Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)



Course Contents (Syllabus) for

Second Year M. Tech (Civil Structural Engineering) Sem. III to IV

AY 2020-21

Title of the	Course:				L	Т	Р	Cr	
Dissertation Phase-I (3ST690)					_	_	8	4	
Desirable Courses: Courses of Semester Land II of F. V. M. Tech (Civil Structures)									
Desirable Courses, Courses of Semester Fand II of F. F. M. Feen (Civil-Structures)									
References	•								
1. Nation	al and Interna	tional journals	s, Conference Prod	ceedings in Str	ructura	al Engi	neering		
2. Techni	2. Technical Reports of Professional societies.								
5. Interna 4 Interne	t sources and	Distance Lear	ning	nudooks.					
5. Publish	ed Ph.D. and	M.Tech Thes	is of Reputed Inst	itutes.					
Course Ob	jectives:								
1. To imp	art knowledg	ge for establis	hing objectives by	y carrying out	exten	sive lit	terature	review on	
2 To dev	a dissertation	topic. Mogy to execu	te the proposed re	esearch work t	hroug	h analy	tical/ex	nerimental	
work.	crop methode	nogy to execu	te the proposed it		moug.	ii allaiy		permentar	
3. To ana	lyze, interpret	, debate and c	lassify the finding	s of the work.					
Course Lea	arning Outco	omes:							
20	After the co	mpletion of th	e course the stude	nt should be		Bloo	m's Co	gnitive	
CO	able to	1			I	Level	De	scriptor	
CO1	Examine re and set up re	ine research developments through literature survey tup research hypothesis.				III	Apply	ving	
CO2	Construct 1 hypothesis.	research meth	odology to evaluate	ate the researc	h	IV	Analy	zing	
CO3	Critique res	search idea wi	th perspective sco	pe.		V	Evalu	ating	
CO-PO Ma	apping: (Use	1, 2, 3 as Cor	relation Strengtl	ns)					
РО	1	2	3	4		5		6	
CO1				3				2	
CO2	1		3	2				2	
CO3	1	2		2		2		2	
Teacher A	ssessment:	Assessment	based on – Sele	ction of topi	c, Lit	erature	survey	, Content,	
Understand	ing, Presentat	ion and Repor	t writing.						

Assessment	Marks
MSE	100

Course Contents:

It is expected that the student has well defined objectives of the dissertation by grasping and analyzing through an extensive literature review. The student shall develop methodology to execute the proposed research work through analytical/experimental work with proper validation.

Title of the	the Course:					Т	Р	Cr	
Dissertation	Dissertation Phase-II (3ST691 and 3ST692)						12	2+4	
Desirable Courses: Dissertation Phase I									
References	:								
1. National and International journals, Conference Proceedings in Structural Engineering.									
2. Technie	2. Technical Reports of Professional societies.								
3. Interna	tional and nat	10nal codes of	Practices and Ha	andbooks.					
4. Interne 5 Publish	ed Ph D and	M Tech Thesis	ning. s of Reputed Ins	titutes					
Course Ob	jectives:								
1. To imp	oart knowledg	e for establish	ing objectives b	y carrying out	exten	sive li	terature	review on	
selected	d dissertation	topic.				_			
2. To dev	elop methodo	logy to execute	e the proposed r	esearch work th	roug	n analy	/tical/ex	perimental	
WORK.	lvze interpret	debate and cla	assify the findin	as of the work					
S. To analyze, interpret, debate and classify the findings of the work.									
After the completion of the course the student should be Bloom's Cognitive									
	After the co	mpletion of the	course the stude	ent should be		Bloo	m's Co	gnitive	
СО	After the con able to	mpletion of the	course the stude	ent should be	I	Bloo Level	m's Co De	gnitive scriptor	
CO CO1	After the con able to Examine re	mpletion of the search develop	course the stude	ent should be literature surve		Bloo Level III	m's Co De Apply	gnitive scriptor	
CO CO1	After the con able to Examine re and set up re	mpletion of the search develop	course the stude	ent should be literature surve		Bloo Level III	m's Co De Apply	gnitive scriptor ying	
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CO CO1 CO2 CO3	After the con able to Examine re and set up re Construct r hypothesis. Critique res	mpletion of the search develop esearch hypothe esearch metho	course the stude oments through tesis. dology to evalu	ent should be literature survey ate the research	I	Bloo Level III IV V	m's Co De Apply Analy Evalu	gnitive scriptor ying yzing nating	
CO CO1 CO2 CO3 CO-PO Ma	After the con able to Examine re and set up re Construct r hypothesis. Critique res	mpletion of the search develop esearch hypothe esearch metho earch idea with 1, 2, 3 as Corr	course the stude oments through t esis. dology to evalu n perspective sco	ent should be literature survey ate the research ope. hs)		Bloo Level III IV V	m's Co De Apply Analy Evalu	gnitive scriptor ying yzing tating	
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Teacher Assessment: Assessment based on – Selection of topic, Literature survey, Content, Understanding, Presentation and Report writing.

