Government College of Engineering, Karad

(An Autonomous Institute of Government of Maharashtra)

First Year M. Tech. Civil - Structural Engineering

Semester – I (W.E.F. AY. 2017-18)

Sr. No.	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Credits	EXAM SCHEME				
								CT1	CT2	TA/CA	ESE	TOTAL
1	SE101	Theory of Elasticity and Plasticity	3	1	-	4	4	15	15	10	60	100
2	SE102	Mechanics of Structures	3	1	-	4	4	15	15	10	60	100
3	SE103	Advanced Design of Concrete Structures	3	1	-	4	4	15	15	10	60	100
4	SE1*4	Elective I	3	1	-	4	4	15	15	10	60	100
5	SE107	Dynamics of Structures	3	-	-	3	3	15	15	10	60	100
6	SE106	Laboratory Practice I	-	-	4	4	2			50	50	100
		Total	15	4	4	23	21	75	75	100	350	600

*- Elective - I list is provided at the end of structure

CT1- Class Test 1, TA/CA- Teacher Assessment/Continuous Assessment

CT2- Class Test 2, ESA- End Semester Examination (For Laboratory: End Semester Performance)

Government College of Engineering, Karad

(An Autonomous Institute of Government of Maharashtra)

First Year M. Tech. Civil - Structural Engineering

Semester – II (W.E.F. AY. 2017-18)

Sr. No.	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Credits	EXAM SCHEME				
								CT1	CT2	TA/CA	ESE	TOTAL
1	SE201	Theory of Plates and Shells	3	1	-	4	4	15	15	10	60	100
2	SE202	Finite Element Method	3	1	-	4	4	15	15	10	60	100
3	SE203	Earthquake Engineering	3	1	-	4	4	15	15	10	60	100
4	SE204	Advanced Design of Steel Structure	3	1	-	4	4	15	15	10	60	100
5	SE2*5	Elective II	3	1	-	4	4	15	15	10	60	100
6	SE 206	Laboratory Practice II	-	-	4	4	2	-	-	50	50	100
7	SE 207	Seminar I	-	-	2	2	1	-	-	50		50
		Total	15	05	06	26	23	75	75	150	350	650

*- Elective - II list is provided at the end of structure

CT1- Class Test 1 TA/CA- Teacher Assessment/Continuous Assessment

CT2- Class Test 2 ESE- End Semester Examination (For Laboratory: End Semester Performance)

Government College of Engineering, Karad

(An Autonomous Institute of Government of Maharashtra)

Second Year M. Tech. Civil - Structural Engineering

Semester – III (W.E.F. AY. 2017-18)

Sr. No.	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Credits	EXAM SCHEME	
								TA/CA	TOTAL
1	SE301	Seminar II	-	-	2	2	1	50	50
2	SE302	Dissertation Phase I	-	-	20	20	10	100	100
		Total	-	-	22	22	11	150	150

TA/CA Teacher Assessment/Continuous Assessment.

ESE End Semester Examination (For Laboratory: End Semester Performance).

Semester IV (W.E.F. AY. 2017-18)

Sr. No.	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Credits	EXAM SCHEME		
								TA/CA	ESE	TOTAL
1	SE401	Dissertation Phase II	-	-	30	30	20	100	200	300
		Total	-	-	30	30	20	100	200	300

TA/CA Teacher Assessment/Continuous Assessment.

ESE- End Semester Examination (For Laboratory: End Semester Performance).

Government College of Engineering, Karad

(An Autonomous Institute of Government of Maharashtra)

Programme: Structural Engineering

List of Elective

Elective I	Elective II
Semester-I	**Semester-II**
SE114 Advances in concrete composites	**SE215** Design of RCC Bridges
SE124 Design of Foundations	**SE225** Stability Structure
SE134 Repairs and rehabilitation of structures	**SE235** Design of folded plates and shell

Government College of Engineering Karad

First Year M. Tech. Civil-Structural Engineering

SE101: Theory of Elasticity and Plasticity

(Revised w. e. f AY 2017-18)

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

Course Objectives

1. Post Graduate should understand elastic behavior of materials.
2. Post Graduate should understand application of theory of elasticity in plane strain and plain stress conditions, bending, and torsion.
3. Post Graduate should understand principal stresses in materials.
4. Post Graduate should understand application of theory of plasticity in practical applications in in analysis and design of structures.

Course Contents		**Hours**
Unit I	Stress & Strain at a point, static indeterminacy of problem of 3-D elasticity, Stress equilibrium equations in rectangular, cylindrical & spherical co-ordinates, Generalized Hooke's Law, rectangular, cylindrical & spherical co-ordinates, Generalized Hooke's Law, Strain compatibility equations, Stress compatibility equations.	7
Unit II	Applications of theory of elasticity: Plane stress and plane strain problem in 2 D elasticity, Airy's stress function & its applications to beam bending problems.	7
Unit III	Principal Stresses and strains in 3-D, stress & strain invariants, numerical problems.	7
Unit IV	Torsion: Shafts of circular and non circular prismatic sections, Saint Venant theory , warping function approach, stress function approach.	7
Unit V	Plasticity: hydrostatic stresses, deviatoric stresses, invariants of deviatoric stresses, various failure theories, various empirical stress – strain relationships, theories of plastic flow, yield criteria, von Misses, Tresca yield criteria, strain hardening.	7
Unit VI	Applications of plasticity. Elastic perfectly plastic materials, plane stress-plane strain problems in plasticity, applications to thick cylinders, thick spheres.	7
Tutorial	**A set of Tutorial/ problems based on above syllabus is to be submitted.**	

Course Outcomes

1. Post Graduate will be able to understand behavior of material
2. Post Graduate will understand stress strain behavior at a point in material
3. Post Graduate will be able to apply theory of elasticity in plane strain and plain stress conditions, bending, and torsion
4. Post Graduate will be able to apply theory of plasticity in failure of materials in analysis and design of structures.

Text Books

1 Theory of Elasticity – S. Timoshenko & J. N. Goodier, McGraw Hill, Singapore. Third Edition 1970, New York
2 Theory of Elasticity: Filonenko, Borodich, Foreign Language Publication House, 1965, USA.
3 Theory of Elasticity: Sadhu Sing, Khanna Publishers, Delhi, 2012
4 Theory of Plasticity: Sadhu Singh, Khanna Publishers, Delhi, 1995
5 Applied Stress Analysis: Sadhu Singh, Khanna Publishers, Delhi, 2007

References

1 Structural Mechanics with Introductions to Elasticity and Plasticity – By Venkatraman, Sharad A. Patel, McGrawHill Book Company, New York. 1970
2 Solid Mechanics -- S. M. A. Kazimi, Tata McGraw Hill, New Delhi
3 Theory of Plasticity – Chakraborty J., Tata Mc Graw Hill Publishing Company Limited.
4 Theory of Plasticity – R. Hill, Van nastrod, USA

Useful Links

1 **nptel**.iitk.ac.in/
2 www.myeducationkey.com/
3 www.wikipedia.Newton.com/

Mapping of CO and PO

	a	b	c	d	e	f	g	h	I	j	k
CO1	√	√	√	√	√		√	√		√	√
CO2	√	√	√	√	√	√			√	√	
CO3	√	√	√	√			√	√	√	√	√
CO4	√	√	√	√		√		√			√

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

Government College of Engineering Karad
First Year M. Tech. Civil-Structural Engineering
SE102: Mechanics of Structures

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

Course Objectives

1 Post Graduate should understand moving load analysis.
2 Post Graduate should learn analysis of curved members.
3 Post Graduate should study different types of beams on elastic foundation.
4 Post Graduate shall force and displacement methods of analysis.
5 Post Graduate should understand beam-column concept.

