National Institute of Technology Durgapur Department of Civil Engineering

M. Tech Structural Engineering Curriculum (Revised effective from JULY, 2019)

FIRST SEMESTER

SI. No	Sub. Code	Subject	L-T-P	Credits
1	CE1001	Advanced Structural Analysis	4-0-0	4
2	CE1002	Advanced Reinforced Concrete	4-0-0	4
3	CE1003	Finite Element Methods	4-0-0	4
4	CE 9011-	Elective I	4-0-0	4
5	20, 31-35	Elective II	4-0-0	4
6	CE1051	Sessional –I: Structural Lab-I	0-0-4	2
7	CE1052	Sessional-II: Computational Lab	0-0-4	2
		TOTAL		24

SECOND SEMESTER

Sl. No	Sub. Code	Subject	L-T-P	Credits
1	CE2001	Advanced Steel Structure	4-0-0	4
2	CE2002	Structural Dynamics	4-0-0	4
3	CE2003	Theory of Elastic Stability	4-0-0	4
4	CE 9021-	Elective III	4-0-0	4
5	30, 36-40	Elective IV	4-0-0	4
6	CE-2051	Sessional III: Structural Lab-II	0-0-4	2
7	CE-2052	Seminar - I (Non-Project)	0-0-2	1
8	CE-2053	Project-I	0-0-2	1
		TOTAL		24

THIRD SEMESTER

Sl. No	Sub. Code	Subject	L-T-P	Credits
1	CE-3051	Project -II	0-0-20	11
2	CE-3052	Project Seminar-I	0-0-5	2
		TOTAL		13

FOURTH SEMESTER

Sl. No	Sub. Code	Subject	L-T-P	Credits
1	CE-4051	Project-III	0-0-20	11
2	CE-4052	Project Seminar-II & Viva-Voce	0-0-5	3
TOTAL				14

CREDIT UNIT OF THE PROGRAM:

Semester	Ι	II	III	IV	TOTAL
Credit Unit	24	24	13	14	75.0

SUMMARY OF COURSES

FIRST SEMESTER

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVELOPER
CE-1001	Advanced Structural Analysis	4-0-0	4	A. K. Banik & D. Das
CE-1002	Advanced Reinforced Concrete	4-0-0	4	A. K. Samanta & S. Karmakar
CE-1003	Finite Element Methods	4-0-0	4	A. K. Datta & P. Topdar
CE-1051	Sessional –I: Structural Lab-I	0-0-4	2	D. K. Singha Roy & A. K. Samanta
CE-1052	Sessional-II: Computational Lab	0-0-4	2	A. K. Datta & P. Topdar

SECOND SEMESTER

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVELOPER
CE-2001	Advanced Steel Structure	4-0-0	4	A. K. Samanta & S. Saha
CE-2002	Structural Dynamics	4-0-0	4	A.K. Banik & D. Das
CE-2003	Theory of Elastic Stability	4-0-0	4	A.K. Banik & D. Das
CE-2051	Sessional III: Structural Lab-II	0-0-4	2	D. K. Singha Roy & A. K. Samanta

Sub Discipline: DEPARTMENTAL ELECTIVES

ODD SEMESTER : Elective-I & II

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVELOPER
CE 9011	Advanced Concrete Technology	4-0-0	4	D. K. Singha Roy & A.K. Samanta
CE 9012	Precast and Prestressed Concrete Structures	4-0-0	4	S. Saha & S. Karmakar
CE 9013	Space Structures and Suspended Structures	4-0-0	4	A. K. Samanta
CE 9014	Structural Rehabilitation and Retrofitting	4-0-0	4	A.K. Datta & P. Topdar
CE 9015	Experimental Stress Analysis	4-0-0	4	A.K. Samanta & D. Das
CE 9016	Structural Optimization	4-0-0	4	A. Das
CE 9017	Reliability Methods in Structural Engineering	4-0-0	4	P. Roy
CE 9018	Offshore Structural Engineering	4-0-0	4	A. K. Banik
CE 9019	Foundation Engineering	4-0-0	4	K. Bhattacharya & S. Pal
CE 9020	Probability and Statistics	4-0-0	4	P. Roy
CE 9031	Wind Analysis and Design of Structures	4-0-0	4	A. K. Samanta

EVEN SEMESTER : Elective-III & IV

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVELOPER
CE 9021	Advanced Bridge Engineering	4-0-0	4	S. Karmakar
CE 9021	Plate and Shell Structures	4-0-0	4	P. Roy
CE 9023	Applied Numerical Methods	4-0-0	4	A. K. Banik
CE 9024	Engineering Elasticity and Plasticity	4-0-0	4	D. Das
CE 9025	Soil Structure Interaction	4-0-0	4	P. Roy
CE 9026	Advanced Theory of Vibration	4-0-0	4	A. K. Banik
CE 9027	Mechanics of Composite and Smart Structures	4-0-0	4	P. Topdar
CE 9028	Analysis and Design of Tall Structures	4-0-0	4	A. K. Samanta
CE 9029	Soil Dynamics & Machine Foundation	4-0-0	4	R. P. Nanda
CE 9030	Behaviour of Concrete Structures	4-0-0	4	A.K. Samanta & P. Roy
CE9036	Advanced Finite Element Method	4-0-0	4	A. K. Datta & P. Topdar

DETAILED SYLLABI OF COURSES

1. <u>Sessional /Practical /Laboratory</u>

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVELOPER	
CE-1051	Sessional -I: Structual Lab-I	0-0-4	0-0-4 2 D. K. S		
Structural Lab (Determination of properties of fine aggregate, coarse aggregate, cement, green concrete and hardened concrete, concrete mix design, casting and testing of RC beam & slab, [42] NDT application & comparison)					
 TEXT BOOKS: Indian Standard Plain and Reinforced Concrete – Code of Practice (4th Revision), IS 456: 2000, BIS, New Delhi. Design Aids for Reinforced Concrete to IS: 456 – 1978 BIS, New Delhi 					
 REFERENCE BOOKS: 1. Concrete Technology by A. M. Neville & J. J. Brooks (Pearson Edu.) 2. Concrete Technology by M. S. Shetty (S. Chand) 3. Indian Standard Concrete Mix Proportioning – Guidelines , IS 10262: 2009, BIS, New Delhi. 					

