PG-Structural Engineering Syllabus Year 2018-19





Rajarambapu Institute of Technology, Sakharale

(An Autonomous Institute, affiliated to Shivaji University, Kolhapur)
Curriculum Structure and Evaluation Scheme
To be implemented from 2018-19

Rev: CIVIL-Structural Engineering/Course Structure/RIT/01/2018-19

Department

: Civil Engineering

Class : F.Y. M. Tech. Structural Engineering

Semester: I

Class	s: F.Y. M. Tech. Str	uctura	il Engi	neen	ng			Seme	ster: I		
		,	Геасh	ing S	cheme		Ev	aluati	on Sch	eme	
Course	Course	Course			Theory (Marks) %			Practical (Marks) %			
Code		L	Т	P	Credits	Scheme	Max		% for ssing	Max	Min % for Passing
						ISE	20			-	-
SHP517	Numerical Methods for	3	_	_	3	UT1	15	40	40	-	-
	Structural Engineers					UT2	15		10	-	-
						ESE	50	40		-	-
						ISE	20			-	-
CES1012	Advanced Structural	3	_	_	3	UT1	15	40	40	-	-
0201012	Analysis	3	_			UT2	15		40	-	-
						ESE	50	40		-	-
						ISE	20			-	-
CES1022	Advanced Solid Mechanics	3	-	-	3	UT1	15	40	40	-3	-
CLSTOZZ						UT2	15		40	-	-
						ESE	50	40		•	-
					-	ISE	20		12		-
CES1032	Structural Dynamics and	4	_	_	4	UT1	15	40	40	-	-
CESTUSE	Earthquake Engineering	7	_	-		UT2	15		40	-	-
8' 11						ESE	50	40		-	=
						ISE	20				
PE-I	Program Elective - I	3	-	-	3	UT1	15	40	40		
1 12-1	1 Togram Elective - 1	'			3	UT2	15		40		-
			1			ESE	50	40			
SHP551	Technical Communication	2	-	-	Audit Course		P	/NP			-
CES1042	Structural Design lab I	_		4	2	ISE	-	-	-	50	50
						ESE	-	-	1	50	50
CES1052	Advanced Concrete Technology Lab.	-	-	2	1	ISE	-		1	100	50
CES1062	Mini Project I	-	-	2	1	ISE	-	-	-	100	50
	Total	18	0	8	20						

Total Contact Hours/week : 26 Total Credits : 20

ISE = In Semester Exam, MSE (UT1+UT2) UT-I = Unit Test-I, UT-II = Unit Test-II ESE =

End Semester Exam, P=Pass, NP=Not Pass



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Department: Civil Engineering

Class: F.Y. M. Tech. Structural Engineering

Semester: II

	. T. T. M. Teell. Still				cheme		Eval	uatio		heme	
Course	Course						(Ma	Theory (Marks) %		Practical (Marks) %	
Code		L	Т	P	Credits	Scheme	Max	fo	1 % or	Max	Min % for
						****	• • •	Pas	sing		Passing
						ISE	20	40		-	-
CES2012	Finite Element Analysis in	3	_	-	3	UT1	15	40	40	-	-
	Structural Engineering					UT2	15	40		-	-
			(4)			ESE	50	40		-	-
					11	ISE	20	40		-	-
PE-II	Program Elective - II	3	-		3	UT1	15	40	40	-	-
						UT2	15	40		-	-
						ESE	50	40		-	
,						ISE	20		til	-	
PE-III	Program Elective - III	3	_	_	3	UT1	_ 15	40	40	_	-
	3					UT2	_15			-	-
						ESE	50	40		-	-
	100.00					ISE	20			-	-
PE-IV	Due susure Elections IV	3			3	UT1	15	40	40	-	_
PE-IV	Program Elective - IV	3	-	-		UT2	15		40	-	-
	2					ESE	50	40		-	
V	Research Methodology &					ISE	50	4	0		-
CES2022	Intellectual Property Rights (IPR)	1	1	-	2	ESE	50	4	0	40	-
CECAGA	Standard David Labora			1	2	ISE		-	-	50	50
CES2032	Structural Design Lab II	-	-	4	2	ESE	-	-	-	50	50
CEC2042	Structural Dynamics and			2		ISE	-	-	-	50	50
CES2042	Earthquake Engineering Lab	-	-	2	1	ESE	-	-	-	50	50
CES2052	Mini project II	-	-	4	2	ISE	-	-	-	100	50
a,	Internship *	_	-	-	-	-	_	_	-	-	
	Total	13	1	10	19						

Total Contact Hours/week : 24 Total Credits : 19

* - Student have to complete internship of 4weeks after 2^{nd} semester however evaluation of this will be carried out in 3^{rd} semester.



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> Rev: CIVIL-Structural Engineering/Course Structure/RIT/01/2018-19

Department: Civil Engineering

Class

: S.Y. M. Tech. Structural Engineering

Semester: III

	35				8			Seme	3001.11	_	
		Т	eachi	ng S	cheme		Eval	uation Sc	heme		
Course	Course							Theory (Marks) %		Practical (Marks) %	
Code	Course	L	Т	P	Credits	Scheme	Max	Min % for Passing	Max	Min % for Passing	
CES3012	Internship	-	-	2	Audit	ISE		-	F	P/NP	
CES3022	Self-Learning:MOOC / Certificate course	-	-	-	3	ESE*	-	-	100	50	
CES3032	Dissertation Phase-I	-	12	08	04	ISE#	-	-	100	50	
CES3042	Dissertation Phase-II			12	06	ISE			100	50	
CE55042	Dissertation Phase-II - 12		00	ESE		-	100	50			
	Total	-	-	22	13						

Total Contact Hours/week : 22 **Total Credits**

: 13

* Note:

- 1. If student completes the MOOC course such as NPTEL/SWAYAM etc. which has rigorous evaluation scheme. Student needs complete online/certification course approved by DPGC and produce certificate of online or certification course at the time of ESE. if student fails to produce this certificate, he or she will not be eligible to give ESE of Online/certification course.
- 2. If student completes certificate course such as C++/JAVA/PYTHON/VB, then supervisor has to conduct in semester evaluation and submit marks to COE.

Note:

Topic should be selected based on relevance to societal needs, value addition to existing facilities in the institute, industry need, problems of national importance, research and development in structural engineering. The student should complete the following:

- Comprehensive Literature survey based on papers published in standard journals.
- Gap Analysis
- Problem Identification
- Define dissertation objectives
- o Complete Preliminary design with feasibility analysis
- o Implementation and Validation of models
- o Prepare report and give presentation



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Curriculum Structure and Evaluation Scheme

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Department : Civil Engineering

Class : S.Y. M. Tech. Structural Engineering Semester: IV

		Т	-	ing S	cheme	Evaluation Scheme					
Course Code	Course						Theory (Marks) %		Practical (Marks) %		
		L	Т	ГР	Credits	Scheme	Max	Min % for Passing	Max	Min % for Passing	
CES4012	Dissertation Phase-III	-	-	10	06	ISE	-	-	100	50	
CES4022	Dissertation Viva Voice	-	-	18	10	ISE	_	_	100	50	
	Total	-	-	28	16	ESE			100	50	

Total Contact Hours/week : 28 Total Credits : 16





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Curriculum Structure and Evaluation Scheme

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List of Program Elective- I

Sr. No.	Course Code	Course
1	CES1072	Advanced Design of Steel Structures
2	CES1082	Structural Health Monitoring
3	CES1092	Advanced Concrete Technology

List of Program Elective - II

Sr. No.	Course Code	Course
1	CES2062	Advanced Earthquake Engineering
2	CES2072	Theory and Application of Cement Composites
4	CES2082	Structural Optimization

List of Program Elective- III

Sr.No.	Course Code	Course
1	CES2092	Design of Bridges and Flyovers
2	CES2102	Design of Pre-stress Concrete Structures.
4	CES2112	Theory of Thin Plates and Shell

List of Program Elective – IV

Sr.No.	Course Code	Course
1	CES2122	Design of Advanced Concrete Structures
2	CES2132	Design of Industrial Structures
3	CES2142	Design of Formwork





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SEMSTER - I





Rajarambapu Institute of Technology, Sakharale

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Syllabus (Theory Courses)

To be implemented from Academic Year 2018-19

Rev: CIVIL-Structural Engineering/Course Structure/RIT/01/2018-19

Class:- F.Y. M. Tech. Structural Engineering	Semester-I
Course Code: CES1012	Course Name: Advanced Structural Analysis

L	Т	P	Credits
3			3

Course Description:

Advanced Structural analysis is offered as core course at the first semester of Civil Structural Engineering post graduate program. This course is focuses on basic concept and different analytical tools for understanding the behavior of especially of statically indeterminate structures. This course divided into four modules. The first module contains influence line diagram for cantilever, fixed, continuous beams, portal frames and arches. The Second module focuses on analysis beams curved in plan and Beam-Columns. The module three includes member oriented and structure oriented stiffness and flexibility matrix methods. Module four contains Boundary value problems

This course intends to build the competency in the students to identify indeterminate structures, and to analyze the structures like fixed beam, continuous beam, arches and portal frames. Also advanced topic such as beams curved in plan, beam-column analysis, matrix methods of analysis of structures and solution of boundary value problems

Course Learning Outcomes:

After successful completion of the course, students will be able to,

- 1. Construct of ILD for reactions, S.F. and B.M. for indeterminate structures
- 2.Draw SFD, BMD and TMD for beams curved in plan for various loading and support condition
- 3. Analyze the beam-columns
- 4. Analyze the skeleton structures using stiffness analysis
- 5. Use direct stiffness method understanding its limitations

Prerequisite:

The course learns through prerequisite courses of Engineering Mathematics, Engineering Mechanics, Solid Mechanics and Theory of Structures should have a clear understanding of methods of analysis of structures.