Course Contents		**Hours**
Unit I	Influence Line Diagrams for Indeterminate Structures: Continuous beams, portal frames & two hinged arches. Muller-Breslau's Principle & Moment distribution method	06
Unit II	Beams Curved in Plan: Determinate & Indeterminate beams curved in plan.	04
Unit III	Beams on Elastic Foundations: Analysis or infinite, semi-infinite & finite beams	05
Unit IV	Beam columns: Concept of geometric & material nonlinearity. Governing differential equation, Analysis of beam-columns subjected to different loadings and support conditions. Stiffness and carry-over factors for beam-columns, fixed end actions due to various loads.	04
Unit V	Stiffness method of structural analysis, flexibility and stiffness matrices, Analysis of continuous beams, trusses and plane frames by Structure oriented stiffness approach.	07
Unit VI	Member Oriented Stiffness Method: Stiffness matrices of beam, truss, plane frame grid, pin & rigid jointed space frame elements on member axes. Transformation of matrices on Structure axes. Over-all joint stiffness matrix and nodal load vector, assembly rules. Calculation of member end forces, Bandwidth.	04

Tutorial

A set of Tutorial/ problems based on above syllabus is to be submitted.

Course Outcomes

1 Post Graduate will understand moving load analysis.
2 Post Graduate will be able to perform analysis of curved members.
3 Post Graduate will be able to study behaviour of different types of beams on elastic foundation.
4 Post Graduate will be able to apply force and displacement methods of analysis.
5 Post Graduate will understand theory and concept of beam-column.

Text Books

1. Basic structural Analysis by C.S.Rcddy, Tata Mc Graw Hill, Delhi
2. Matrix Analysis of Framed Structures by Gere & Weaver, CBS Publishing, Delhi.

References

1 Theory of Elastic Stability by Timoshcnko & Gere, East West Press Ltd.
2 Mechanics of Structures Vol. LII & III by Junnarkar& Shah, Chartor Publishing House, Delhi
3 Advanced Theory of Structures by Vaziram & Ratwani, Khanna Publisher, Delhi.
4 Analysis of Structures Vol.11, by Vazirani & Ratwani, Khanna Publisher, Delhi.
5 Structural Analysis by Negi and Jangid, Tata Mc Graw Hill, Delhi

Mapping of CO and PO

	A	B	c	d	e	F	g	h	i	J	k
CO1	√	√	√	√	√		√	√		√	√
CO2	√	√	√		√	√	√	√	√	√	
CO3	√	√	√	√	√	√	√	√	√	√	√
CO4	√	√	√					√			√

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

Government College of Engineering Karad
First Year M. Tech. Civil-Structural Engineering
SE103: Advanced Design of Concrete Structures

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

Course Objectives

1 Post Graduate should understand analysis and design of various types of slabs as per situation and loading conditions.
2 Post Graduate should understand analysis and design of different types of footings as per superstructure and substructure (soil conditions).
3 Post Graduate should understand analysis and design of different types of water tanks as per situation and loading combinations.
4 Post Graduate should understand analysis and design of different structures using method of prestressing, study concept of prestressing, its methods and behaviour under loading.

Course Contents		**Hours**
Unit I	Analysis and design of flat slab, grid slab, circular slab.	06
Unit II	Analysis and design of combined footing & raft foundation.	05
Unit III	Analysis and design of overhead water tank – Rectangular & circular with flat bottom Design of staging for wind & seismic loads .	05
Unit IV	Mechanics of pre-stressed concrete, stress concept, strength concept & load balancing concept, high strength material, systems of prestressing, losses of prestress.	05
Unit V	Design of Prestressed Concrete, beams, box, T& I Sections, Shear, Deflection, Design of End Block, IS code method.	05
Unit VI	Analysis & design of continuous beams, partial prestressing, circular prestressing – pipes.	04

Tutorial

A set of Tutorial/ problems based on above syllabus is to be submitted.

Course Outcomes

1 Post Graduate will understand analysis and design of various types of slabs as per situation and loading conditions.
2 Post Graduate will understand analysis and design of different types of footings as per superstructure and substructure (soil conditions).
3 Post Graduate will understand analysis and design of different types of water tanks as per situation and loading combinations.
4 Post Graduate will be able to perform analysis and design of different structures using method of prestressing, study concept of prestressing, its methods and behaviour under loading.
5 Post Graduate will be able to perform analysis and design of various types of slabs as per situation and loading conditions.

Text Books & References

1 Reinforced concrete, Limit state design by Ashok K. Jain, New Chand & bros. Roorkee.

2 Advanced Reinforced Concrete design by P.C. Vargese – Prentice Hall of India, Delhi.
3 Advanced Reinforced Concrete design by N. Krishnaraju – CBS Publishers & Distributors, Dehli.
4 Prestrssed Concrete by S. Ramamurtham, Dhanpat Rai & Sons.
5 Prestrssed Concrete by N. Krishnaraju
6 Prestrssed Concrete by T. Y. Lin.

Useful Links

1 **nptel**.iitk.ac.in/
2 www.myeducationkey.com/
3 www.wikipedia.com/

Mapping of CO and PO

	A	b	C	D	e	f	g	h	i	J	K
CO1	√	√	√	√	√		√	√	√		√
CO2	√	√	√	√		√	√	√	√	√	
CO3	√	√	√	√	√	√	√	√	√	√	√
CO4	√	√	√	√	√	√		√			

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

Government College of Engineering Karad
First Year M. Tech. Civil-Structural Engineering
SE114: Elective-I Advances in Concrete Composites

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

Course Objectives

1 Students should understand weakness of plain concrete, and understand the latest development in trend in concrete composites
2 To understand advanced applications of composite materials.
3 To understand manufacturing and properties of concrete composites

Course Contents		**Hours**
Unit I	Fiber reinforced composites: Introduction to Fiber Reinforced Concrete, types of fibers, properties of fibers. properties of constituent materials. Mix proportion, mixing, casting methods.	06
Unit II	Properties of freshly mixed concrete (fiber reinforced concrete), workability tests, mechanical properties, Mechanics and mechanism of Fiber Reinforced Concrete.	06
Unit III	Testing of fibre reinforced concrete under compression, flexure, shear and bending. Various toughness indices. Stress-strain behaviour. Design aspects of reinforced concrete structures with fibres.	06
Unit IV	Ferro cement - Introduction, materials used, mechanical properties, construction techniques, design in direct tension, applications, merits as structural materials.	06
Unit V	Silica Fume Concrete - Introduction, physical and chemical properties of silica Hume, reaction mechanism of silica fume, properties of silica fume concrete in fresh state, mechanical properties and durability of silica fume concrete.	06
Unit VI	Polymer Concrete : Introduction, Classification, properties of constituent materials, polymer impregnated concrete, polymer concrete, application	06

Tutorial

A set of Tutorial/ problems based on above syllabus is to be submitted.