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVELOPER	
CE-1052	Sessional -II: Computational Lab	0-0-4	2	Datta opdar	
Introduction to advanced computing environment. Introduction to high-level scientific languages, Solution of structural Engineering problems using high level languages. Development of software for analysis of different types structures. Introduction to commercial Finite Element software for solving Structural Engineering problems					
TEXT BOOKS: 1. Relevant books as per faculty members. REFERENCE BOOKS:					

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVELOPER		
CE-2051	Sessional -III: Structural Lab-II	0-0-4	2	D. K. Singha Roy & A. K. Samanta		
Design Project (Design and detailing of various structural connections -RC, Structural Steel & [42] Composite)						
TEXT BOOKS	:					
1. Indian S	standard Plain and Reinforced Concrete -	Code of Pra	ctice (4th Re	evision), IS 456: 2000,		
BIS, Ne	w Delhi.					
2. Design A	2. Design Aids for Reinforced Concrete to IS: 456 – 1978, BIS, New Delhi					
REFERENCE BOOKS:						
1. IS 800-2	1. IS 800-2007 : General Construction in Steel-Code of Practice					

2. Project /Term Paper/Seminar

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVELOPER			
CE-2052	Seminar -I: (Non Project)	0-0-2	1				
Term Paper (Study of Special Topic related or not related to Project) [28]							
TEXT BOOKS	:						
1. Relevan	1. Relevant books as per Supervisor						
REFERENCE BOOKS:							

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVELOPER			
CE-2053	Project-I	0-0-2	1				
Problem Identification / Literature Review [28]							
TEXT BOOKS	:						
1. Relevan	t books as per Supervisor /Guide						
REFERENCE BOOKS:							

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVELOPER			
CE-3051	Project-II	0-0-20	11				
Attempt for solution (Numerical /Experimental) & Progress							
TEXT BOOKS	:						
1. Relevan	1. Relevant books as per Supervisor						
REFERENCE BOOKS:							

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVELOPER			
CE-4051	Project-III	0-0-20	11				
Final reporting & Thesis submission							
TEXT BOOKS	:						
1. Relevan	t books as per Supervisor						
REFERENCE BOOKS:							

3. <u>Compulsory Subjects</u>

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVELOPER			
CE-1001	Advanced Structural Analysis	4-0-0	A.K. & D.	Banik Das			
Recapitulation of basic concepts of structural analysis, force and displacement methods, statical and kinematic indeterminacies of pure truss, pure frame and generalized structures							
Stiffness/ Displacement Method: System approach of solution, global and local coordinate systems, element stiffness matrices for truss and frame elements, displacement and force transformation matrices, connectivity arrays, global stiffness matrix, global load vector, assembling of stiffness matrix and load vector, solution of stiffness equation, output of global displacements and local number end forces, introduction to warping torsion and shear deformation, three dimensional element stiffness matrix and transformation matrix, analysis of grids, different types of example problems.							
Flexibility/ Force Method : System approach of solution, global and local coordinate systems, element flexibility matrices for truss and frame elements, force transformation matrices, global flexibility matrix, global load vector, assembling of flexibility matrix, solution of flexibility equation, output of global displacements and number end forces, different tunes of avample problems.					[8]		
Elastic Stability	y Analysis of beam, column and frames.				[10]		
Nonlinear ana	lysis: geometric stiffness matrix, simple	example g	eometric no	onlinearity,	[10]		
Newton-Raphso truss and plane f	n's technique: solution of nonlinear equa frame.	ations, tange	ent stiffness	matrix of	[12]		
TEXT BOOKS	:						
1. Structur	al Analysis, L.S. Negi & R.S. Jangid, Tata	McGraw-Hi	ill Publishing	g Company	Limited		
 Structural Analysis: A Matrix Approach, G.S. Pandit & S.P. Gupta, Tata McGraw-H Publishing Company Limited 					Graw-Hill		
REFERENCE BOOKS: Structural Analysis: A Unified Classical and Matrix Approach, Amin Ghali, Adam M. Nev & FN SPON 4th Ed. 							
2. Stability	Analysis and Design of Structure, M. L. C	Gambhir, Spi	ringer 2004	edition.			

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	OPER	
CE-1002	Advanced Reinforced Concrete	4-0-0	A.K. S & S. Ka	amanta armakar	
Basic concepts of reinforced concrete structures & recapitulation of WSM & LSM. Exposure to IS & Foreign Codes of practice. Design of frames, gables and structures subjected to bending and direct load by Limit State method					[6] [8]
Design of water	tanks (Rectangular, circular and Intz type)	and staging			[8]
Fundamentals of formwork	f pre-stressed concrete, Design of simple	elements, C	able profile,	Design of	[12]
Design of Silo a	nd bunker, chimney.	onen web sti	ructures		[12]
Moment Redist Raft foundatio	ribution: Examples of single and multispa ns: Theory related to raft foundations,	n beams. Codal spec	ifications, S	imple raft	[6]
design and beam	slab raft, Pile-raft and circular raft.		C 1 11 1	1 11	[2]
Shell Structure	s: Theory related shells, Shells for foundated conical shells	itions, Desig	gn of shell, h	yper shell,	
Water Tank:	Fundamentals, Design of Ground St	upported, (Over Head,	Circular,	[4]
Rectangular, Intz type, prestressed tank, Staging and Foundations with the considerations earthquake.				[10]	
Flat Slab: Ter Equivalent frame	minology, Methods of analysis and de e method, Slab reinforcement, Shear in slal	sign: Direc b, Transfer o	et design me of moment fr	ethod and om slab to	[12]
columns, Transfer of moment by flexure and shear, Opening in slabs, Codal provision and Design Examples.				[4]	
Detailing of ear ductility, detailin	thquake resistant constructions: Introdung of ductility and shear wall.	ction, ductil	lity of beam,	design for	[4]

TEXT BOOKS:

- 1. Reinforced Concrete Design, 2nd Edition, by S. Unnikrishna Pillai and Devdas Menon, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2003.
- Indian Standard Plain and Reinforced Concrete Code of Practice (4th Revision), IS 456: 2000, BIS, New Delhi

REFERENCE BOOKS:

- 1. Design Aids for Reinforced Concrete to IS: 456 1978, BIS, New Delhi
- 2. Reinforced Concrete, 6th Edition, by S.K. Mallick and A.P. Gupta, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, 1996.
- 3. Reinforced Concrete Design, 1st Revised Edition, by S.N. Sinha, Tata McGraw-Hill Publishing Company. New Delhi, 1990.
- 4. Limit State Design of Reinforced Concrete, 2nd Edition, by P.C. Varghese, Prentice-Hall of India Pvt. Ltd., New Delhi, 2002.
- 5. Advanced Reinforced Concrete Design N Krishna Raju, CBS Publishers
- 6. Handbook Concrete Engineering, Mark Fintel, CBS Publisher.
- 7. P.C.Varghese, (ii) Karunamay Ghosh, (iii) B.M. Dash (iv) N.K.Raju and (v) S.S. Bhabvikatti Vol.-(ii), (vi)B. K. Chatterjee (vii) A.K.Jain and (viii) Mallick and Gupta (ix). Shina.
- IS: 456 2000, IS 2950, IS: 3370 (i to iv) 1965 & 1967, IS: 11682-1985 and IS: 1893 (i) 2002, IS: 4326-1993 and IS: 13920 1993.