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Syllabus (Theory Courses)

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Cours Unit	se Content	
No	Description	Hrs
1.	Influence Lines:	06
	Physical Significance, Muller Breslau's Principle, Moment distribution method,	
	ILD for propped cantilever, fixed beams, continuous beam, portal frames and two	
	hinged arches	
2.	Beams Curved in Plan:	06
	Analysis of determinate and indeterminate beams curved in plan such as cantilever	
	circular arch, semicircular beams fixed at two ends subjected to point load and udl,	
	simply supported semicircular beams, circular ring beam.	
3.	Beam Columns:	06
	Governing differential equation, geometric and material nonlinearity, analysis of	
	beam- columns simply and fixed supported at ends with concentrated load, moment	
	and uniformly distributed load, magnification factor	
4.	Member Oriented Stiffness Matrix:	06
	Stiffness matrices for beam, truss, plane frame, pin and rigid jointed space frame	
	element on member axis, transformation of matrices on structure axes, overall joint	
	stiffness matrix and nodal vector, assembly rules, calculation of member end forces	
5.	Structure Oriented Stiffness Method:	
	Flexibility and stiffness matrices, analysis of continuous beams, trusses and plane	
	frames by structure oriented approach	
6.	Boundary Value Problems:	06
	Approximate solution of boundary value problems, Modified Galerkin Method for	
	one-dimensional BVP, Matrix formulation of the Modified Galerkin Method	





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References -

Text Books:

- 1. Vazirani and Ratwani,- Advanced Theory of Structures & Matrix method, Khanna Publisher, Delhi
- 2. C.S. Reddy,- Basic structural Analysis, Tata Mc Graw Hill, Delhi

Reference Books:

- 1. Timoshcnko and Gere, Strength of Materials Vol II, East West Press Ltd.
- 2. Gere and Weaver, Matrix Analysis of Framed Structures, CBS Publishing, Delhi.
- 3. Pandit & Gupta, Structural Analysis A matrix approach, Tata Mc Graw Hill, Delhi
- 4. Negi and Jangid, -Structural Analysis, Tata McGraw Hill Pub.Co.Delhi
- 5. Thimoshenko, Strength of Materials Vol. II, East-West Press ltd.
- 6. N. Krishnaraju and D.R. Gururaja,- Advanced Mechanics of Solids & Structures, Narosa Pub. House delhi,
- 7. C. K. Wang, Indeterminate Structural Analysis
- 8. Lewis P. E. and Ward J. P., -The Finite Element Method, Addison-Wesley Pub.Co.
- 9. Meek J. L., E and FN, -Computer Methods in Structural Analysis, Span Pub.
- 10. Desai and Able, The Finite Element Method, CBS Publication





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Syllabus (Theory Courses)

To be implemented from Academic Year 2018-19

Rev: CIVIL-Structural Engineering/Course Structure/RIT/01/2018-19

Class: First Year M.Tech. Structural Engineering	Semester: I
Course Code: CES1022	Course Name: Advanced Solid Mechanics

L	T	P	Credits
3		-	3

Course Description:

This course is introduced at first semester of F Y M Tech Structural Engineering as core course. It consists of study of stress, strain and displacement of deformable bodies and relationship between them. Also, torsion of solid non-circular cross sections and thin tubes is included in this course. Plasticity, yield criteria and elasto-plastic loading for beams and thick cylinders are also studied in this course.

Course Learning Outcomes

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

- 1. Analyze bodies for stresses and strains.
- 2. Analyze prismatic bars and tubes subjected to torsion
- 3. Analyze beams and thick cylinders for elasto-plastic loading.

Prerequisite: This course requires the knowledge of basic mathematics and structural analysis.

Unit No	Description	Hrs
1.	Stress Basic concepts of continuum, concept of stress, equilibrium equations, stress on oblique plane, stress transformation, principal stresses, stress invariants, deviatoric stresses, maximum shear stress, octahedral stresses, plane stress.	06
2.	Strain Strain at a point, concept of strain, strain components, compatibility equations, strain transformation, principal strains, strain invariants, deviatoric strains, maximum shear strain, octahedral strains, plane strain	06
3.	Stress-strain relations Generalized Hooke's law, stress strain relationship for isotropic material, strain displacement and compatibility relations, Airy's stress function and its applications.	06
4.	Torsion Torsion of Prismatic Bars:Saint Venant's method, Prandtl's membrane analogy, torsion of elliptical, triangular and rectangular bar, torsion of thin tubes.	06





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5.	Plasticity Strain Hardening, Idealized Stress- Strain curve, yield criteria, vonMises yield criterion, Tresca yield criterion, plastic stress-strain relations, principle of normality and plastic potential, isotropic hardening.	
6.	Elasto-Plastic loading Beams under elasto-plastic condition, collapse load, plastic hinge, elasto-plastic deflections of beams of rectangular cross sections, residual stresses, thick- walled cylinders.	0

References:

- 1. S.P. Timoshenko & J. N. Goodier, "Theory of Elasticity", Mc Graw Hill International Editions, 1988
- 2. Sadhu Singh, "Theory of Elasticity", Khanna Publishers, 2002
- 3. Sadhu Singh, "Theory of plasticity", Khanna Publishers, 2002
- 4. S. M. A. Kazimi, "Solid Mechanics, Tata McGraw Publishing Company Limited, 1990
- 4. L.S. Srinath, "Advanced Mechanics of Solids, McGraw Publishing Company Limited, 2003
- 5. Continuum Mechanics by Valiappan, Mc. Graw Hill
- 6. Arthur P. Boresi and Richard J. Schmidt, "Advanced Mechanics of Materials", Wiley, India, 2009





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Rev: CIVIL-Structural Engineering/Course Structure/RIT/01/2018-19

Class:- First Year M. Tech Structural Engineering	Semester-I
Course Code: CES1032	Course Name: Structural Dynamics & Earthquake Engineering

L	T	P	Credits
4		-	4

Course Description:

Structural Dynamics is offered as a core course at the first semester of Civil Structural Engineering postgraduate programme. This course focuses on vibrations types and their causes. Response for single and multiple degree of freedom system by fundamental theory. This course also throws light on response by numerical methods. This course also focuses on elements of seismology and static method for lateral load evaluation.

This course intends to build the competency in the students to evaluate responses developed due to vibrations caused by various means. This theoretical knowledge will help to student for studying behavior of structures under earthquake loading.

Course Learning Outcomes:

After successful completion of this course students will be able to:

- 1. Analyze and study of the response of single and multi-degree freedom systems by fundamental theory and equations of motion.
- 2. Analyze and study of the response of single and multi-degree freedom systems by numerical methods.
- 3. Develop mathematical solutions to predict system response subjected to dynamic loads
- 4. Explain causes, measurements and sources of earthquakes.
- 5. Evaluate lateral loads developed on multi-storeyed structures by the Response Spectrum Analysis Method and Static Equivalent Method.

Prerequisite:

As a prerequisite to study this course, the students must possess the knowledge of D'Alembert's principle, differential equations and Integration by parts.

	Course Content	
Unit No	Description	Hrs
1.	Introduction	08
	Introduction to dynamic problems of Civil Engineering, Concept of degrees of	
	freedom, D'Alembert's principle, Types of vibrations, Principle of virtual	
	displacement and energy, Single degree of freedom systems, Examples of Single	





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	1
degree of freedom systems in Engineering, Free vibration of damped and undamped	a
systems. Mathematical modeling of dynamic system. Equivalent stiffness.	
 Single Degree of Freedom Systems Free and force vibration with and without damping, Response to harmonic loading, Response to general dynamic loading, Duhamel integral solution, Response to suddenly applied load and triangular pulse loading, Vibration isolation transmissibility, Methods of damping measurements, Response of Single degree of freedom systems to arbitrary excitation, Principles of vibration measuring instruments. Numerical Methods: 	o i, f
Numerical methods of frequency analysis, Rayleigh's method and matrix iteration methods, Stadola method, Newmarks method, Direct integration method.	
4. Multiple Degree of Freedom System Two and multiple degrees of freedom system, Determination of Natural Frequence and normal modes, Orthogonality of modal vectors, Shear building model without damping and with proportional damping,	
5. Introduction Engineering seismology: Earthquake phenomenon, cause of earthquakes-Faults- plate seismic tectonic waves- Terms associated with earthquakes-Magnitude/Intensity of an earthquake scales- Energy released-Earthquake measuring instruments-seismograph accelerograph, Characteristics of strong ground motions - Seismic zones of Indi Earthquake prediction.	:- h
6. Conceptual design Introduction-Functional planning, continuous load path, overall form, simplicity and symmetry, elongated shapes, stiffness and strength, Horizontal and Vertice members, Twisting of buildings, Ductility, definition, ductility relationship flexible buildings, framing systems, choice of construction materials, Introduction to earthquake resistant design: seismic design requirements, regular and irregulation configurations, basic assumptions, design earthquake loads, basic load combinations, permissible stresses, seismic methods of analysis, factors in seism analysis, Evaluation of equivalent lateral forces, response spectrum method at Time history method.	nl s, n ir d





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References -

Text Books:

- 1. Mechanical Vibrations, Grover,
- 2. Structural Dynamics and Introduction of Earthquake Engineering, Chopra A. K.
- 3. Structural Dynamics: Theory and Computation, 2nd Edition, Mario Paz, CBS Publisher ISBN: 9788123909783, 8123909780.
- 4. Earthquake Resistant Design of Structures, P. Agarwal & M. Shrikhande, Prentice Hall Publications.
- 5. Elements of earthquake Engineering, Jai Krisna, A. R. Chandrashekharan& B. Chandra, South Asian Publishers Private Limited.

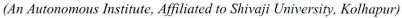
Reference Books:

- 1. Structural Dynamics: Vibrations and Systems, MadhujitMukophadhyay, Publisher: ANE Books ISBN: 9788180520907, 8180520900 Edition: 01, 2008.
- 2. Dynamics of Structures, R,W. Clough and J.Penzien, McGraw Hill Education, 2nd revised Edition, 1993, ISBN -10: 0071132414, ISBN -13: 978-0071132411.
- 3. Theory of Vibration with applications, Willaim Thomson, CRC Press; 4th edition, 1996, ISBN -10: 0748743804, ISBN -13: 978-0748743803.
- 4. I. S. 1893 2016, Criteria for Earthquake Resistant Design of Structures.