Course Outcomes

1 Students will have knowledge of weakness of plain concrete, and understand the latest development in trend in concrete composites
2 Students will understand advanced applications of composite materials.
3 Students will understand manufacturing and properties of concrete composites such as fibre reinforced concrete, ferrocement, silica fume concrete and polymer concrete

Text Books

1 Concrete Technology & Design by R N. Swamy,Surrey University Press.
2 Special Structural Concretes by Rafal Siddiquc,Galgotia pub. Pvt.ltd.
3 Fiber Reinforced Cement Composites by P. N. Balaguru, S. P. Shah, Mc-Graw Hill
4 Fiber Cement and Fiber Concrete by D.J Hannant, John Wiley and Sons.
5 Fracture Mechanics and Structural Concrete by Bhusan L. Karihal.

Mapping of CO and PO

	a	B	C	D	E	f	g	h	i	J	k
CO1	√	√	√	√		√	√	√	√		√
CO2	√	√	√	√	√	√		√	√	√	
CO3	√	√	√	√	√		√	√		√	

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

Government College of Engineering Karad
First Year M. Tech. Civil-Structural Engineering
SE124: Elective-I Design of Foundations

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

Course Objectives

1 Post Graduate should understand theories of failure of soil with respect to foundation engineering.
2 Post Graduate should learn methods for design of shallow foundation.
3 Post Graduate should learn methods for design of combined footing and raft foundation.
4 Post Graduate should understand analysis and design of drilled piers and well foundation.
5 Post Graduate should understand analysis and design of simple machine foundations using I. S. Code and also Vibration isolation.

Course Contents		**Hours**
Unit I	Theories of failure of soil, Determination of ultimate bearing capacity, Dynamic bearing capacity. Different methods of design of shallow foundations for axial and eccentric load.	06
Unit II	Design of wall footing, strap footing, combined footing,(Rectangular & Trapezoidal)	06
Unit III	Raft foundation, different types, Design considerations and various methods of analysis of raft.	06
Unit IV	Determination of load carrying capacity of single pile, rock socketing, Negative skin friction, Design of axially loaded piles, design of pile groups and pile cap, under-reamed piles.	06
Unit V	Analysis and design of drilled piers and well foundation.	06
Unit VI	Dynamic response of soil, criteria for satisfactory machine foundation, framed and massive foundation, Analysis and design of simple machine foundations using I. S. Code. Vibration isolation.	06

Tutorial

A set of Tutorial/ problems based on above syllabus is to be submitted.

Course Outcomes

1 Post Graduate will understand theories of failure of soil with respect to foundation engineering.
2 Post Graduate will learn methods for design of shallow foundation.
3 Post Graduate will use different methods for design of combined footing and raft foundation.
4 Post Graduate will be able to perform analysis and design of drilled piers and well foundation.
5 Post Graduate will be able to perform analysis and design of simple machine foundations using I. S. Code and also Vibration isolation.

Text Books

1 Winterkorn H. F. and Fang H. Y. ,"Foundation Engineering Hand Book"-Van Nostand Reinhold Company,1975
2 Bowles J.E.," Foundation Analysis and Design"-McGraw Hill Book Company,1968.
3 Vibration Analysis and Design of Foundations for Machines and Turbines"-Major A. Collets Holding Ltd.,1962.
4 Kany M. ,"Design of Raft Foundations" Elithelm Earnest and Sohn.1974.
5 Goodman, L. J.and Karol, R. H.,"Theory and Practice of Foundation Engineering",McMillion,1968.
6 Soil Dynamics," Shamsher Prakashan, McGraw Hill Book Co

7 D. D. Barkan, “Dynamics of Bases & Foundation.”

Mapping of CO and PO

	a	b	c	d	e	f	g	h	i	j	k
CO1	√	√	√	√	√		√	√	√	√	√
CO2	√	√	√	√		√	√	√	√		√
CO3	√	√	√	√	√	√		√		√	

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

Government College of Engineering Karad
First Year M. Tech. Civil-Structural Engineering
SE134: Elective-I Repairs and Rehabilitation of Structures

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

Course Objectives

1 Post Graduate should understand causes of deterioration.
2 Post Graduate should understand Facets of Maintenance, importance of Maintenance, Various aspects of Inspection
3 Post Graduate should understand causes of distress in concrete /steel structures
4 Post Graduate should learn Damage assessment and evaluation models
5 Post Graduate should learn methods of repair and rehabilitation and should perform Seismic Retrofitting of reinforced concrete buildings.

Course Contents		**Hours**
Unit I	**Introduction** to deterioration of structures with aging; Need for rehabilitation. Maintenance, Repair and Rehabilitation, Facets of Maintenance, importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration.	06
Unit II	**Distress in concrete /steel structures** Types of damages; Sources or causes for damages; effects of damages; Case studies, Quality assurance for concrete – Strength, Durability and Thermal properties, of concrete – Cracks, different types, causes – Effects due to climate, temperature, Sustained elevated temperature, Corrosion – Effects of cover thickness.	06
Unit III	**Damage assessment and evaluation models** Damage testing methods; Non-destructive Testing Techniques, Epoxy injection, Shoring, Underpinning, Corrosion protection techniques – Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, cathodic protection.	06
Unit IV	**Rehabilitation methods** Grouting; Detailing; Imbalance of structural stability; Polymer concrete, Sulphur infiltrated concrete, Fibre reinforced concrete, High strength concrete, High performance concrete, Vacuum concrete, Self compacting concrete, Geopolymer concrete, Reactive powder concrete, Concrete made with industrial wastes. Case studies	06
Unit V	**Methods of Repair** Shortcreting; Grouting; Epoxy-cement mortar injection; Crack ceiling Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, Leakage, earthquake – DEMOLITION TECHNIQUES – Engineered demolition methods – Case studies.	06
Unit VI	**Seismic Retrofitting of reinforced concrete buildings** Introduction; Considerations in retrofitting of structures; Source of weakness in RC frame building – Structural damage due to discontinuous load path; Structural damage due to lack of deformation; Quality of workmanship and materials; Classification of retrofitting techniques; Retrofitting strategies for RC buildings – Structural level (global) retrofit methods; Member level (local) retrofit methods; Comparative analysis of methods of retrofitting	06

Tutorial

A set of Tutorial/ problems based on above syllabus is to be submitted.

Course Outcomes

1 Post Graduate will understand causes of deterioration.
2 Post Graduate will understand Facets of Maintenance, importance of Maintenance, Various aspects of Inspection
3 Post Graduate will understand causes of distress in concrete /steel structures
4 Post Graduate will learn Damage assessment and evaluation models
5 Post Graduate will learn methods of repair and rehabilitation and will be able to perform Seismic Retrofitting of reinforced concrete buildings.

Text Books

1 Denison Campbell, Allen and Harold Roper, "Concrete Structures, Materials, Maintenance and Repair", Longman Scientific and Technical UK, 1991.
2 Allen R.T. & Edwards S.C, Repair of Concrete Structures, Blakie and Sons, UK, 1987
3 Dov Kominetzky.M.S., "Design and Construction Failures", Galgotia Publications Pvt. Ltd., 2001
4 Ravishankar.K., Krishnamoorthy.T.S, "Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004.
5 Diagnosis and treatment of structures in distress by R.N.Raikar, 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.
7 Earthquake resistant design of structures by Pankaj Agarwal and Manish Shrikhande, Prentice-Hall of India, 2006.