SUBJECT CODE	SUBJECT	L-T-P CREDIT DEVELOPER				
CE-1003	Finite Element Methods	4-0-0	Datta Topdar			
Review of principles of virtual work and minimum potential energy, Introduction to F.E.M. Basic concept, General applicability, Solid bar under axial load, Engineering applications. Elementary theory of elasticity						
Use of Matrix Techniques, Sol	Use of Matrix Algebra in implementation of FEM : Importance, Matrix Manipulation Techniques, Solution of Simultaneous Linear Equations, Inverse of Matrix, Eigen Values and					
Eigen Vectors, C	Computer Implementation				[8]	
Spring Element Bar Elements : functions, Proble	t: General, Implementation in FEM, Applic Definition, Property Matrix using Dire ems and Validation.	cations, Protect and Ene	olems. ergy Approa	ch, Shape	[4]	
Structural Eng	gineering Problems: Analysis of Trusse	es, Beams,	Frames etc.	by FEM.	[16]	
Real life Stru	cture: Modelling of real life structural	Engineeri	ng problems	s, element	[8]	
Computer Prog solution in Indus	selection, convergence studies, error analysis. Computer Programs / SOFTWARES: Exposure to structural engineering problems and their solution in Industry and Research.					
TEXT BOOKS	:					
1. Fundam Educatio 2. Finite E	entals Of Finite Element Analysis by David on Private Limited (2005) lement Procedures by Klaus-Jsrgen Bathe I	d V. Hutton Publisher: P	Publisher: T	ata Mcgraw	Hill	
REFERENCE	BOOKS:			()		
1. Finite Element Analysis Theory and Application with ANSYS by Moaveni Publisher (2008)					r: Pearson	
2. Finite element analysis: theory and programming by C Krishnamoorthy (2001) Tata Hill Education					a McGraw	
3. Concept Wiley.	t and Applications of Finite Element Ana	alysis by Ro	obert D. Co	ok, David S	5. Malkur;	

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVELOPER	
CE-2001	Advanced Steel Structure	4-0-0	amanta Saha		
TOPICS : Principles of stee Design of Ind Analysis and D Shoe Plate and H Multistoried fran Plastic Analysi design, Shake-D Design of tall str Design of Casted Bridges : Desig and railway. Light gauge stee	el design, recapitulation of basic concepts. ustrial Shed : Description of Different esign of Truss members, Purlin, Top Cho Bolts design, Columns Design, Base Plate a nes : Analysis and design of semi-rigid cor s and Design of structures: Plastic mom- own theorem. Analysis and design of Sing- ructures, Chimneys, Transmission line towo llated beams and open web structures. gn loads for highway / railway bridges, Do el structures.	component ord and Bot and Anchor I nection. ent distribut gle and Mult er, Water tar esign of trus	s, Loads C tom Chord B Bolts Design ion, Minimu iple stored p iks, Silos. ss bridges fo	alculation, Diagonals, um weight ortals. r highway	hrs [6] [8] [4] [6] [10] [4] [8] [4]

REFERENCE /TEXT BOOK(S) :

- 1. Design of steel Structures : N. Subrhamanium (Oxford publications)
- 2. Victor. D.J. (1973): Essentials of Bridge Engineering, Oxford and IBH Publishers.
- 3. IRC: 6 2000– Section II, Indian Standard for loads and stresses on Highway Bridges.
- 4. Bridge rules 1982, Specifications for Indian Railway loading.
- 5. IS: 875 1987 (Parts I to V), Indian Code of Practice for evaluating loads excepting earthquake load, BIS New Delhi.
- 6. Introduction to Steelwork Design to BS 5950: Part 1, The Steel Construction Institute, 1988.
- 7. IS 800-2007 : General Construction in Steel-Code of Practice
- 8. IS 808-1989 : Dimensions of Hot Rolled Steel beam, column, channel and angle sections
- 9. SP 6(1)-1964 : Handbook for Structural Engineers.

REFERENCE / TEXT BOOK(S) :

1. Limit State Design of Steel structures : Virendra Gehlot & Dr. Ram Chandra (Scientific publisher).

SUBJECT CODE	SUBJECT	L-T-P	L-T-P CREDIT DEVEL			
CE-2002	Structural Dynamics	4-0-0 4 A.K. Bar & D. Da				
Theory of vibration , D'Alembert's principle, different loads causing vibration, definition of degree of freedom, damping, stiffness coefficients, flexibility coefficients etc. Free vibration of SDF system, Equation of motion and its solution. Problems						
Forced vibration of SDF under sinusoidal force with constant and variable amplitude, suddenly applied loads, step pulse, arbitrary loadings, Duhamel's Integrals. Transmissibility and base isolation. Working Principals of different pick-ups. A brief introduction of						
Numerical integration technique. Problems Multi-degree freedom system , Development and solution of equations of motion for Two Degree of freedom system. Eigen values and Eigen-vectors, concept of normal/generalized coordinates						
Numerical tech Method, Stoddol	miques of solving free vibration of MI la's method. Problems	DF, Rayleig	gh's method	, Holzer's [10]		
Forced vibration two degree freed	on of MDF, Sinusoidal loading and arbitr lom system. Problems. Earthquake analysis	ary loading. s of building	Vibration is	solation of [5]		
TEXT BOOKS: 1. Dynamics of Structures, By: M. Mukhopadhyay. New-Age Publication. N. Delhi 2. Theory of Vibration with Applications, W.T. Thomson, PHI						
 REFERENCE BOOKS: 1. Elements of Earthquake Engineering, Jai Krishna, A.R. Chandrasekaran, B. Chandra. S Asian Publishers. 						

2. Earthquake Resistant Design of Structure by Pankaj Agarwal & Manish Shrikhande.

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVELOPER		
CE-2003	Theory of Elastic Stability	4-0-0	4	A.K. Banik & D. Das		
TOPICS : Introduction, fur Stability as an E Energy methods Beam columns continuity and re Stability of cor members with an Numerical integ Inelastic bucklim	ndamental principle and models for elastic a Eigen value problem, Approximate method , Rayleigh-Ritz's method, Galerkin's meth- under concentrated and continuous lat estrained ends. ntinuous beams and frames, Stiffness ma nd without lateral restraints. ration for stability problems by Newmark's ng of structures.	stability of c ls for buckli od. teral loads, atrices and s method.	column. ng of bars a Beam colu stability fun	nd frames, umns with actions for	[2] [10] [10] [10] [5] [5]	

TEXT BOOKS:

1. Stability Analysis and Design of Structures - M.L. Gambhir Publisher - Springer-Verlag Berlin Heidelberg

REFERENCE BOOKS:

2. Theory of Elastic Stability - Stephen P. Timoshenko & James M. Gere Publisher - McGraw-Hill Book Co., Inc.

4. Elective Subjects

ODD SEMESTER (Elective-I & II) : CE 9011-20, 31-35

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	OPER	
CE-9011	Advanced Concrete Technology	4-0-0	D. K. Sing & A.K. Sa	ha Roy manta	
Brief Introduction to Concrete: Classification of concrete, Properties of concrete, Grades of concrete, Advantage and disadvantages of concrete as a construction material, Concept of quality control.					
Concrete making materials : Cement, Aggregates, Water, Admixture : Review of types, classification; chemical composition, properties and application, Codal provisions.					
of mix. Review	of other codes provision.	indian Star	nortars and	concretes:	[6]
workability, seg	regation and bleeding. Theory and princip	ples governi	ing the corre	ect placing	[6]
Properties of I	Hardened concrete: Strength; deformation of the strength of th	ion under l	load; elastic	ity; creep;	[6]
Special concretes: Lightweight concrete: autoclaved aerated concrete, Ready – mix concrete, no-fines concrete, lightweight aggregate concrete and foamed concrete. High strength					[6]
concrete; fibre-re Special purpos	einforced concrete; recycled concrete. e concrete: sparyed concrete, underwa	ter concrete	e, grouts an	d grouted	
concrete, mass concrete, pumped concrete, concrete for liquid retaining structures. Repairing concrete: diagnosis, material, no-destructive evaluation and other techniques					[6] [6]
TEXT BOOKS: 1. Adv. Concrete Technology by John Newman & Ban Seng Cho, Elsevier. 2. Concrete Technology by A. M. Neville & J. J. Brooks (Pearson Edu.)					
 REFERENCE BOOKS: 1. Concrete Technology by M. S. Shetty (S. Chand) Concrete Technology by M. L. Gambhin McGraw Hill). 					

