useful Links:

1	http://www.nptel.ac.in/courses/105106117/
2	http://www.iitg.ernet.in/scifac/qip/public_html/cd_cell/chapters/dmaity_adv_struct_design/prestress%20concrete%20(17-23).pdf

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	b	c	d	E	F	g	h	i	j	k
1	√	√		√							√
2	√	√		√							√
3			√		√	√	√	√	√	√	√

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	1	1	2	5
Understand	5	5	5	20
Apply	5	5	3	20
Analyze	2	2	-	
Evaluate	2	2	-	15
Create	-	-	-	-
Total	15	15	10	60

Elective-II

Government College of Engineering, Karad
Final Year B. Tech.
CE842 : Advanced Engineering Geology

Teaching Scheme			Examination Scheme	
Lectures	4 Hrs/week		**CT1**	15
Tutorial	-		**CT2**	15
Total Credits	4		**TA**	10
			ESE	60
			Duration of ESE	2Hrs 30 min.

Course Objectives	
1	To understand and apply the knowledge of tectonic activities in Deccan traps.
2	To acquire and apply knowledge of the preliminary geological investigations for civil engineering projects
3	To develop skills to apply geophysical methods for geological investigation of civil engineering sites.

Course Contents		
		Hours
Unit I	**Plate Tectonics and Seismicity** Introduction to the concept of plate tectonics collective explanation of seismic activity, volcanism and continental drift by plate tectonics. Lineaments: types, civil engineering significance. seismic zones of India, seismic activity of Deccan trap region, Reservoir Induced Seismicity (RIS), Tectonic nature of seismic activity of Deccan trap region	07
Unit II	**Groundwater in Relation to Engineering Works**. Aquifer parameters, water bearing capacity of common rocks, Darcy's law, cone of depression and its significance in civil engineering, saline water intrusions: control and prevention .Systematic groundwater investigation. Occurrence of groundwater in Deccan trap region. Water Pumping Tests: approach and utility, influence of subsurface water in engineering constructions, case study on groundwater problems and its solution	08

Unit III	**Application of Rock Mechanics in Engineering**	06
	Introduction, relevance of rock mechanics in evaluating rock and rock mass properties, measurement of strength of intact rock, elastic properties of rocks, measurement of stress in underground rocks, estimation of rock mass properties, introduction to basalt fiber.	
Unit IV	**Site Investigation**	08
	Introduction, different stages of site investigation, aerial photography interpretation and satellite remote sensing, geophysical exploration, subsoil exploration and sampling of soils, methods of subsoil exploration, exploratory drilling in rocks. Engineering consideration of structural features	
Unit V	**Engineering Geology considerations for**:	10
	Dam: Influence of geomorphology and geology in the design of a dam, adverse effects of faults in dam Foundation and its treatment, causative factors of dam disasters, Preliminary investigation and selection of a dam site **Tunnel:** Geological hazards in tunneling **Bridge:** Supports and foundations of bridges, different aspects of engineering geological investigation of a bridge site, locating a bridge at different reaches of a river, bridge sites in alluvial plains, bridge foundation in subsoil in relation to depth of scouring, case studies on bridges including a collapsed bridge	
Unit VI	**Natural Hazard: Landslide**	09
	Introduction, hazards of landslides, landslide type: classification and description, causes of landslides, investigation of areas affected by landslides and slide-prone areas, Landslide Hazard Zonation mapping, Landslide Hazard Mitigation, concept of Glacial Lake Outburst Flood (GLOF), instances of major landslides in India, case study on landslides in India in recent past	

Course Outcome (CO):	
At the end of this course, student will be able to	
1	Understand and apply the knowledge of tectonic activities in Deccan traps.
2	Acquire and apply knowledge of the preliminary geological investigations for civil engineering projects
3	Develop skills to apply geophysical methods for geological investigation of

	civil engineering sites.

Text Books:

1	Parbin Singh, 'Engineering & General Geology' S.K.Kataria and Sons., 1997
2	S. Gangopadhyay 'Engineering Geology' Oxford University Press, 2013
3	N ChennaKesavulu 'Textbook of Engineering Geology', Laxmi Publications, 2013

References:

1	D.K. Todd, 'Groundwater Hydrology', John Wiley & Sons, 1993.
2	A. C Waltham, 'Foundations of Engineering Geology', Blackie Academic & Professional, Chapman & Hall, First Edition, 1997.
3	Krynine& Judd, 'Principles of Engineering Geology and Geotechnics', CBS Publishers and Distributors., 2003
4	M.B.Billings, 'Structural Geology', Prentice Hall, INC , 1961

Useful Links:

1	http://nptel.ac.in/courses/105105106/Dr. Debasis RoyIIT Kharagpur
2	http://nptel.ac.in/courses/105104152/**Prof. Javed N. Malik**IIT Kanpur
3	http://nptel.ac.in/courses/105104156/**Prof. Javed N. Malik**IIT Kanpur

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	b	c	d	E	F	g	h	i	j	k
1	√	√	√			√					√
2		√	√	√		√	√	√			√
3		√	√	√	√	√	√	√			√

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	02	02	-	08
Understand	02	02	03	08
Apply	05	05	03	20
Analyze	05	05	02	20
Evaluate	01	01	-	04
Create	-	-	02	-
Total	15	15	10	60

Elective-II

Government College of Engineering, Karad		
Final Year B. Tech.		
CE852: Pavement Design		

Teaching Scheme			Examination Scheme	
Lectures	4 Hrs./week		**CT1**	15
Tutorial	-		**CT2**	15
Total Credits	4		**TA**	10
			ESE	60
			Duration of ESE	2 Hrs 30 Min

Course Objectives:	
1	Analysis ofstresses and deflections in flexible and rigid pavements
2	Understand design of rigid and flexible pavements both for highways and airports
3	Understand concept and of drainage in pavements and their design and different types of appurtenances
4	To train for designs of pavements of all types as per IRC standards/AASHTO standards

Course Contents		
Hours		
Unit I	**Stresses and Deflections in Flexible Pavements** Pavement structure and functional attributes, factors affecting pavement design, Comparison of highway and airfield Pavements types of wheel loads for highways and airports, development of design method for highway and airport pavements. Stresses in flexible pavements 1-layer, 2-layers, 3-layer theories, EWF, ESWL load coverage Stresses in rigid pavement: load and temperature stresses, combined stresses.	8
Unit II	**Flexible Pavement Design** Airport pavement: Corps of Engineers (CBR) method, FAA Method, CDOT method, Asphalt Institute method. Highway pavement: Empirical methods using no soil strength criteria, Empirical method based on soil strength-CBR, Design procedure in Road Note 29(U.K.), IRC (1984) guidelines, AASHO method, Asphalt Institute method.	8

Unit III	**Stresses in Rigid Pavements:** Types of stresses and causes, factors influencing the stresses; general considerations in rigid pavement analysis, Westergaard's Analysis, EWL; wheel load stresses, warping stresses, frictional stresses, combined stresses.	8
Unit IV	**Rigid Pavement Design:** Design of CC pavement for roadway, Types of joints in cement concrete pavements and their functions, joint spacing; design of joint details for longitudinal joints, contraction joints and expansion joints. IRC:58-2011 method of design, Design of continuously reinforced concrete pavements Airport pavement: PCA methods, corps of engineer's method, FAA method Joints and reinforcement requirement Highway pavement: current British procedure, IRC method	7
Unit V	**Drainage** Importance, principles of good drainage, surface drainage, sub-surface drainage, role of shoulders, Use of geotextiles. Culverts, Causeways; Importance, types, site selection	6
Unit VI	**Evaluation and strengthening** Flexible and rigid pavement distresses, condition and evaluation surveys, present serviceability index, Roughness measurement, Benkelman's Beam deflections, design of overlays, skid-resistance and its measurement. Economics of pavement types, basis for comparison, period of analysis, cost of initial construction, cost of maintenance, cost of vehicle operation, equivalencies in thickness.	9

Course Outcomes (COs):	
At the end of this course, student will be able to	
1	modeling and to analyze flexible and rigid pavements
2	design of pavements of all types as per IRC standards/AASHTO standards
3	understand concept and of drainage in pavements and their design and different types of appurtenances for safety requirements
Text Books:	
1	Khanna S.K., Arora M.G. and Jain S.S, "Airport Planning and Design", Nem Chand and Bros,Roorkee, 6thEdition,1999,
2	Khanna S.K. & Justo C.E.G., "Highway engineering", Nem Chand, 10th Edition, 2015.
3	Kadiyali L.R. and N.B. Lal, "Principles and Practice of Highway Engineering(Including Expressways and Airport Engineering)",Khanna Publishers, New Delhi, 4th Edition, 2005
References:	