Assessment	Marks
ISE 2	100
ESE	100

Course Contents:

It is expected that the student has well defined objectives of the dissertation by grasping and analyzing through an extensive literature review. Subsequently, outcomes based on preliminary research work, shall be reviewed critically in order to verify whether the research is in line with defined objectives and scope.

Title of the Course:					L	Т	Р	Cr
Professional Elective 4 Computer Aided Analysis and Design (3ST611)					3	_	_	3
Design (3ST611)					5			5
Desirable Courses: Dynamics of Concrete Structures, Design of Steel Structures								
Textbooks:	:							
 Pratap Jain M Compu Pundit 	Rudra,"Gettir . K., Iyengar itation ", 4th e & Gupta "Str	ng started with S. R. K. & Jai ed. 2004. uctural Analysi	MATLABTM", in R. K. " Nume is", Tata MC Gra	Oxford Unive erical Methods aw Hill Book o	rsity p for S compa	ress, 20 cientifi ny.	010. c and E	Engineering
References	:							
 Steve C Springe Cotes, 2 Chopra 	Otto and Jame er Internationa R.C., Couties A. K., "Struc	es P. Denier a al books, 1 st Ed , M.G., and Ko ctural Dynamic	n Introduction t lition, 2007 ong, F.K., Structu es for Earthquake	to Programmin 1ral Analysis, l 2 Engineering"	ng and ELBS.	l Numo	erical N olication	Aethods in, ns.
Course Ob 1. To prov 2. To imp in the f 3. To pro profess	jectives: vide knowled part necessary ield of engine vide pre-requi ional software	ge of numerica knowledge of eering. iisite knowledg e.	l approach and s numerical tools ge to the studen	ignificance of required for a ts for analyzin	analys malyzi ng and	is by c ing and l desig	ompute I solving ning str	rs. g problems ructures by
Course Lea	arning Outco	omes:						
After the completion of the course the student should be Bloom's Cognitive								
	After the co	mpletion of the	course the stude	ent should be		Bloo	m's Co	gnitive
СО	After the con able to	mpletion of the	e course the stude	ent should be]	Bloo Level	m's Co De	gnitive scriptor
CO CO1	After the con able to Apply vario	mpletion of the	e course the stude	ent should be ructures]	Bloo Level III	m's Co De Apply	gnitive scriptor ying
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ISE 2	10	
ESE	50	
ISE 1 and ISE 2 are based on assignment	t/declared test/quiz/seminar etc.	
MSE: Assessment is based on 50% of co	ourse content (Normally first three modules)	
ESE: Assessment is based on 100% cou (normally last three modules) covered at	rse content with 60-70% weightage for course content fter MSE.	-
Course Contents:		
Module 1: Algorithm Development ar	nd Programming Languages	8 Hrs.
Basics of computer hardware and os, analysis and flowcharting, fundamental & functions + input-output + data han programming in MS EXCEL [®] , MATLA	WWW and Apps, Algorithm essentials: problem s of sequential programming: Variables, data types dling + various development units, Introduction to B [®] , PYTHON.	
Module 2: Matrix Methods and Progr	amming	6 Hrs.
Matrix operations: product-inverse etc method, Algorithm /Programming techn	c., Simultaneous linear equations, Eigen analysis iques of above methods.	
Module 3: Numerical Methods and Pr	ogramming	6 Hrs.
Numerical Integration methods, Nume tools and curve fitting, Numerical Meth techniques of above methods.	rical differentiation methods, Regression Analysis ods in structural dynamics. Algorithm/Programming	
Module 4: Computer Aided Structura	ll Analysis	8 Hrs.
Analysis of Trusses by Stiffness metho PF by Stiffness method. 3D Analysis analysis type.	d. Analysis of CB by Stiffness method, Analysis of issues. Algorithm development for each structural	
Module 5: Computer Aided Structura	l Design	6 Hrs.
Design of Steel Truss members by IS-80	00, Design of Beam sections in RCC, Design of One	
way and Two-way slabs by IS-456. Alg	orithm development for each structural design type.	
Woulde U. Commercial Software Ap		6 Hrs.
Application in commercial software Analysis of 2D frame, Analysis of 3 Design of building members- Beam, S other commercial soft-wares.	SAP [®] /ABACUS [®] /ANSYS [®] : Analysis of TRUSS, D structure for various LOAD COMBINAIONS. lab, Column, Footing by STAAD [®] , Introduction to	
Module wise Outcomes		
At end of each module students will be a	able to:	
 Apply fundamentals of Algorithm a Execute Matrix operations by progr Apply Numerical methods by progr Perform 1D & 2D structural analysis Design simple RCC and STEEL methods Use finite element based commerce problems 	nd programming. amming. amming s by programming embers by latest IS-codes ial software's for analysis of structural engineering	