July 5, 2019

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVEI	LOPER	
CE-9012	Precast and Prestressed Concrete Structures	4-0-0 4 S. Saha & S. Karmakar				
Part-A:						
Precast Concrete: Different types precast concrete and its application. Prestressed Concrete: Introduction, Stress analysis, Losses, Shear, Torsion, Deflections, Cracking, Transmission length, End zone, Bursting reinforcement, Bearing Plate, limit state criteria.						
<u>Part-B:</u> Prestressed Concrete: Analysis of Flexure, design of PSC flexural members, design of section for Axial tensions, design of section for compression and bending, Statically indeterminate structures design of PSC poles. Sleepers Pipes tanks and others.						
TEXT BOOKS: 1. N. Krishna Raju, "Prestressed Concrete", Tata McGraw Hill, New Delhi, 1995. 2. E. H. Gaylord, C. N. Gaylord and J. E. Stellmeyer, "Design of Steel Structures", McGraw Hill. REFERENCE BOOKS:						
2. Ramasv 3. Lin T.V	 N. Kajagopaian, Prestressed Concrete, Narosa Publishing House, 2002 Ramaswamy G.S., Modern prestressed concrete design, Arnold Heinimen, New Delhi,1990 Lin T.Y. Design of prestressed concrete structures. Acia Publishing House, Bombay 1005 					
 4. David A.Sheppard, William R. and Philips, Plant Cast precast and prestressed concrete 5. A design guide, McGraw Hill, New Delhi 1992. 6. A.K.Jain 7. IS : 1343-2012 					ie	

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVELOPER		
CE-9013	Space Structures and Suspended Structures	4-0-0	4	A. K. Samanta		
Determinate and indeterminate space structures, Methods of analysis, Design of pin-jointed and rigid space frames. Different types of suspended structural systems, Methods of static and dynamic analysis. Linear and non-linear analysis of Suspended structures, Suspension Bridges, analysis & design of suspension cable.						
 TEXT BOOKS: 1. Stafford S. B. etc. (1991), Tall Buildings, Analysis and Design, John Wiley & Sons Inc. 2. Moore F. (1999), Understanding Structures, McGrew-Hill. REFERENCE BOOKS:						
1. Troitsky M. S. (1994), Planning and Design of Bridges, John Wiley & Sons Inc.						

- Walther R. etc. (1988), Cable-Stayed Bridges, 2nd Edition, Thomas Telford Ltd.
 Troitsky M. S. (1988), Cable-Stayed Bridges, 2nd Edition, BSP Professional Books.

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVELOPER	
CE 0014 Structural Rehabilitation and A. K.					
CE-9014	Retrofitting	4-0-0	4	P. To	opdar
Introduction: Terminology; Repair, rehabilitation and retrofitting.					
Causes of deteri	oration and durability				[6]
Qualitative Me	thods of Seismic Evaluation: Rapid visual	l screening p	procedure (R	VSP) and	
simplified evaluation of buildings; non-destructive testing (NDT) method.					[8]
Quantitative Methods of Seismic Evaluation: Performance based method using nonlinear					
static push-over analysis (NSP) and non linear dynamic method of analysis (NDP)					[8]
Materials for rep	pairs, rehabilitation and retrofitting process	es			[6]
Rehabilitation	methods: Shortcreting; Grouting, Epoxy-co	ement morta	r injection, C	Crack	
ceiling, Local an	d Global Methods of Seismic Retrofitting	of RC and I	Masonry Bui	ldings;	
Introduction to s	supplemental energy dissipation and base is	olation.	·		[8]
Case study					[6]
TEXT BOOKS: 1. Earthquake resistant design of structures by Pankaj Agarwal and Manish Shrikhande, Pro Hall of India, 2006.					rentice-

2. Handbook on Repair and Rehabilitation of RCC buildings, Published by CPWD, Delhi, 2002.

REFERENCE BOOKS:

- 1. Seismic Evaluation and retrofit of concrete building Vol. I & II,1996, Applied Technology Council, California, ATC 40.
- 2. Rapid Visual Screening of Buildings for Potential Seismic Hazards, 2002, Federal Emergency Management Agency, Building Seismic Safety Council, Washington, D.C., FEMA 154/155.

SUBJECT CODE	SUBJECT	L-T-P	L-T-P CREDIT DEVEL			
CE-9015	Experimental Stress Analysis	4-0-0	Samanta D. Das			
Basic equations and Plane Elasticity Theory: Introduction, Strain equations of Transformation, Compatibility, Stress-Strain Relations-Two dimensional State of Stress.						
The Plane-Elastic problem, The Plane-Strain Approach, Plane Stress, Airy's Stress function- Cartesian Co-ordinates-Two dimensional problems in Polar Co-ordinates, Polar Components of Stress in terms of Airy's Stress function, Forms. Principles of Experimental Approach: Merit of Experimental Analysis introduction, uses of experimental stress analysis-Advantages of experimental stress analysis - Advantages						
Strain Measurement using Strain Gauges: Definition of strain and its relation to Experimental Determinations, properties of strain-gauge systems, Types of strain gauges, Mechanical and				[8]		
Electrical Strain Gauges - Introduction, LVDT - resistance strain gauge - various types - gauge factor, Materials for adhesion base, etc. Strain Rosettes: Introduction, The three				[8]		
Brittle Coating Method: Introduction, Coating stresses - Failure theories - Brittle coating Crack pattern - Crack detection - Types of Brittle coating - Test procedures for brittle coating analysis - Calibration procedures - Analysis of brittle coating data						
Theory of Photo Elasticity: Introduction, Temporary double refraction - The stress optic law - Effects of stressed model in a Polaris cope for various arrangements - Fringe sharpening, Brewster stress optic law.						
Two Dimension fringe patterns, j fringe pattern -	hal Photo Elasticity: Introduction, Isochropassage of light through plane Polaris cope Compensation techniques - calibration me	omatic Frin and circular thods, separ	ge patterns r Polaris coperation metho	- Isoclinic e, Isoclinic ds, scaling	[6]	

Model to Proto type stress- Materials for photo - elasticity, properties of photo elastic
materials.
TEXT BOOKS:
1. Experimental Stress Analysis by J.W.Dally and W.F.Riley
2. Experimental Stress Analysis by Dr. Sadhu Singh
REFERENCE BOOKS:
1. Experimental Stress Analysis by Dove and Adams