1	Croney, David et al, "The Design and Performance of Road Pavements", McGraw Hill, 3rd edition, 1997,	
2	Roder and Witciak, "Principles of Pavement Design", Wiley International, 2nd Edition,	
3	Chakroborty and Animesh Das,"Principles of Transportation Engineering", Prentice-Hall India, Partha, New Delhi,(2011)	
4	Horonjeff Robert, "The Planning and Design of Airports", McGraw Hill Co., New York.	
5	IRC: 76-1979 –Tentative Guidelines for Structural Strength Evaluation of Rigid Airfield Pavement, IRC, New Delhi.	
6	IRC: 85-1983 –Code of Practice for Accelerated Strength Testing and Evaluation of Concrete Road and Air Field Constructions, IRC, New Delhi.	
7	RC: 58-2002 (Second Revision) –Guidelines for the Design of Rigid Pavements for Highways, IRC, New Delhi	
8	IRC: 37-2001 –Guidelines for the Design of Flexible Pavements for Highways, IRC, New Delhi.	

Useful Links:

1	http://nptel.ac.in/courses/105104098/#

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	A	b	c	d	E	F	g	h	i	j	k
1		√		√				√			
2			√	√				√			
3			√	√							

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	2	2	10
Understand	3	2	2	10
Apply	3	3	2	10
Analyze	2	3	2	10
Evaluate	2	3	2	10
Create	2	2	2	10
Total	15	15	10	60

Elective-II

Government College of Engineering, Karad			
Final Year B. Tech.			
CE862: Industrial Wastewater Treatment			
Teaching Scheme		**Examination Scheme**	
Lectures	04 Hrs/week	**CT1**	15
Tutorial	-	**CT2**	15
Total Credits	04	**TA**	10
		ESE	60
		Duration of ESE	2 Hrs. 30 min.
Course Objectives			
	1	To study the various characteristics of Industrial Wastewater.	
	2	To study the waste minimization techniques and to design industrial wastewater treatment systems	
	3	To impart the skills of design and operation of common effluent treatment plants.	
Course Contents			
			Hours
Unit I	**Sources of Pollution and Effects** Sources of wastewater, Physical, Chemical, Organic and Biological properties of Industrial Wastes, quality and quantity variation in waste discharge, water budgeting, characterization and monitoring of wastewater flow, stream standards and effluent standards, Differences between industrial and municipal waste waters, Effects of industrial effluents on sewers and treatment plants.		**08**
Unit II	**Wastewater Minimization Techniques:** Wastewaters audit, Concept of waste minimization, Techniques of volume and strength reduction, Equalization: Process, Flow and quality, Location, Volume requirement, Design considerations, Reuse and recycling concepts Process description, Objectives, and Methods of Neutralization and Proportioning, Gas Stripping for ammonia, design of stripping towers		**08**
Unit III	**Advanced Industrial Wastewater Treatment Methods**:		**08**

	Nitrification and De-nitrification, Phosphorous removal, Heavy metal removal, Membrane Separation Process, Air Stripping and Absorption Processes, Special Treatment Methods, Disposal of Treated Wastewater	
Unit IV	**Manufacturing Process and Water Requirements of Various Industries** Manufacturing process, water requirements, water usage, and sources of effluent from the process of industries like chemical, fertilizer, petroleum, petro -chemical, paper, sugar, distillery, textile, tannery food processing, dairy and steel manufacturing	**08**
Unit V	**Characteristics and composition of effluents of various industries and treatment methods.** Characteristics and composition of effluent and different methods of treatment & disposal of effluent for the following industries: sugar, distillery, dairy, pulps, paper mill, Steel, Petroleum Refineries, Textiles, Tanneries, Atomic Energy Plants and other Mineral Processing Industries.	**08**
Unit VI	**Common Effluent Treatment Plant:** Location, Need, Design, Operation & Maintenance Problems, and Economical aspects.	**08**

Course Outcome (CO):	
At the end of this course, student will be able to	
1	analyze industrial waste treatment problems and apply waste minimization techniques.
2	apply the concepts of physical, chemical and biological processes for industrial wastewater treatment.
3	understand and develop sensitivity towards safety and safety in the context of industrial hazards.
Text Books:	
1	Rao M. N. and Datta, "Wastewater Treatment", Oxford & IBH Publication, 1st Edition, 1992.
2	Masters, G, M, "Introduction to Environmental Engineering and Science", Pearson Education, 2004.
References:	
1	Nelson Nemerow, "Theories and Practices of Industrial Waste Treatment", Wiley

	Publication Company, 1st Edition, 1971.
2	Metcalf and Eddy, "Wastewater Engineering Treatment and Reuse", Tata McGraw Hill Publication, 2nd Edition, 2004,
3	Wentz. C.A., "Hazardous Waste Management", McGraw Hill Publication, 1st Edition, 1989.
4	Eckenfelder, W. W., "Industrial Water Pollution Control", McGraw-Hill, 2000.
5	"IS Standards for Treatment and Disposal of Various Industries"
6	Nemerow, N. L., "Zero Pollution for Industry: Waste Minimization through Industrial Complexes", John Wiley & Sons, 1995.
7	Nemerow, N. L and Dasgupta, A., "Industrial and Hazardous Waste Treatment", Van Nostrand Reinhold (New York), 1988.
Useful Link:	
1	"Water and Wastewater Engineering- Industrial wastewater treatment" by Prof. B.S. Murty and Prof. Ligy Philip IIT Madras http://nptel.ac.in/courses/105106119/36

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	A	b	c	d	E	F	g	h	i	j	k
1	√	√	√	√			√				√
2		√	√	√	√		√				√
3	√	√	√		√	√		√	√	√	√

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	2	2		8
Understand	5	5	3	20
Apply	3	3	2	12
Analyze	3	3	3	12
Evaluate	2	2	2	8
Create	-	-	-	-
Total	15	15	10	60

Elective-II

Government College of Engineering, Karad			
Final Year B. Tech.			
CE872: Bridge Engineering			
Teaching Scheme		**Examination Scheme**	
Lectures	4Hrs/week	**CT1**	15
Tutorial	-	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60
		Duration of ESE	2.30Hrs.
Course Objectives:			
	1	To choose the appropriate bridge type for a given site conditions, and to analyse and design the main components of the bridge	
	2	To have state-of-the-art knowledge and practices in bridge engineering	
	3	To learn analysis and design of bridge substructure and superstructure	
Course Contents			
			Hours
Unit I	Standard specifications for Road Bridges. I.R.C. bridge code, width of carriage way, clearances, loads to be considered i.e. D.L., L.L., Impact load, wind load, Earthquake load, Longitudinal force, Centrifugal force, buoyancy, Earth pressure, water current force, thermal force etc.	8	
Unit II	Aesthetics of bridges, general design considerations for R.C.C. & P.S.C. bridges, Traffic aspects for highway bridges	8	
Unit III	Design of reinforced concrete deck slab using Pigeaud's theory, beam and slab and T – beam, Courbon's theory.	8	
Unit IV	Design of sub structure: Abutments, Piers, Approach slab.	8	
Unit V	Construction Techniques: Construction of sub structure footing, piles, caissons, construction of reinforced earth retaining wall and reinforced earth abutments, super structure erection method for bridge deck construction by cantilever method	8	
Unit VI	Different types of bridge Bearing and expansion joints – forces on bearings, Types of bearings, design of	8	

	unreinforced elastomeric bearings, expansion joints Repair, Strengthening, and Rehabilitation of Existing Bridges	

Course Outcomes (COs):

At the end of this course, student will be able to

2	have state-of-the-art knowledge and practices in bridge engineering
3	analyse and design of bridge substructure and superstructure

Text Books:

1	Dr B. C. Punmia, AshokKumar Jain&Arun Kumar Jain, "Reinforced Concrete Structures – Vol. II",Laxmi Publications, 15th Edition,2010,
2	S. PonnuSwamy, "Bridge Engineering", Tata McGraw-Hills PublishingCompany Limited, 2nd edition,2007,

References:

1	Dr V. K.Raina, "Concrete Bridge Practice, Analysis, Design and Economics", Tata McGraw- Hills Publishing Company Limited, 2002
2	N. Krishna Raju, "Design of Bridges", Oxford & IBH Publishing Co. Pvt Ltd., New Delhi, 4th edition,
3	IRC Codes – IRC: 5, IRC: 6, IRC: 18, IRC: 27, IRC: 45, IRC: 78, IRC: 83.