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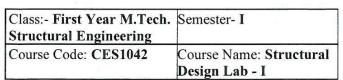
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Syllabus (Laboratory Courses)

To be implemented from Academic Year 2018-19

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L	Т	P	Credits
-	-	4	2

Course Description:

Structural design lab – I is the core laboratory course offered in first semester of M. Tech. Structural Engineering program. This laboratory course is mainly focused on analysis and design of steel structures using standard software packages like STAAD- Pro, ETABS and SAP etc. Students are expected to design various steel structures and prepare drawing of the same.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

- 1. Analyze and design of the steel structures such as truss, Towers, Steel Building Frame and Hoarding Board etc. using standard software packages.
- 2. Interpret the results of analysis and design obtained from the software.
- 3. Prepare drawings of detailing of structural elements.

Prerequisite:

As a prerequisite to this course student must know limit state design of steel structures

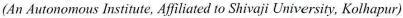
Course Content				
Experiment No	Description	Lab Hrs		
1.	Analysis and design of truss	5		
2.	Structural drawing of truss	4		
3.	Analysis and design of transmission tower	5		
4.	Analysis and design of steel building (Frame)	5		
5.	Analysis and design of hoarding boards	. 5		

References -

- 1. M. R. Shiyekar, "Limit State Design in Structural Steel", , PHI Learning.
- 2. K. S. Sai Ram, "Design of Steel Structures", Pearson.
- 3. S. K. Duggal, "Design of Steel Structures", Tata Mc-Graw Hill publishing company Ltd., New Delhi
- 4. Dr. N. Subramanian, "Design of Steel Structures", Oxford University Press, New Delhi.
- 5. J.E.Lothers, "Design in Structural Steel Structures", Prentice Hall New Jersy

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Syllabus (Laboratory Courses)

To be implemented from Academic Year 2018-19

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Class: First Year M. Tech. Structural Engineering	Semester- I	
Course Code: CES1052	Course Name: Advanced Concrete Technology Lab	

I	,	T	P	Credits
-		-	2	01

Course Description:

The Advanced Concrete Lab course focuses on the experimental study of properties of various concrete ingredients and concrete elements / structure in order to analyze the quality and durability aspects. The course deals mix design methods of some special concretes and study of their properties in fresh and hardened state. The course aims to carry out condition survey of any structure for assessing its quality status using various standard and advanced NDT tools / equipment.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

- 1. determine properties of ingredients and different types of concretes (ordinary & special) using standard procedures.
- 2. design ordinary and special concretes using existing and new methods of mix design.
- 3. perform various durability and non-destructive tests on concrete elements / structures using standard and advanced tools / equipment for assessing the quality.
- 4. examine the concrete elements / structures by carrying out condition survey and recommend appropriate methods / techniques for their repair / strengthening works.

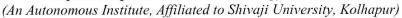
Prerequisite:

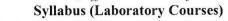
Fundamental knowledge of basic ingredients of concrete and properties of ordinary concrete

Experiment No	Description
1.	Experimental verification of properties of ingredients of various types of concrete
2.	Design of concrete Mixes of Ordinary and Special Concretes – HSC, SCC,
3.	Tests to determine properties of special concrete in fresh and hardened state- a. Workability tests b. Compressive Strength
4.	Experimental study of behavior of concrete members under flexure /shear.



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5.	Nondestructive Testing of concrete elements/structure using standard and advanced NDT equipment.
6.	Durability Tests on Concrete (minimum two tests) a. Carbonation Test b. Water Permeability Test c. Effect of elevated temperatures d. Effect of acids, sulphates and chlorides e. Rapid Chloride Penetration Test
7.	Condition survey of any structure for assessing its present condition to provide the quality status.

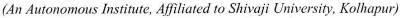
References -

Reference Books:

- 1) Design of Concrete Mixes by Krishna Raju
- 2) Concrete Microstructure, Properties and Material by P. Kumar Mehta &Paulo J. M. Monteiro
- 3) Concrete Technology by M.S. Shetty (S. Chand)
- 4) Properties of Concrete by A. M. Neville
- 5) Concrete Technology by A.R. Santhakumar



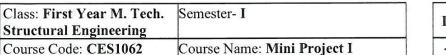
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L	T	P	Credits
-		2	01

Laboratory Work (Mini Project):

Mini project shall be delivered on one of the advanced topics chosen in consultation with the supervisor, based on dissertation work/ societal problem / special structure. A hard copy of the report (25 to 30 pages A4 size, 12 fonts, Times New Roman, single spacing single side printed, preferably in TRM format) should be submitted to the Department Post Graduate Committee (DPGC) before delivering the seminar. A copy of the report in soft form must be submitted to the supervisor, along with other details, if any. Minimum 03 presentations should be delivered by the students.

Course Outcomes:

After successful completion of the course, students will be able to,

- 1. Identify research problem
- 2. Prepare and present statement of Purpose
- 3. Perform analysis work.
- 4. Communicate with outside agencies.
- 5. Write report and Present the work carried out.
- 6. Develop self-learning ability.





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Class: First Year M. Tech. Structural Engineering	Semester-I
Course Code: CES1072	Course Name: Advanced Design of Steel Structures (PE I)

L	Т	P	Credits
3	ı	1	3

Course Description: This course is introduced at the first semester of F Y M Tech Structural Engineering as program elective. It consists of design of steel structures, components, design of plate girders, beam-columns, portal frames, cold formed light gauge steel sections, composite sections and bolted and welded connections.

This course intends to build confidence in students to design elements steel structures and their connections.

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

- 1. Design plate girder, beam columns, portal frames, cold formed light gauge steel sections, composite sections.
- 2. Design welded and bolted connection.

Prerequisite: This course requires the knowledge of structural analysis and design of basic structural elements of steel structures.

Unit No	Description	Hrs	
1.	Plate girder Introduction, plate buckling, web buckling in shear, tension field action, design of plate girder,	06	
2.	Design of beam-columns Introduction, general behavior of beam-columns, P-Δ effects, elastic lateral-torsional buckling of beam columns, interaction between beam-column and structure, design of beam columns, beam-columns subjected to tension and bending, crane columns.		
3.	Design of portal frames Introduction, plastic analysis of rectangular portal frames, plastic analysis of gable portal frames, design of portal frames.	06	
4.	Cold formed light gauge steel sections Introduction, behavior of light gauge sections, design of axially loaded compression members, design of beams. deflection calculation.	06	



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5.	Composite beams:	06
	Introduction, elastic behavior, shear connectors, ultimate load behavior of composite beam, serviceability limit state.	
6.	Connections	06
	Bolted connections, behavior of bolted connections, design strength, block shear	
	failure, truss joint connections, design of seat connection, web angle connection,	
	eccentrically loaded connections, beam splices, column splices, welded	
	connections, design of welds for truss members, angle seat connections, web	
	angles and end plate connections, moment resistant connections, beam and	
	column splices, tubular connections.	

Reference Books:

- 1. N. Subramanian, "Design of Steel Structures", Oxford University Press, New Delhi 2008
- 2. K. S. Sai Ram, "Design of Steel Structures", Pearson, 2012
- 3. M. R. Shiyekar ,"Limit State Design in Structural Steel", , PHI Learning Private Limited, 2010
- 4. S. K. Duggal, "Design of Steel Structures", Mc-Graw Hill Education (India) Private Limited, 2009.
- 5. Dayaratnam, "Design of Steel Structures", Wheeler Publishing, New Delhi.
- 6. IS:800-2007, General Construction in Steel- Code of Practice
- 7. IS:811-1987
- 8. IS:4923-1997
- 9. IS:11384-1985





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Rev: CIVIL-Structural Engineering/Course Structure/RIT/01/2018-19

Class: First Year M. Tech Structural Engineering	Semester-I
Course Code: CES1082	Course Name: Structural Health Monitoring

L	Т	P	Credits
3			3

Course Description:

Structural Health Monitoring is offered as an Elective course at the first semester of Civil Structural Engineering postgraduate programme. This course focuses on various facts of Health monitoring of existing damaged structures. Various materials used in carrying out rehabilitation works forms the important aspect of this course. The course throws light on effects of various weathering agencies on serviceability and durability of the structures. It also includes preventive measures on various aspects and provides the information on inspection, assessment procedure for evaluating a damaged structure, causes of deterioration and testing techniques. The course covers the basic principles and methods for strengthening the existing structures.

This course intends to build the competency in the students to diagnose the causes of damaged concrete structures and analyze for rehabilitating them with suitable repair techniques or methods.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

- 1. Carry out non-destructive testing of various elements of the structure for streng evaluation of existing structures.
- 2. Demonstrate various techniques for strengthening the existing structures.
- 3. Explain the assessment procedure for evaluating a damaged structure.

Prerequisite:

As a prerequisite to study this course, the students must possess the knowledge of concrete technology as a whole, the basic chemistry of the concrete and various mechanisms involved in the concrete.

Unit No	Description	Hrs
1.	Structural audit:	06
	Definition and objective of Condition survey, stages of condition survey	
	(Preliminary, Planning, Inspection and Testing stages)	
	Possible defects in concrete structures, quality control of concrete structures	





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	Definition and need, Quality control applications in concrete structures, NDT as an	
	option for Non-Destructive Evaluation (NDE) of Concrete structures, case studies	
	of a few NDT procedures on concrete structures.	
2.	- 100 mm - 1	06
	Introduction to NDT - Situations and contexts, where NDT is needed, classification	
	of NDT procedures, visual Inspection, half-Cell electrical potential methods,	
	Schmidt Rebound Hammer Test, resistivity measurement, electromagnetic	
	methods, radiographic Testing, ultrasonic testing, InfraRed thermography, ground	
50700004	penetrating radar, radio isotope gauges, other methods.	
3.		06
	Definitions: Maintenance, repair and rehabilitation, importance of Maintenance,	
	Preventive measures on various aspects Inspection, Assessment procedure for	
	evaluating a damaged structure, causes of deterioration, testing techniques.	
4.	Materials and Methods for Repairs and Rehabilitation:	06
	Rust eliminators and polymers coating for rebar during repair foamed concrete,	
	mortar and dry pack, vacuum concrete, Gunite and Shotcrete, Epoxy injection,	
	Mortar repair for cracks, shoring and underpinning.	
5.	Introduction to Structural Health Monitoring (SHM):	
	Definition & motivation for SHM, SHM - a way for smart materials and structures,	
	analog between the nervous system of a man and a structure with SHM	
6.	Application of SHM in Civil Engineering:	06
	Introduction to capacitive methods, capacitive probe for cover concrete, SHM of a	
	bridge, applications for external post tensioned cables, monitoring historical	
	buildings.	
	oundings.	