SUBJECT CODE	SUBJECT	L-T-P	CREDIT DEVEL		LOPER		
CE-9016	Structural Optimization	ural Optimization 4-0-0 4 A. D					
Basics of engineering analysis and design, Need for optimal design, formulation of optimal design problems, basic difficulties associated with solution of optimal problems, Classical optimization methods, Necessary and sufficient optimality criteria for unconstrained and							
constrained problems, Kuhn-Tucker conditions, Global optimality and convex analysis, Linear optimal problems, Simplex method, Introduction to Karmarkar's algorithm.					[15]		
Numerical methods for nonlinear unconstrained and constrained problems, sensitivity					[10]		
Introduction to	variational methods of sensitivity analysis	, shape sens	sitivity, Intro	duction to			
integer program	nming, dynamic programming, stochast	tic program	ming and	geometric			
programming, Ir	ntroduction to genetic algorithm and simula	ted annealir	ng.		[15]		
TEXT BOOKS	:						
1. Optimizat	ion: Theory and Applications by S.S.Rao.						
2. Numerica	l Optimization Techniques for Engineering	Design wit	h application	is by			
G.N.Vand	lerplaats.						
3. Elements of Structural Optimization by R.T.Haftka and Z.Gurdal.							
REFERENCE BOOKS:							
1. Optimum	Structural Design by U.Kirsch.						
2. Optimum	Design of Structures by K.I.Majid.						
3. Introducti	on to Optimum Design by J.S.Arora.						

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVEL	OPER
CE-9017	Reliability Methods in Structural Engineering	4-0-0	4	Roy	
Introduction: Introduction to structural safety and reliability, Concepts of uncertainty in					
reliability-based	analysis and design.				[2]
Basic statistics	and probability: Definition of random	variables, A	Axioms of p	robability,	
probability functions, conditional probability, Discrete and continuous random variables,					
probability distribution of random variables, random vectors and functions of random				[8]	
variables.					
Simulation tec	hniques: Monte Carlo method, Latin I	Hypercube	simulations,	Variation	
reduction technic	ques.				[6]
Basic reliabilit	w methods: Basic definition of Reliabi	lity Index,	First order	reliability	
method, Hasofer-Lind reliability index. Rackwitz-Fiessler reliability method.				[8]	
Reliability-based design: Reliability-based design code and its development. Load and					
resistance factor design format. Calibration of partial safety factors for a level I code.					
Uncertainty mod	lels for load and resistance parameters.			,	r •1
Advanced relia	bility methods: Second order reliability methods	ethod, respo	nse surface a	approach.	[4]

Struct	ural system reliability: Introduction to structural system reliability.	[2]
TEXT	BOOKS:	
1.	Ang and Tang, 'Probability concepts in engineering planning and design'Vol I and II,	John
2.	R Ranganathan 'Structural Reliability Analysis and Design' Jaico Publishing House	
REFE	RENCE BOOKS:	
1.	Halder, A., and Mahadevan, S. 'Probability, reliability and statistical methods in engine	eering
2	design'. John Wiley and Sons. New York.	TT'11
2.	Papoulis, A. 1991, 'Probability, random variables and stochastic processes' McGra	aw Hill
3	New YORK. Melchers R F 1987 Structural Reliability Analysis and Prediction Chichester Englar	d. Filis

Melchers, R.E. 1987. Structural Reliability Analysis and Prediction. Chichester, England: Ellis 3. Horwood.

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVEL	OPER
CE-9018Offshore Structural Engineering4-0-04A. K.					
Loads and struc	tural forms of different types of offshore str	ructures;			[4]
Elements of single d.o.f. system subjected to free and forced vibrations; Analysis for transient					
and steady state	e force; Equivalent damping for nonlinear	systems; Dy	ynamics of r	nulti d.o.f.	
systems; Eiger	n values and vectors; Iterative and	transformation	tion metho	ds; Mode	[10]
superposition. F	ourier series and spectral method for respon	nse of single	d.o.f. syster	ns;	
Vibrations of ba	rs, beams and cones with reference to soil a	as half space	;		[4]
Behaviour of concrete gravity platform as a rigid body on soil as a continuum;					
Short and long term statistics of wind; Static wind load; Effect of size, shape and frequency;					[4]
Aerodynamic admittance function and gust factor, spectral response due to wind for various					
types of structur	res; Wave loads by Morison's equation; St	atic and dyr	namic analys	is of fixed	
structures; Use of	of approximate methods.				
Design of offsh	ore platforms: Introduction, fixed and floa	ting platfori	ns. Steel, co	ncrete and	[10]
hybrid platform	s. Design criteria. Environmental loading.	Wind, wave	and current	loads after	
installation Be	haviour under dynamic loading. Static and	dynamic an	alysis of pla	tforms and	[4]
components.					
TEXT BOOKS	:				
1. Dynamics of Offshore Structures, James F. Wilson, Wiley; 2 edition					
2. Wave Forces on Offshore Structures, <u>Turgut 'Sarp' Sarpkaya</u> , Cambridge University Pre					
edition					
REFERENCE	BOOKS:				
1. Hydrod	ynamics of Offshore Structures, S.K. Chak	<u>rabarti</u> , WIT	Press / Com	putational N	Aechanics

1. Hydrodynamics of Offshore Structures, <u>S.K. Chakrabarti</u>, WIT Press / Computational Mechanics

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVEI	LOPER
CE-9019	Foundation Engineering	4-0-0	4	K. Bhattacharya & S. Pal	
Part-A: A). Bearing C bearing capacity inclined loading SPT value, different efficiency and se	apacity of Foundations: Definitions, ty 7, modification for shallow, square and rec 3. Effect of local shear failure, BIS ultimat erent types of bearing capacity for piles b ettlement.	ppes of she tangular, wa te bearing ca oth in sand	ar failures; ater table ecc apacity, plate and clay, G	Terzaghi's centric and e load test, roup piles,	[10]

B). Foundations Design: Theory related to foundation, Simple square and rectangular	
foundation design, foundation with moments, combined footing design.	[06]
C). Soil Structure Interaction and beams on Elastic Foundations: Fundamentals of soil	
structures interaction and beam on elastic foundations and design.	[04]
D). Effects of Earthquake on Foundation Structures: Seismic waves, Response Spectrum,	
effect of soil properties, liquefaction of soils, Base shear and Design.	[04]
E) Rigid Retaining Wall: Theory related to retaining wall, Design of Cantilever and	
Anchored retaining wall.	
Part-B:	
E). Raft foundations: Theory related to raft foundations, Codal specifications, Simple raft	
design and beam slab raft, Pile-raft and circular raft.	[06]
F). Sheet Pile & Braced Cuts: Theory related to sheet piles and braced cuts, Design of	
cantilever and Anchored Sheet piles using rigid and flexible method and design of different	[12]
braced cuts.	
G). Deep Foundations: Theory related Piles and Well foundations, Design of simple piles,	
well, under-reamed piles and pile cap.	[06]
H). Shell Foundations: Theory related shells foundations, Shells for foundations, Design of	
Hyper shell and conical shells	[06]
TEXT BOOKS:	
1. Foundation analysis and Design by J.E.Bowles	
2. Basic and Applied Soil Mechanics by G.Ranjan and A.S.Rao	
REFERENCE BOOKS:	
1. Soil Mechanics and Foundations by M.Budhu	
2. Soil Mechanics and Foundation Engineering by S.K. Garg, Khanna Publishers	
3. Advanced Soil Mechanics B.M. Das, McGraw Hills Publishers	