Useful Links:

1	https://www.youtube.com/watch?v=Rn9RPAOcQ_0
2	https://www.youtube.com/watch?v=WZJYEBZu03Q

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	b	c	d	e	F	g	h	i	j	k
1	√	√	√	√	√		√	√	√	√	√
2	√	√	√	√		√	√	√	√		√
3	√	√	√	√	√	√		√		√	
4	√	√	√		√	√		√		√	

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	1	10
Understand	3	3	2	10
Apply	3	3	2	10
Analyze	2	2	2	10
Evaluate	2	2	2	10
Create	2	2	1	10
Total	15	15	10	60

Elective-II

Government College of Engineering, Karad		
Final Year B. Tech.		
CE882: Watershed Development and Management		

Teaching Scheme			Examination Scheme	
Lectures	4Hrs/week		**CT1**	15
Tutorial	-		**CT2**	15
Total Credits	4		**TA**	10
			ESE	60
			Duration of ESE	**2Hrs30 Min**

Course Objectives	
1	To study sustainable and integrated watershed management and its social aspects.
2	To study watershed modeling and use of modern techniques in watershed management.
3	To study flood, drought and water quality management.

Course Contents		
		Hours
Unit I	**Introduction and Basic Concepts:** Concept of watershed, introduction to watershed management, different stakeholders and their relative importance, watershed management policies and decision making. **Sustainable Watershed Approach & Watershed Management Practices:** sustainable integrated watershed management, natural resources management, agricultural practices, integrated farming, soil erosion and conservation; watershed management practices in arid and semiarid regions, case studies, short term and long term strategic planning.	07
Unit II	**Integrated Watershed Management:** Introduction to integrated approach, integrated water resources management, conjunctive use of water resources, rainwater harvesting; roof catchment system. **Social Aspects of Watershed Management:** Community participation, Private sector participation, Institutional issues, Socio-economy, Integrated development, Water legislation and implementations, Case studies and Visit to developed water shed	07
Unit III	**Watershed Modeling:**	07

	Standard modeling approaches and classifications, system concept for watershed modeling, overall description of different hydrologic processes, modeling of rainfall-runoff process, subsurface flows and groundwater flow.	
Unit IV	**Management of Water Quality:** Water quality and pollution, types and Sources of pollution, water quality modeling, environmental guidelines for water quality. **Water Conservation and Recycling:** Perspective on recycle and reuse, Waste water reclamation	07
Unit V	**Storm Water and Flood Management:** Storm water management, design of drainage system, flood routing through channels and reservoir, flood control and reservoir operation, case studies on flood damage. **Drought Management:** Drought assessment and classification, drought analysis techniques, drought mitigation planning.	07
Unit VI	**Use of Modern Techniques in Watershed Management**: Applications of Geographical Information System and Remote Sensing in Watershed Management, Role of Decision Support System in Watershed Management.	05

Course Outcomes (COs): At the end of this course, students will be able to	
1	understand sustainable and integrated watershed management and its social aspects.
2	understand watershed modeling and use of modern techniques in watershed management.
3	understand study flood, drought and water quality management.
Text Books:	
1	Murthy, J.V.S., "Watershed Management", New Age Intl., New Delhi 1998.
2	Murthy, J.V.S., Watershed Management in India, Wiley Eastern, New Delhi, 1994
3	Vir Singh Raj, "Watershed Planning and Management", Yash Publishing House, Bikaner, 2000
References:	
1	Allam, Gamal Ibrahim Y., "Decision Support System for Integrated Watershed Management", Colorado State University, 1994.
2	American Soc. of Civil Engr., "Watershed Management", American Soc. of Civil Engineers, New York, 1975.
3	Black Peter E., "Watershed Hydrology", Prentice Hall, London, 1991.
4	Michael A.M., "Irrigation Engineering", Vikas Publishing House, 1992
5	Purandare A.P., Jaiswal A.K., "Waterhed Development in India", NIRD,

	Hyderabad, 1995.
Useful Links:	
1	http://nptel.ac.in/courses/105101010/Dr. T.I. EldhoIIT Bombay

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	b	c	d	e	F	G	h	i	j	k
1		√	√		√	√	√		√	√	√
2	√	√	√	√	√	√		√		√	√
3	√	√	√	√	√	√		√		√	√

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	5	5	5	20
Understand	5	5	5	20
Apply	5	5		20
Total	15	15	10	60

Elective-III

Government College of Engineering, Karad			
Final Year B. Tech.			
CE: 813 Repairs & Rehabilitation of Structures			
Teaching Scheme		**Examination Scheme**	
Lectures	4 Hrs/week	**CT1**	15
Tutorial	-	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60
		Duration of ESE	2.30Hrs**.**

Course Objectives:

1	To assess strength and materials deficiency in building structures.
2	To suggest methods and techniques used in repairing / strengthening of existing concrete structures.
3	To apply Non-Destructive Testing techniques to field problems.
4	To apply cost effective retrofitting strategies for repairs in buildings.

Course Contents		
		Hours
Unit I	**Introduction:** Aging of structures, assessment procedure, causes of deterioration, need for repair and rehabilitation, performance of structures, Inspection, Maintenance	6
Unit II	**Distress in load bearing, RCC, steel structures:** damage, source, cause, effects of damage, case studies. Effects of climate, temperature, Corrosion, Strength, Durability and Thermal properties of building materials.	7
Unit III	**Damage assessment and Evaluation methods:** Damage testing methods, Non-destructive Testing Techniques (NDT), destructive testing method, Core samples	7
Unit IV	**Repairing methods and techniques:** Guniting and Shotcreting, grouting, Crack ceiling, Polymer concrete, Fiber wrapping techniques, steel plate flitching, Case studies.	7
Unit V	**Retrofitting methods:** Seismic Retrofitting of reinforced concrete buildings, Considerations in retrofitting of	6

		structures; Source of weakness in RC frame building, Structural damage due to discontinuous load path, Quality of workmanship and materials, Jacketing	
Unit VI		**Repair and maintenance of buildings:** IS standards, Bridge repairs, Seismic strengthening, Estimation and costing of repairing techniques such as jacketing, grouting, polymer mortar etc.	7

Course Outcomes (COs):	
At the end of this course, student will be able to	
1	assess strength and materials deficiency in building structures.
2	understand and apply methods and techniques used in repairing / strengthening existing concrete structures.
3	apply Non-Destructive Testing techniques to field problems.
4	apply cost effective retrofitting strategies for repairs in buildings and assist in structural audit of buildings
Text Books:	
1	R.N.Raikar, "Diagnosis and treatment of structures in distress", Published by R&D Centre of Structwel Designers & Consultants Pvt. Ltd., Mumbai, 1994.
2	Bridge Rehabilitation by V K Raina
3	"Building Failures – Diagnosis and Avoidance" by W H Ranson.
4	Forensic Engineering by Kenneth and Carper.
References:	
1	Dr B. C. Punmia, Ashok Kumar Jain & Arun Kumar Jain, "Reinforced Concrete Structures – Vol. II", Laxmi Publications.
2	Dr V. K. RAINA,"Concrete Bridge Practice, Analysis, Design and Economics", Tata McGraw- Hills Publishing Company Limited.
3	S. Ponnuswamy, "Bridge Engineering", Tata McGraw-Hills Publishing Company Limited.
4	Ravishankar.K., Krishnamoorthy, "Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004.
5	R.N. Raikar, "Diagnosis and treatment of structures in distress", Published by R&D Centre of Structural Designers & Consultants Pvt.Ltd., Mumbai, 1994.
6	Handbook on Repair and Rehabilitation of RCC buildings, Published by CPWD, Delhi, 2002.
Useful Links:	
1	https://www.youtube.com/watch?v=w308Si7DriU
2	https://www.youtube.com/watch?v=3SW_K2G9mcI

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	b	c	d	e	F	g	h	I	j	k
1	√	√	√	√	√		√	√	√	√	√
2	√	√	√	√		√	√	√	√		√
3	√	√	√	√	√	√		√		√	
4	√	√	√		√	√		√		√	

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	1	10
Understand	3	3	2	10
Apply	3	3	2	10
Analyze	2	2	2	10
Evaluate	2	2	2	10
Create	2	2	1	10
Total	15	15	10	60

Elective-III

Government College of Engineering, Karad			
Final Year B. Tech.			
CE823: Water Distribution Systems			
Teaching Scheme		**Examination Scheme**	
Lectures	4 Hrs/week	**CT1**	15
Tutorial	-	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60
		Duration of ESE	2Hrs. 30 min

Course Objectives		
	1	To acquaint students with various aspects of water supply engineering problems.
	2	To design the water distribution system.