Mapping of CO and PO

	a	b	c	d	e	f	G	h	i	j	k
CO1	√	√	√	√	√		√	√	√		√
CO2	√	√	√	√	√	√	√	√	√	√	√
CO3	√	√	√	√		√		√		√	

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

Government College of Engineering Karad
First Year M. Tech. Civil-Structural Engineering
SE107: Dynamics of Structures

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

Course Objectives:

1 Post Graduate should understand the behavior of structure under dynamic loading.
2 Post Graduate should model the structure mathematically.
3 Post Graduate should understand the physics of the problem.
4 Post Graduate should understand the design of earthquake resistant structures.

Course Contents

		Hours
Unit I	Single-Degree-of-Freedom System, Analysis models, Equations of motion, Free vibration, Damping, Types of Damping, Response to harmonic loading, Resonance, Support motion, Transmissibility, Vibration isolation	**4**
Unit II	SDOF systems subjected to periodic and impulsive loading, Fourier series loading, Sine wave pulse, rectangular pulse, introduction to Frequency-Domain Analysis.	**5**
Unit IV	MDOF System, Selection of DOFs, Formulation of Equation of motion, Structure matrices, Static condensation, Free vibrations, Eigen Value problem, Frequencies and Mode Shapes, Determination of natural frequencies and mode shapes by Stodola-Vianello Method, Orthogonality conditions, Proportional Damping Matrix	**5**
Unit IV	MDOF System, Selection of DOFs, Formulation of Equation of motion, Structure matrices, Static condensation, Free vibrations, Eigen Value problem, Frequencies and Mode Shapes, Determination of natural frequencies and mode shapes by Stodola-Vianello Method, Orthogonality conditions, Proportional Damping Matrix	**5**
Unit V	Discrete systems, Fundamental mode analysis, Rayleigh method, Rayleigh-Ritz Method, Dunkerly's Method, Response of MDOF systems to dynamic loading, Mode superposition Method, Coupled and uncoupled equations of motion, Modal contributions	**5**
Unit VI	Distributed-Parameter Systems, Partial differential equations of motion, free and forced vibrations, Application to beams in flexure	**5**

Tutorial

A set of Tutorial/ problems based on above syllabus is to be submitted

Course Outcomes:

1 Post Graduate will understand the behaviour of structure under dynamic loading
2 Post Graduate will be able to model the structure mathematically
3 Post Graduate will be able to understand the physics of the problem
4 Post Graduate will be able to perform the design of earthquake resistant structures

Text Books

1 Dynamics of structures - R.W. Clough and J. Penzine, McGraw-Hill Pubication
2 Structural Dynamics – Roy Craig, John-Wiley & Sons
3 Dynamics of Structures – Theory & Application to Earthquake Engineering- A.K. Chopra, Prentice Hall Publications
4 Dynamics of Structures – Mukhopadhyay
5 Structural Dynamics – Mario Paz 6. Elements of Earthquake Engineering by Jaikrishna, A.R. Chandrashekharan, Brijesh Chandra, Standard Publishers Distributors

Useful Links

1 nptel.iitk.ac.in/
2 www.myeducationkey.com/

Mapping of CO and PO

	a	b	c	d	e	f	g	h	i	j	k
CO1	√	√	√	√	√		√	√		√	√
CO2	√	√	√	√	√	√		√	√	√	
CO3	√	√	√	√	√	√	√	√	√		√
CO4	√	√	√	√				√		√	

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

Government College of Engineering Karad
First Year M. Tech. Semester-I
SE106: LAB PRACTICE - I

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

Course Objectives:

1. Post Graduate should understand the physics of the problem
2. Post Graduate should be familiar with hands on practice.
3. Post Graduate should understand codal provisions and its applications.
4. Post Graduate should learn various softwares in Analysis and design of structures.

Experiment 1

a. To obtain the failure mode for the stressed material using Mohr's circle for given state of stress
b. For higher order stress function (4th order and above) to find different states of stress

Experiment 2

a. To investigate state of stress given by particular stress function
b. To develop stress strain curve for given data for various types of Hardening of materials

Experiment 3

a. Polymer impregnated concrete, polymer concrete, application
b. Ferrocement concrete

Experiment 4

a. Analyze a plate by finite difference method
b. Analyze a truss by flexibility method

Experiment 5

a. Analyze a frame by stiffness method
b. Generate input data for software for analysis of grid by stiffness method. Use both the type of code numbering

Experiment 6

a. Distributed-Parameter Systems, Partial differential equations of motion
b. Free and forced vibrations, Application to beams in flexure

Experiment 7

a. Raleigh-Ritz approach for deflection calculations in beams and columns
b. Analysis of beams curved in plan and elevation

Experiment 8

a. Analysis and Design of Overhead water tank- Circular with flat bottom
b. Design of prestress concrete beams, box, T and I Sections

Experiment 9

a. Behaviour of Fiber reinforced concrete under Compression, tensile, flexure, research findings, application of Fiber Reinforced Concrete
b. Physical and chemical properties of silica Fume, reaction mechanism of silica fume, properties of silica fume concrete in fresh state, mechanical properties and durability of silica fume concrete

Experiment 10

a. To obtain octahedral normal, shear stress by hydrostatic stress and

stress deviator tensor for a given stress tensor

b. To write a program for any one of practical

List of Submission

1 Total number of Experiments
2 Total number of sheets
3 Project/Dissertation Report
4 Seminar report
5 Field Visit Report

Additional Information

Course Outcome(CO):

1 Post Graduate will understand the physics of the problem
2 Post Graduate will be familiar with hands on practice.
3 Post Graduate will understand codal provisions and its applications.
4 Post Graduate will learn various software's in Analysis and design of structures.

Mapping of CO and PO

	a	b	c	d	e	f	g	h	i	j	k
CO1	√	√	√	√	√	√	√	√	√	√	√
CO2	√	√	√	√	√	√	√	√	√	√	√
CO3	√	√	√	√	√	√	√	√	√	√	√
CO4	√	√	√	√	√	√	√	√	√	√	√

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

Government College of Engineering Karad
First Year M. Tech. Civil-Structural Engineering
SE201: Theory of Plates and Shells

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

Course Objectives

1 Post Graduate should understand analysis of 2D flat and curved surfaces.
2 Post Graduate should learn mathematical techniques for solutions of these problems.
3 Post Graduate should know numerical method for the analysis of 2d problems
4 Post Graduate should understand the behaviour of such elements in practice.
5 Post Graduate should understand the behaviour of thick plates
6 Post Graduate should understand the geometry and strength of shell structures.

Course Contents **Hours**

Unit I **Introduction to Plate Theory:** Thin and Thick Plates, small and large deflection theory of thin plates-assumptions, moment-curvature relations, stress resultants, Governing Differential Equation for bending of plates, various boundary conditions. 05

Unit II **Rectangular plates-Navier's solution :** Simply supported rectangular plates subjected to uniformly distributed and varying loads on entire area, parabolic loads, sinusoidal loads, partly loaded plates, concentrated loads and couples, distributed couples, symmetric & anti-symmetric loading. 05

Rectangular plates-Levy's solution: Plates subject to uniformly distributed and varying loads and sinusoidal parabolic loads between simply supported edges. Conditions for other two edges simply supported, fixed, free, elastically restrained. 05

Unit III **Energy methods:** Use of potential energy principle, solution of rectangular plates with various boundary conditions and loadings. Buckling of rectangular plates, circular plates.