	Course:				L	Т	Р	Cr			
Professional Elective 4 Numerical Methods in Structural					2			2			
Engineering (3ST612)							3				
Desirable Courses: Applied Mathematics, Structural Engineering											
Textbooks:	:										
 Chapra Steven and Canale Raymond, "Numerical Methods for Engineers", Mc-Graw Hill, 7th Edition, 2012. Gourdin A. and Boumhrat M., "Applied Numerical Methods", Prentice Hall India, New Delhi, 2000. Joe D Hoffman, "Numerical Methods for Engineers and Scientists", Marcel Dekker, 2nd Edition, 2001. 											
References	:										
 Gilbert Strang, "Computational Science and Engineering", Wellesley-Cambridge Press. Gilbert Strang, "Linear Algebra and Its Applications", Wellesley Cambridge Press, 4th Edition, 2009. Philips, G. M., and Taylor P. J. "Theory and Applications of Numerical Analysis", Academic 											
Course Ob	jectives:										
 To prov To import other m To prov 	vide knowledg part knowledg umerical appr vide exposure	ge of Matrix mage of numerica oximations. to field applica	ethods and statistica I differentiation, ir ation of numerical r	al tools for some of the second secon	solutic root f	on of pr inding, ral eng	oblems curve	fitting and g.			
Course Lea	arning Outco	mes:									
	After the cor	npletion of the	course the student	should be		Bloo	m's Co	gnitive			
CO After the completion of the course the student should be able to Doom 's Cognitive'						Level	De	scriptor			
CO	able to				Execute numerical recipes for problem solving in III Apply						
C0 C01	able to Execute nu engineering.	umerical recip	pes for problem	solving	in	III	Apply	y y			
CO CO1 CO2	able to Execute nu engineering. Examine of engineering	umerical recip lifferent num problems.	pes for problem erical tools for	solving isolution	in of	III IV	Apply Analy	/ze			
CO1 CO2 CO3	able to Execute nu engineering. Examine of engineering Discuss num applications.	umerical recip lifferent num problems. nerical schemes	bes for problem erical tools for s for modeling and	solving isolution of solving field	in of ld	III IV V	Apply Analy Evalu	/ze late			
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CO1 CO2 CO3 CO-PO Ma PO	able to Execute nu engineering Examine of engineering Discuss num applications. Apping: (Use 1	umerical recip lifferent num- problems. nerical schemes 1, 2, 3 as Corr 2	bes for problem erical tools for s for modeling and elation Strengths) 3	solving isolution of solving field	in of Id	III IV V 5	Apply Analy Evalu	y vze late 6			
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CO1 CO2 CO3 CO-PO Ma PO CO1 CO2 CO3 Assessment	able to Execute nu engineering Examine c engineering Discuss num applications. apping: (Use 1 1 1 ts:	umerical recip lifferent num problems. nerical schemes 1, 2, 3 as Corr 2	erical tools for s for modeling and relation Strengths) 3 3 2 2 2	solving isolution of solving field and a solvi	in of d	III IV V 5 2	Apply Analy Evalu	6 2 2 2 2 2 2 2			
CO1 CO2 CO3 CO-PO Ma PO CO1 CO2 CO3 Assessment Teacher As	able to Execute integration of the engineering of	umerical recip lifferent numproblems. nerical schemes 1, 2, 3 as Corr 2	bes for problem erical tools for s for modeling and relation Strengths) 3 3 2 2 2	solving isolution of solving field and a solvi	in of d	III IV V 5 2	Apply Analy Evalu	6 2 2 2 2			
CO1 CO2 CO3 CO-PO Ma PO CO1 CO2 CO3 Assessment Teacher As Two compo End Semest	able to Execute nu engineering Examine of engineering Discuss num applications. apping: (Use 1 1 1 ts: ssessment: onents of In Secure 2 apping: (Use) 1 1 1 1 1 1 1 1 1 1 1 1 1	umerical recip lifferent num- problems. nerical schemes 1, 2, 3 as Corr 2 emester Evalua on (ESE) havin	tion (ISE), One Mid g 20%, 30% and 50	solving i solution of solving fiel 4 2 3 2 d Semester 0% weights	Exami respec	III IV V 5 2	Apply Analy Evalu	y //ze late 6 2 2 2 2 and one			
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MSE	30				
ISE 2	10				
ESE	50				
ISE 1 and ISE 2 are based on assignment	nt/declared test/quiz/seminar etc.				
MSE: Assessment is based on 50% of course content (Normally first three modules)					
ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.					
Course Contents:					
Module 1: Solving Linear Algebraic I	Equations and Eigen Analysis	8 Hrs.			
System of linear algebraic equations, c solution approaches as direct and iterat to methods for solving Block-diagonal, sparse linear systems: Thomas algorit Iterative methods: Jacobi, Gauss-Si Convergence of iterative solution schem Jacobi and other Methods.	onditions for existence of solution, Classification of tive, solution by matrix decomposition, Introduction triangular, block-triangular systems. Introduction to hm for tridiagonal and block tridiagonal matrices, iedel and successive over relaxation methods, nes. Ill conditioning of equations. Eigen Analysis by				
Module 2: Solving Nonlinear Algebra	ic Equations [Root Locating methods]	7 Hrs.			
Method of successive substitutions de method, regula falsi method, Modified Broyden's update, Optimization based f	erivative free iterative solution approaches, Secant l Newton's method and qausi-Newton method with formulations and Leverberg-Marquardt method.				
Module 3: Solving Ordinary Differen	tial Equations and Approximations	6 Hrs.			
Solutions of Linear ODE-IVPs by imp Runge-Kutta methods, Multi-step appropro- Problem discretization using approxim difference method for solving ODE interpolations, Least square approximat squares method, Gauss Newton Method	blicit and explicit methods, Taylor series based and baches, Stability issues. mation theory, polynomial approximations, Finite E-BVP with examples, Polynomial and function tions, Model Parameter Estimation using linear least l.				
Module 4: Probability, Statistics, Reli	ability Analysis	8 Hrs.			
Probability basics and applications ir methods and applications. Reliability ar	n engineering, Statistical parameters, distributions, nalysis in structural engineering.				
Module 5: Numerical Integration		7 Hrs.			
Newton-Cotes schemes, Romberg, Gau	ss-quadrature, Multiple Integrals.				
Module 6: Structural Engineering Ap	oplications	6 Hrs.			
Digital Signal Processing, Nonlinea Earthquake engineering applications. SI	ar structural analysis, Structural dynamics and HM.				
At end of each module students will be	able to:				
1. Execute Linear algebra analysis in	structural engineering				
2. Calculate roots of nonlinear equation	ons.				
3. Execute solution of IVP and BVP b	by different numerical analysis.				
4. Discuss statistics and probability m	ethods in engineering.				
6. Execute numerical solutions to diff	erent structural engineering problems in field.				