Course Contents		
		Hours
Unit I	**Water Demand and Quality:** Introduction, Population forecast, Population Factors affecting population growth, water demand, Rate of water Supply, Factors affecting rate of demand, fluctuations and effect, estimation of demand, alternative sources of supply, components of water supply system	08
Unit II	**Intake Works:** Types of intake, jack well, rising main, gravity mains **Water supply appurtenances:** Introduction to pipes, types of pipes and valves, stresses in pipes, corrosion in pipes, pipe flow problems, pumping	08
Unit III	**Water Distribution:** Introduction, requirements good distribution systems, arrangement of distribution pipes and other accessories, layout of distribution system, methods of distribution, pressure in distribution mains, systems of water supply	08
Unit IV	**Distribution Reservoirs:** Functions of distribution reservoir, types of storage and distribution reservoirs, storage capacity of distribution reservoirs, wastage of water in distribution system	08

Unit V	**Design of Distribution System:** General, pipe hydraulics, pipes in series and parallel, design procedure, design of pipe lines, analysis of pressure in distribution system, hardy cross method	08
Unit VI	**Introduction to water distribution software's:** EPANET, Water GEMS, Water CAD etc. and design problems	08

Course Outcome (CO):	
At the end of this course, student will be able to	
1	identify and understand water supply engineering problems
2	analyse water supply engineering problems
3	design the water supply scheme
Text Books:	
1	B. C. Punmia, A. K. Jain and A. K. Jain, "Water Supply Engineering", Laxmi Publications Private limited, 2006.
2	S.K. Garg, "Water Supply Engineering", Khanna Publishers, 28th edition, 2010,
3	P. N. Modi, "Water Supply Engineering", Standard Book House, First Edition, 2001
4	P. K. Swamee and A. K. Sharma, "Design of water supply pipe networks", A John Wiley and Sons publication, 2008,
References:	
1	Manual of Water supply and treatment by Government of India Publication (1999)
2	T. J. McGhee, "Water Supply and sewerage", McGraw Hill, 6th edition, 2007
3	CPHEEO, "Manual on Water Supply and Treatment", Ministry of Urban Development, GoI, New Delhi, 1999.
Useful Links:	
1	http://nptel.ac.in/courses/105104103/

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	b	c	d	e	F	g	h	i	j	k
1	√								√		√
2	√	√	√	√			√	√			√
3	√	√	√		√	√	√	√		√	√

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	2	2	-	8
Understand	5	5	3	20
Apply	3	3	2	12
Analyze	3	3	3	12
Evaluate	2	2	2	8
Create	-	-	-	-
Total	**15**	**15**	**10**	**60**

Elective-III

Government College of Engineering, Karad			
Final Year B. Tech.			
CE833: Rock Mechanics			
Teaching Scheme		**Examination Scheme**	
Lectures	4 Hrs/week	**CT1**	15
Tutorial	-	**CT2**	15
Total Credits	04	**TA**	10
		ESE	60
		Duration of ESE	**2.5**Hrs.

Course Objectives		
	1	To study classification of rocks and test to be carried out on rocks
	2	To study field testing of rocks and methods of improving rock properties
	3	To study foundation on rocks and tunneling in rocks by considering rock properties

Course Contents		
		Hours
Unit I	**Introduction:** historical development of rock mechanics, application of rock mechanics, defects in rocks **Laboratory Testing of Rocks:** Rock sampling, determination of index and mechanical properties viz. density, porosity, water absorption, uniaxial compressive strength, tensile strength, shear strength, flexural strength, triaxial compressive strength, swelling and slake durability, point load strength, factors affecting strength and deformation of rocks	06
Unit II	**Classification of Rocks:** Weathering grades of Rocks as per ISRM, rock mass classification systems, Terzaghi's rock load classification, RQD classification, RQD when bore core is unavailable, Rock structure rating, NGI and geomechanics classification	06
Unit III	**Field Testing of Rocks:** Geophysical Methods: - Electrical Resistivity method & its applications, Seismic refraction method. In-situ Tests: - requirement of insitu tests, Types of insitu tests, insitu determination of shear strength, Permeability and modulus of deformation, Plate load test, Radial jacket test, dialometer test, Flat jack test	06

Unit IV	**Methods of improving Rock properties:** shotcreting, grouting, rock bolting, ground freezing. **Stability of Rock slopes:** modes of failure, methods of analysis, improvement of slope stability and protection	08
Unit V	**Foundation on Rock:** shallow foundation, pile and well foundation, settlement in rocks, remedial measures for foundations on rocks, allowable bearing pressures	05
Unit VI	**Tunnels:** Terminology, rock stresses and deformation around tunnels, underground blast design for tunnel, rock supports, design of tunnel lining,Tunnel Boring Machine (TBM), Alimake Raise Climber	05

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

1	understand classification of rocks and test to be carried out on rocks
2	understand field testing of rocks and methods of improving rock properties
3	understand foundation on rocks and tunneling in rocks by considering rock properties

Text Books:

1	B.P.Varma, "Rock Mechanics for Engineers", Khanna Publications, 2015
2	R.E.Goodman, "Introduction of Rock Mechanics", John Wiley & Sons.
3	Stag and Zienkiewec, "Rock Mechanics in Engineering Practice", John Wiley and Sons Ind.,1968

References:

1	Manual on Rock Mechanics by Central Board of Irrigation and Power.
2	Hand Book on Mechanical properties of Rocks by R. D. Lama and V.S. Vulukuri Vol. I to IV.
3	T.Ramamurthy, "Engineering in Rocks for slopes foundation & Tunnels", Prentice Hall of India Pvt. Ltd., New Delhi

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	b	c	d	e	F	g	h	I	j	k
1	√	√	√	√	√	√		√		√	√
2	√	√	√	√	√	√		√		√	√
3	√	√	√	√	√	√		√		√	√

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	5	5	5	20
Understand	5	5	5	20
Apply	5	5	-	20
Total	15	15	10	60

Elective-III

Government College of Engineering, Karad
Final Year B. Tech.
CE843 : Advanced Construction Techniques

Teaching Scheme			Examination Scheme	
Lectures	4 Hrs/week		**CT1**	15
Tutorial	-		**CT2**	15
Total Credits	4		**TA**	10
			ESE	60
			Duration of ESE	2 Hrs. 30 min

Course Objectives

1	To create awareness among students about advanced construction techniques
2	To make students to understand paradigm shift in construction techniques
3	To expose students to developments taking place in construction practices

Course Contents

		Hours
Unit I	**Concrete and Concreting Methods** : Mass Concrete and Temperature Control, Special Types of Concrete (Shotcrete,Pumpcrete, RMC)	07
Unit II	**Formwork**: Types, Components, Removal of Formwork, Cost of Formwork. Special Types of Formworks for Pavements and Multistoried Buildings:	07
Unit III	**Pre-fabricated Construction**: Types, Sizes and Economy, Fabrication techniques, Transportation, Erection, Jointing of Components, Light Weight Panels, Standardization of Components,	06
Unit IV	**Advanced Material of Construction** : Geosynthetics, Epoxy Resins, Adhesives, MDF, FRC, FRP, Polymer-Based Composites	06
Unit V	**Rehabilitation and Strengthening of Structures**: Necessity, Methods, Strengthening and Preservation of Bridges, Dam Rehabilitation.	07

Unit VI	**Composite Construction**: Composite v/s Non Composite Action; Composite Steel-Concrete Construction	07

Course Outcomes (COs):	
At the end of this course, student will be	
1	aware about advanced construction techniques
2	able understand paradigm shift in construction techniques
3	exposed to developments taking place in construction practices
Text Books:	
1	Stubbs, "Hand Book of Heavy Construction" McGraw Hill Inc, 1971
2	Wedel, "Concrete Construction Hand Book" McGraw Hill Higher Education; 2nd edition ,1974
3	Singh Jagman, "Heavy Construction – Planning, Equipment and methods", Oxford and IBH publishers, New Delhi 9.
References:	
1	Peurifoy R. L, "Construction, Planning, Equipment and methods", McGraw hill book corp., New Delhi
2	Prof. Ataev S. S., "Construction Technology", Mir Publishers, Moscow.
3	Baron Thomas, "Erection of Steel Structures
4	Day, "Construction Equipment Guide",
5	Varma Mahesh, "Construction Equipment", Metropolitan book C, New York 12.