Unit IV **Circular Plates:** Bending of circular plates with clamped & simply supported edges, Plate with a central hole, uniformly distributed and varying loads, conical loads, distributed couples, ring loads, semicircular plates, axisymmetric loaded plates. 05

Unit V **Introduction to shells:** Classification of shells on geometry, thin shell theory, equation of shell surfaces, stress resultants, stress displacement relations, compatibility and equilibrium equations. 05

Membrane analysis :

a. Equation of equilibrium for synclastic shells, solution for shells subject to self weight, live load.

b. Equation of equilibrium in rectangular coordinate system. Hypar shells, use of Pucher's function, simple problems on hyperbolic paraboloids. Elliptic paraboloidal shells, conoids.

c. Cylindrical shells: Equations of equilibrium, open shells with parabolic, circular, elliptical directrix, simple problems.

d. Shells with closed directrix-circular, elliptical-simple problems. Problems on pipes carrying fluid/liquid under pressure, just filled & partly filled 05

Unit VI **Bending theory of cylindrical shells:** Symmetrically loaded circular cylindrical shell. Derivation of Governing Differential Equation, resembling that for beam on elastic

foundation, beam theory. Finsterwalder's theory: Derivation of governing differential equation of 8th order. D.K.J. theory, Donnell's equation. Characteristic equation. Schorer's theory: Derivation of differential equation.

Tutorial

A set of Tutorial/ problems based on above syllabus is to be submitted.

Course Outcomes

1 Post Graduate will understand analysis of 2D flat and curved surfaces.
2 Post Graduate will learn mathematical techniques for solutions of these problems.
3 Post Graduate will be able to apply numerical method for the analysis of 2d problems
4 Post Graduate will understand the behaviour of such elements in practice.
5 Post Graduate will understand the behaviour of thick plates
6 Post Graduate will know the geometry and strength of shell structures.

Text Books & References

1. Theory of plates & shells by Timoshenko & W.Kreiger, S W Tata Mc. Graw. Hill, Pub. Co. Ltd., Delhi, 1985, 2nd Edition.

2. Design of R. C. sh ell roofs by G.S. Ramaswamy, CBS Publisher and Distributors, 1s t Edition 2003, Delhi.
3. Analysis of thin concrete shells by K.Chandrashekhara, Tata Mc.Graw Hi llPub. Co. Ltd, Delhi.

4. Stresses by Anselc, Ugural, S W Tata Mc. Graw. Hill, Pub. Co. Ltd., 1985, 2nd Edition 2003, Delhi.

Useful Links

1 **nptel**.iitk.ac.in/
2 www.myeducationkey.com/
3 www.wikipedia.Newton.com/

Mapping of CO and PO

	a	B	c	d	e	f	g	h	i	j	k
CO1	√	√	√	√	√	√	√	√	√	√	√
CO2	√	√	√	√	√	√	√	√	√	√	√
CO3	√	√	√	√	√	√	√	√	√	√	√
CO4	√	√	√	√	√	√	√	√	√	√	√

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

Government College of Engineering Karad
First Year M. Tech. Civil-Structural Engineering
SE202: Finite Element Method

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

Course Objectives

1 Students should learn the fundamentals of the finite element method for the analysis of engineering problems arising in solids and structures
2 Students should learn how to judge the quality of the numerical solution and improve accuracy in an efficient manner by optimal selection of solution variables.
3 To enable the students to formulate the design problems into FEA
4 Use commercially available, state-of-the-art finite element analysis software to analyze complex structural systems, including interfacing with CAD models and solving nonlinear structural analyses,

Course Contents		**Hours**
Unit I	**Introduction to Finite Element Method :** Principle of minimum potential energy. Variational principle, Galerkin approach, RayleighRitz method, finite element procedure.	05
Unit II	**1D problems:** Discretization, nodes, element incidence, displacement model, shape function, selection of order of polynomials, application to bars with constant and variable cross sections subjected to axial forces. **2D problems:** Development of element stiffness matrix and nodal load vector for truss, beam and plane frame elements. Transformation of matrices, relevant structural engineering applications. 2D elements of triangular and quadrilateral shapes for plane stress and plane strain problems. Pascal's triangle, convergence requirements and compatibility conditions, shape functions, boundary conditions, element aspect ratio, applications to a continuum.	05
Unit III	**3D problems:** Development of element stiffness matrix and nodal load vector for Tetrahedron, Hexahedral elements.	05
Unit IV	**Isoparametric Elements:** Shape function. Natural coordinate systems, classification-isoparametric, subparamelric, superparametric elements, 1D & 2D isoparametric elements, Gauss quadrature integration.	06
Unit V	**Axisymmetric Elements :** Development of element stiffness matrix and nodal load vector	04
Unit VI	**Plate and Shell Elements :** Formation of stiffness matrix for plate bending elements of triangular and quadrilateral shapes, cylindrical thin shell elements.	05

Tutorial

A set of Tutorial/ problems based on above syllabus is to be submitted.

Course Outcomes

1 Post Graduate will learn the fundamentals of the finite element method for the analysis of engineering problems arising in solids and structures
2 Post Graduate will be able to judge the quality of the numerical solution and improve accuracy in an efficient manner by optimal selection of solution variables.
3 Post Graduate will be able to formulate the design problems into FEA
4 Post Graduate will be able to use commercially available, state-of-the-art finite element an analysis software to analyze complex structural systems, including interfacing with CAD models and solving nonlinear structural analyses,

Text Books

1 The Finite Element Method (fourth edition) vol I & II by O.C. Zienkiewicz & R. L Ta ylor, Tata

Mc Graw Hill Publication Co. Ltd.
2 An introduction to the finite element method by J. N. Reddy, Tata McGraw Hill Publication Co. Ltd.
3 Concepts & applications of finite element analysis by R. D. Cook, John Wiley & Sons ltd.

4 Introduction to finite element method by C.S. Desai, CBS Publicati on & Distributors
5 Programming in finite element metho d by C.S.Krishnamoorthy, Tata McGraw Hill Publication Co. Ltd.
6 Introduction to finite el ement in engineering by T.R.Chandrupatla and Belegundu, Prentice Hall of India.

Mapping of CO and PO

	a	b	c	d	e	f	g	h	i	J	k
CO1	√	√	√	√		√	√	√		√	√
CO2	√	√	√	√	√	√		√	√	√	
CO3	√	√	√	√	√		√	√	√		√
CO4	√	√	√	√				√		√	

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

Government College of Engineering Karad
First Year M. Tech. Semester-II
SE203: Earthquake Engineering

Laboratory Scheme		**Examination Scheme**	
Practical	3 Hrs/Week	CT1	15
Total Credits	3+1=4	CT2	15
		TA	10
		ESE	60
		Duration of ESE	3 Hrs.