References -

Text Books:

- 1. R. T. Allen and S. C. Edwards, "Repair of concrete structures", Blakie and Sons, UK, 1987.
- 2. **Denison Campbell, Allen and Harold Roper**, "Concrete structures", Materials, Maintenance and Repair, Longman Scientific and technical UK, 1991.
- 3. SP25-84, "Hand book on causes and prevention of cracks on buildings", Indian standards.
- 4. M. S. Shetty, "Concrete Technology- Theory and Practice", S. Chand and Company, New Delhi, 1992.

Reference Books:

- 1. Hand book on "Repair and Rehabilitation of RCC Buildings", Published by Director General, CPWD, Govt. of India, 2002.
- 2. Johnson. S.M., "Deterioration, maintenance and repair of structures", McGraw-Hill book company, New York, 1965.
- 3. Daniel Balageas, Claus Peter FritzenamI Alfredo Guemes, Structural Health Monitoring, Published by ISTE Ltd., U.K. 2006.





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Class: First Year M. Tech. Structural Engineering	Semester-I	
Course Code: CES1092	Course Name:	
	Advanced Concrete Technology	

L	Т	P	Credits
3	-		3

Course Description:

The Advanced Concrete Technology course focuses on properties of newly developed concrete ingredients such as supplementary cementitious materials, artificial sand, chemical and mineral admixtures etc. The quality control and durability aspects of the concrete are also considered in the course content. The course throws light on various types of special concretes, mix design methods, manufacturing processes, properties in fresh and hardened state. The course aims to give updated information in the field of concrete technology involving modern trends and techniques.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

- 1. illustrate the micro-structural aspects associated with concrete/concrete ingredients and their effect on concrete quality, strength and durability properties.
- 2. design special concretes using existing and new methods of mix design.
- 3. explain various types of special concretes, their properties and methods of manufacturing and placing.
- 4. discuss various special processes and new techniques involved in various concreting iobs.
- 5. analyze qualities of fresh and hardened concrete / concrete elements using appropriate destructive or non destructive testing methods for evaluating quality.
- 6. identify and discuss various mechanisms affecting durability of concrete / concrete structures /elements.

Prerequisite:

Fundamental knowledge of basic properties of concrete ingredients is required.





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	Course Content			
Unit No	Description	Hrs		
1.	Micro-structural aspects of cement and concrete Ingredients of concrete, phases in concrete, microstructure of cement paste, microstructure of concrete, microstructure investigation methods, basic properties of concrete, mineral and chemical admixtures, effect of admixtures on concrete properties.			
2.	Methods of Concrete mix design Mix design: Review of methods and philosophies of IS, BS and ACI methods, mix design for special purposes, acceptance criteria for compressive strength of concrete. Design of high strength and high performance concrete, design of self compacting concrete. Rheological behavior of fresh concrete, properties of fresh and hardened concrete.	06		
3.	Special Concretes - light weight concrete, foamed concrete, sulphur concrete and sulphur infiltrated concrete, high strength concrete, high performance concrete, self compacting concrete, pervious concrete, polymer concrete, fibre-reinforced concrete, refractory concrete, high density and radiation-shielding concrete, geopolymer concrete.	06		
4.	Special processes and technology for particular types of structure Sprayed concrete, underwater concrete, grouts, grouting and grouted concrete, mass concrete, slip form construction, pumped concrete, concrete for liquid retaining structures, vacuum process, concrete coatings and surface treatments.	06		
5.	Test methods Analysis of fresh concrete, Accelerated testing methods, Tests on hardened concrete, Core cutting and testing, partially destructive testing, advanced non-destructive testing methods of concrete structures: ground penetration radar, probe penetration, break off maturity method, stress wave propagation method, electrical/magnetic methods, nuclear methods and infrared thermographs.	06		
6.	Durability of concrete and concrete construction Durability concept, permeability of concrete, reinforcement corrosion, fire resistance, frost damage, sulphate attack, alkali silica reaction, delayed	06		



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ettringite formation, methods of providing durable concrete, short-term tests to assess long-term behavior.

References -

Reference Books:

- 1) Design of Concrete Mixes by Krishna Raju
- 2) Concrete Microstructure, Properties and Material by P. Kumar Mehta &Paulo J. M. Monteiro
- 3) Concrete Technology by M.S. Shetty (S. Chand)
- 4) Properties of Concrete by A. M. Neville
- 5) Concrete Technology by A.R. Santhakumar





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Class: First Year M. Tech Structural Engineering	Semester-I
Course Code: SHP517	Course Name: Numerical Methods for Structural Engineers

L	Т	P	Credits
3	=		3

Course Description:

Numerical Methods for Structural Engineers is a core subject introduced at Semester I of first year M. Tech. Civil Structural Engineering. This course intends to build the competency in the students to apply the knowledge of mathematics to the solution of engineering problems and to analyze it.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

- 1. Estimate the error.
- 2. Apply the relevant numerical method for interpolating the polynomial
- 3. Develop the equation to be fitted and fit the curve for given data
- 4. Estimate numerically the solution of given algebraic equation.
- 5. Use the relevant method for solving the simultaneous linear equations and compute the Eigen values.
- 6. Construct the fuzzy set for given linguistic variable and apply fuzzy logic.

Prerequisite:

Undergraduate Engineering Mathematics

Unit No.	Details of Content	Hrs.
1.	Unit-IError Analysis and Estimation: Error and their analysis, A general error formula, Error in numerical computations, Error in series approximation.	6
2.	Unit-II Interpolations: Introduction, Finite differences, Relation between operators, Differences of a polynomial, Factorial notation, Missing term technique, Lagrange's interpolation formula, Newton's Divided difference formula.	-6





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3.	Unit-III Curve Fitting:	6
	Method of least squares, Fitting a straight line, Fitting of an exponential	
	curve $y = ae^{bx}$, Fitting of the curve $y = ax^b$, Fitting of the curve $y = ab^x$,	2
	Fitting of the curve of the type $xy = b + ax$, Fitting of the curve $y = ax + bx^2$.	
4.	Unit-IV Solution of Nonlinear Algebraic and Transcendental Equations Muller's Method, Horner's Method, Multiple roots, Lin Bairtow's Method, Graeffe's Squaring Method.	6
5.	Unit-VElements of Matrix Algebra: Gaussian Elimination method, Gauss Jordan method, LU- decomposition from Gaussian Elimination method, Solution of Tridiagonal Systems, Eigen Value problems.	6
6	Unit-VI Fuzzy Logic Theory and Applications: Classical logic theory, Logical functions of the Two Valued logic, Boolean algebra. Multi valued logic, Fuzzy logic and approximate reasoning, Fuzzy relations, Applications of fuzzy logic for product quality evaluation, Decision making for investment.	6

Reference Books:

- 1. An Introduction to Numerical Analysis, Atkinson K. E., J. Wiley and Sons, 1989.
- 2. Theory and Problems of Numerical Analysis, Scheid F, McGraw Hill Book Company, (Shaum Series), 1988.
- 3. Introductory Methods of Numerical Analysis, Sastry S. S, Prentice Hall of India, 1998.
- 4. Fuzzy Mathematics, M. S Bapat, ShivajiUnivesrsity, Kolhapur, 2015.
- 5. Introduction to Fuzzy Systems, Guanrong Chen, Trung Tat Pham, Chapman and Hall/CRC Taylor

and Francis Group.





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Class:- First Year M. Tech. Structural Engineering	Semester-I	
Course Code: SHP551	Course Name: Technical Communication	

L	Т	P	Credits
2			Audit Course

Course Description:

This is the core course offered in first semester of M. Tech. Structural Engineering to enhance corporate communication of students.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

- 1. Acquire skills required for good oral and written communication
- 2. Demonstrateimproved writing and reading skills
- 3. Ensure the good quality of oral and written communication

Course Content		
Unit No Description		Hrs
1.	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	06
2.	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism,	06
3.	Sections of a Paper, Abstracts, Introduction, Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	06
4.	4 key skills needed when writing a Title, key skills needed when writing an Abstract, key skills needed when writing an Introduction, skills needed when writing a Review of the Literature,	06
5.	Key skills needed when writing the Methods, skills needed when writing the Results, skills needed when writing the Discussion, skills needed when writing the Conclusions, useful phrases, how to ensure good quality of the paper at the time of submission	06
6.	Resume Writing, e-Mails, Interview skills , Dos and Don'ts while Answering, FAQs, GROUP DISCUSSION: Structured and Unstructured GD, Opening and Closure, Showing Agreement and Disagreement	06





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References -

Text Books:

- 1. Goldbort R, Writing for Science, Yale University Press (available on Google Books), 2006
- 2. Day R , How to Write and Publish a Scientific Paper, Cambridge University Press, 2006
- 3. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book, 1998.
- 4. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
- 5. John Seely, Oxford Guide to Effective Writing and Speaking; Oxford University Press, 2009.
- 6. Thomas N. Huckin and Leslie A. Olsen, Technical Writing and Professional Communication for Nonnative Speakers of English; Tata McGraw Hills, International Edition, 1991.
- 7. Jeff Butterfield, Soft Skills for Everyone, Cengage Learning India Private Limited, 2010





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SEMSTER - II





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Class:- First Year M. Tech Structural Engineering	Semester-II	L	Т	P	Credits
	Course Name: Finite Element Analysis in Structural Engineering	3	-	1	3

Course Outcomes:

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

- 1. Use Finite Element Method for structural analysis.
- 2. Execute the Finite Element Program/ Software.
- 3. Solve continuum problems using finite element analysis.