CODE	VELOPER				
CE-9020Probability and Statistics4-0-04P. 1					
Probability: Axiomatic definitions of probability, addition rule and conditional probability.	[05]				
multiplication rule, total probability, Bayes Theorem and independence, problems.	[05]				
density and cumulative distribution functions, mathematical expectation, moments	[06]				
probability and moment generating function, Markov inequality, Chebyshev's inequality					
problems.	[00]				
Special Distributions: Discrete uniform, binomial, geometric, negative binomial	[08]				
hypergeometric, Poisson, continuous uniform, exponential, gamma, Weibull, beta, normal,					
lognormal.	[02]				
Function of a random variable: Different functions of a random variable.	[04]				
correlation and regression independence of random variables bivariate normal distribution	[02]				
Sampling Distributions: The Central Limit Theorem, distributions of the sample mean and	[03]				
the sample variance for a normal population, Chi-Square, t and F distributions, problems.	[06]				
Estimation: Unbiasedness, consistency, the method of moments and the method of	[]				
maximum likelihood estimation, confidence intervals for parameters in one sample and two					
sample problems of normal populations, confidence intervals for proportions.					
Testing of Hypotheses: Null and alternative hypotheses, the critical and acceptance					
regions, power of the test, the most powerful test and Neyman-Pearson Fundamental	[02]				
Lemma, tests for one sample and two sample problems for normal populations, tests for	[02]				

proportion. Goodness of fit tests: Chisquare goodness of fit test and its applications, problems. TEXT BOOKS: Ang, A. H. S. and Tang, W. H. 1975. Probability Concepts in Engineering Planning and Design: Volume 1, Basic Principles, Wiley. Ang, A. H.-S. and Tang, W. H. 1984. Probability Concepts in Engineering Planning and Design: Volume 2 Decision, Risk and Reliability, Wiley, New York. Ross, S, 1998. A First Course in Probability, Prentice Hall, NJ.

- 4. Montgomery, D.C. and Runger, G.C. 1998. Applied Statistics and Probability for Engineers, Wiley, New York.
- 5. Ross, S. 1987. Introduction to Probability and Statistics for Engineers and Scientists, John Wiley, New York.

REFERENCE BOOKS:

- 1. Speiegel M. R., Schiller, J.J. and Srinivasan, R. A. 2010. Probability and Statistics, Tata-Mcgraw-Hill, New Delhi.
- 2. Papoulis, A. 1991. Probability. Random variable and Stochastic process, McGraw-Hill, New York.

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVELOPER	
CE-9031	Wind Analysis and Design of Structures	4-0-0	4	A. K. S	amanta
Introduction : Concept of wind, Causes and types of wind, Along wind and across					[2]
wind, Gust, Reference to different codes of practices related to wind					
Wind pressure effect on tall structures & slender structures ; Buildings, Sheds,			[19]		
chimneys; Towers etc.					54.03
Wind pressure effect on cable supported bridges, steel bridges			[19]		
Wind pressure, effect on cooling towers, silo					
Wind tunnel testing & simulations, Statistical analysis of wind.					
TEXT BOOKS:					
1. Indian S	Standard Plain and Reinforced Concrete	e – Code of	Practice (4	th Revision	n), IS

456: 2000, BIS, New Delhi.

2. Design Aids for Reinforced Concrete to IS: 456 – 1978, BIS, New Delhi

3. Advanced Reinforced Concrete Design N Krishna Raju, CBS Publishers

4. Handbook Concrete Engineering, Mark Fintel, CBS Publisher

5. IS 875-Part III : Dimensions of Hot Rolled Steel beam, column, channel and angle sections

6. www.nptel.iitm.ac.in

7. Wind and Earthquake Resistant Buildings: Structural Analysis and Design by Bungale S. Taranath, CRC Press Book.

EVEN SEMESTER (Elective-III & IV)) : CE 9021-30, 36-40

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVELOPER	
CE-9021	Advanced Bridge Engineering	4-0-0 4 S. Karmakar			
HYDRAULIC Economic span,	DESIGN: Catchment, site selection, Hydr Afflux and Scour.	aulic Geom	etry, linear v	waterways,	[04]
Fundamentals of load, impact fa centrifugal force stress, secondar	t Different type of loading & Codes related actor, foot path load, longitudinal force e, thermal force, pressure due to water cur y stresses, earth pressure, seismic forces, ination for multilane, design standard and	ed to Bridge e, erection rent, buoyar wind forces working st	: Dead Load forces, rack acy effect, de s, snow load ress Method	ing force, eformation l, collision	[10]
and Limit State Method of design. Slab and box Culvert Bridge: Analysis of deck slab - effective width & length method and numerical example with different type of live load.					[04]
numerical example with different type of live load. R.C. BEAM-SLAB AND STEEL COMPOSITE BRIDGES: Brief introduction to R.C. T- beam bridge, design of deck panel by Pigeaud's method, dispersion of two way deck slab, design of cantilever portion, analysis of longitudinal girders by Courbon's method, design of longitudinal & cross girders and numerical example of R.C. T-beam deck slab with different tupe of live loading and steel Composite bridge					[08]
DYNAMIC RESPONSE OF BRIDGE DECK: General features, factor affecting vibration, practical approach for vibration analysis, blast loading on bridge deck and numerical					[02]
examples. PRESTRESSE design details of	D CONCRETE BRIDGE: General feat	ures, advant	tage of P.S.	C. Bridge,	[10]
tensioned and po BRIDGE BEA	ost –tensioned deck and T-beam bridge. RING: Introduction, types of bearing, des	sign principl	es of differe	ent bearing	[04]
BRIDGE PIER stability analysi	S AND ABUTMENTS: Introduction, typs of abutment, types of wing wall and	pe of piers, numerical	forces acting examples of	g on piers, f Pier and	[04]
BRIDGE FOUR well foundations	NDATION: General aspect, types of four s and numerical examples of pile and well f	ndations, de	sign aspect of	of pile and	[04]
CABLE STAY longitudinal cab	ED BRIDGES : General Features, com le arrangement, approximate structural ana DGE : Skew bridges rigid frame bridge	ponents of lysis and nu	cable staye merical exan	d bridges, nples.	[04] [14]
bridge, balanced cantilever bridge and continuous bridge. CLASSICAL BRIDGES: Pipe culvert and masonry					[06]
TEXT BOOKS: 1. Book by N.K.Raju (Oxford & IBH publishing co. pvtltd), 2. D.J.Victor (Oxford & IBH publishing co. pvtltd), REFERENCE BOOKS: 1. Jagadeesh & Javaram (PHI Learning Private Limited)					
2. N.Rajag	opalan (Norsa Publishing House)	/(II)+ 1967 -1	S_13/3·198() IRC- 18·2	000 BC-

83(Part-I): 1999, IRC-83(Part-II): 1987 & IRC-83(Part-III): 2002, IRC- 78:2000, IS-456:2000

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVELOPER		
CE-9022	Plate and Shell Structures	4-0-0	4	P.Roy		
Basic curvature and displacement relationships. Expressions for bending, moment, twisting moments, shear forces.						