Title of the Course:	L	Т	Р	Cr					
Professional Elective 4 Advances in Composites (3ST613)	3	-	-	3					
Desirable Courses: Concrete Technology									
Textbooks:									
1. Siddique Rafat, "Special Structural Concretes", Galgotia Publication Private Ltd., 2000									
2. Swamy R. N., "Concrete Technology & Design", Surrey Universit	ty Pre	ss., illu	strated,	1984.					
References:									
1. Balaguru P. N., Shah S.P., "Fiber Reinforced Cement Compos 1992.	ites, N	/IcGraw	v Hill.,	illustrated,					
2. Hannant D. J., "Fiber Cement and Fiber Concrete", John Wiley &	Sons.	Illustra	ated, 19	78.					
Course Objectives: 1 To illustrate various concrete composites used in practice									
 To impart knowledge of variations in strength of concrete compositions 	ites.								
3. To provide knowledge of various advanced types of concrete in m	odern	constr	uction i	ndustry.					
Course Learning Outcomes:									
After the completion of the course the student should be		Bloo	m's Co	gnitive					
able to]	Level	De	scriptor					
CO1 Illustrate engineering properties, behavior an applications of FRC and Ferro cement.	nd	III	Appl	ying					
CO2 Appraise applications of silica fume concrete and polym concrete by knowing their properties.	er	IV	Analy	zing					
CO3 Justify use of light weight and high strength concrete modern constructions.	in	V	Evalu	ating					
CO-PO Mapping: (Use 1, 2, 3 as Correlation Strengths)			•						
PO 1 2 3 4		5		6					
CO1 2				2					
CO2 2 2 1				2					
CO3 1 3				2					
Assessments:									
Teacher Assessment:									
Two components of In Semester Evaluation (ISE), One Mid Semester End Semester Examination (ESE) having 20%, 30% and 50% weights	Exam respec	ination ctively.	(MSE)	and one					
Assessment M	arks								
ISE 1	10								
MSE	30								
ISE 2	10								
ESE	50								
ISE 1 and ISE 2 are based on assignment/declared test/quiz/seminar et	c.								