Course Content			
Unit No	Description	Hrs	
1.	Introduction:	06	
	Principle of minimum potential energy, finite element procedure.		
	discretization, nodes, element incidence, displacement model, application to		
	springs, bars with constant and variable cross sections subjected to axial		
	forces, nodal equilibrium equations, assembly of global stiffness	0.6	
2.	2D problems:	06	
	Development of element stiffness matrix and nodal load vector for truss, beam and plane frame elements, transformation of matrices, relevant		
	structural engineering applications		
3.	3D problems:	06	
3.	Pascal's triangle, Convergence requirements and compatibility conditions,	VV	
	element aspect ratio, half band width, development of element stiffness		
	matrix and nodal load vector for tetrahedron, hexahedral elements		
4.	Application to Solid Mechanics:	06	
	Plane Stress, CST element, plane strain rectangular element, Shape		
	function, Natural coordinate systems, Isoparametric formulation, 1D &		
	2D isoparametric elements, axi-symmetric elements		
5.	Plate and Shell Elements:	06	
	Formation of stiffness matrix for plate bending elements of triangular and		
	quadrilateral shapes, types of shells elements, formation of stiffness matrix		
	for cylindrical thin shell element		
6.	Computer Implementation:	06	
	FEM procedure, Pre-processing, solution, post-processing, use of		
	commercial FEA software, Result interpretation		





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Reference Books:

- 1. O.C. Zienkiewicz& R.L. Taylor, The Finite Element Method Vol. I & II, Tata McGraw Hill
- 2. J.N. Reddy, An introduction to the Finite Element Method, Tata McGraw Hill Pub.
- 3. R. D. Cook, Concept and Application of Finite Element Analysis, John Wiley & sons
- 4. Hutton D.V., Fundamentals of Finite Element Analysis, Tata McGraw Hill Pub.
- 5. C. S. Desai & J. F. Abel, Introduction to the Finite Element Method, CBS Pub.
- 6. C. S .Krishnamoorthy, Programming in the Finite Element Method, Tata McGraw Hill
- 7. T. R. Chandrupatla and Belegundu, Introduction to the Finite Element in Engineering-Prentice Hall of India, pvt.ltd
- 8. Bathe K.J., Finite Element Procedures, PHI learning pvt.ltd
- 9. Y.M. Desai, T.I Eldho, Finite Element Method with application in Engineering, Pearson, Delhi
- 10. Seshu P., Finite Element Analysis, Prentice-Hall of India
 - 11. Buchanan G.R., Finite Element Analysis, McGraw Hill Publications, New York





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To be implemented from Academic Year 2018-19

Rev: CIVIL-Structural Engineering/Course Structure/RIT/01/2018-19

Class:- First Year M. Tech. Structural Engineering	Semester-II
Course Code : CES2022	Course Name: Research Methodology & Intellectual Property Rights (IPR)

L	Т	P	Credits
1	1		2

Course Description:

Research Methodology and Intellectual Property Rights (IPR) is offered as a core course in second semester of structural engineering PG program.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

- 1. Formulate a research problem.
- 2. Analyze research related information
- 3. Prepare and present research proposal/paper by following research ethics
- **4.** Make effective use of computers and computing tools to search information, analyze information and prepare report.
- 5. Describe nature and processes involved in development of intellectual property rights

Course Content				
Unit No	Description	Hrs		
1.	Meaning of research problem, Sources of research problem, Criteria and Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.	06		
2.	Effective literature studies approaches, Plagiarism, Research ethics, Approaches of investigation of solutions for research problem, data collection, Data analysis with software, interpretation, Necessary instrumentations	06		
3.	Effective technical writing, how to write technical report and paper, Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee	06		





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4.	Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property, Procedure for grants of patents, Patenting under PCT.	06
5.	Patent Rights: Scope of Patent Rights, Licensing and transfer of technology, Patent information and databases, Geographical Indications.	06
6.	New Developments in IPR: Administration of Patent System, New developments in IPR; IPR of Biological Systems, Computer Software etc., Traditional knowledge Case Studies, IPR and IITs.	06

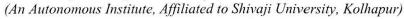
References -

Text Books:

- 1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students", Juta & Co Ltd
- 2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction", Juta Academic
- 3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners", SAGE Publication
- 4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
- 5. Mayall, "Industrial Design", McGraw Hill, 1992.
- 6. Niebel, "Product Design", McGraw Hill, 1974.
- 7. Asimov, "Introduction to Design", Prentice Hall, 1962.
- 8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", Wolters Kluwar, 2016.
- 9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008



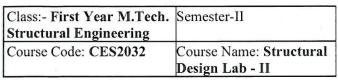
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L	Т	P	Credits
-	-	4	2

Course Description:

Structural design lab – II is the core laboratory course offered in second semester of M. Tech. Structural Engineering program. This laboratory course is mainly focused on analysis and design of concrete structures using standard software packages like STAAD- Pro, ETABS and SAP etc. Students are expected to design various steel structures and prepare drawing of the same.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

- 1. Analyze and design of the RCC structures such as building, retaining wall, flat slab and foundations using standard software packages.
- 2. Interpret the results of analysis and design obtained from the software.
- 3. Prepare drawings of detailing of structural elements.

Prerequisite:

As a prerequisite to this course student must know limit state design of steel structures

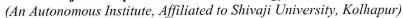
Course Content						
Experiment No	Description	Lab Hrs				
1.	Analysis and design RCC building	8				
2.	Structural drawing of RCC building	8				
3.	Analysis and design of RCC retaining wall	8				
4.	Analysis and design of flat slab	8				
5.	Analysis and design of water tank	8				
6.	Analysis and design of foundation	8				

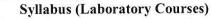
References -

- Sinha and Roy Fundamentals of Reinforced Concrete, 3rd Edition, S. Chand and Company Ltd, New Delhi
- 2. A. K. Jain Reinforced Concrete Design
- 3. Karve and Shah Limit State Theory and Design, Structures Publications, Pune
- P. C. Varghese Limit State Design of Reinforced Concrete, 2nd Edition, Prentice Hall of India, New Delhi
- 5. IS: 456-2000
- 6. IS:3370-1 to 4- Code of Practice for concrete structures for the storage of liquids.

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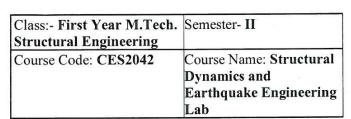
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L	Т	P	Credits
-	-	2	1

Course Description:

Model testing laboratory is a core lab in the 2nd semester. This lab focuses on study of behavior of single and multi-storied structures under dynamic loads. The responses are measured with help of measuring instruments. This laboratory develops skills among the students such as leadership, life long learning skills and applications of fundamentals of vibrations for calculation of responses.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

- 1. Interpret the response of structures due dynamic loading.
- 2. Prepare the models.
- 3. Conduct model testing for static and dynamic loading.
- 4. Conduct model testing for free and forced vibrations.

Prerequisite:

As a prerequisite to this course student should apply theory of fundamentals of vibrations for

single and multiple degrees of freedom systems.

	Course Content	
Experiment No	Description	Lab Hrs
1.	Dynamics of a three storied building frame subjected to harmonics base motion.	4
2.	Dynamics of a vibration absorber.	4
3.	Dynamics of one-span and two-span beams.	4
4.	Earthquake induced waves in rectangular water tanks.	4
5.	Dynamics of a one-storied building frame with planar asymmetry subjected to harmonic base motions.	4
6.	Vibration isolation of a secondary system.	4

References -

- 1. Structural Dynamics: Vibrations and Systems, MadhujitMukophadhyay, Publisher: ANE Books ISBN: 9788180520907, 8180520900 Edition: 01, 2008.
- 2. Structural Dynamics and Introduction of Earthquake Engineering, Chopra A. K.
- 3. Structural Dynamics: Theory and Computation, 2nd Edition, Mario Paz, CBS Publisher.





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Syllabus (Laboratory Courses)

To be implemented from Academic Year 2018-19

Rev: CIVIL-Structural Engineering/Course Structure/RIT/01/2018-19

Class: First Year M. Tech. Structural Engineering		L	T	P	Credits	
Course Code: CES2052	Course Name: Mini Project II	-	-	4	02	

Laboratory Work (Mini Project):

Mini project shall be delivered on one of the advanced topics chosen in consultation with the supervisor, based on dissertation work/ societal problem / special structure. A hard copy of the report (25 to 30 pages A4 size, 12 fonts, Times New Roman, single spacing single side printed, preferably in TRM format) should be submitted to the Department Post Graduate Committee (DPGC) before delivering the seminar. A copy of the report in soft form must be submitted to the supervisor, along with other details, if any. Minimum 03 presentations should be delivered by the students.

Course Outcomes:

After successful completion of the course, students will be able to,

- 1. Identify research problem
- 2. Prepare and present statement of Purpose
- 3. Perform analysis work.
- 4. Communicate with outside agencies.
- 5. Write report and Present the work carried out.
- 6. Develop self-learning ability.



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Syllabus (Theory Courses)

To be implemented from Academic Year 2018-19

Rev: CIVIL-Structural Engineering/Course Structure/RIT/01/2018-19

Class:- First Year M. Tech Structural Engineering	Semester-II
Course Code: CES2062	Course Name: Advanced Earthquake Engineering (PE-II)

L	Т	P	Credits
3			3

Course Description:

Design of Earthquake Resistant Structures is offered as a program elective course at the first semester of Civil Structural Engineering postgraduate programme. This course focuses on fundamentals/elements of seismology, conceptual design of earthquake resistant structures, principles of planning, and strong column weak beam concept. This course also focuses on lateral load evaluation and ductile elements. IS cod provisions for ductility of structures and water tanks.

This course intends to build the competency in the students to evaluate loads developed due to earthquake loadings. This theoretical knowledge will help to student for studying behavior of structures under earthquake loading and design structures for EQ Loads.

Course Learning Outcomes:

After successful completion of this course students will be able to:

- 1. Evaluate lateral loads developed on multi-storeyed structures by the Response Spectrum Analysis Method.
- 2. Apply ductility requirements for the design of structural components.
- 3. Assess seismic performance of non-structural components and structural components and identify effective measures to mitigate potential damage.
- 4. Apply clauses given in IS codes to increase resistance of structures to earthquake force.
- 5. Apply new techniques for controlling the vibrations of the structures.

Prerequisite:

As a prerequisite to study this course, the students must possess the knowledge of Fundamentals of vibration, natural frequency, resonance condition, mode shapes.