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	b	c	d	e	F	g	h	Is	j	k
1	√			√		√	√		√	√	√
2	√	√			√						√
3	√		√	√		√	√		√	√	

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	4	4	3	15
Understand	5	5	2	15
Apply	5	5	2	15
Analyze	1	1	2	15
Total	15	15	10	60

Elective-III

Government College of Engineering, Karad
Final Year B. Tech.
CE853:Legal Aspects in Civil Engineering

Teaching Scheme			Examination Scheme	
Lectures	4 Hrs/week		**CT1**	15
Tutorial	-		**CT2**	15
Total Credits	4		**TA**	10
			ESE	60
			Duration of ESE	2Hr30Min

Course Objectives

1	To expose the students to Indian Contract and Arbitration act
2	To provide knowledge about bailment and international contracting
3	To expose the students to Labour laws
4	To provide the knowledge about safety acts

Course Contents

		Hours
Unit I	**Professional Practice and Administration contracts:** The standard form of building contracts. The right of building owner, Third parties, Indian contract Act, Real Estate (Regulation and Development) Act, 2016 (RERA), Sale of Goods Act, Professional Ethics.	10
Unit II	**Arbitration and Award:** Indian Arbitration Act, Arbitration Agreement, Conduct of Arbitration, Power and Duties of Arbitrator, Rules of Evidence, Preparation and publication of award, Methods of Enforcement impending and Awards	06
Unit III	**Bailment:** Nature of Transactions, Delivery of Bailee, care to be taken, Bailee's Responsibility, Termination, Bailment of pledges. **International Contracting:** Meaning Scope, Nature, Distinctive Features of FIDIC	08
Unit IV	**Injunction:** Types Temporary, Perpetual, and Mandatory when referred. **Indemnity and Guarantee:** Difference between the two, The Contract of Guarantee and Indemnity, Consideration of Guarantee, Surety's Liability, Discharge of Surety	06
Unit V	**Industrial Act and Labour Laws:** Industrial Dispute Act,	08

		Payment of Wages Act.	
Unit VI		**Safety Engineering:** Sources, Classification, Cost of Accident and Injury, Workmen's Compensation Act, Safety Programme, Safety Organization. Employers Liability Act, Employers Insurance Act, Safety and Health Standards Occupations Hazards, personal Protective equipment, preventive measures Factory Act, Fatal accidents.	08

Course Outcomes (COs):	
At the end of this course, student will be able to	
1	learn Indian contract act, Arbitration act and contract administration
2	gain knowledge about bailment and FIDIC
3	understand the labor laws
4	exposed to safety engineering and relevant acts
Text Books:	
1	B. S. Patil, "Indian arbitration Act", 6th Edition, 1996
2	Indian Contract Act,1872
3	Safety Engineering, Govt. of India Publicaiton,2017
4	Krishnamurti K. G, "Professional Practice",Prentice Hall India Learning Private Limited (2014)
5	B. S. Patil, "Legal Aspects of building and Engineering Contracts", Orient Blackswan Private Ltd; 4th edition, 2015
References:	
1	Avatar Singh, "Indian contract Act", 10th edition, 2015
2	Jhamb, "Indian contract Act", 1872
Useful Links:	
1	http://www.nptel.ac.in/syllabus/105102013/ by Dr. K. C. Ayer

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	b	C	d	e	F	g	h	i	j	k
1	√	√		√		√		√		√	√
2		√	√	√	√				√		
3	√	√	√			√	√	√		√	√
4	√	√	√	√	√	√	√		√	√	

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	10

Understand	5	3	2	10
Apply	5	3	3	10
Analyze	3	3	1	10
Evaluate	5	2	1	10
Create	0	1	1	10
Total	15	15	10	60

Elective-III

Government College of Engineering, Karad
Final Year B. Tech.
CE863: Solid Waste Management

Teaching Scheme			Examination Scheme	
Lectures	04 Hrs/week		**CT1**	15
Tutorial	-		**CT2**	15
Total Credits	04		**TA**	10
			ESE	60
			Duration of ESE	2 Hrs. 30 min.

Course Objectives

1	To study the sources, types, composition of solid waste and functional elements of municipal solid waste management
2	To study the solid waste generation, collection, and processing techniques.
3	To study the concept of Composting,
4	To understand the concept of Biomedical waste & Hazardous waste management

Course Contents	
Hours	

Unit I	**Introduction to Solid Waste Management**	8
	Solid Waste: Quantity, Physical, Chemical, and Biological properties.	
	Solid Waste Management: Introduction, Objectives, Functional elements, rules& regulation, present status to Indian context.	

Unit II	**Elements of Solid Waste Management System**	8
	Solid Waste Generation Rate: Definition, Typical values for Indian cities, Factors affecting Generation Rate.	
	Storage and collection: General considerations for waste storage at source, Collection components, Types of collection systems.	
	Transfer station: Meaning, Types, Capacity, Location, and Viability, Waste Collection system design, Transportation Systems	

Unit III	**Solid Waste Processing Techniques and Material Recovery and Recycling**	9

	Waste Processing Techniques: Purpose, Mechanical volume, and size reduction, component separation techniques.	
	Material Recovery and Recycling: Objectives, Recycling program elements, Commonly recycled materials and processes	
	Energy recovery from solid waste: Parameters affecting, Fundamentals of thermal processing, Bio methanation, Pyrolysis, Incineration, Refuse derived fuels, Planning, and design of incineration facility, Energy recovery	
Unit IV	**Landfilling** Introduction, components of landfilling, methods/ types of landfilling, site selection, construction techniques, maintenance and precautions, landfill gas and leachate and its control measures, design of sanitary landfills	**8**
Unit V	**Composting** Processes, Stages, Types of composting, Factors affecting, composting, Properties of compost, Vermicomposting.	**6**
Unit VI	**Biomedical and Hazardous waste management** Biomedical waste management: Generation, identification, storage, collection, transport, treatment, common treatment, and disposal, occupational hazards, and safety measures. Biomedical waste legislation in India Hazardous Waste Management: Fundamentals, Characterization of waste, compatibility and flammability of chemicals, fate and transport of chemicals, health effects	**9**

Course Outcome (CO):	
At the end of this course, student will be able to	
1	classify, characterize, and analyze solid waste.
2	formulate appropriate collection and processing techniques considering technical, environmental, safety, health and social aspects.
3	design and implement the municipal solid waste processing conveniences.
Text Books:	
1	Bhide. A.D. And Sundaresan. B.B, "Solid Waste Management", Indian National ScientificDocumentation Centre, 1st Edition, 1983.
2	Vesilind P. A., Worrel W. A. and Reinhart D. R., "Solid Waste Engineering", Thomson Brooks/Cole, 1st Edition., 2002.

3	Tchobanoglous, G., Theisen and Vigil, "Integrated Solid Waste Management: Engineering Principles and Management Issues", McGraw Hill, 1993
4	LaGrega, M. D., Buckingham, P. L. and Evans, J. C., "Hazardous Waste Management", McGraw Hill, 2nd Ed., 2001.