Plate equation, Edge conditions. Solution of simply supported plates by Navier's and Levy's	
methods. Introduction to anisotropic plates.	[08]
Plate subjected to in plane forces, Buckling of plates. Numerical analysis of plates. Design of	
plates.	[06]
Shell structure: Classification, Differential geometry, Curvature, Strain, Displacement	
relations.	[05]
Membrane theory of thin shells and design of cylindrical shells of double curvature	
(synclastic and anticlastic), Shells of revolution, North light shell.	[10]
Design of shell and review of IS code provisions, Introduction to bending theories:	
Application to cylindrical shells and design.	[05]
TEXT BOOKS:	

- 1. Theory of Plates and Shells: Timoshenko and Krieger, McGraw Hill
- 2. Theory and Analysis of Plates: Classic and Numerical Methods, Rudolph Szilard, Prentice Hall Inc. New Jersey

1. Design and Construction of Concrete Shell Roofs : G.S. Ramaswamy, CBS Publisher & Distributors (2005)

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	CREDIT DEVELOPER	
CE-9023	Applied Numerical Methods	4-0-0	4	A. K.	Banik
Fundamentals of	of numerical methods, Elements of ma	trix algebra	a, Solution	of Linear	
equations and e	igenvalue problems; Solution of differen	tial equation	ns, Error an	alysis and	[02]
stability of algor	ithms.				
Nonlinear equa	tions:				
Newton Raphso	on method, Muller's method, system of	f non-linea	equations.	Roots of	[06]
polynomial equa	tions.				
Linear system of algebraic equations:					
Gauss elimination method, LU decomposition method; matrix inversion, iterative methods, ill					[08]
conditioned syst	ems. Eigenvalue problems: Jacobi, Given	's and Hous	seholder's m	ethods for	
symmetric matrices, Power and inverse power methods.					
Interpolation and approximation:					[0,6]
Newton's, Lagrange and Hermite interpolating polynomials, cubic splines; least square and				[06]	
minimax approximations.					
Numerical diffe	erentiation and integration:				[06]
Ondinamy diffe	no Gaussian type quadrature methods.				[00]
Initial value pro	blams: single step and multistep method	e etability a	and their co	nvergence	
Boundary value	problems: functional approximation finite	s, statifierence	method fini	te element	[08]
method	problems. runedonar approximation, mine		method, min	te cicilient	[00]
Partial Differer	tial Equations:				
Difference meth	ods for solution of parabolic and hyperbol	lic equations	s in one and	two-space	
dimensions, sta	bility and their convergence, difference	e methods	for elliptic	equations.	[06]
Computer orient	ed algorithms; Numerical solution of differ	rent problem	IS.	- 1	[]
TEXT BOOKS	•	1			
1 Numerio	• cal Methods for Scientists and Engineers R	W Hamm	ing Dover F	Publications	2 edition
2 Numerio	cal Methods for Scientists and Engineers, No.	ahinder Kur	nar Iain (Ar	(thor) SRI	Z Cultion K Ivengar
(Author), R. K. Jain, New age publishers					r. iyongui
REFERENCE	BOOKS:				
1 Applied	Numerical Methods for Engineers Using	Matlah and	1 C Robert	I Schilling	(Author)
Sandra I	L. Harris, Nelson Engineering: Har/Cdr edi	tion	<i>. .</i> , noont		(1 1001),

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVEI	OPER
CE-9024	Engineering Elasticity and Plasticity	4-0-0	4	. Das	
3-Dimensional stress strain analysis, Principal stress and maximum shear stress, Stress invariants, Equilibrium and compatibility equations, Boundary conditions, 2-Dimensional problems in Cartesian, Polar co-ordinates, Bending of beam, Thick cylinder under pressure,					
Complex variable, Harmonic and bi-harmonic functions, Torsion of rectangular bars					
Including hollow section energy principles. Plastic stress-strain relations Tensile test Universal stress-strain relations for strain					
hardening of metals, Treska and Mises' yield conditions, St. Venant's theory of plastic flow, Reuss's theory Work during plastic deformations					[10]
Thick walled sp	herical shell under internal pressure, Equa	ation of equ	ilibrium con	ditions for	[10]
yielding, Stresse	es and deformations, Plane stress and plane	strain condi	tion.		
Solids and annul	lar rotating cylinders and discs.				[05]
TEXT BOOKS	:				
1. Richard. G. Budynas, "Advanced Strength and Applied Stress Analysis" Mc Graw-Hill, New Delhi, Second Edition, 2011					
2. Chakrab 2006	party, "Theory of Plasticity", Tata McGra	w Hill Bool	k Co., New	Delhi, Thir	d Edition,

- 1. Mendelson. A., "Plasticity Theory and Applications", Krieger Pub Co., Florida, U.S.A, Second edition, 1983.
- 2. Chwo. P. C. and Pagano. N. J. "Elasticity Tensor, Dyadic and Engineering Applications", D. Van Nastrand and Co., Inco. 1990
- 3. Wang "Applied Elasticity", Mc Graw Hill, New Delhi, 1990

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVELOPER		
CE-9025	Soil Structure Interaction	4-0-0	4	Roy		
Part I:						
Introduction, Su	perstructure-foundation interaction, static	soil-structure	e interaction.		[04]	
Non-uniform co	ontact pressure, Interaction problems o	f shallow f	foundation,	Combined	[0]	
footing, Rigid method, Flexible method.					[06]	
Various Soil Models:						
Reams on elastic foundation. Infinite beam, Finite beam, Modulus of subgrade reaction and					[10]	
effecting parameters.					[04]	
Sheet pile wall,	Cantilever and anchored sheet pile wal	l, Fixed ear	th support,	Free earth		
support.					[08]	
Piles under diffe	erent loading conditions, Analysis under	lateral load,	Different a	pproaches,		
Mechanism of	failure, Ultimate load, Deflections, Elas	stic continu	um approacl	n, Design,		
Analysis.					[02]	
Part-II: Introduction to I	Dynamic Soil Structure interaction				[02]	
Estimations of damping ratio of DSSI					[02]	
Geotechnical consideration of DSSI						
TEXT BOOKS:						
1. Advance	ed GEOTECHNICAL Engineering soil	-structure]	interaction	using Com	puter and	
Material	Material Models by C.S.Desai, Musharraf Zaman.					

2. Foundation analysis and Design by J.E.Bowles

- 1. Soil-Structure Interaction Numerical Analysis and Modelling by J. W. Bull.
- 2. Advanced Soil Mechanics B.M. Das, McGraw Hills Publishers.
- 3. Dynamic Soil-Structure Interaction, John. P. Wolf, Prentice Hall Inc.