Course Content				
Unit No	locorintion			
1.	Masonry Buildings	06		
	Introduction-Elastic properties of masonry assemblage- Categories of masonry			
	buildings- Behaviour of unreinforced and reinforced masonry walls- Behaviour of			



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Syllabus (Theory Courses)

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	walls- Box action and bands- Behaviour of infill walls- Improving seismic behaviour	
	of masonry buildings- Load combinations and permissible stresses- seismic design	
	requirements- Lateral load analysis of masonry buildings. Structural Walls and Non-	
	structural Elements: strategies in the location of structural walls- sectional shape+	
	variations in elevation- cantilever walls without openings- Failure mechanism of non-	
	structures- Effects of non-structural elements on structural system- Analysis of non-	
	structural elements- prevention of non-structural damage.	
2.	Ductility considerations in Earthquake Resistant Design of RC Buildings	06
	Introduction- Impact of Ductility, Requirements for Ductility, Assessment of ductility,	
	Factors-affecting Ductility, Ductile detailing considerations as per IS 13920 2016.	
	Behaviour of beams, columns and joints in RC buildings during earthquakes-	
	Vulnerability of open ground storey and short columns during earthquakes. Case	
	studies.	
3.	New Techniques in Seismic Design	06
	Cyclic loading behavior of RC C and pre-stressed concrete elements, modern	
	concepts, base isolation, dampers, Adoptive systems, case studies, Field visit.	
4.	Water Tank	06
	Seismic design of Elevated RC Circular Water Tanks. Ductility requirements, types	
	of ductility, factors affecting ductility. IS code provisions.	
5.	Continuous systems	06
	Flexural vibration of beams, Simply supported and cantilever beams, Longitudinal	
	vibrations of bars, Longitudinal waves in bars, Waves and vibration response of	
	simply supported beams under uniformly distributed triangular pulse loading,	
	Matrix formulation of beams with lumped masses.	
6.	Special Topics in Structural Dynamics	06
	Dynamic effects of wind loads, Moving loads, Vibration caused by traffic, blasting	
	and pile driving. Vibration control by applying new techniques such as Tuned mass	
	Dampers.	

References -

Text Books:

- 1. Earthquake Resistant Design of Structures, P. Agarwal & M. Shrikhande, Prentice Hall Publications.
- 2. Elements of earthquake Engineering, Jai Krisna, A. R. Chandrashekharan& B. Chandra, South Asian Publishers Private Limited.
- 3. Principles of Vibration Control, A. K. Mallick.
- 4. Structural Dynamics, Mario Paz.
- 5. Earthquake Resistant Structures, Vinod Hosur.





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- 1. Structural Dynamics: Vibrations and Systems, MadhujitMukophadhyay, Publisher: ANE Books ISBN: 9788180520907, 8180520900 Edition: 01, 2008.
- 2. Dynamics of Structures, R,W. Clough and J.Penzien, McGraw Hill Education, 2nd revised Edition, 1993, ISBN -10: 0071132414, ISBN -13: 978-0071132411.
- 3. Theory of Vibration with applications, Willaim Thomson, CRC Press; 4th edition, 1996, ISBN -10: 0748743804, ISBN -13: 978-0748743803.
- 4. I. S. 1893 2016, Criteria for Earthquake Resistant Design of Structures. Part I & II.
- 5. IS 13920 2016, Ductile Detailing of RCC Structures.
- 6. IS 4326:
- 7. IS 13828:
- 8. IS 13827:





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Syllabus (Theory Courses)

To be implemented from Academic Year 2018-19

Rev: CIVIL-Structural Engineering/Course Structure/RIT/01/2018-19

Class: F.Y. M. Tech. Structural Engineering	Semester: II
Course Code: CES2072	Course Name: Theory and Applications of Cement Composites (PE-II)

L	, T	P	Credits
3			3

Course Description:

The course focuses on various composite materials and study of their properties to understand their behavioral aspects. The main objective of this course is to analyze and design the cement composites elements or structures and study their mechanical behavior, uses and applications.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

- 1. Formulate constitutive behavior of composite materials Ferrocement, SIFCON and Fibre Reinforced Concrete by understanding their strain- stress behavior.
- 2. Classify the materials as per orthotropic and anisotropic behavior.
- 3. Estimate strain constants using theories applicable to composite materials.
- 4. Analyze and design structural elements made of cement composites.

Prerequisite:

Fundamental knowledge of basic properties of concrete ingredients is required.

	Course Content				
Unit No	Description	Hrs			
1.	Introduction: Classification and Characteristics of Composite Materials - Basic Terminology, Advantages Stress-Strain Relations- Orthotropic and Anisotropic Materials, Engineering Constants for Orthotropic Materials, Restrictions on Elastic Constants, Plane Stress Problem, Biaxial Strength, Theories for an Orthotropic Lamina.	06			
2.	Mechanical Behavior: Mechanics of Materials Approach to Stiffness- Determination of Relations between Elastic Constants, Elasticity Approach to Stiffness - Bounding	06			





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	Techniques of Elasticity, Exact Solutions - Elasticity Solutions with Continuity, Halpin, Tsai Equations, Comparison of approaches to Stiffness.	
3.	Cement Composites: Types of Cement Composites, Terminology, Constituent Materials and their Properties, Construction Techniques for Fibre Reinforced Concrete - Ferrocement, SIFCON, Polymer Concretes, Preparation of Reinforcement, Casting and Curing.	06
4.	Mechanical Properties of Cement Composites: Behavior of Ferrocement, Fiber Reinforced Concrete in Tension, Compression, Flexure, Shear, Fatigue and Impact, Durability and Corrosion	06
5.	Application of Cement Composites: FRC andFerrocement- Housing, Water Storage, Boats and miscellaneous Structures Composite Materials- Orthotropic and Anisotropic behavior, Constitutive relationship, Elastic Constants.	06
6.	Analysis and Design of Cement Composite Structural Elements Ferrocement, SIFCON and Fibre Reinforced Concrete.	06

References -

- Mechanics of Composite Materials, Jones R. M., 2nd Ed., Taylor and Francis, BSP Books, 1998
- Ferrocement Theory and Applications, Pama R. P., IFIC, 1980.
- New Concrete Materials, Swamy R.N., 1stEd., Blackie, Academic and Professional, Chapman & Hall, 1983.





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Rev: CIVIL-Structural Engineering/Course Structure/RIT/01/2018-19

Class:- First Year M. Tech Structural Engineering	Semester-II	L	Т	P	Credits
The state of the s	Course Name: Structural Optimization (PE-II)	3	-		3

Course Description:

Structural optimization can be defined as the process of finding the optimal parameters, which yield maximum or minimum value of an objective function, subject to certain set of specified requirements called constraints. Such problem of optimization is known as constrained optimization problems or nonlinear programming problems. Most design optimization problems in structural engineering are highly nonlinear, involving mixed (discrete and continuous) design variables under complex constraints, which cannot be solved by traditional calculus - based methods and enumerative strategies.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

- 1.Use variational principle for optimization
- **2.**Apply optimization techniques to structural steel and concrete members.
- 3.Design using frequency constraint.

Prerequisite: Reinforced Concrete Structures, Design of Steel Structures.

Unit No	Description			
1.	Introduction: Simultaneous Failure Mode and Design, Classical External Problems.			
2.	Calculus of Variation: Variational Principles with Constraints.			
3.	Linear Programming, Integer Programming, Nonlinear Programming, Dynamic Programming.	06		
4.	Geometric Programming and Stochastic Programming.	06		





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5.	Applications: Structural Steel and Concrete Members, Trusses and Frames.	06
6.	Design: Frequency Constraint, Design of Layouts.	06

Reference Books:

1. Elements of Structural Optimization, Haftka, Raphael T., Gürdal, Zafer, Springer.

2. Variational methods for Structural optimization, Cherkaev Andrej, Springer





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Class:- First Year M. Tech Structural Engineering	Semester-II	L	Т	P	Credits
	Course Name: Design of Bridges and Flyovers (PE-III)	3	-	-	3

Course Learning Outcomes:

At the end of this module student would be able to;

- 1. Study various components and loadings on bridge
- 2. Analyse and design of super-structure of various bridges and flyovers
- 3. Analyse and design of sub-structure of various bridges and flyovers

Unit No	Description	Hrs
1.	Introduction	06
	Introduction, types, geometric design parameters, loading standards	
2.	Design of slab and girders of bridges	06
	Design of deck slab, slab culvert, box culvert, longitudinal and cross girders.	
3.	Theory of bridges	06
	Pieguads and Courbon's theory, design problem	
4.	Multi-span bridges and flyovers	06
	Analysis and Design of Multi-span bridges, flyovers	541,000
5.	Foundation design	06
	Design of bridge foundation, piers, abutments, wing walls	
6.	Bearing and joints	06
	Design of various joints, bearings for various types of bridges	

- 1. Dr.V.K.Raina- Concrete Bridge Practice Tata McGraw Hill. Delhi
- 2.Dr.B.C.Punmia, Ashok Kumar Jain, Arun Kumar Jain Reinforced Concrete Structures ,Vol. II Laxmi Publications.
- 3. Jagadish & Jayaram Design of Concrete Bridges, Tata McGraw Hill.
- 4. Victor Design of Concrete Bridges, Tata McGraw Hill.





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Class: First Year M. Tech Structural Engineering	Semester-II	L	Т	P	Credits
Course Code: CES2102	Course Name: Design of Prestress Concrete Structures (PE-III)	3	-		3

Course Description:

Pre-stressed concrete is a form of concrete used in construction which is "pre-stressed" by being placed under compression prior to supporting any loads beyond its own dead weight. This compression is produced by the tensioning of high-strength "tendons" located within or adjacent to the concrete volume, and is done to improve the performance of the concrete in service. Tendons may consist of single wires, multi-wire strands or threaded bars, and are most commonly made from high-tensile steels, carbon fiber or aramid fiber. The essence of pre-stressed concrete is that once the initial compression has been applied, the resulting material has the characteristics of high-strength concrete when subject to any subsequent compression forces, and of ductile high-strength steel when subject to tension forces. This can result in improved structural capacity and/or serviceability compared to conventionally reinforced concrete in many situations.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

- 1. Explain the concept of pre-stressing, behavior of the pre-stressed structures vis-à-vis that of the RCC structure.
- 2. Choose the decision with respect to the choice of pre-stressed section over RCC.
- 3. Describe the application of these techniques in civil engineering construction.
- **4.** Analyze the various pre-stressed components of the structures and design the same.
- 5.Design the various pre-stressed components of the structures and design the same.