References:

1	Peavy, Rowe and Tchobanoglous, "Environmental Engineering", Tata McGraw-Hill Publishing Company Limited, 1st Edition, 1985
2	CPHEEO, "Manual on Municipal Solid waste management", Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2000
4	Bagchi, A., "Design, Construction and Monitoring of Landfills", WileyInterscience, 1994.
5	Haas, C. N. and Vamos, R. J., "Hazardous and Industrial Waste Treatment", Prentice Hall, 1995
6	Martin, E.J. and Johnson, J.H., "Hazardous Waste Management Engineering", Van Nostrand, 1987.
7	Wentz, C. A., "Hazardous Waste Management", McGraw Hill, 2nd Edition, 1995.
8	Lewandowski, G.A. and DeFilippi, L.J., "Biological Treatment of Hazardous Wastes", John Wiley & Sons, INC., 1998
9	Kuhre, W. L., "Practical Management of Chemicals, and Hazardous Wastes: An Environmental and Safety Professional's Guide", Prentice Hall, 1995

Useful Links:

1	"Municipal Solid Waste Management" byProf. T.V. Ramachandra (IISc Bangalore) http://nptel.ac.in/courses/120108005/
2	"Integrated Waste Management for a Smart City" by Prof. Brajesh Kumar Dubey (IIT Kharagpur) http://nptel.ac.in/courses/105105160/

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	b	c	d	e	F	g	h	i	j	k
1	√	√	√	√			√				√
2		√	√	√	√		√				√
3	√	√	√		√	√		√	√	√	√

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	2	2		8
Understand	5	5	3	20
Apply	3	3	2	12
Analyze	3	3	3	12

Evaluate	2	2	2	8
Create	-	-	-	-
Total	15	15	10	60

Elective-III

Government College of Engineering, Karad		
Final Year B. Tech.		
CE873: Ground Improvement Techniques		

Teaching Scheme			Examination Scheme	
Lectures	04 Hrs/week		**CT1**	15
Tutorial	-		**CT2**	15
Total Credits	04		**TA**	10
			ESE	60
			Duration of ESE	2 Hrs. 30 Min.

Course Objectives	
1	To introduce and to make the students familiar to the different ground improvement techniques
2	To make the students understand the theoretical background for different ground improvement techniques such as stone column, soil nailing
3	To elaborate the design methods for some ground improvement techniques as stone column, soil nailing

	Course Contents	
		Hours
Unit I	**Introduction to Ground Improvement** Definition of ground improvement, objectives, classification of ground improvement techniques, suitability of different techniques, preloading: need, preloading without vertical drain, preloading with vertical drain, dynamic consolidation	**08**
Unit II	**Drainage And Dewatering** Drainage techniques - Well points - Vacuum and electro osmotic methods - Seepage analysis for two-dimensional flow-fully and partially penetrating slots in homogenous deposits (Simple cases only).	**08**

Unit III	**Insitu Treatment of Soils and Rocks**	**10**
	Insitu densification of cohesionless and consolidation of cohesive soils, Dynamic compaction and consolidation - Vibrofloation - Sand pile compaction, Preloading with sand drains and fabric drains.	
	Stone column, Design of stone column: unit cell concept, area replacement ratio, spacing and diameter, depth, stress ratio, Load bearing capacity of individual stone column, settlement of stone column, Failure mechanism	
	Ground anchors, components, load transfer mechanism, rock anchors, anchors in granular soil, anchors in cohesive soil, Rock bolt, types, action of rock bolt, Soil nailing, analysis of nailed soil.	
Unit IV	**Soil stabilization and Grouting**:	**08**
	Soil stabilization: use of cement, lime, fly ash in soil stabilization, factors affecting. Grouting: classification, types of grouts, equipment, grouting Types of grouts - Grouting equipment and machinery, Injection methods - Grout monitoring design and layout, applications	
Unit V	**Earth reinforcement**	**07**
	Concept of reinforcement, Types of reinforcement material, mechanism and concept, stress strain relationship of reinforced soil, design theories, stability analysis of retaining wall: tie back analysis, coherent gravity analysis, application areas of earth reinforcement	
Unit VI	**Geosynthetics**	**07**
	Geosynthetics: Types, functions, Application of geosynthetics: reinforcement, separator, filter, drainage, Selection of geosynthetics; damage and durability of geosynthetics.	

Course Outcomes (COs):	
At the end of this course, student will be able to	
1	understand the importance of the ground improvement and will be familiar with different ground improvement techniques
2	identify application areas for different ground improvement techniques
3	design and analyze the different ground improvement techniques
Text Books:	
1	Dr. P. Purushothama Raj, "Ground improvement techniques", Laxmi Publications;

		2ndedition, 2016

	2	NiharRanjanPatra"Ground improvement techniques",2012
S		
	1	Klaus Kirsch and Fabian Kirsch. "Ground Improvement by Deep Vibratory Methods", CRC Press Boo, Second Edition.
	2	An introduction to ground improvement engineering by Satyendra Mittal
	3	Reinforced soil and its engineering applications by Swami Saran
	4	Earth reinforcement and soil structures by Colin JFP Jones
	5	An introduction to soil reinforcement and geosynthetics by G. L. SivakumarBabu
Useful Links:		
	1	"Ground Improvement Techniques" by Dr. N.R. Patrahttp://nptel.ac.in/courses/105104034/
	2	"Ground Improvement Techniques" by Dr. G.L. SivakumarBabuIIScBangalorehttp://nptel.ac.in/syllabus/105108075/

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	b	C	d	e	f	g	h	i	j	k
1	√	√	√						√		√
2	√	√	√		√	√	√	√	√	√	√
3		√	√	√	√	√	√	√		√	√

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	2	2		8
Understand	5	5	3	20
Apply	3	3	2	12
Analyze	3	3	3	12
Evaluate	2	2	2	8
Create	-	-	-	-
Total	15	15	10	60

Government College of Engineering, Karad		
Final Year B. Tech.		
CE804 : Construction Equipment and Techniques		

Teaching Scheme			Examination Scheme	
Lectures	3 Hrs/week		**CT1**	15
Tutorial	-		**CT2**	15
Total Credits	3		**TA**	10
			ESE	60
			Duration of ESE 2Hrs	30 min**.**

Course Objectives

1	To introduce various construction techniques
2	To acquaint with functions of various construction equipment
3	To impart knowledge to students about various options available for selecting equipment.
4	To enable the students to compare mechanical and manual construction

Course Contents		
		Hours
Unit I	**Introduction :**Planning for new project, site access, services required, mechanical v/s manual construction	04
Unit II	**Excavation in Earth:** Earth Moving Equipment, Calculation of Cycle time and Production Rates. Drainage in Excavation: Necessity and Methods of Dewatering	08
Unit III	**Excavation in Hard Rock:** Jack hammers, Drills, Compressor, Blasting of Rocks, Explosives, Detonators, Fuses, Tunneling in Hard Rock	08
Unit IV	Ready Mix Concrete (RMC) plant Layout and Production Capacity. Grouting, Shotcreting, Under Water Concreting, Vertical Slip Formwork	08
Unit V	**Construction of Steel Structures:** Planning and Field operations, Erection Equipment including different types of cranes, wheel barrow, construction lifts, Hauling and hoisting Equipment, Floating and Dredging equipment	07
Unit VI	**Construction of Concrete and Bitumen Pavements:** Asphalt Mixing and Batching Plant (Hot mix plant),	05

	Horizontal slip formwork, Crushed sand	

Course Outcomes (COs):		
At the end of this course, student will be able to		
	1	compare mechanical and manual construction
	2	understand various construction techniques
	3	select proper equipment for given process.
Text Books:		
	1	F.W. Stubbs and J.A. Havers,"Hand Book of Heavy Construction", Mac Graw Hill publication,2nd edition ,1971
	2	J.J. Waddell and J. A ,Dobrowolski,"Concrete Construction Hand Book , Mac Graw Hill publication, 3rd edition ,1993
	3	Singh Jagman,"Heavy Construction – Planning, Equipment and methods", Oxford and IBH publishers, New Delhi ,1993
	4	M. Varma ,"Construction equipment and its planning and application", Metropolitan book company ,2nd edition, 1975
References:		
	1	Safety Management in Construction Industry- A Manual for Project Managers by NICMAR, Mumbai
	2	Construction Safety Manual Published by National Safety Commission of India
	3	R.L. Peurifoy, "Construction planning equipment and methods''

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	b	c	d	e	F	g	h	i	j	k
1	√			√		√	√	√			√
2	√			√		√			√	√	
3	√	√	√	√	√			√		√	√

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	4	4	2	15
Understand	4	4	2	15
Apply	4	4	2	15
Analyze	3	3	4	15
Total	15	15	10	60