Course Objectives:

1. Post Graduate should understand the behaviour of structure under dynamic loading
2. Post Graduate should model the structure mathematically
3. Post Graduate should understand the physics of the problem
4. Post Graduate should understand the design of earthquake resistant structures

Course Contents

		Hours
Unit I	Characteristics of Earthquakes: Earthquake terminology, Indian Earthquakes, Measurement of Earthquakes, Magnitude, Intensity, Frequency-magnitude relationship, Liquefaction	**5**
Unit II	Earthquake response of linear SDOF systems: Response spectrum theory, Strong ground motion, Accelerometers, Peak parameters, Concept of earthquake response spectrum, tripartite spectrum, Construction of design response spectrum	**5**
Unit III	Earthquake response of linear MDOF systems: Modal Analysis, Participation factors, Modal contributions, multistoreyed buildings with symmetric and unsymmetric plan, Torsional response	**5**
Unit IV	Concept of Earthquake resistant design, Objectives, Ductility, Ductility reduction factors, Overstrength, Response reduction factor, Design response spectrum, Lateral stiffness, Conceptual design, Building configuration	**5**
Unit V	Lateral load analysis, Provisions of IS-1893 for buildings, Base Shear, Application to Multistorey buildings, Load combinations	**4**
Unit VI	Detailing of RCC and Masonry buildings, Provisions of IS-13920, IS – 4326	**6**

Tutorial:

A set of Tutorial/ problems based on above syllabus is to be submitted

Course Outcomes:

1. Post Graduate will understand the behaviour of structure under dynamic loading
2. Post Graduate will be able to model the structure mathematically

3 Post Graduate will be able to understand the physics of the problem
4 Post Graduate will be able to perform the design of earthquake resistant structures

Text Books:

1 Dynamics of Structures - R.W. Clough and J. Penziene, McGraw-Hill Pub
2 Structural Dynamics - Roy Craig, John-Wiley & Sons.
3 Dynamics of Structures- Theory & Application to Earthquake Engineering – A.K.Chopra. Prentice-H; Pub..
4 Structural Dynamics – Madhujit Mukhopadhyay , Ane's Student Edition, Ane Books India
5 Structural Dynamics - Mario Paz
6 Elements of Earthquake engineering by Jaikrishna, A.R. Chandrashckharan, Brijesh Chandra.Stands Publishers
7 Earthquake Design Practice for Buildings – David Key, Thomas Telford Publication
8 Earthquake Resistant Design for Engineers & Architects- D.J. Dowrick, John Wiley & Sons
9 Passive vibration control- Robinson, T.T.Soong

Mapping of CO and PO

	a	b	c	d	e	f	g	h	i	j	k
CO1	√	√	√	√	√		√	√		√	√
CO2	√	√	√	√	√	√		√	√	√	
CO3	√	√	√	√	√	√	√	√	√		√
CO4	√	√	√	√				√		√	

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

Government College of Engineering Karad

First Year M. Tech. Civil-Structural Engineering

SE204: Advanced Design of Steel Structures

(Revised w. e. f AY 2017-18)

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

Course Objectives

1. Post Graduate should understand natural force systems.
2. Post Graduate should develop skill of modelling and resolution of force system using mechanics.
3. Post Graduate should understand application of mechanics to industry.
4. Post Graduate should understand application of mechanics in high performance machines and systems.

Course Contents		**Hours**
Unit I	Design of Trussed girder bridges and bearings. Deck type and through type bridges, bracing systems, end bearings, mechanical and elastomeric bearings.	5
Unit II	Multi-storey steel buildings, load transfer mechanism, lateral load resisting systems, Design of moment resistant frames, concentrically braced frames, interacting moment resisting frames with shear walls for seismic/ wind effects structural systems, framed tube structures, braced tube structures, tube in tube structures.	5
Unit III	Cold-formed light gauge steel sections, special design considerations for compression elements, design of compression elements, stiffened compression elements, multi-stiffened elements, design of light gauge beams, behaviour under repetitive loads and temperature effects.	5
Unit IV	Buckling of beam-column, buckling of sway and non-sway frame, various end conditions, elastically restrained conditions, stiffness and continuous factor, stability function.	5
Unit V	Plastic analysis and design of portal frames, collapse mechanisms, analysis and design of gables, multistory-multibay frames, rectangular and tapered haunch knee, check for stability of frames, plastic moment distribution method, minimum weight design, variable repetitive loads, Introduction to Limit States in Steel Design.	5
Unit VI	Concrete-Steel composite sections, elastic behaviour of composite beams, shear connectors, behaviour at ultimate load, Design of composite beams, Design of encased steel columns.	5

Tutorial

A set of Tutorial/ problems based on above syllabus is to be submitted.

Course Outcome

1 Post Graduate will understand natural force systems.
2 Post Graduate will develop skill of modelling and resolution of force system using mechanics.
3 Post Graduate will be able to solve industrial problems related to steel structures.
4 Post Graduate will perform applications in composite construction.

Text Books

1 Design of steel structures-Vol. II by Ramchandran, standard book house delhi
2 Design of steel structures-A.S. Arya. J.L. Ajamani, Nemchand and brothers.
3 Structural analysis and design of tall buildings by B.S. Taranath. McGrawHill.
4 Steel skeletal Vol. II Plastic behavior and design by J.F.Bekar, M.R. Horne, J. Heyman. ELBS.
5 Plastic methods of structural analysis by Neal B.G.Chapter and Hall.
6 Teaching Resource for Structural Steel Desing-Vol. III by IIT Madras, Anna University Chennai, SERC, Madras and Institute for Steel Development and Growth (INSDAG), Kolkatta.

Useful Links

1 **nptel**.iitk.ac.in/
2 www.myeducationkey.com/
3 www.bis.org.in

Mapping of CO and PO

	a	b	c	d	e	f	g	h	I	J	k
CO1	√	√	√	√		√	√	√	√		√
CO2	√	√	√	√	√	√		√	√	√	
CO3	√	√	√	√	√	√	√	√	√		√
CO4	√	√	√	√				√		√	

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

Government College of Engineering Karad
First Year M. Tech. Civil-Structural Engineering
SE215: Elective-II - Design of R.C.C. Bridges

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

Course Objectives

1 Post Graduate should understand different types of loads related to construction of roads and bridges.
2 Post Graduate should develop skill of modelling and resolution of force system using mechanics.
3 Post Graduate should understand application of structural mechanics for analysis of bridges .
4 Post Graduate should acquire knowledge of behaviour of bridges subjected to different types of situations.

Course Contents		**Hours**
Unit I	General Basic bridge forms –beam, arch, suspension, various types of bridges, selection of type of Bridge and economic span length, super structure -philosophy, geometric alignment, drainage, road kurb, wall foundation, pile foundation, open well foundation.	06
Unit II	Design loads for bridges –dead load, vertical live load, IRC loading, wind load, longitudinal forces, centrifugal forces, buoyancy, water current forces, thermal forces, deformation and horizontal forces.	05
Unit III	Design of R. C. deck slab, beam and slab, T beam, Pigeaud's theory, Courbon's theory, balanced cantilever bridge, box culvert.	06
Unit IV	Construction techniques -construction of sub structure footing, piles, cassions, construction of reinforced earth retaining wall and reinforced earth abutments, super structure erection method bridge deck construction,by cantilever method, Inspection maintenance and repair of bridges.	04
Unit V	Design of sub structure abutments, Piers, approach slab.	04
Unit VI	Bearing and expansion joints forces on bearings Types of bearings, design of unreinforced elastometric bearings, expansion joints.	05

Tutorial

A set of Tutorial/ problems based on above syllabus is to be submitted.