Prerequisite: Reinforced Concrete Structures, Strength of materials, Concrete Technology.





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	Course Content	
Unit No	Description	Hrs
1.	Mechanics of Pre-stressed concrete, Advantages of pre-stressed concrete, High strength materials- concrete and steel, Classification and types of pre- stressing, Stress concept, Strength concept and Load balancingconcept	06
2.	Introduction to losses of pre-stress, Loss due to elastic deformation of concrete, shrinkage of concrete, creep of concrete, relaxation of stress in steel, friction and anchorage slip. Pre-tensioning and Post-tensioning losses, immediate and time dependent losses, systems of pre-stressing.	06
3.	Analysis and design of pre-stress concrete beams, box, T and I Sections, shear, deflection, I.S. recommendations for quality of materials, pre-stressing steel, pre-stressing equipment and design. Design of end block by IS code method.	80104864
4.	Analysis and Design of continuous beams, linear transformation and concordant cable profile.	06
5.	Analysis and design of cylindrical structures in pre-stressed concrete-pipes and tanks.	06
6.	Composite construction, behavior, I.S. recommendations for composite action, differential shrinkage and creep, deflection and flange width of composite beams, Analysis and design of composite beam, and shrinkage stresses.	06

References -

Text Books:

- 1. Prestressed Concrete- N. Rajaopalan (2012): Narosa Publishing House
- **2.** Fundamentals of Prestressed Concrete- Sinha.N.C. and Roy.S.K. (1998): ', S. Chand and Co.

- 1. Design of Prestressed Concrete Structures- Lin, T.Y. and Burns, N.H. (2004):', 3rdEdition, John Wiley and Sons.
- **2.** Design of Reinforced Concrete Structures S. Ramamrutham (2013): *DhanpatRai Publishing Company*.
 - 3. Prestressed Concrete-Krishna Raju (2000): Tata McGraw Hill Publishing Co.





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Class:- First Year M. Tech Structural Engineering	Semester-II	L	Т	P	Credits
1	Course Name: Theory of Thin Plates and Shells (PE-III)	3	-		3

Course Description:

This course is a Program offered Elective course in FY M Tech program in Semester II. This course, deals with the theory of plate and shell structures, using the membrane and bending theories for various types of shells and their applications. In this course, thin plate will be analyzed by Classical Plate Theory Bending Buckling problems will be discussed for Plates.

Course Outcomes:

After successful completion of this course student will be able to:

- 1. Analyze various problems using different theories based on plates and shells.
- 2. Derive equilibrium equations related with different theories of plates and shells.

Prerequisite: Theory of Structural Analysis.

Unit No	Description	Hrs
1.	Fundamental concepts of plate analysis	06
	Elasticity approach to solution, Stress, Strain, Plane Stress and Strain,	
	Constitutive relationships, Equilibrium Equations	
2.	Classical plate theory	06
	Assumptions, boundary conditions, Stress Resultants, General Equations	
3.	Analysis of plate by Navier's method	06
	Simply supported plates and various boundary and loading conditions.	
	Problems.	
4.	Analysis of plate by Levy's method	06
	Simply supported plates and various boundary and loading conditions.	
	problems	- Ti
5.	Membrane theory of Shells	06
	Introduction, Types of theories, membrane theory of cylindrical Shell	
	equilibrium equations, limitations, problems	





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6.	Bending theory of Shells	06
	Equilibrium equation, Bending theory, synclastic and anticlastic shell,	0.0
	problems on bending theory	

- Timoshenko, S. "Theory of plates and shells" McGraw Hills Book Comp 8th edition 2014
- 2. Chandrashekhar K, "Theory of Plates" Universities Press (India) Limited 9th edition 2013.
- 3. Chandrashekhar K, "Analysis of Thin Concrete Shells" New Age International (P) Ltd.
- 4. Ramaswamy, "Design of concrete shell" roofs CBS publishers and distributors New Delhi
- 5. Reddy, J. N. "Theory and analysis of elastic plates and shells" Taylor & Francis, 2007.





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Class:- First Year M. Tech Structural Engineering	Semester-II	L	Т	P	Credits
	Course Name: Design of Advanced Concrete Structures (PE-IV)	3	-		3

Course Description:

The course 'advanced design of concrete structures' mainly focuses on analysis and design of various concrete elements and structures subjected to different types of loads using latest methods of analysis and design. The analysis and design of concrete structures namely bunkers, silos, water tanks, flat slabs, grid floor slabs deep beam etc. forms the core content of the course. The RCC structures exposed to higher temperatures or fire are also considered for analysis and determining their capacity in the event of fire.

Course Outcomes:

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

- 1. Analyze the special R.C.C. structures.
- 2. Design and prepare detail structural drawings

Prerequisite: The student should possess fundamental knowledge of concrete technology, RCC, earthquake engineering and basic methods of analysis and design of RCC elements and structure.

Unit No	Description	Hrs
1.	Analysis and design of slabs- Yield line theory	06
	Various patterns of yield lines, Assumptions in yield line theory, Equilibrium and virtual work method of analysis, Design of various slabs such as	
	rectangular, circular using yield line theory.	
2.	Design of Reinforced Concrete Members for Fire Resistance: Introduction, ISO 834 standard heating conditions, Grading orclassifications, Effect of high temperature on steel and concrete, Effect of high temperatures on different types of structural members, Analytical determination of the ultimate bending moment, Capacityof reinforced concrete beams under fire.	06





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3.	Analysis and design of deep beam:	06
	Introduction, Assumptions and analysis of deep beam, Design of rectangular	
	beams	
4.	Analysis and design of flat and grid slabs:	06
	Introduction, Proportioning of flat slabs, Design by direct design method,	
	Analysis and design of rectangular grid floors by Timoshenko's plate theory.	
5.	Elevated service reservoir	06
	Rectangular and Circular type and flat bottom only, Design of staging for wind	
	and earthquake forces, Effect of joint reactions and continuity.	
6.	Design of Special structures	06
	Introduction, Design of rectangular and circular bunkers and silos	
	Design of Shear wall.	

- 1. Advance R.C.C. Design by S.S.Bhavikatti. New Age International Publishers
- 2. Reinforced Concrete Structures-Vol. II by B.C. Punmia, Ashok K. Jain, Arun K. Jain. Laxmi Publications, New Delhi.
- 3. Fundamentals of Reinforced Concrete by N.C. Sinha and S.K. Roy. S. Chand & Co. Ltd, New Delhi.
- 4. Advanced Reinforced Concrete Design (2nd Edition) by P.C. Varghese, Prentice Hall of India, 2008.
- 5. Reinforced Concrete design by Dr. H. J. Shah, Charotar Publishing House
- 6. Reinforced Concrete Structural Elements (3rd Edition), by Purushothaman P. Tata Mc Graw- Hill Publishing Co, 2004.
- 7. IS: 456-2000, IS 3370 Indian Standard code of practice, Bureau of Indian Standards, New Delhi.





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Rev: CIVIL-Structural Engineering/Course Structure/RIT/01/2018-19

Class: First Year M. Tech Structural Engineering	Semester-II
Course Code: CES2132	Course Name: Design of Industrial Structures (PE-IV)

L	Т	P	Credits
3		-	3

Course Description:

This is introduced at the second semester of F Y M Tech Structural Engineering. This covers the design of various industrial structures- gantry girders, portal frames, steel bunkers & silos, chimneys, water tanks and connections.

Course Learning Outcomes:

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

- 1. Design the Steel Gantry Girders.
- 2. Design the Steel Portal, Gable Frames.
- 3. Design Steel Bunkers and Silos.
- 4. Design Chimneys and Water Tanks.

Prerequisite:

This course requires the knowledge of structural analysis and design of basic structural elements of steel structures

Unit No	Description	Hrs
1	Steel Gantry Girders – Introduction, loads acting on gantry girder, permissible stress, types ofgantry girders and crane rails, crane data, maximum moments and shears, construction detail, design procedure.	06
2	Portal Frames – Design of portal frame with hinge base, design of portal frame with fixed base -Gable Structures – Lightweight Structures.	06
3	Steel Bunkers and Silos – Design of square bunker – Jansen's and Airy's theories – IS Codeprovisions – Design of side plates – Stiffeners – Hooper – Longitudinal beams Design of cylindrical silo – Side plates – Ring girder – stiffeners.	06
4	Chimneys – Introduction, dimensions of steel stacks, chimney lining, breech openings and access ladder, loading and load combinations, design considerations, stability consideration, design of base plate, design of foundation bolts, design of	06



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	foundation.	
5	Water Tanks – Design of rectangular riveted steel water tank – Tee covers – Plates – Stays –Longitudinal and transverse beams –Design of staging – Base plates – Foundation and anchor bolts.	06
6	Design of pressed steel water tank – Design of stays – Joints – Design of hemispherical bottomwater tank – side plates – Bottom plates – joints – Ring girder –Design of staging and foundation	06

- 1. Dr. N. Subramanian, "Design of Steel Structures", Oxford University Press, New Delhi.
- 2. K. S. Sai Ram, "Design of Steel Structures", Pearson
- 3. "Limit State Design of Steel Structures", Dr V. L. Shah and Veena Gore, Structures Publications
- 4. M. R. Shiyekar, "Limit State Design in Structural Steel", , PHI Learning
- 5. S. K. Duggal, "Design of Steel Structures", Tata Mc-Graw Hill publishing company Ltd., New Delhi.
- 6. Dayaratnam, "Design of Steel Structures", Wheeler Publishing, New Delhi.
- 7. Ram Chandra, "Design of Steel Structures", Vol. I& Vol. II Standard Book House, New Delhi.
- 8. A.S.Arya and J.L.Ajamani, "Design of Steel Structures", Nemchand and Bros., Roorkee
- 9. Vazirani & Ratwani. "Design of Steel Structures",
- 10. B.C.Punmia, Jain & Jain "Design of Steel Structures", Laxmi Publication, New Delhi.
- 11. ",E.H.Gaylord and C.N. "Design of Steel Structures", Gaylord, Mc-Graw Hill, New York.
- 12. J.E.Lothers, "Design in Structural Steel Structures", Prentice Hall New Jersy.