Elective-II Lab

Government College of Engineering Karad			
Final Year B. Tech			
CE815: Advanced Design of Concrete Structures Laboratory			
Laboratory Scheme			**Examination Scheme**
Practical	2Hrs/week		**CA**	50
Total Credits	1		**ESE**	50

Course Objectives:

1	To analyze and design of special RC structures
2	To prepare detailing of reinforcement of special RC structures as per IS provisions

Course Contents

Experiment 1	Design and detailing of flat slab
Experiment 2	Design and detailing of simply supported deep beam
Experiment 3	Design and detailing of continuous deep beam
Experiment 4	Design and detailing of RC chimney
Experiment 5	Design and detailing of circular water tank
Experiment 6	Design and detailing of rectangular water tank
Experiment 7	Design and detailing of cantilever retaining wall
Experiment 8	Design and detailing of counterfort retaining wall
Experiment 9	Analysis and design of slab using yield line theory

Course Outcomes (COs): Students will be able to

1	convey the concepts of structural design procedure
2	design the various special RC structures
3	draft the detailing of reinforcement as per site requirements

Mapping of CO and PO

	a	B	c	d	e	F	G	h	i	j	k
1	√		√			√	√	√			√
2	√	√			√			√	√		
3	√		√			√	√	√			√

Assessment Pattern

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Avg
Task I	15	15	15	15	15	15	15	15	15	
Task II	05	05	05	05	05	05	05	05	05	
Task III	05	05	05	05	05	05	05	05	05	
CA										

Elective-II Lab

Government College of Engineering Karad		
Final Year B. Tech		
CE825: Channel and River Hydraulics Laboratory		
Laboratory Scheme		**Examination Scheme**
Practical	02 Hrs/week	**CA**	50
Total Credits	1	**ESE**	50

Course Objectives:		
	1	To study and understand various concepts in open channel flow.
	2	To get acquainted with use of GIS
	3	To study hydraulic structure
Course Contents		
Experiment 1		Assignment based on Energy and Momentum coefficients, Specific energy and Critical depth.
Experiment 2		Assignment based on reservoir/channel routing using different analysis methods / spread sheet.
Experiment 3		Assignment based on Gradually varied steady flow and rapidly varied steady flow in open channels
Experiment 4		Study and use of GIS software in hydraulic engineering
Experiment 5		Study of one research paper from referred journal and it's report in the form of discussion
Experiment 6		Visit to hydraulic structure like dam and submit visit report exploring the field aspects.
List of Submission		
	1	Total number of Experiments 05
	2	Project Visit Report 01
Course Outcomes(COs): Students will be able to		
	1	formulate and design economical channel.
	2	understand various design parameters for hydraulic structure
	3	use GIS for hydraulic analysis

Mapping of CO and PO

	a	b	c	d	e	F	G	h	i	j	k
1	√	√		√		√		√	√		√
2	√		√		√					√	√
3	√	√	√	√		√	√	√	√		

Assessment Pattern

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Avg.
Task I	15	15	15	15	15	15	
Task II	05	05	05	05	05	05	
Task III	05	05	05	05	05	05	
CA							

Elective-II Lab

Government College of Engineering, Karad				
Final Year B. Tech				
CE835:Pre-stressed Concrete Design Laboratory				
Laboratory Scheme			**Design of Concrete Structures –I (Lab)**	
Practical	**2**Hrs/week		**CA**	**50**
Total Credits	**1**		**ESE**	**50**

Course Objectives:	
1	To prepare detailing of reinforcement of members under various loading conditions
2	To prepare schedule of the reinforcement
3	To practice the elementary, deign of different structural elements

Course Contents	
Experiment 1	Analysis and Design of Pre-stressed concrete beams – Rectangular, Flanged and I sections
Experiment 2	Analysis and Design of Pre-stressed concrete end blocks
Experiment 3	Analysis and Design of Pre-stressed concrete slabs
Experiment 4	Analysis and Design of Pre-stressed concrete pipes and sleepers
Experiment 5	Analysis and Design of Pre-stressed concrete portal frames, single storey and limited to two bays
Experiment 6	Analysis and Design of Pre-stressed concrete bridges (simply supported)

List of Submission	
1	Total number of Experiments-6
2	Visit Report should be submitted with 10-15 pages duly signed by course coordinator.

Course Outcomes (COs):	
Students will be able to	
1	convey the concepts of structural design procedure
2	design the individual members and hence building as a whole

Mapping of CO and PO

	a	b	c	D	e	F	G	h	i	j	k
1	√		√			√	√	√			√
2	√	√			√			√	√		

Assessment Pattern

Skill Level (as per CAS Sheet)	Exp. 1	Exp. 2	Exp. 3	Exp. 4	Exp. 5	Exp. 6	Project1	Avg.
Task I	15	15	15	15	15	15	15	
Task II	05	05	05	05	05	05	05	
Task III	05	05	05	05	05	05	05	
CA								

Elective-II Lab

Government College of Engineering Karad
Final Year B. Tech
CE845 : Advanced Engineering Geology Lab

Laboratory Scheme			Examination Scheme	
Practical	2Hrs/week		**CA**	50
Total Credits	1		**ESE**	50

Course Objectives:

	1	To understand the concepts of Petrological and optical properties of rocks and minerals and their civil engineering significance.
	2	To apply the geophysical techniques for site selection for civil engineering projects

<div align="center">Course Contents</div>

Experiment 1	Study of geological map of Maharashtra state and India
Experiment 2	Microscopic Properties of Rocks and minerals and Introduction to Petrological Microscope
Experiment 3	Microscopic study of rocks and minerals
Experiment 4	Three-point problems
Experiment 5	Core logging of exploring drill hole
Experiment 6	Use of electrical resistivity method for determining depth of bedrock or groundwater
Experiment 7	Site visit to study the geological features of deccan plateau
Experiment 8	Study of geological features, lithology and geomorphology by Aerial Photography.

List of Submission

	1	Total 8 number of Experiments
	2	Project Visit Report

	Course Outcome(CO):
	After completion of this lab, students will be able to
1	understand the concepts of Petrological and optical properties of rocks and minerals and their civil engineering significance.
2	apply the geophysical techniques for site selection for civil engineering projects

Mapping of CO and PO

	a	b	c	d	e	F	G	h	i	j	k
1	√			√				√			√
2			√	√	√			√			√

Assessment Pattern

Skill Level (as per CAS Sheet)	Exp. 1	Exp. 2	Exp. 3	Exp. 4	Exp. 5	Exp.6	Exp. 7	Exp. 8	Avg.
Task I	15	15	15	15	15	15	15	15	
Task II	05	05	05	05	05	05	05	05	
Task III	05	05	05	05	05	05	05	05	
CA									

Elective-II Lab

Government College of Engineering Karad				
Final Year B. Tech				
CE855:Pavement Design Laboratory				
Laboratory Scheme			**Examination Scheme**	
Practical	2Hrs/week		**CA**	50
Total Credits	1		**ESE**	50
Course Objectives:				
	1	To Analyze stresses and deflections in flexible and rigid pavements		
	2	To understand design of rigid and flexible pavements both for highways and airports		
	3	To understand concept and of drainage in pavements and their design and different types of appurtenances		
	4	To train for designs of pavements of all types as per IRC standards/AASHTO standards		
Course Contents				
Experiment 1		Assignment based on stresses and deflections in flexible pavements		
Experiment 2		Assignment based on design of flexible pavements		
Experiment 3		Assignment based on numerical of flexible pavement design by different methods		
Experiment 4		Assignment based on stresses in rigid pavements		
Experiment 5		Assignment based on numerical of rigid pavement design by different methods		
Experiment 6		Assignment based on numerical of rigid pavement design by different methods		
Experiment 7		Visit report		
List of Submission				
	1	Total number of Experiments =9		
	2	Project Visit Report =1		
Course Outcomes(COs): Student will be able to				
	1	modeling and to analyze flexible and rigid pavements		
	2	design of pavements of all types as per IRC standards/AASHTO standards		
	3	realize different details of pavements		

Mapping of CO and PO

	a	B	c	d	e	F	G	h	i	j	k
1	√	√			√						
2		√	√					√		√	
3			√	√		√	√		√		√

Assessment Pattern

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Project 1	Project 2	Avg.
Task I	15	15	15	15	15	15	15	15	15	15	15	15	
Task II	05	05	05	05	05	05	05	05	05	05	05	05	
Task III	05	05	05	05	05	05	05	05	05	05	05	05	
CA													