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVELOPER			
CE-9026	Advanced Theory of Vibration	4-0-0	4	4 A. K. Banik			
Wave Propagation	on in one and two dimensions, Dynamics o	f a mass on	an elastic ha	lf space;	[10]		
Computational structural dynamics solution of dynamic equations by convolution, time step							
integration, complex modes, frequency domain methods Modal synthesis in frequency					[10]		
domain.					1001		
Sub-structuring techniques spatially periodic structures Numerical methods for nonlinear					[08]		
hysteretic systems Lanczos method.					[00]		
Dynamic soil-si	tructure interaction, Fluid-structure intera	action probl	lems related	to liquid	[08]		
storage tanks and	d offshore structures.						
Elements of Ran	dom vibration, Wind induced vibration of	Structures			[04]		
Variational form	nulation of equations of motion, Non-lin	ear vibration	n, Design fo	or extreme			
dynamic loads s	uch as impact, blast and seismic loading.				[10]		
TEXT BOOKS	:						
1. Non-line	ear dynamics and random vibration analysi	s by J.S. Ra	o, Wiley Pub	lishers			
2. Theory of Vibration by A. A. Shabana, Springer							
REFERENCE	BOOKS:						
1. Vibratio	ons and stability by J. J. Thomson, Springer						

SUBJECT CREDIT **SUBJECT** L-T-P DEVELOPER CODE **Mechanics of Composite Structures CE-9027** 4-0-0 4 P. Topdar and Smart Structures **Composite Structures :** Composites, Various reinforcements and matrix materials, Strength and stiffness properties, Effective moduli, spherical inclusions, cylindrical and lameller [20] systems, Laminates: Laminated plates, analysis, strength and design with composites, Fibre reinforced pressure vessels, Dynamic inelastic and nonlinear effects, Technological applications. Introduction to smart material and its construction, Different types of smart materials and their specific properties and applications, Introduction to MEMs. and different smart [20] materials (Piezoelectric materials, Optical Fiber, Shape Memory Alloy (SMA), Electorehological fluid, Megnetorehological fluid, Magnetostrictive materials, etc.) **TEXT BOOKS:** 1. Mechanics of composite structures by L. P. Kollar and G. S. Springer, Cambridge University Press. 2. Introduction to the Design and Analysis of Composite Structures by Jeffery A. Wollschlager **REFERENCE BOOKS**: 1. Smart Structures: Analysis and Design by A. V. Srinivisan and D. M. McFarland, Cambridge University Press.

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVEI	OPER
CE-9028	Analysis and Design of Tall Structures	4-0-0	A. K. S	amanta	
Concept of tall structure- design	building, factor affecting growth, height a process, strength and stability, stiffness a	and structur nd drift lim	al form. Ta	ll building an comfort	[12]
criteria, creep, shrinkage and temperature effects. Foundation settlement and soil structure interaction, gravity loading, wind loading, earthquake loading, and combination of loading. Braced frame structures, rigid frame structures, in filled frame structure, flat plate and flat-slab structures shear wall structures wall- frame structures framed-tube structures outrigger					[10]
-braced structures, suspended structures, core- structures, space and hybrid structures. Floor systems- reinforced concrete and steel framing.					[10]
Design considerations Nature of wind, Characteristics of wind, provisions of IS 875(part-3) Wind tunnel engineering- introduction, objectives of wind tunnel tests, rigid model studies.					[10]
Steel:- Introduction frames.	Steel:- Introduction, Rigid frame, braced frame, interacting system of braced and rigid frames.				
Concrete:- Introduction, Flat slab, shear walls, column.					
TEXT BOOKS:					
1. Bryan st sons, 20	afford smith and alex coull, Tall Building 8	Structures- A	Analysis and	Design, Joh	n wiley &
2. Woltang	s Schuller, High- rise building Structures, J	ohn wiley ai	nd Sons, Nev	w York 1976	5

- 1. Lynn S. Beedle, Advances in Tall Buildings, CBS Publishers and Distributors Delhi, 1996.
- 2. B.S. Taranath, Structural Analysis & Design of tall Buildings, McGraw Hill, 1998.

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVELOPER	
CE-9029	Soil Dynamics and Machine Foundation	4-0-0	4	R. P. Nanda	
Vibration of ele	ementary system, Single degree and two	o degree fre	edom syste	ms, Wave	
propagation in an elastic, homogeneous, isotropic medium,					
Propagation of waves in saturated media, Behaviour of dynamically loaded soils, Evaluation					
of dynamic properties of soil.					[10]
Theories for vibration of foundations in elastic media, Design procedures for dynamically					
loaded foundation	ons for vertical and rocking vibrations	0	-		[14]
Foundations und	ler reciprocating engines, Foundations for	forge hamn	ners, motor g	generators,	
turbo-generators	and crushers			_	[12]
-					
TEXT BOOKS	:				
1. Soil Dy	namics and Machine Foundation by Swami	Saran, Galg	gotia Publica	ions	
2. Foundat	ion for Machine by S. Prakash, John Wiley		-		
REFERENCE BOOKS:					
1. Geotech	nical Engineering by C. Venkatramaiah.				

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVELOPER		
CF-9030	F-9030 Behaviour of Concrete Structures 4-0-0 4 A.K.					
CE-9030	Benaviour of Concrete Structures	400	-	& P.	Roy	
R.C. Structures: Material-load environment and time dependent responses. Problems relating						
to non-uniform drying shrinkage and creep under varying stress.					[10]	
Behaviour of concrete under multi-axial stress, failure theories of plasticity, Damage in RC						
structures, interaction with reinforcement.					[10]	
General principles and philosophies of design with special references to the codal provisions.						
Serviceability an	nd stability requirements.				[10]	
Yield line and st	rip methods of design of reinforced concre	te slabs			[10]	
TEXT BOOKS	:					
1. P.C. Va	rghese, Advanced Reinforced Concrete De	sign, PHI, N	ew Delhi.			
2. W. F. Chen, Plasticity in Reinforced Concrete, J. Ross Publishing, USA.						
REFERENCE	BOOKS:					

1. Concrete Technology by A. M. Neville & J. J. Brooks (Pearson Edu.)

SUBJECT CODE	SUBJECT	L-T-P	CREDIT	DEVELOPER	
CE-9036	Advanced Finite Element Method	4-0-0	Datta & opdar		
Review of Introd	duction to Finite Element Method				3
Two dimensional Finite Element Analysis: Introduction, Review of Theory of Elasticity,					
Application of three dimensional equations for two dimensional analysis, CST Element for					
plane stress and	plane strain analysis, Triangular elements,	, four node 1	ectangular e	element for	8
plane problems			U U		
Finite Element analysis of Plates and Shells: Introduction, Review of plate theories,					5
formulation of triangular and rectangular elements for plate bending analysis, introduction to					
analysis of shells	S S	U	•		
Dynamic Analys	sis using Finite Element Method: Introduc	ction, Gover	ning Equation	ons, Mode	5
superposition me	ethods, direct time integration method		0 1		
Application of F	inite Element Method in real life engineeri	ng application	ons		3
Computer Imple	ementation of Finite Element Method:	Introduction	n, static co	ndensation	4
procedure, appli	cation of static condensation		-		
Exposure to con	nmercial/research application FEM softwar	e, Introducti	on to CAE u	using FEM	3
Modelling technique and application of symmetry concept in Finite Element Method					
Error analysis in	Finite Element Method				3

TEXT BOOKS:

 The Finite Element Method, O. C. Zienkiewicz, 3rd Ed., McGraw-Hill, 1997. Fundamentals Of Finite Element Analysis by David V. Hutton Publisher: Tata Mcgraw Hill Education Private Limited (2005)
 Concepts and Applications of Finite Element Analysis by R. D. Cook, 2003, John Wiley & Sons, INC.
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