Rajarambapu Institute of Technology, Sakharale

(An Autonomous Institute, Affiliated to Shivaji University, Kolhapur)

Syllabus (Theory Courses)

To be implemented from Academic Year 2018-19

Rev: CIVIL-Structural Engineering/Course Structure/RIT/01/2018-19

Class: Final Year M. Tech Structural Engineering	Semester-II
Course Code: CES2142	Course Name: Design of formwork (PE-IV)

L	Т	P	Credits
3	_	-	3

Course Description:

Design of formwork is elective course offered in 2nd semester which mainly focusses on types and design of falsework required for concrete structures (i.e. formwork). Although cost of formwork contributes significantly to the total reinforced concrete constructioncost and formwork failure will result in a very complicated construction problem, formwork design is oftenneglected and left to the foreman to design. Therefore, in this course emphasis is given on materials used for form work, design of various formworks for regular structural members, design of formwork for special structures, some special formwork systems and failure of formwork.

Course Learning Outcomes:

After successful completion of the course, students will be able to,

- 1. Select proper formwork, accessories and material.
- 2. Design the form work for Beams, Slabs, columns, Walls and Foundations.
- 3. Design the form work for Special Structures.
- 4. Explain the working of flying formwork.
- 5. Judge the formwork failures through case studies.

Prerequisite:

Basic knowledge of concrete technology and construction procedures.

Course	e Content	
Unit No	Description	Hrs
1.	Introduction:	04
	Introduction to formwork system, Requirements of formwork and Factors	
	affecting Selection of Formwork	
2.	Formwork Materials	04
	Timber, Plywood, Steel, Aluminum, Plastic, and Accessories.	
	Horizontaland Vertical Formwork Supports.	



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Rajarambapu Institute of Technology, Sakharale

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Syllabus (Theory Courses)

To be implemented from Academic Year 2018-19

Rev: CIVIL-Structural Engineering/Course Structure/RIT/01/2018-19

3.	Formwork Design:	08
	Concepts, Formwork Systems and Design for Foundations, Walls,	
	Columns, Slab and Beams.	
4.	Formwork Design for Special Structures:	08
	Shells, Domes, Folded Plates, OverheadWater Tanks, Natural Draft	
	Cooling Tower, Bridges.	
5.	Flying Formwork:	06
	Table Form, Tunnel Form, Slip Form, Formwork for Precast	
	Concrete, Formwork Management Issues – Pre- and Post-Award.	
6.	Formwork Failures:	06
	Causes and Case studies in Formwork Failure, Formwork Issues in Multi-	
	Story Building Construction.	
	*	

References .

- 1. Formwork for Concrete Structures, Peurify, McGraw Hill India, 2015.
- 2. Formwork for Concrete Structures, Kumar Neeraj Jha, Tata McGraw Hill Education, 2012.
- 3. IS 14687: 1999, False work for Concrete Structures Guidelines, BIS.





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Syllabus (Theory Courses)

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SEMSTER - III





Rajarambapu Institute of Technology, Sakharale

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Syllabus (Laboratory Courses)

To be implemented from Academic Year 2018-19

Rev: CIVIL-Structural Engineering/Course Structure/RIT/01/2018-19

Class: S. Y. M. Tech. Structural Engineering	Semester- III	
Course Code: CES3012	Course Name: Internship	

L	Т	P	Credits
-	-	2	Audit

Field Work:

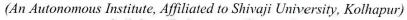
In the field training work, the student is expected to get training in the industry, related to structural engineering for duration of 4 weeks for at least 6 hours per day. Student should work as an employer of the organization. He should learn work culture and latest development in structural engineering. Student should write a report on the field training and submit to department for ISE evaluation at the beginning of third semester. Student should include the certificate from company regarding satisfactory completion of the field training.

Course Outcomes:

- 1. Identify training area
- 2. Prepare on site work report of training
- 3. Perform analysis work
- 4. Communicate with agencies
- 5. Generate report and Present the work carried out



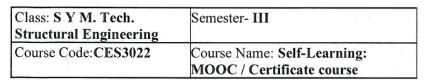
Rajarambapu Institute of Technology, Sakharale



Syllabus (Laboratory Courses)

To be implemented from Academic Year 2018-19

Rev: CIVIL-Structural Engineering/Course Structure/RIT/01/2018-19



L T		P	Credits	
-	1	-	03	

Online Certification Course:

- 1. Student should select any one course floated by NPTEL related to their dissertation topic in consultation with supervisor.
- 2. Student should report and maintain file of weekly submission as per assignments given by NPTEL.
- 3. Student should attach weekly grade sheet in the hard copy form to weekly submission file.
- 4. Final written exam is compulsory to all and it will be scheduled by NPTEL.
- 5. Submit the final grade sheet with course completion certificate.
- 6. The final grades will be given based on grades offered by NPTEL and file submission.

Course Outcomes:

- 1. Develop technical competence in skills of structural engineering field.
- 2. Apply the techniques for structural engineering practice.
- 3. Develop oral and written presentation skills for structural engineering projects.
- 4. Design and interpret data for structural engineering projects.





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Syllabus (Laboratory Courses)

To be implemented from Academic Year 2018-19

Rev: CIVIL-Structural Engineering/Course Structure/RIT/01/2018-19

Class: S Y M. Tech.	Semester- III	I	Т
Structural Engineering		"	1
Course Code: CES3032	Course Name: Dissertation Phase-I	_	-

L	Т	P	Credits
	-	8	04

Dissertation phase I and synopsis approval presentation:

Under the guidance of faculty called as _Supervisor', PG student from second year is required to do innovative and research oriented work related to various theory and laboratory courses he/she studied during previous semesters. Dissertation work should not be limited to analytical formulation, experimentation or software based project. Student can undertake an interdisciplinary type project with the prior permission of DPGC from both departments.

Synopsis:

Student need to carry out exhaustive literature survey with consultation of his/her supervisor for not less than 25 reputed national international journal and conference papers. Student should make the Synopsis Submission Presentation (SSP) with literature survey report to DPGC and justify about the innovativeness, applicability, relevance and significance of the work. At the time of presentation, student shall also prepare Synopsis of the work and submit to department for approval. Student shall submit synopsis of dissertation as per the prescribed format in 02 copies to department.

Course Outcomes:

- 1. Identify research problem from literature survey
- 2. Prepare research design for identified problem
- 3. Prepare synopsis report
- 4. Present the work plan to be carried out.





Rajarambapu Institute of Technology, Sakharale

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Syllabus (Theory Courses)

To be implemented from Academic Year 2018-19

Rev: CIVIL-Structural Engineering/Course Structure/RIT/01/2018-19

Class: S Y M. Tech. Structural Engineering	Semester- III
Course Code: CES3042	Course Name: Dissertation Phase-II

	L	Т	P	Credits
2000	-	-	12	06

Dissertation phase II:

Phase II evaluation is based on End semester Examination (ESE) which is based on the work during the semester. It is expected that student shall present preliminary results from his/her work during the semester with report as per prescribed format. DPGC including external examiner as expert will approve the report and progress of student.

ISE will be evaluated DPGC and ESE will be evaluated by DPGC and one external expert. Student will submit a report (soft bound before 1 week of date of presentation) as per prescribed format and present to DPGC for ISE and ESE. If student is not showing satisfactory performance in, then he/she will be given grace period of two weeks. After two weeks student will again be evaluated as per guidelines given in rules and regulations.

Course Outcomes:

- 1. Prepare the set up for experimentation/ develop/ learn software.
- 2. Perform experimental/software analysis for validation of research work.
- 3. Generate report of work carried out.
- 4. Present the work carried out.





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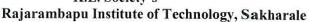
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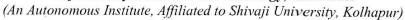
To be implemented from Academic Year 2018-19

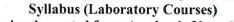
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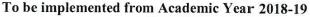
SEMSTER - IV











Rev: CIVIL-Structural Engineering/Course Structure/RIT/01/2018-19

Class: S Y M. Tech. Structural Engineering	Semester- IV
Course Code: CES4012	Course Name: Dissertation Phase-III

L	T	P	Credits
-		10	06

Dissertation Phase III:

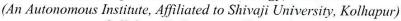
Student is required to give a presentation on the progress of his/her dissertation work in front of supervisor and DPGC. It is expected that up to this stage almost 90% of dissertation work is almost completed. Student will make the presentation and seek the suggestions from the supervisor and DPGC. Supervisor and DPGC will ensure that work carried out by the student till this stage is satisfactory and in compliance with synopsis of the dissertation submitted by student. This is In Semester Evaluation (ISE).

Course Outcomes:

- 1. Perform experimental/software analysis for developing research work
- 2. Generate report work carried out.
- 3. Present the work carried out.

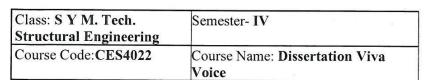


Rajarambapu Institute of Technology, Sakharale



Syllabus (Laboratory Courses) To be implemented from Academic Year 2018-19

Rev: CIVIL-Structural Engineering/Course Structure/RIT/01/2018-19



L	Т	P	Credits
-	-	18	10

Dissertation Phase IV:

This is final presentation, i.e., viva voce of the dissertation. Student will be allowed to make this presentation only if he has submitted duly completed and certified dissertation report. Students will make the presentation in front of supervisor, DPGC and external supervisor. Examiners will check whether the dissertation work is in full compliance with synopsis of dissertation or not. Dissertation will assess on the basis of quality of dissertation work, efforts taken by the student, quality of paper(s) published on the dissertation work, etc. Student should publish work carried by him along with supervisor in reputed journals as per institute rules and regulations.

Course Outcomes:

After successful completion of the course, students will be able to,

- 1. Perform experimental/software analysis for developing research work.
- 2. Generate report work carried out.
- 3. Publish a research paper in journals/conference.
- 4. Prepare report using total work done as dissertation report
- 5. Present the work carried out.



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