MSE: Assessment is based on 50% of course content (Normally first three modules)	
ESE: Assessment is based on 100% course content with 60-70% weightage for course content (normally last three modules) covered after MSE.	t
Course Contents:	
Module 1: Fiber Reinforced Concrete	7 Hrs.
Introduction, Properties of constituent materials, Mix proportion, mixing, casting methods, properties of freshly mixed concrete (fiber reinforced concrete), workability tests, mechanical properties, behavior of fiber reinforced concrete under compression, tension flexure, research findings, and application of fiber reinforced concrete.	
Module 2: Ferro Cement	6 Hrs.
Introduction, materials used, mechanical properties, construction techniques, design in direct tension, applications, and merits as structural materials.	
Module 3: Silica Fume Concrete	7 Hrs.
Introduction, physical and chemical properties of silica Hume, reaction mechanism of silica fume, properties of silica fume concrete in fresh state, mechanical properties and durability of silica fume concrete.	
Module 4: Polymer Concrete	6 Hrs.
Introduction, classification, properties of constituent materials, polymer impregnated concrete, polymer concrete, application.	
Module 5: Light Weight Concrete	6 Hrs.
Introduction, classification, properties of constituent materials, artificial aggregates, application.	
Module 6: High Strength Concrete	7 Hrs.
Introduction, properties of constituent materials, Mix Design, application.	
Module wise Outcomes	
At end of each module students will be able to:	
1. Illustrate the change in concrete properties due to fiber reinforcements.	
2. Illustrate the use of Ferro cement.	
3. Appraise the effect of silica fumes in concrete application.	
4. Appraise the use of polymer in concrete.	
5. Justify use of light weight concrete in field.	
6. Justify the use of high strength concrete in field.	