Course Outcomes

1 Post Graduate will understand different types of loads related to construction of roads and bridges.
2 Post Graduate will be able to develop skill of modelling and resolution of force system using mechanics.
3 Post Graduate will apply structural mechanics for analysis of bridges.
4 Post Graduate will acquire knowledge of behaviour of bridges subjected to different types of situations.

Text Books

1 Concrete Bridge Practice by Dr. V.K. Raina Tata McGraw Hill Pub. Co.
2 Reinforced Concrete Structures Vol II by Dr. B. C. Punmia, Ashok Kumar Jain, Anil Kumar Jain – Laxmi Publications, 1992, 7th Edition.
3 Essential of bridge Eng. By D Johnson Victor, Oxford & IBH Publishing Co. Pvt. Ltd.
4 Concrete bridge design R. E. Rowe, John Willey & sons, 1963, 1st Edition.
5 Design of bridge structure by Jagadesh T. R. Jayram M A Prentice Hall of India Pvt. Ltd.
6 Advanced Reinforced Concrete Design, by N KrishnaRaju, CBS Publication & distributors, 2000, 1st Edition.

Useful Links

1 **nptel**.iitk.ac.in/
2 www.myeducationkey.com/
3 www.wikipedia.Newton.com/

Mapping of CO and PO

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CO1	√	√	√	√	√	√		√	√		√
CO2	√	√	√	√	√		√	√	√	√	
CO3	√	√	√	√	√	√	√	√	√	√	√
CO4	√	√	√	√				√			

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

Government College of Engineering Karad
First Year M. Tech. Civil-Structural Engineering,
SE225: Elective-II - Stability Of Structures

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

Course Objectives

1 Post Graduate should understand concept of structural stability.
2 Post Graduate should understand causes of buckling and structural instability.
3 Post Graduate should be able to use numerical techniques like finite difference method, and energy methods for the analysis of beams and columns.
4 Post Graduate should learn methods for finding the buckling loads for thin plates subjected to in-plane loading

Course Contents		**Hours**
Unit I	Concept of stability: stable, unstable and neutral equilibrium, energy criteria for stability and method of stability analysis.	06
Unit II	Elastic buckling of columns, uniform and varying section volumes, finite Difference method, Rayleigh–Ritz method.	05
Unit III	Buckling of continuous beams Buckling of frames, neutral equilibrium method, matrix approach, and moment Distribution method.	06
Unit IV	Torsional buckling of columns, pure torsion of open sections, torsion – flexure buckling of symmetric and unsymmetric columns (hinged end only)	04
Unit V	Lateral buckling of beams, thin rectangular and I sections, pure bending.	04
Unit VI	Buckling of thin plate subjected to in plane edge forces, governing equation, finite difference method.	05

Tutorial

A set of Tutorial/ problems based on above syllabus is to be submitted.

Course Outcomes

1 Post Graduate will understand concept of structural stability.
2 Post Graduate will understand causes of buckling and structural instability.
3 Post Graduate will be able to use numerical techniques like finite difference method, and energy methods for the analysis of beams and columns.
4 Post Graduate will use numerical techniques for finding the buckling loads for thin plates subjected to in-plane loading

Text Books

1 Theory of Elastic Stability, S. Timoshenkoo and J.N. Gere, 7th Impression edition, McGraw-Hill Book Co., New York, 1961.
2 Principles of Structural Stability Theory, Alexander Chajes, 7th edition, Prentice Hall College Division, March 1974.
3 Theory of Elastic Stability: Analysis and Sensitivity, Luis A. Godoy, 1st edition, CRC Publication, 1999.

Useful Links

1 **nptel**.iitk.ac.in/
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Mapping of CO and PO

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CO1	√	√	√	√	√			√	√	√	√
CO2	√	√	√	√	√	√	√	√	√	√	
CO3	√	√	√	√		√	√	√	√	√	√
CO4	√	√	√	√			√	√			

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

Government College of Engineering Karad
First Year M. Tech. Civil-Structural Engineering,
SE235: Elective-II - Design Of Folded Plates and Shells

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

Course Objectives

1 Post Graduate should understand concept of folded plates and shells with forces acting on it.
2 Post Graduate should understand analysis and design of folded plates
3 Post Graduate should understand analysis and design of shells.
4 Post Graduate should be able to use commercial softwares for analysis and design of folded plates and shells

Course Contents		**Hours**
Unit I	Shells and folded plates Introduction, Behaviour, Different forms, factors governing selection of shell type and Dimensions of folded plates, Advantages and Disadvantages of shell roofs.	06
Unit II	Analysis and Design of cylindrical shells by membrane theory.	05
Unit III	Analysis and Design of cylindrical shells by beam Theory.	06
Unit IV	Shells of Double curvature-Analysis and Design by membrane theory of shells of revolution.	04
Unit V	Anticlastic and synclastic shells of Double curvature. Analysis and Design by membrane Theory.	04
Unit VI	Design of Folded Plates – iteration method and Simpsons method.	05

Tutorial

A set of Tutorial/ problems based on above syllabus is to be submitted.

Course Outcomes

1 Post Graduate will understand concept of folded plates and shells with forces acting on it.
2 Post Graduate will understand analysis and design of folded plates
3 Post Graduate will understand analysis and design of shells.
4 Post Graduate will be able to use commercial softwares for analysis and design of folded plates and shells

Text Books

1 Design and Construction of Concrete Shell Roofs- G.S.Ramaswami CBS Publishers.
2 Analysis of Thin Concrete Shells- K.Chandrashekhara. TMcGH
3 Theory and Design of Concrete Shells- B.K.Chatterjee Oxford &IBH.
4 IS 2204-1962.
5 IS 2210-1962

Useful Links

1 **nptel**.iitk.ac.in/
2 www.myeducationkey.com/
3 www.wikipedia.Newton.com/

Mapping of CO and PO

	a	B	c	d	e	f	g	h	I	j	k
CO1	√	√	√	√	√		√	√	√	√	√
CO2	√	√	√	√	√	√	√	√	√	√	
CO3	√	√	√	√	√	√	√	√	√	√	√
CO4	√	√	√	√				√			

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

Government College of Engineering Karad
First Year M. Tech. Semester-II
SE206: LAB PRACTICE - II

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

Course Objectives:

1 Post Graduate should understand the behaviour of structure under dynamic loading
2 Post Graduate should model the structure mathematically
3 Post Graduate should understand the physics of the problem
4 Post Graduate should understand the design of earthquake resistant structures.

Experiment 1
a. Determination of deflections various forces in a S.S. rectangular plate subjected to u.d.l. using Navier's solution
b. Determination of deflection of various forces in a S.S. rectangular plate subjected to patch load

Experiment 2
a. Determination of deflection of a clamped plate using Levy's method
b. Practical example on determination of forces in a spherical shell

Experiment 3
a. Working problem on determination of forces in a cylindrical shell using membrane theory
c. Write a program for Gauss elimination method of solving simultaneous equations

Experiment 4
a. Analyze a plate by finite difference method
c. Analyze a truss by flexibility method

Experiment 5
a. Develop finite element formulation for a 8 noded plane stress element
c. Study any one FEM based software available in lab. Study mathematical modeling

Experiment 6
a. Study element library available in different software's available in lab
b. Develop assembly subroutine of program for analysis of any continuum structure

Experiment 7
a. Plastic analysis and design of portal frames
b. Design of deck type and through type trussed bridges

Experiment 8
a. Design of R. C. deck slab, beam and slab, T beam bridge
b. Analysis of balanced cantilever bridge, box culvert

Experiment 9
a. Design of sub structure abutments, Piers

Experiment 10
a. Lateral load analysis, Provisions of IS-1893 for buildings, Base Shear
b. Application to Multi-storey buildings, Load combinations

List of Submission

1 Total number of Experiments
2 Total number of sheets
3 Project/Dissertation Report
4 Seminar report
5 Field Visit Report

Additional Information

Course Outcome(CO):

1 Post Graduate will understand the physics of the problem
2 Post Graduate will be familiar with hands on practice.
3 Post Graduate will understand codal provisions and its applications.
4 Post Graduate will learn various softwares in Analysis and design of structures.