Elective-II Lab

Government College of Engineering Karad				
Final Year B. Tech				
CE865: Industrial Wastewater Treatment Laboratory				
Laboratory Scheme			**Examination Scheme**	
Practical	2 Hrs/week		**CA**	50
Total Credits	01		**ESE**	50
Course Objectives:				
	1	To study the various characteristics of Industrial wastewater.		
	2	To study the treatability of Industrial wastewater.		
	3	To design various chemical and Biological Treatment Units for Industrial wastewater treatment.		
Course Contents				

Experiment 1	Characterization of wastewater from Different Industry (Any Two) [pH, BOD, COD, DO, TDS, Colour,]
	    a. Sugar and Distillery Industry
	    b. Pulp and paper mill
	    c. Textiles
	    d. Tanneries
	    e. Food Processing Industry			

Experiment 2	Design of Oxidation Pond for industrial wastewater comprising biodegradable organic matter.			
Experiment 3	Design of Trickling filter for Industrial wastewater treatment system			
Experiment 4	Design of Primary and Secondary Sedimentation tank for Industrial wastewater treatment system.			
Experiment 5	Study and Design of Common Effluent Treatment Plant for Textile Industry			

Experiment 6	Design of effluent treatment plant for treatment of wastewater from different industries (Any one)
	
	    a. Sugar and Distillery Industry
	    b. Pulp and paper mill,
	    c. Tanneries, Atomic
	    d. Food Processing Industry.			

List of Submission				
	1	Total number of Experiments-6		
	2	Industrial Visit Report-01		

Course Outcome(CO): Students will able to	

	1	Characterize the industrial wastewater and decide the treatment for wastewater from the various Industries.
	2	Determine treatability of industrial wastewater.
	3	Design the various chemical and biological treatment units for industrial wastewater treatment.

Mapping of CO and PO

	a	b	c	d	e	f	G	h	I	J	k
1	√	√	√		√		√				√
2		√	√	√	√		√				√
3	√	√	√	√	√	√		√	√	√	√

Assessment Pattern

Skill Level (as per CAS Sheet)	Exp. 1	Exp. 2	Exp. 3	Exp. 4	Exp. 5	Exp. 6	Avg.
Task I	15	15	15	15	15	15	
Task II	05	05	05	05	05	05	
Task III	05	05	05	05	05	05	
CA							

Elective-II Lab

Government College of Engineering Karad				
Final Year B. Tech				
CE875: Bridge Engineering Lab				
Laboratory Scheme			**Examination Scheme**	
Practical	2Hrs/week		**CA**	50
Total Credits	1		**ESE**	50

Course Objectives:		
	1	To study various loads and load class for analysis of bridges on bridges
	2	To study methods of analysis of bridges
	3	To provide students with fundamental knowledge in a wide range of state-of-the-art practices, including code specifications, in bridge engineering
	4	To learn analysis and design of bridge substructure, foundations, bearings and deck joints
Course Contents		
Experiment 1	Study of Components of bridge	
Experiment 2	Study of types of bridge and loads on bridges	
Experiment 3	Design of deck slab bridge	
Experiment 4	Design of T beam bridge	
Experiment 5	Design of foot bridge	
Experiment 6	Design of foundation for bridge, any one	
Experiment 7	Design of bearings	
Experiment 8	Visit to site of bridge construction.	
List of Submission		
	1	Total number of Experiments-8
	2	Site visit report

Course Outcomes (COs): Students will be able to	
1	calculate various loads and load class for analysis of bridges on bridges
2	provide students with fundamental knowledge in a wide range of state-of-the-art practices, including code specifications, in bridge engineering
3	analyze and design of bridge substructure, foundations, bearings and deck joints

Mapping of CO and PO

Course Outcomes	Program Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
1	√	√	√	√	√		√	√	√	√	√
2	√	√	√	√		√	√	√	√		√
3	√	√	√	√	√	√		√		√	

Assessment Pattern

Task I	15	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05	05
CA	25	25	25	25	25	25	25	25	25	25	25	25

Elective-II Lab

Government College of Engineering Karad
Final Year B. Tech
CE885: Watershed Development and Management Laboratory

Laboratory Scheme			Examination Scheme	
Practical	2 Hrs/week		**CA**	50
Total Credits			**ESE**	50

Course Objectives:		
	1	To study various Watershed Management Practices on site
	2	To carry out watershed modelling of selected site
	3	To study how to manage flood and drought condition at site

Course Contents		
PROJECT -1		Site Visit containing study of following points: 1. Implementation of Watershed Management Practices in selected site region 2. Watershed modelling of selected site 3. Use of modern techniques in watershed management at selected site 4. Flood Management or drought management in selected area 5. Water quality management in selected site area

List of Submission		
	1	Project Visit Report containing points mentioned in project-1

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

	1	study various Watershed Management Practices on site
	2	carry out watershed modelling of selected site
	3	manage flood and drought condition at site

Mapping of CO and PO

	a	b	c	d	e	f	G	h	I	j	k
1		√	√		√	√	√			√	√
2	√	√	√	√	√	√		√	√	√	√
3	√	√	√	√	√	√		√		√	√

Assessment Pattern

Skill Level (as per CAS Sheet)	Project 1	Avg.
Task I	15	
Task II	05	
Task III	05	
CA	25	

Government College of Engineering Karad
Final Year B. Tech
CE: 806 Design & Drawing of RC Structures

Laboratory Scheme			Examination Scheme	
Practical	4 Hrs/week		**CA**	50
Total Credits	2		**ESE**	50

Course Objectives:

1	To plan, analyse, segment & design RCC building & other Civil Engineering Structures
2	To get an exposure to the methods of analysis & design of structures using software

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Course Contents

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Experiment 1	Residential four (G+3) storied building (Minimum 120 Sq.m) Drawings prepared shall indicate ductility details as per the provision in IS: 13920
Experiment 2	Any one of following: Retaining wall (cantilever or counter fort type) Design of combined footing Design of water tank resting on ground.
Experiment 3	Analysis and design of RCC framed structure using structural engineering software

List of Submission

1	Required drawing sheets indicating all detailing of structural members
2	At least one drawing sheet for 2 and 3 experiment each.

Course Outcomes (COs):

After successful completion of course students will be able to

1	check feasibility of architectural plan to classify the components and its structural action
2	design individual structural members and the structure as a whole
3	draft the detailing of reinforcement considering site feasibility

Mapping of CO and PO

	a	b	c	d	e	f	g	h	i	j	k
1	√		√			√	√	√			√
2	√		√	√	√			√			
3	√		√			√	√	√			√

Assessment Pattern

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Avg.
Task I	15	15	15	
Task II	05	05	05	
Task III	05	05	05	
CA				

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Avg.

Government College of Engineering, Karad
Final Year B. Tech.
CE:807 Project Phase – II

			Examination Scheme	
Practical	5Hrs/week		**CA**	100
Total Credits	8		**ESE**	100

Course Objectives

1	To perform further literature survey on the research topic of work.
2	To carry out detailed mathematical modelling or experimental validation.
3	To draw inferences from the findings and present conclusion.
4	To learn presentation skills for technical report

Course Contents

The project work started in the seventh semester will continue in this semester. The students will complete the project work in this semester and present it before the assessing committee. The presentation of the project shall be of 45min followed by 50 min viva voce.

The assessment committee as constituted in the seventh semester will assess the various projects for the relative grading and group average. The guide will award the marks for the individual student depending on the group average. Each group will submit the copies of the completed project report. One copy will be kept in the departmental library.

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

1	study and analyze technical literature on the research topic of work.
2	carry out detailed mathematical modeling or experimental validation
3	draw inferences from the findings and present conclusion.
4	learn presentation skills for technical report.

Mapping of Course outcomes to Program outcomes

Course Outcomes	Program Outcomes										
	a	b	c	d	e	f	g	h	i	j	k
1	√	√	√	√	√		√	√	√	√	√
2	√	√	√	√	√	√	√	√	√	√	
3	√	√	√	√	√	√	√	√	√	√	√
4	√	√	√	√		√	√	√	√	√	

Assessment Pattern

Knowledge Level	TA	ESE
Remember	18	18
Understand	17	17
Apply	16	16
Analyze	17	17
Evaluate	16	16
Create	16	16
Total	100	100