Title of the	Course:				L	Т	Р	Cr
Dissertatio	on Phase-III	-	8	4				
Desirable (C ourses: Diss	sertation Phase	Π					
References	:							
1. Nationa	al and Interna	tional journals,	Conference Pro	oceedings in St	ructura	al Engi	neering	
2. Technical Reports of Professional societies.								
3. International and national codes of Practices and Handbooks.								
5. Publish	ed Ph.D. and	M.Tech Thesis	s of Reputed Ins	titutes.				
Course Ob	jectives:		<u> </u>					
1. To anal	lyze / experim	nent selected rea	search problem	further.				
2. To rev	iew, classify	and consolida	ate observation	s / results ba	sed of	n the	detail a	nalytical /
experin 3 To doc	nental work.	earch work in t	he prescribed fo	rmat and prese	ont it o	ffectiv	ماد	
Course Les	arning Outco	mes.	ne presenteu re				<i></i>	
			.1 . 1	. 1 111		Bloo	m's Co	gnitive
СО	After the con	mpletion of the	course the stud	ent should be				
						Level	De	scriptor
C01	Apprise and	alytical / expension	rimental work	in detail for th	ne	IV	Ar	alyzing
<u> </u>	Classify and	d assess researc	h outcomes crit	ically		V	Ev	aluating
002	Classify and	a assess researc	in outcomes en	lically.		v	LV	aruating
CO3	Compose a	nd conclude t	he results for	presentation an	nd	VI	Creat	ing
	dissertation	writing.						
CO-PO Ma	apping: (Use	1, 2, 3 as Corr	elation Strengt	ths)				
РО	1	2	3	4		5		6
CO1	2			3		2		2
CO2	1			2		2		2
CO3	2	3		2		2		2
Teacher As Modeling, I	ssessment: A Presentation a	Assessment bas nd Report writi	ed on – Literatu ng.	ure survey, Co	ntent,	Unders	standing	, Analysis,
	Assessment	t		Μ	arks			
	MSE			1	00			
Course Co	ntents:							
In continuat experimenta outcomes cr	tion with the a al work in d ritically.	research work or etail. Based or	carried out in so n this work, st	emester III, stu udent shall cl	dent sl assify	hall can and a	rry out a ssess th	numerical / e research

Title of the	Course:				L	Т	Р	Cr
Dissertation Phase-IV (3ST694 and 3ST695)					_	-	24	4 + 8
Desirable Courses: Dissertation Phase III								
References	:							
 National and International journals, Conference Proceedings in Structural Engineering. Technical Reports of Professional societies. International and national codes of Practices and Handbooks. Internet sources and Distance Learning. Published Ph.D. and M.Tech Thesis of Reputed Institutes. Course Objectives: To analyze / experiment selected research problem further. To review, classify and consolidate observations / results based on the detail analytical / experimental work. 								
Course Lea	arning Outco	mes:	*	-				
60	After the con	mpletion of the	course the stude	ent should be		Bloo	m's Co	gnitive
CO	able to	L]	Level	De	scriptor
CO1	Apprise and selected rese	alytical / expe arch problem.	rimental work i	n detail for th	ne	IV	Ar	nalyzing
CO2	Classify and	l assess researc	ch outcomes crit	cally.		V	Ev	aluating
CO3	Compose at dissertation	nd conclude (writing.	the results for p	presentation ar	nd	VI	Creat	ing
CO-PO Ma	apping: (Use	1, 2, 3 as Corr	elation Strengt	hs)				
РО	1	2	3	4		5		6
CO1	2			3		2		2
CO2	1			2		2		2
CO3	2	3		2		2		2
Teacher As Modeling, I	ssessment: A Presentation a	Assessment bas nd Report writ	ed on – Literatu ing.	re survey, Coi	ntent,	Unders	tanding	, Analysis,
	Assessment	t		M	arks			
	ISE II			1	00			
	ESE			1	00			
Course Co	ntents:							

Student shall carry out numerical / experimental work in detail. Based on this work, student shall classify and assess the research outcomes critically. Student shall compose the results and conclude research findings. Finally, student shall document research work in appropriate format and present it effectively.