Mapping of CO and PO

	a	b	c	d	e	f	g	h	i	j	k
CO1	√	√	√	√	√	√	√	√	√	√	√
CO2	√	√	√	√	√	√	√	√	√	√	√
CO3	√	√	√	√	√	√	√	√	√	√	√
CO4	√	√	√	√	√	√	√	√	√	√	√

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

Government College of Engineering Karad
First Year M. Tech. Civil- Structural Engineering
SE 207: Seminar-I

Seminar Scheme | **Examination Scheme**

Practical 2 Hrs/week | **CA** 50

Total Credits 1

Course Objectives

1 Post graduate should know the state of the art in the relevant subjects of structural engineering.
2 Post graduate should know the experimental procedure to validate theories related to structural engineering.
3 Post graduate should learn how to prepare and present research project.

Course Contents

1 Seminar-I to be delivered by the students on general topic related to structural engineering to be evaluated by three members committee headed by HOD wherein guide should be one of the members.

List of Submission

1 Seminar report duly signed by respective guide and head of department

Course Outcome(CO):

1 Post graduate will know the state of the art in the relevant subjects of structural engineering.
2 Post graduate will know the experimental procedure to validate theories related to structural engineering.
3 Post graduate will be able to prepare and present research project.

Mapping of CO and PO

	A	b	C	d	e	f	G	h	i	j	K
CO1	√	√	√	√	√	√	√	√		√	√
CO2	√	√	√	√	√		√	√	√	√	√
CO3	√	√	√	√	√	√	√	√	√	√	√
CO4	√	√	√	√				√	√	√	

Assessment Pattern

Knowledge Level	CT1	CT2	CA/TA	ESE
Remember			09	
Understand			09	
Apply			08	
Analyze			08	
Evaluate			08	
Create			08	
Total			50	

Government College of Engineering Karad
Second Year M. Tech. Civil- Structural Engineering
SE 301: Seminar-II

Laboratory Scheme
Practical 2 Hrs/week
Total Credits 1

Examination Scheme
CA 50

Course Objectives

1 Post graduate should know the state of the art in the relevant subjects of structural engineering.
2 Post graduate should know the experimental procedure to validate theories related to structural engineering.
3 Post graduate should be able to conduct extensive literature survey in subjects of structural engineering.
4 Post graduate should learn how to prepare and present research project.

Course Contents

1 Seminar-II to be delivered by the students on general topic related to structural engineering to be evaluated by three members committee headed by HOD wherein guide should be one of the members.

List of Submission

1 Seminar report duly signed by respective guide and head of department

Course Outcome(CO):

1 Post graduate should know the state of the art in the relevant subjects of structural engineering.
2 Post graduate should know the experimental procedure to validate theories related to structural engineering.
3 Post graduate should be able to conduct extensive literature survey in subjects of structural engineering.
4 Post graduate should learn how to prepare and present research project.

Mapping of CO and PO

	A	b	C	d	e	F	g	h	i	j	k
CO1	√	√	√	√	√		√	√	√		√
CO2	√	√	√	√	√	√	√	√	√	√	
CO3	√	√	√	√	√	√		√	√	√	√
CO4	√	√	√	√				√		√	√

Assessment Pattern

Knowledge Level	CT1	CT2	CA/TA	ESE
Remember			09	
Understand			09	
Apply			08	
Analyze			08	
Evaluate			08	
Create			08	
Total			50	

Government College of Engineering Karad
Second Year M. Tech. Civil-Structural Engineering
SE 302: Dissertation Phase-I

Laboratory Scheme | **Examination Scheme**
Practical 20 Hrs/week | **TA/CA** 100
Total Credits 10

Course Objectives

1 To perform extensive literature survey on the research topic of work.
2 To identify the problem statement for the research work.
3 To decide methodology for the research work.
4 To carry out initial mathematical modelling or experimental set up.

Course Contents

1 Dissertation (Phase-I): Student has to submit the report and deliver the seminar based on 25% or more work on Dissertation topic. It is to be evaluated internally by three members panel of examiners headed by HOD wherein guide should be one of the members of the panel. Last date of submission of report shall be two weeks before the end of semester.

List of Submission

1 Dissertation report of phase-I duly signed by respective guide and head of department

Course Outcome(CO):

1 Student will perform extensive literature survey on the research topic of work.
2 Student will be able to identify the problem statement for the research work.
3 Student will decide methodology for the research work.
4 Student will be able to carry out initial mathematical modelling or experimental set up.

Mapping of CO and PO

	a	b	C	d	e	f	g	h	i	j	k
CO1	√	√	√	√	√		√	√	√	√	√
CO2	√	√	√	√	√	√	√	√	√	√	
CO3	√	√	√	√		√	√	√	√	√	√
CO4	√	√	√	√				√			

Assessment Pattern

Knowledge Level	CT1	CT2	CA/TA	ESE
Remember			18	
Understand			17	
Apply			16	
Analyze			17	
Evaluate			16	
Create			16	
Total			100	

Government College of Engineering Karad
Second Year M. Tech. Civil-Structural Engineering
SE 401: Dissertation PHASE-II

Laboratory Scheme		**Examination Scheme**	
Practical	30 Hrs/week	**TA/CA**	100
Total Credits	20	**ESE**	200

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

1 Dissertation (Phase-II): Internal assessment of dissertation (complete work) is to be carried out by the guide for 100 marks. The external assessment of dissertation work is to be carried out by panel of examiners consisting of internal (guide) and external examiner for 200 marks. Candidate shall present the entire work on Dissertation, followed by viva-voce.
Last date of submission of dissertation will be the end of the semester. Please see Appendix- C of Rules & Regulation For Further information.

List of Submission

1 Dissertation report of phase-II duly signed by respective guide and head of department

Course Outcome(CO):

1 Student will be able to study technical reports on the research topic of work.
2 Student will be able to carry out detailed mathematical modelling or experimental validation.
3 Student will be able to draw inferences from the findings and present conclusion.
4 Student will be able to learn presentation skills for technical report.

Mapping of CO and PO

	a	b	c	d	e	f	g	h	i	j	k
CO1	√	√	√	√	√		√	√	√		√
CO2	√	√	√	√	√	√	√	√	√	√	
CO3	√	√	√	√	√	√	√	√	√	√	√
CO4	√	√	√	√				√			

Assessment Pattern

Knowledge Level	CT1	CT2	CA/TA	ESE
Remember			18	36
Understand			17	34
Apply			16	32
Analyze			17	34
Evaluate			16	32
Create			16	32
Total			100	200